

## Chicago Natural History Museum

FOUNDED BY MARSHALL FIELD, 1893

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## COAPTATION IN SNAILS, TURTLES AND ARMADILLOS

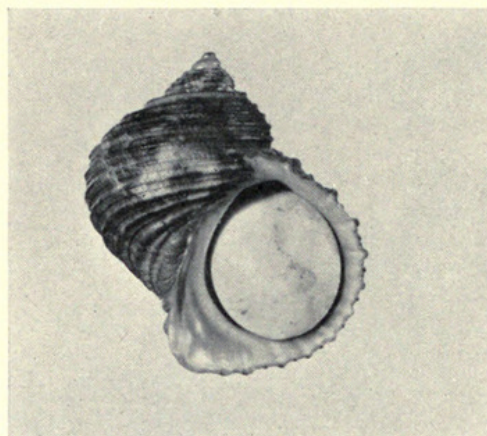
By KARL P. SCHMIDT

CHIEF CURATOR, DEPARTMENT OF ZOOLOGY

"**P**HRAGMOSIS" is the ecological term for crawling into a hole and pulling the hole in after one's self (as the American colloquialism has it), as related in an earlier article (BULLETIN, March, 1955). The phragmotoc devices evolved in animal bodies, like the bony heads of certain toads and tree-frogs, by which animals close the holes into which they retreat are quite evidently related to a still more widespread phenomenon. In this, the separate parts of an animal's body (often the front and rear end) have evolved to fit each other, as when an animal rolls into a ball or when an animal already protected by a shell develops the capacity for closing the openings left when head and limbs, or even the whole body, are pulled in for concealment.

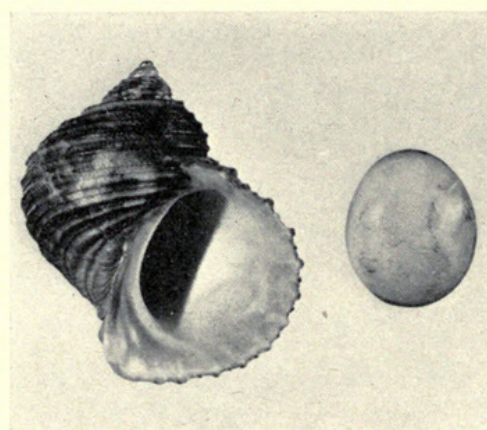
This kind of adaptation of separate parts of the body by evolution is referred to as *coaptation*. In a sense such evolution is only a special case, though a conspicuous one, of the interadaptation of structures and functions in the bodies of all animals, which must evolve as wholes, with the function of the lungs adjusted to that of the heart and that of the nervous system to every movement of the body. Nevertheless, the very exact adjustment of one part of the external covering

of the body to fit against another part, sometimes at the opposite end of the animal, may be so striking and often so remarkable in the details of its mechanical perfection that the term *coaptation* is useful and is, in fact, in current use to describe this kind of adaptation. It may be extended to apply even



#### TRAPDOOR OF SNAIL, CLOSED

Operculum attached to animal's foot-muscle by which it may be retracted, as shown above, or opened. On Pacific island beaches these were frequently mistaken for "cat's-eyes" by servicemen.



#### SNAIL'S TRAPDOOR REMOVED

Illustrating construction of protective shield and showing why it might be mistaken for a gemstone.

to those plants that have movable parts, like the clovers and other legumes whose leaves fold up for the night.

#### MECHANICAL PRECISION

The extremes of mechanical perfection of such adjustments may be especially notable in insects and crustaceans, in which there is a watch-like precision of fit of the movable parts that connect with the hard external covering. In such creatures a great number of elements of the body-covering may be modified to fit together when the over-all adaptation is for rolling into a compact ball. Rolling into a compact ball is a defensive reaction in some kinds of sow-bugs (the familiar little land crustaceans found in damp places), in certain tropical millipedes, and in various quite distinct groups of beetles. There should perhaps be a term for "rolling

### —THIS MONTH'S COVER—

"River found on a mountaintop in a 'lost world'" would appropriately describe the scene depicted on our cover. The photograph was taken by Dr. Julian A. Steyermark of the Department of Botany at the spot where his expedition in Venezuela successfully broke through jungle tangle and rock barriers onto the summit of Chimantá-tepuí and stepped into this weird landscape. The picture shows the Tirica River as it flows across the unusually expansive and plateau-like mountaintop at an altitude of about 6,300 feet. The expedition pitched its camp beside this river and for a month worked in the surrounding area collecting plants and zoological specimens. The banks of the river are lined with many peculiar rock formations. Curator Steyermark's account of the expedition, from which he has just returned, appears on page 3.

up into a ball," for this is a habit somewhat different from the familiar retreat into a shell of the mussels and snails, and different also from the withdrawal of the heads and limbs of turtles into their bony case.

Coaptation is often illustrated in various stages of the evolution toward perfection in animals that retreat into a shell. One of the most familiar devices for closing the opening in a protective shell is the operculum of many different kinds of marine and fresh-water snails. This may be a shield of horn-like material, or it may be composed of the same material as the shell. After World War II, museums were showered with inquiries from servicemen about the "cat's-eyes" they had picked up on the beaches of the Pacific islands. These objects were the shelly opercula of various kinds of marine snails. An element of confusion was introduced into these inquiries by the more proper application of the term *cat's-eye* to a semi-precious mineral that is often cut as a gemstone. The snail opercula, with their coiled structure and bright colors, are ornamental; but the inquirers had to be told that they were not semiprecious. The now familiar use of the term *cat's-eye* for the bright-colored snail opercula does not seem to have found its way into the dictionaries.

#### TURTLE'S DEVICES

Less familiar instances of closing up a shell by the co-ordinate evolution of different parts of the body are to be found in turtles. In almost every family of this reptilian order some genus has carried the concealment of

(Continued on page 6, column 2)



# RARE PLANTS AND ANIMALS DISCOVERED IN 'LOST WORLD'

By JULIAN A. STEYERMARK  
CURATOR OF THE PHANEROGAMIC HERBARIUM

THAT MYSTERIOUS and awe-inspiring area of Venezuela known as the "lost world" can always be counted upon to provide adventures and misadventures as well as an abundance of plants and animals for the museum collector, including many species hitherto unknown to science. On the 1954-



BACKBONE OF AN EXPEDITION

Some of the twenty Indian porters required to transport the packs containing about 5,000 pounds of provisions and equipment through jungles, over streams, and up mountains for the botanical expedition to the Venezuelan "lost world."

55 joint expedition of Chicago Natural History Museum and New York Botanical Garden, this land of rugged mountains, rushing streams with many rapids, and strange terrain did not fail to provide its customary thrills and rigors, but it rewarded the two participating institutions with notable collections exceeding even our expectations when plans were being made.

Co-leader of the expedition was Dr. John J. Wurdack. We sailed from Philadelphia on December 23, 1954, on a Gulf Oil Company tanker, *S. S. Coro*, and arrived at Puerto de La Cruz on December 30. Thanks to the co-operation of officials of the Mene Grande and Sinclair Oil companies, admittance of our equipment into the country was greatly facilitated. The paraphernalia was trucked the next day across the *llanos* to Ciudad Bolívar on the Orinoco River, nearly 300 miles (by air) southeast of Caracas. There food supplies for the next three months were obtained.

What does an expedition live on? Our provisions included such staples as 100 pounds of black beans, 150 pounds of rice, 200 pounds of lentils, large quantities of *casabe* (chief breadstuff of the Indians who were to accompany us), and large quantities of salt, coffee, native brown-sugar, onions, cereals, powdered milk, canned meats, and sardines.

We were ready the next day to fly to the airport of Urimán on the Caroní River with our load—nearly 5,000 pounds split up into 70 packs, which included besides the tons of food, a variety of trade goods, gear for camping, for cooking, and for collecting, old newspapers for pressing botanical specimens, an outboard motor for canoes, and drums of gasoline for it as well as for fueling

the stoves used to dry plant-specimens. Then with a thud came news that because of local observance of the coming New Year's weekend, the cargo plane that was to transport our impedimenta could not leave Ciudad Bolívar until January 7; so we were faced with a week's delay. Concern over this developed into other worries about details of the expedition, particularly about whether I could obtain the invaluable services of Sabas Cardona, chief guide, and the other Indians who accompanied me on my expedition in 1953 to the same destination, the mountain of Chimantá-tepuí.

From Urimán I set out with a native worker on an arduous three-day trek to Uruyen, about 50 miles north, to sign up Sabas and his crew. After crossing numerous streams and mountains, we reached this village, the home of Sabas, on the night of a fiesta. I joined in the dances, and out of respect for the Indians' customs, tasted *kachiri*, a lavender-colored drink, made largely from the fermented root of the same *casabe* plant (the tapioca-yielding *manihot*) that the Indians use for bread flour. The next day Sabas rounded up friends and relatives from surrounding villages to make up the party of twenty Indians that I needed, and the day after that we began the long trek back to Urimán.

On January 14 our expedition started up

the Caroní River. This involved portaging all the equipment around the 200-foot-high waterfall of Techiné-merú, then proceeding past the Indian village of Kon-quen and up the Tirica River to the original campsite of our 1953 trip at the base of the mountain. Three dugout canoes were used to bring the cargo upstream to base camp, and several trips had to be made to relay the three-months' supply of food and other equipment from Urimán to base camp at an elevation of 1,700 feet. This required more than a week. Then, while the old trail was re-cut to allow the cargo to pass through more easily, Sabas, four other Indians, Wurdack, and I went ahead to see how practical it might be to reach the summit via the uncompleted trail started by Sabas at the end of my previous trip.

Our flight on January 7 from Ciudad Bolívar had carried us over the summit of Chimantá-tepuí, and we had seen broad level stretches traversed by meandering streams. We knew, therefore, that if Sabas' uncompleted new trail headed in the right direction, paralleling the course of the Tirica River, we should reach this summit and be able to establish a campsite along the river. As good fortune proved, Sabas' trail took us through the tangled scrub forest to a point where the Indians could climb trees and take direction sights. On January 27 we were within sight of our goal. A few more hours of trail-cutting on January 28 brought us above another waterfall. Here we crossed the river where it had channeled and gouged out peculiar rock formations bordered by white sandy beaches.



WATERFALL NAMED FOR MUSEUM BOTANIST

This is Steyermark-merú or Julian A. Steyermark Falls, thus named by Indians of the "lost world" in honor of the explorer on an expedition in 1953. Photographed for first time by 1954-55 expedition to the same area.

At last we reached the summit and in a short time established a campsite on a level open stretch of white sand surrounded by



myriad kinds of peculiar plants. Here Wur-dack and I stayed, assisted by Sabas, while the other four Indians returned to help carry the remainder of the 70 pieces of cargo that were gradually being brought up. Finally, three weeks after having left Urimán, all the cargo arrived. The elevation at this point was 6,300 feet. Temperature went down to a low of 47 degrees at night and reached a high of 75 degrees in the shade during the day (47 degrees is the very lowest temperature ever recorded from the summits of any of the mountains of the "lost world"). We found ourselves surrounded by weird rock-formations and bluffs on all sides towering to still higher portions of the summit that reached an altitude of 7,500 feet. We kept eight of the Indians as regular workers until the end of the trip, sending back the twelve others who had assisted in bringing the cargo up the mountain.

From then on our collecting began in earnest. Trails were made in many directions to reach various parts of the extensive mountain-mass that is about 50 miles long and 40 miles wide. We explored as many sections as possible, sometimes remaining fully four days away from our main camp. We found uncharted waterfalls and unmapped rivers and their tributaries, and we took compass readings. We found ourselves adding significant geographical details to our data about this mountain as we explored different sections each day. New plants were discovered along every new trail traversed.

There were long stretches of open swampy savanna alternating with dry rocky slopes full of peculiar sandstone and quartz formations. There were numerous rifts and narrow chasms in the rocks that descended perpendicularly for a hundred feet or more. These often forced us into long detours. Some, however, were narrow enough to jump across. Sphagnum bogs with peculiar plants often lined parts of the river valley that seemed to wind endlessly across the summit. We reached edges of the escarpment of portions of the mountain that broke off into mile-high chasms and canyons of great length and magnitude. In such deeply eroded sections of Chimantá-tepuí, the scenery was truly of the most spectacular type, and we could see how the various lobes of the great mountain stretched out from here for miles and miles of unexplored fantastic areal surface.

Wherever we traveled on the summit of the main-central portion of Chimantá-tepuí, we could see miles and miles of meanderings of the Tirica River and its tributaries as they flowed over swampy savannas or through rocky openings to distant parts of the giant mountain. This was the most unusual feature of Chimantá-tepuí—that the main section of its summit should be well-watered by a good-sized stream, the

Tirica River. This, indeed, was a real discovery, as previous maps of the mountain failed to reveal any stream running over the summit. Although some streams have been found on the summits of a few of the other mountains of the "lost world" section of Venezuela, Chimantá-tepuí is the first on which such an extensive river-system has been found traversing the summit. This has provided all sorts of habitats for swamp and aquatic plants and animals. Water-striders, water beetles, and many other kinds of aquatic insects were noted and collected.

The cool valleys with rivers occurring on the summit, ascending to 7,500 feet, were the habitats also for a number of Andean species of groundpine (*Lycopodium*), of a type found in the high mountains of Ecuador, Peru, and Colombia, and other Andean genera such as St. John's wort (*Hypericum*), cherry (*Prunus*), *Weinmannia*, holly (*Ilex*), various members of the heath family including huckleberry (*Vaccinium*), *Baccharis*, *Viburnum*, sedges such as *Carex*, an Andean tree (*Laplacea*) of the *Camellia* family, *Cestrum*, *Aegiphila*, and many others. This vast assemblage of plants of the cooler temperate climate was intermingled with other genera of plants known only from the mountains of the "lost world" area.

#### ANIMAL SPECIMENS COLLECTED

Although we climbed and hiked many miles each day, bringing back marvelous specimens, we realized that only the surface aspects of this remarkable summit could be touched within the time at our disposal. We could remain only until March 2, and then would have to start down the long trail again. During the six weeks on the summit, we collected 1,500 different species of plants, totaling about 10,000 duplicate specimens. Photographs were taken of various plants and details of scenery to add to the geographic knowledge of the mountain. Remarkable zoological discoveries also were made during these six weeks. A small catfish was found in the river near our summit campsite at 6,300 feet, and specimens were collected for the Museum. This is the first record of any fish ever taken from the summit of any of the mountains of the "lost world." Other interesting collections made on the summit were lizards, frogs, snakes of several kinds, including a distinct species of poisonous fer-de-lance (*mapanare*), snails, termites, various other insects, spiders, centipedes, millipedes, earthworms, a species of grebe, a coati mundi, and a white-eared opossum. The two mammals are the largest fur-bearers found on the summit. Bats were seen in flight, but we were unable to snare any in our bat net. Several small birds were collected, two of them new to the Museum's collection.

Although there were numerous rainy days, the weather was in our favor during most

of the trip, expediting travel and collecting. Altogether, about two weeks were required on the return trip from the time our cargo left the summit of the mountain until we all reached Urimán on March 17. Here everything was packed for the trip by plane back to Ciudad Bolívar, where a truck carried the expedition's collections to Puerto de La Cruz. On March 25 the *S. S. Las Piedras* sailed with the treasures of Chimantá-tepuí aboard, arriving in Philadelphia on March 30. Half of the botanical specimens will be deposited with New York Botanical Garden and half with Chicago Natural History Museum. Many new species were found. A joint botanical report by the two institutions will be published eventually, encompassing the results obtained by this expedition and by those conducted separately by us in 1953.

#### Director's Annual Report Ready for Members

All Members of the Museum will soon receive their copies of the Annual Report for 1954 of the Director to the Board of Trustees, which has just been published by Chicago Natural History Museum Press. It is a volume of 146 pages and contains 24 illustrations. All phases of the Museum's activities are covered by Colonel Clifford C. Gregg, Director — expeditions, research, accessions, new exhibits, building maintenance, etc.

#### Mammals of the Sea

An especially attractive array of sea mammals, with painted backgrounds and built-up scenes representing their habitats, is to be seen in Hall N. One group shows Pacific walruses on an arctic ice-floe lighted by the midnight sun. Equally impressive are the elephant seals, largest of all seals, on the beach of Guadalupe Island and the giant northern sea-lions of the coast of Washington. Other mammals are Pacific seals (smallest of earless seals), northern fur seals in the Pribilof Islands, the narwhal, and a pair of Florida sea cows. A representation of the snow and ice of the Antarctic provides the setting for specimens of Weddell's seal collected by the Second Byrd Antarctic Expedition.

Devotees of the current do-it-yourself trends in making furniture and other useful household articles in home workshops will find the exhibits in Charles F. Millsbaugh Hall (North American Woods) and the Hall of Foreign Woods (Halls 26 and 27) of special interest. Here they may study the characteristics of different woods in order to select those most suitable to a particular purpose or design.



## SPARROWS JOIN EXODUS FROM CITY LIFE

BY AUSTIN L. RAND  
CURATOR OF BIRDS

THE FLIGHT of city dwellers to the suburbs has been going on long enough for sociologists to write accounts of its influence on the social structure of the nation, for builders to devise a prefabricated house that takes little more time to put up than to have a well-built martin house made and installed, and for economists to view with alarm the tax situation in the cities.

House sparrows have changed, too. They used to be concentrated in the cities. This was so noticeable that old ecology textbooks used the sparrow as an example of an animal whose population density correlated directly with the density of human population. But it's no longer true.

For the last few years I've been noting the situation in Chicago. On Michigan Avenue, on the edge of Grant Park, and on the South Side where the buildings are spaced out a little there are sparrows. But they've gone from the heart of Chicago. I've seen none in the Loop. There are pigeons, yes. On Van Buren Street and about the La Salle Street Station there are scores of them. Sometimes the flocks number a hundred or more. Sometimes I see them looking for scraps in the alleys, sometimes they're getting a good feed of grain that some kind-hearted birdlover has poured out for them (I've wondered what influence the proximity of the Grain Exchange of the Board of Trade may have on this), and sometimes they're cadging peanuts from the passengers at the elevated stations. There's evidently food in plenty for pigeons, but it doesn't suit the sparrows.

### THE AUTO DID IT

The motor car has made suburban living possible. It has made feasible supermarkets, drive-in theatres, and homes remote from public transportation. I know people who work in the city who drive 10 or 15 miles to get to their morning train that takes them cityward.

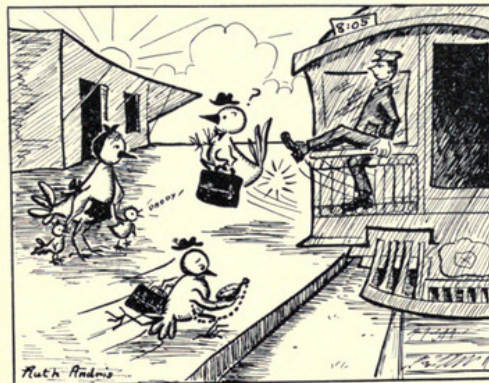
It was likewise the motor vehicle that caused the shift in the sparrow population out of the city. But the factors at work reflect a different aspect of the change. Before motor transport, horse-drawn vehicles were the standard transportation in the city. Where there were horses there was waste grain in abundance, and it supported a dense sparrow population in the centers of cities. With the replacement of horses by motors, the sparrows' food supply disappeared, and the sparrows disappeared or became scarce in the cities.

There are lots of sparrows in the suburbs, visiting bird feeding-stations and picking up scraps, but for real sparrow concentration one must go a little farther out where people are raising pigs and feeding them well on a

special ground-grain diet. About such feed lots I've seen hundreds of sparrows in a winter afternoon. The wheat fields in late summer are rich feeding grounds, too, and also we find sparrows spreading out during the summer even to the picnic grounds on the Lake Michigan beaches. But with winter they must withdraw to the feed lots in order to survive.

### CORRELATE WITH HOGS

The ecology textbooks will have to revise their correlations about house sparrows. They will have to write that after the introduction of the house sparrow into North



America and before the widespread introduction of the automobile into our culture, the sparrows' population density varied directly with the density of one kind of domestic animal, the horse. With the wide use of motor cars, the sparrows' population density suffered a shift, and now it correlates with the density of another domestic animal, the hog.

In reading over the above I realize that I may have given the impression that the suburban sparrow commutes, catching the 8:05 each morning for the city and returning, weary, on the 6:10. This is not so. There may be slight seasonal shifts and a greater concentration of sparrows about food lots and villages in the winter, but the suburban sparrows are suburban twenty-four hours a day.

### STAFF NOTES

**John R. Millar**, Deputy Director, will be a speaker on "Careers in Museum Work" on a program to be given Saturday, May 14, at 3 P.M. over WBBM-TV . . . **Dr. Theodore Just**, Chief Curator of Botany, recently conducted a seminar for the department of botany at the University of Illinois in Urbana . . . **Dr. B. E. Dahlgren**, Curator Emeritus of Botany, has returned from Cuba where he has been continuing the collecting and study of palms . . . **Loren P. Woods**, Curator of Fishes, recently lectured on cave fishes at the annual convention of the National Speleological Society held at Natural Bridge, Virginia.

## EL SALVADOR BIRD BOOK BY MUSEUM WRITERS

El Salvador has just attained the distinction of being the only Central American country with a guidebook to its bird life. The generally increasing interest in science found expression in El Salvador in 1950 with the establishment of a research station, Instituto Tropical de Investigaciones Cientificas de la Universidad de El Salvador. In support of this new research project, Chicago Natural History Museum sent several members of its scientific staff to carry on investigations there. They were Dr. Sharat K. Roy, Chief Curator of Geology, who is now in El Salvador again investigating volcanoes; the late Dr. Norman C. Fasset, of the University of Wisconsin, who was sponsored by the Museum in a study of aquatic plants; and Dr. Austin L. Rand, Curator of Birds, accompanied by Stanley Rand, who studied birds.

One of the early fruits of the co-operation is the bird guide, in Spanish, entitled *Manual de las Aves de El Salvador*, by Curator Rand and Melvin A. Traylor, Research Associate in Birds, which was published recently by Universidad de El Salvador. The basic research in El Salvador had, of course, already been done by A. J. van Rossem and was published in 1938 by the Museum in a volume for the specialist. This new *Manual*, which carries the work one stage further, was prepared for the general reading-public of El Salvador.

The *Manual*, arranged in systematic order, provides keys for the identification of members of each bird family. Under each form is a description, a paragraph about the young, and notes on identification and range—all of this the work of Traylor. A summary of each bird's life-history and finally a word-sketch of the bird in its habitat based on van Rossem, other literature, and first-hand experience in the field are by Curator Rand. The manuscript was translated from English into Spanish in San Salvador. The illustrations, by Douglas E. Tibbitts, Museum Staff Illustrator, are reproduced from Associate Curator Emmet R. Blake's *Birds of Mexico*. The book, which was printed by offset lithography, is bound in paper (308 pages, 7½ by 9¾ inches).

### "Highlights Tours" Offered Daily

Free guide-lecture tours are offered daily except Sundays under the title "Highlights of the Exhibits." These tours are designed to give a general idea of the entire Museum and its scope of activities. They begin at 2 P.M. on Monday through Friday and at 2:30 P.M. on Saturday.

Special tours on subjects within the range of the Museum exhibits are available Mondays through Fridays by advance request.



## 'ABOMINABLE SNOWMAN' OF THE HIMALAYAS

BY ROBERT L. FLEMING

FIELD ASSOCIATE, DEPARTMENT OF ZOOLOGY

*Dr. Fleming has given notable collections of Asiatic animals to the Museum. As an American mission-school supervisor in India he has been able to devote several months each year to his avocation as naturalist and has collected for the Museum in the Himalayas during various periods from 1938 to 1954.*

WHEN I told about my Nepal bird work in the BULLETIN (December, 1954), I said nothing about the "Abominable Snowman." Actually I had written a paragraph on the subject, for accounts of travels in the Himalayas seem to be incomplete without some mention of this Snowman. But the subject had seemed so overdone that I left it out. Since then, however, I've seen references and speculations about the Abominable Snowman and been asked so many questions that I've written the following.

The editors of the *Journal of the Bombay Natural History Society* (August-December, 1954, pp. 594-598) have summarized the facts and theories about this Abominable Snowman:

(1) Only one eyewitness report is recorded—that of N. A. Tombazi, who writes that he had a fleeting glimpse of an upright figure, first taken for a man (later reported as a Snowman), dark but without clothes, in a glade between dwarf rhododendrons in a Sikkim valley. The creature left tracks similar in shape to those of a man but only 6 to 7 inches long. Tombazi conjectures that what he saw was a wandering man, perhaps a pious Buddhist ascetic, mortifying himself in the utter desolation of high places.

(2) Eric Shipton, the Himalaya climber, reports footprints 12½ inches long in the snow at an elevation of 12,000 feet, tracks that were considered by authorities at the British Museum to be monkey tracks.

(3) There are stories in Tibet of the *Yeti*, as the local people call the Abominable Snowman, playing in the snow (*Yeti* are said to kill and skin yaks and plant the horns in the ground).

(4) There are additional hearsay reports of seeing *Yeti*. One *Yeti* was described as five feet tall, covered with reddish hair and having a conical head. Another was said to have been seen walking on all fours, screaming, sometimes standing up on its hind legs and scratching its chest. A living *Yeti* being kept in a zoo at Shigatse, Tibet, was reported (news of a zoo at Shigatse is more fantastic than that of the existence of a *Yeti*, according to Lama Angarika Govinda, who knows the area). A giant figure was seen ambling along a railway track in the outskirts of Siliguri—this *Yeti*, knocking at a door and being mistaken for Yama, the God of Death, left footprints in the mud

14 or 15 inches long and 8 inches wide. Other reports ascribe a "peculiar whistling note" to the *Yeti*.

(5) A "scalp," said to be of a *Yeti* and used by the Lamas of Gompa as a leather cap in rituals, was seen by Navnit Parikh's party and by Dr. R. C. Evans, and a single hair taken from it was sent to Dr. L. A. Hausman, of New Jersey, an authority on hairs of all kinds. His report indicated that the hair had been dyed and that the "scalp" could well be an artifact.

(6) The recent *Daily Mail* (London) expedition in search of the Abominable Snowman was unsuccessful.

From the above it is obvious that evidence for the Abominable Snowman is composite: the footprints may be human; they may be the tracks of bears that live above timberline; they may be tracks of monkeys that live in the higher forests. Reports of the creature may be rooted in a belief in the supernatural; they may in part be manufactured.

My own experience with the Abominable Snowman is slight. I've climbed to the edges of the permanent snowfields and have seen no sign of it. My closest contact was in Kathmandu, where a year ago last winter I saw the little motor-car bustling about with "Abominable Snowman Expedition" painted on its sides—it was part of the expedition from London to investigate the matter. As far as I can learn, results have been slight.

Under the influence of museum thinking I've come to believe that we should accept the existence of animals only if actual examples can be examined. Disregarding secondhand evidence about the Abominable Snowman, we can only say that there is something living in the high Himalayas that makes tracks. These tracks resemble human footprints but are larger or smaller. They also resemble bear tracks, and they also resemble monkey tracks. Tracks in the snow become distorted and enlarged by the hot sun. Taxonomy based on tracks only is unlikely to be sound.

Until we get definite evidence to the contrary I think the safest course is to assume that one of the animals that could have made these tracks did make them: man, monkey, or bear.

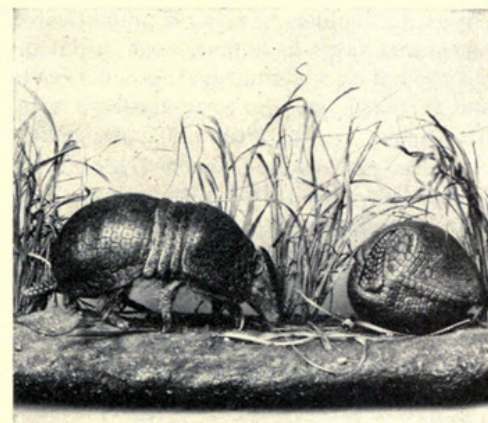
## COAPTATION—

(Continued from page 2)

the limbs and of the head and neck to a more than ordinary degree by the development of hinges at various points in the shell. These make it possible to close the front lobe of the plastron (the lower shell), the rear lobe, both ends of the plastron by separate hinges, both ends by a single hinge, and in one instance by a crude hinge at the rear of the carapace (the upper shell). In a remarkable series of genera of soft-shelled turtles, the limbs and

head are withdrawn through separate openings, each of which has a separate valvular closure.

Rolling into a ball that is tightly closed by the meeting of the front and rear ends of an armored shell is conspicuously illustrated by the little three-banded armadillo abundant on the plains of Brazil and Argentina. The



PORTABLE PROTECTIVE SHELTER

The three-banded armadillo of South America offers an illustration of coaptation principles.

nine-banded armadillo that reaches the southern United States is often spoken of as if it habitually "rolled up into a ball." In truth, this form represents only a primitive stage in the ball-rolling habit, and one must see the three-banded *Tolypeutes* to appreciate the great advance it has made in this adaptation.

In the three-banded armadillo the three bands at the middle of the body form an effective hinge by which the solid front and rear shells can be brought together until their lower edges meet and the limbs and belly are completely hidden. The half round hole for the short tail and the similar opening for the head are thus brought together on one side of the armored sphere. This last oval opening is neatly closed by the juxtaposition of two bony wedge-shaped shields, respectively on the upper side of the tail and the top of the head. These wedges lie head to point so as to fit the opening with remarkable precision.

Coaptation in varying degrees pervades all animate creation. The phenomenon serves to emphasize the basic biological principle that the factors involved in the evolution of animal structures only rarely escape from the dominance of the whole to develop into the bizarre.

## Visiting Hours Extended for Summer Season

Effective May 1 and continuing through September 5 (Labor Day) visiting hours at the Museum are extended by one hour. The Museum will be open daily, including Sundays and holidays, from 9 A.M. to 6 P.M. At the end of this period, hours will revert to 9 A.M.—5 P.M.





Schmidt, Karl Patterson. 1955. "Coaptation in Snails, Turtles and Armadillos." *Bulletin* 26(5), 2-6.

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