MADRAS GOVERNMENT MUSEUM

GUIDE TO THE GALLERIES OF FOREIGN ANIMALS, GENERAL ZOOLOGY, SKELETAL EXHIBITS AND AMPHIBIANS

BY

S. T. SATYAMURTI, M.A., D.Sc., F.Z.S.,

(Superintendent, Government Museum, Madras.)

Published by :
The Principal Commissioner of Museums
Government Museum
Chennai-8
1999

MADRAS GOVERNMENT MUSEUM

GUIDE TO THE GALLERIES OF FOREIGN ANIMALS, GENERAL ZOOLOGY, SKELETAL EXHIBITS AND AMPHIBIANS

BY

S.T. SATYAMURTI, M.A., D.Sc., F.Z.S.,

(Superintendent, Government Museum, Madras.)

Published by :
The Principal Commissioner of Museums
Government Museum
Chennai-8
1999

First Edition : 1963
Reprinted : 1999

Price : Rs.50.00

Printed at
Madipakkam Stationery & Register Making
Industrial Co-op. Society Ltd.,
Chennai-81.

S. RANGAMANI, I.A.S.
Principal Commissioner of Museums

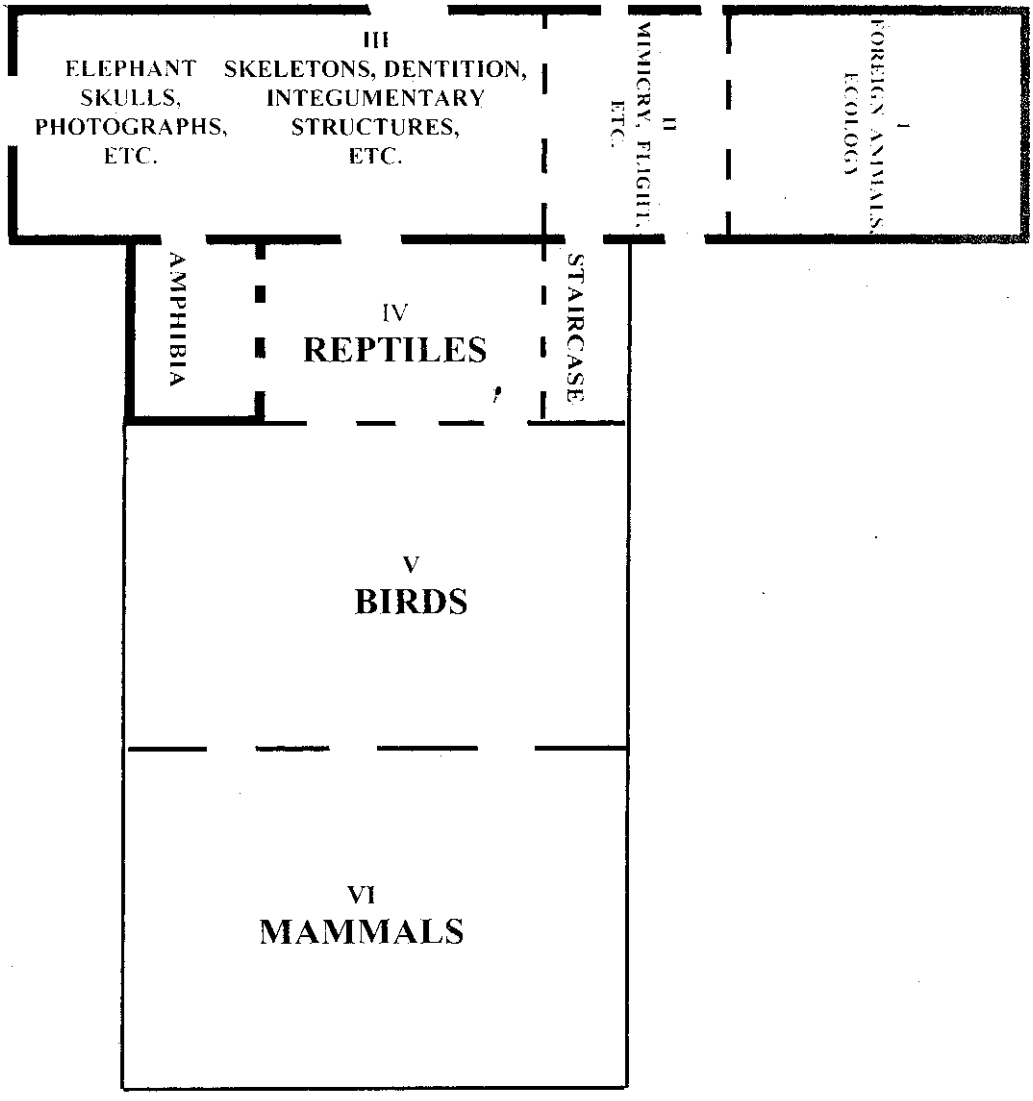
Government Museum,
Chennai - 600 008.

PREFACE

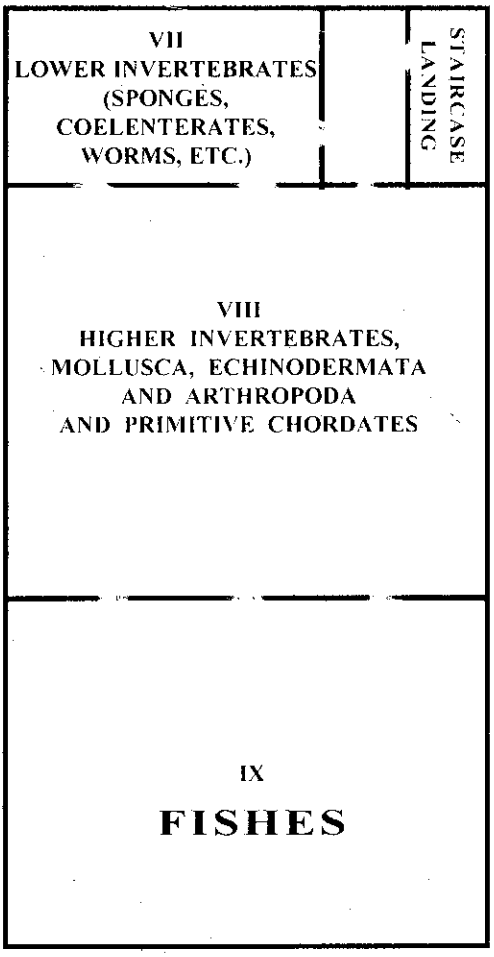
The Madras Government Museum had started acquiring Zoological specimens from 1856 onwards. At present, although our Museum is primarily devoted to specimens of South Indian fauna, it can still boast of a small representation of animals from foreign countries. Among these, the orang-utan, Tapir, Cassowary and the Kangaroo are perhaps the most outstanding ones. Apart from collection, preservation, display arrangement and interpretation of the exhibits in the galleries, a great deal of effort had been concentrated on various other fields of museum activity, such as the building up of reserve collection for faunistic surveys for research and reference purposes, the publication of the results of these researches in a valuable series of guide books and bulletins. It is believed that this guide book will meet all the needs of students and other visitors and prove useful to them.

Chennai - 8.
18.02.1999.

(S. Rangamani, I.A.S.)



PLAN OF THE ZOOLOGICAL GALLERIES (GROUND FLOOR).



PLAN OF THE ZOOLOGICAL GALLERIES (FIRST FLOOR).

GUIDE TO THE GALLERIES OF FOREIGN ANIMALS, GENERAL ZOOLOGY, SKELETAL EXHIBITS AND AMPHIBIANS.

INTRODUCTION

The Zoological Galleries of the Madras Government Museum are accommodated in nine halls of varying sizes, extending over the ground floor and first floor of the western wing of the main buildings, adjoining the Archaeological Sculpture galleries, and plans are now well under way to extend the galleries into the new building just constructed at the rear, to accommodate the increasing collections. The general plan of the existing galleries is illustrated in the accompanying sketches, the sizes of the halls indicated in these diagrams being only approximately proportional to the actual dimensions of the respective galleries. The portions of the galleries covered in the present Guide are indicated by bold border lines.

On the ground floor, the Zoological Galleries commence with a hall devoted mainly to a small selection of foreign animals and birds. They include several specimens of mammals and attractive birds with brilliantly coloured plumage from various countries such as Australia, Africa, Malaya, China and South America. A few exhibits of ecological interest, represented by small dioramas depicting indigenous reptiles and marine invertebrates in their natural haunts are also exhibited in a section in this hall.

This gallery is followed by a small section devoted to exhibits illustrating certain general biological principles such as mimicry, the significance of the various types of colouration in animals, such as protective, warning and courtship colouration, and examples of various classes of vertebrate animals which have, to a greater or less extent, been able to conquer the air, and have acquired the power of flight. In the centre of this gallery is exhibited a tree of evolution illustrating the main lines on which evolution had proceeded in the animal kingdom, beginning with the simplest creatures such as the amoeba and terminating with man at the top of the tree, representing the climax of animal evolution.

In the adjoining hall are displayed a wide range of specimens relating to General Biology and skeletal and integumentary structures of animals, which are of special interest to students. Besides the huge articulated skeleton of the Whale, which is suspended from the ceiling along the centre of this hall, there are several other mounted skeletons, the more impressive among them being those of the Indian Elephant, the horse and a human skeleton. Specimens illustrating various types of dentition in mammals, and integumentary structures of fishes, amphibians, reptiles, birds and mammals, types of feathers, beaks and feet of birds and variation in the horns of domestic animals such as the goat and the buffalo, are also exhibited in this gallery.

At the further end of this gallery, a small section is set apart for the display of exhibits and photographs relating to the Indian Elephant, including a miniature model to illustrate the method of capturing wild elephants by means of hidden trenches.

The adjoining hall is the Gallery of Reptiles. It is a comparatively small and narrow, rectangular hall, but contains a fairly complete representative series of South Indian specimens of snakes, lizards, crocodiles, turtles and tortoises arranged in systematic order and presenting a more or less comprehensive picture of South Indian Reptilian fauna.

A small section at one extreme end of this gallery is set apart for Amphibians and contains a systematic series of specimens of South Indian Coecilians, frogs and toads, including an interesting habitat group illustrating the spawning habit of the Chunam Frog, and the skeleton of the frog, both articulated and disarticulated, with its various parts named.

The large and spacious hall adjoining the Reptile Gallery is the Gallery of Birds. In this hall are exhibited a more or less complete series of birds represented in South India, arranged in the systematic order, some of them with their eggs and nests. Some of the more familiar and better known species of bird are exhibited in the form of habitat groups with painted backgrounds, illustrating particularly their nesting habits.

The large hall adjoining the Bird Gallery is the Gallery of South Indian Mammals. Mounted specimens of most of the better known species of mammals recorded from South India, representing almost every order of the Class Mammalia, are exhibited in this gallery, supplemented wherever possible, by specimens of skeletons, skulls, skins and horns of various species, and arranged in their systematic order.

The remaining galleries of the Zoological Section, containing Invertebrates, primitive Chordates and fishes are accommodated in the three halls on the first floor directly above the reptile, bird and mammal galleries and may be reached by the staircase leading from the near end of the Reptile Gallery.

The narrow hall on the first floor directly above the Reptile Gallery and immediately adjacent to the landing of the staircase contains specimens, diagrams, and photographs illustrating the lower groups of Invertebrates such as sponges, Coelenterates, including specimens of dry corals, and various species of worms, both free-living and parasitic.

The large hall adjoining the Coral Gallery on the first floor contains a varied and interesting collection of specimens of South Indian species of the higher Invertebrates, comprising the Molluscs, Echinoderms and Arthropods. Fairly extensive and complete systematic series of South Indian species of shells, starfishes, sea urchins, crabs, lobsters, prawns, centipedes, millipedes, moths, butterflies, beetles and other insects, enlarged models of insects, and species of scorpions, spiders, mites and ticks, together with a collection of economic products derived from insects are exhibited in this gallery. A small section in a corner of this gallery is devoted to the display of a few models, specimens and photographs relating to the Prochordates.

The passages at the further end of this hall lead to the gallery of fishes. It contains a fairly representative collection of South Indian species of fishes, exhibited in the systematic order. A huge mounted specimen of the Whale Shark *(Rhineodon typus)*, suspended from the ceiling and other large specimens of sharks such as the Saw-fish, Tiger sharks and Sting Rays, and the Sword fish and its skeleton, mounted on the wall are exhibits of special interest in this gallery.

In the present Guide, the exhibits displayed in the first four galleries of Zoological Section on the ground floor are described. Gallery IV, however, includes both Reptiles and Amphibians, but since reptiles have already been covered in two of the Guide books published earlier in this series, the Amphibians alone among the exhibits in Gallery IV are dealt with in the present account.

GALLERY I.

FOREIGN ANIMALS (INCLUDING HIMALAYAN SPECIES) AND SELECT DIORAMAS OF INDIGENOUS FAUNA.

In this gallery are exhibited a few interesting animals and birds from foreign countries such as Malaya, Borneo, China, Africa and Australia, as well as a series of small dioramas illustrating Indian reptiles, sea shore fauna, etc., in their natural haunts.

The Tapir *(Tapirus)* (Fig. 1) is found at the present day in only two localities in the world, widely separated from each other, namely in South and Central America, and in the Malay Peninsula, Java and Sumatra, thus affording an excellent example of discontinuous geographical distribution. It is nocturnal in habit, and frequents the most secluded places in the forests. Its food consists of vegetables. It takes readily to water, and is said to plunge and walk along the bottoms of rivers instead of swimming. The specimen exhibited is a Malayan Tapir *(Tapirus indicus)* which once lived in the Madras Zoo. A few photographs of foreign animals are also exhibited in this case.

The Raccoon *(Procyon lotor)* (Fig. 2) is a small, bear-like carnivorous mammal confined to North America. Its fingers are particularly long and flexible, and it uses its hands a great deal. The Raccoon frequents the margins of streams and hunts in shallow water beneath stones for crayfish, and it also captures fish. It has the habit of dipping its food into water. It can also climb well, making its home in trees, but descending to the streams for feeding. Raccoons are mostly nocturnal creatures and can be readily tamed, but are not altogether welcome as pets, as they have the habit of prying about everywhere.

The Anthropoid apes are represented in this gallery by a model of the bust of the Gorilla and a mounted male specimen of the Orang Utan, accompanied by an articulated skeleton of a smaller female specimen of the same species.

THE GORILLA *(Gorilla gorilla)* is the largest of the Anthropoid apes, inhabiting the dense forest tract of the Gaboon in Central Africa, particularly French Equatorial Africa and the Congo. Gorillas wander about either in family parties or in groups of up to 20 to 30 animals, normally with only one adult male. In the evening, they build a sort of a nest of branches and twigs up in treees and (or) bushes. Usually such a nest is used only for one night. Their food consists of fruits, berries, corn, sugarcane and other plants, but the young eat insects, young birds and eggs in addition. When excited, the Gorilla stands up on its hind legs, bares it's teeth and drums on its broad breast with its fists. They have been known to attack man.

THE ORANG UTAN *(Simia satyrus)* (Fig 3) lives in the dense tropical forests of Borneo and Sumatra. The male is considerably larger than the female. The great length of its arms enables the animal to swing rapidly from branch to branch. They usually live alone or in family parties. The young remain with the family until they are about ten years old when they become sexually mature. Old males develop enormous swollen folds on the cheeks. The Orang Utan spends almost the whole of its life among the branches of trees and constructs a nest on a tree on which it sleeps at night. They feed exclusively on fruits. The maximum height of the Orang, when standing erect, is about 4 feet 2 inches.

Australian animals are represented in this gallery by the Kangaroo, the Duck-billed Platypus and the Cassowary. The Kangaroo belongs to the primitive order of mammals, the Marsupialia, which includes animals in which the females carry their young in a pouch

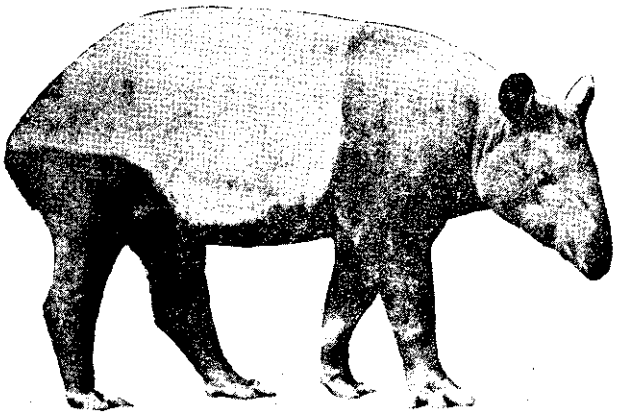


Fig.1. TAPIRUS INDICUS : THE MALAYAN TAPIR

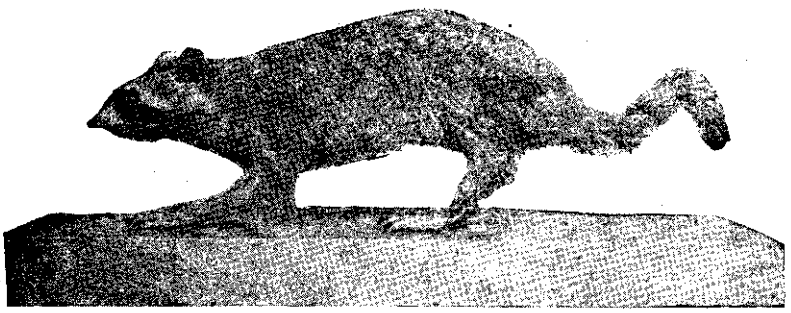


Fig.2. PROCYON LOTOR : THE RACCOON

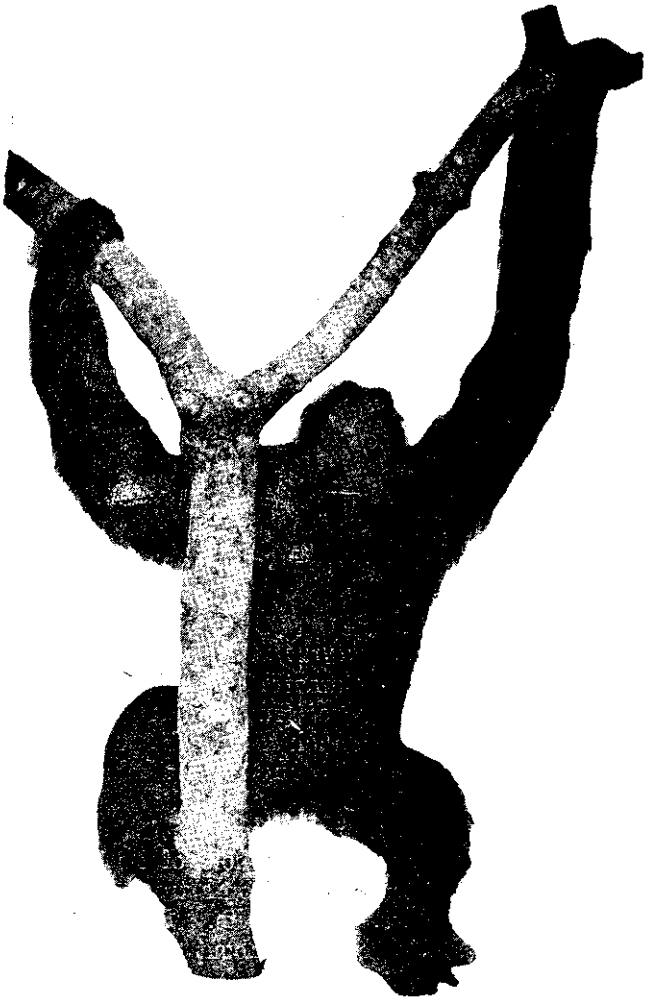


Fig.3. SIMIA SATYRUS : THE ORANG UTAN

during the earlier stages of their growth. A large male specimen of the Kangaroo (Fig. 4) the skin of which was obtained from the South Australian Museum on exchange basis, is exhibited. Its forelimbs are extremely short and are of no use to it in walking. Its hind limbs are disproportionately long and with these it is able to hop seven or eight feet at a time. kangaroos are purely vegetarian, feeding on fruits, berries, etc. The young are born in an imperfect condition, being small, naked and helpless. They attach themselves to one of the teats in the mother's pouch and undergo their development until they are large enough to fend for themselves.

THE DUCK-BILLED PLATYPUS *(Ornithorhynchus)* (Fig. 5) is a curious aquatic mammal inhabiting the Australian Region. It belongs to the most primitive among the existing orders of Mammals-the Monotremata. They are the only mammals that lay eggs. which are large-yolked and develop after the manner of the egg of a reptile. The Duck-billed Platypus is an aquatic mammal confined to the southern and eastern parts of Australia and to Tasmania. The animal excavates a burrow for itself in the bank of the slow streams which it frequents. It feeds on animal food, chiefly grubs, worms, snails and mussels. The food is stored at first in its cheek pouches, to be chewed and swallowed at leisure. It can dive very well, and possesses an acute sense of sight and hearing.

THE CASSOWARY *(Casuarius)* (Fig. 6) is a large flightless bird confined to the Australian Region, inhabiting densely wooded country. They are shy and retiring in their disposition, being extremely wary and running to cover at the least sign of danger. They generally keep to shady spots, emerging from cover only in the morning and evening and feeding chiefly on fallen fruits, berries and sometimes also on insects and crustaceans. The Cassowary can run with amazing speed leaping over obstacles as much as six feet high. In captivity they are almost omnivorous and become extemely tame. Old males become very fierce when cornered, kicking and striking with their beaks. Their plumage is used for making mats, rugs, head-ornaments, etc.

Apart from the bust of Gorilla mentioned earlier a few specimens relating to, or representative of,African fauna are exhibited in this gallery. These consist of a large front horn of the African Rhinoceros (Rhinoceros bicornis), the skull of the Hippopotamus (Hippopotamus amphibius), the skull and hoofs of the Giraffa (Giraffa camalopardis), the Ostrich (Struthio camelus) and the Great Bustard (Otis tarda) which, how-ever, is not confined only to Africa, but has a much wider distribution.

THE AFRICAN BLACK RHINOCEROS *(Rhinoceros bicornis)* is a large, heavily built animal with a thick, armour-like skin which is thrown into folds. It bears two powerful horns on the fore part of the head, the front one being much larger and curved backwards. The horns consist of an agglomeration of hair-like structures and are fixed upon a roughened patch of bone. The horn of the Rhinoceros is believed to possess medical and magical properties, and pieces of its are sometimes used as charms. It is even believed that a cup made out of rhino horn will split into two if poisoned wine is poured into it. The upper lip of the African Black Rhinoceros is prehensile, and projects beyond the lower, being thus adapted to feed principally upon the branches of trees. The specimen exhibited here is the front horn of the Black Rhinoceros. The position occupied by the hind horn, however, is indicated by a large, circular depression behind the front horn.

THE HIPPOPOTAMUS *(Hippopotamus amphibius)*, the massive skull of which is exhibited in an adjoining case, is a large, powerfully built, thick-skinned and enormously heavy animal at present confined to the African continent. The males may weigh two or three tons, but the females are comparatively lighter. The strong incisors and canines

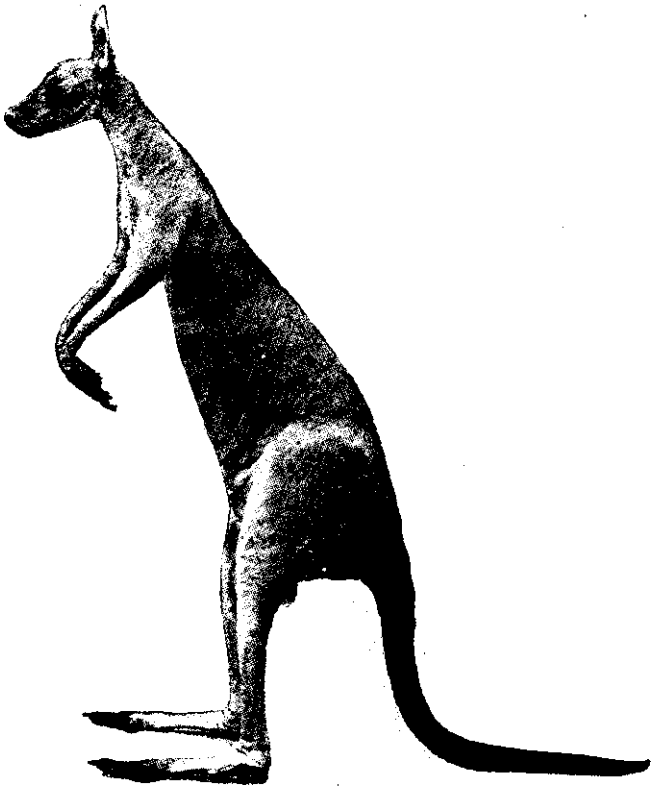


Fig.4. MACROPUS GIGANTEUS : THE KANGAROO

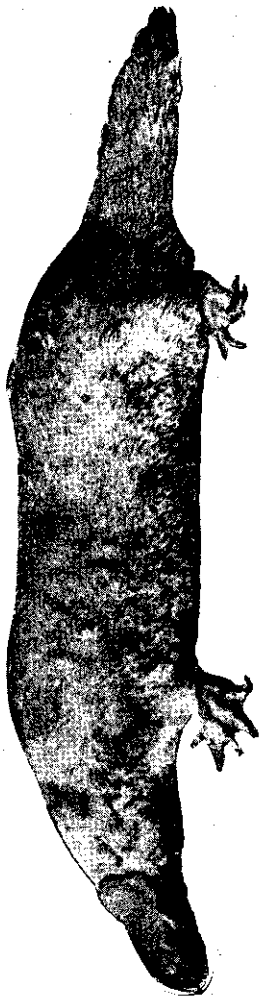


Fig.5. ORN THORHYNCHUS SP. : THE DUCK-BILLED PLATYPUS

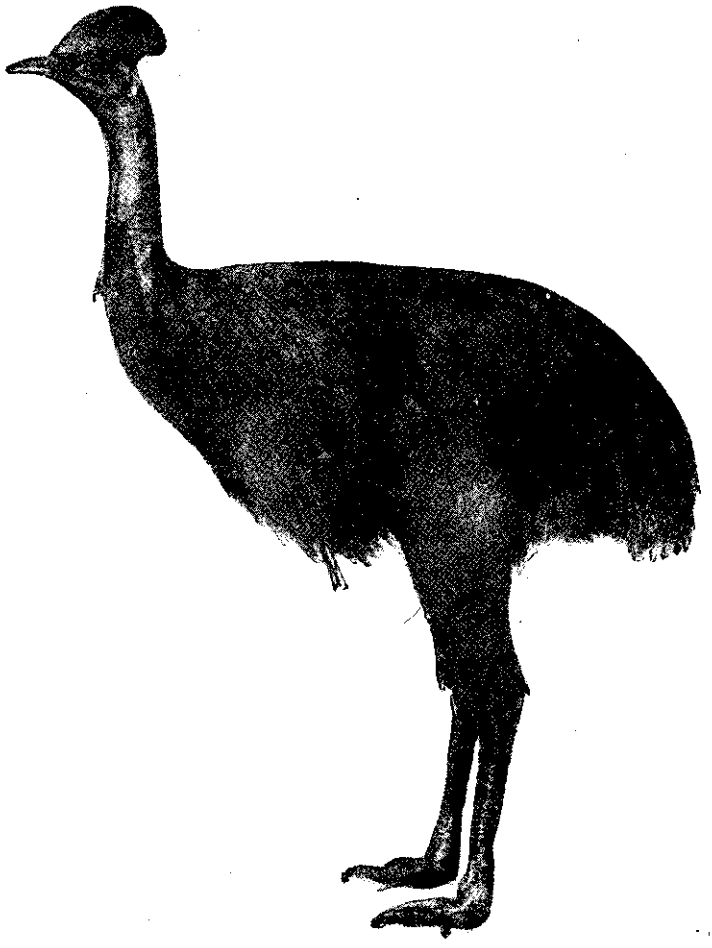


Fig.6. CASUARIUS SP : THE CASSOWARY

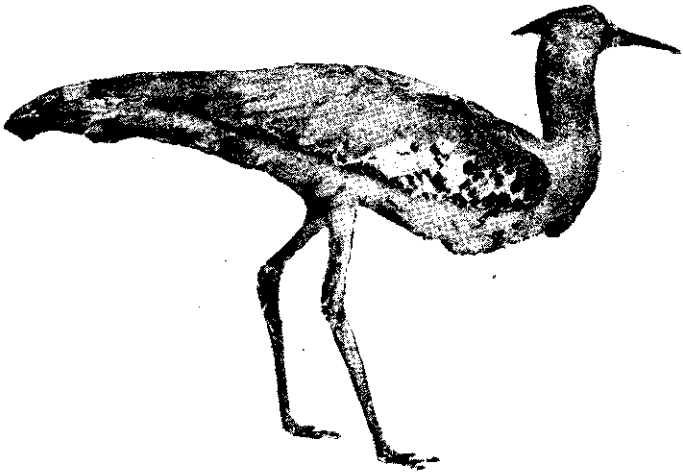


Fig.7. OTIS TARDA : THE GREAT BUSTARD

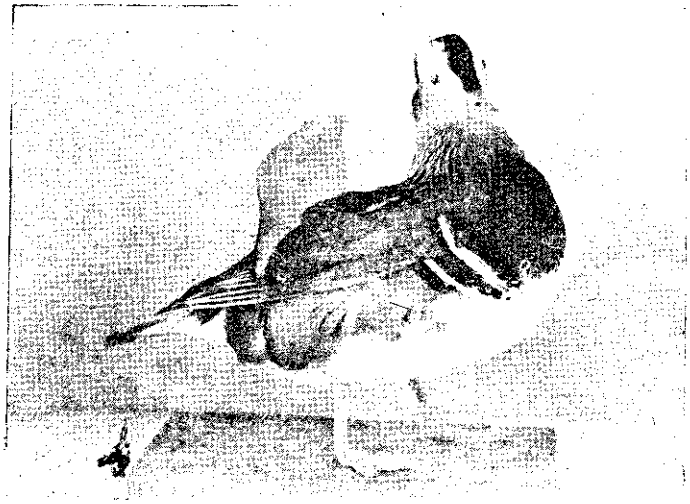


Fig. 8. AEX GALERICULATA : THE MANDARIN DUCK

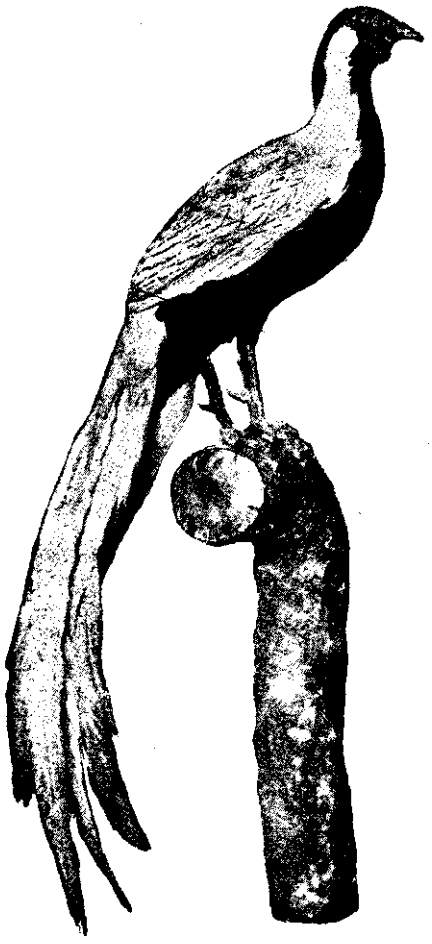


Fig.9. GENNAEUS NYCTHEMERU : THE SILVER KALLEGE PHEASANT

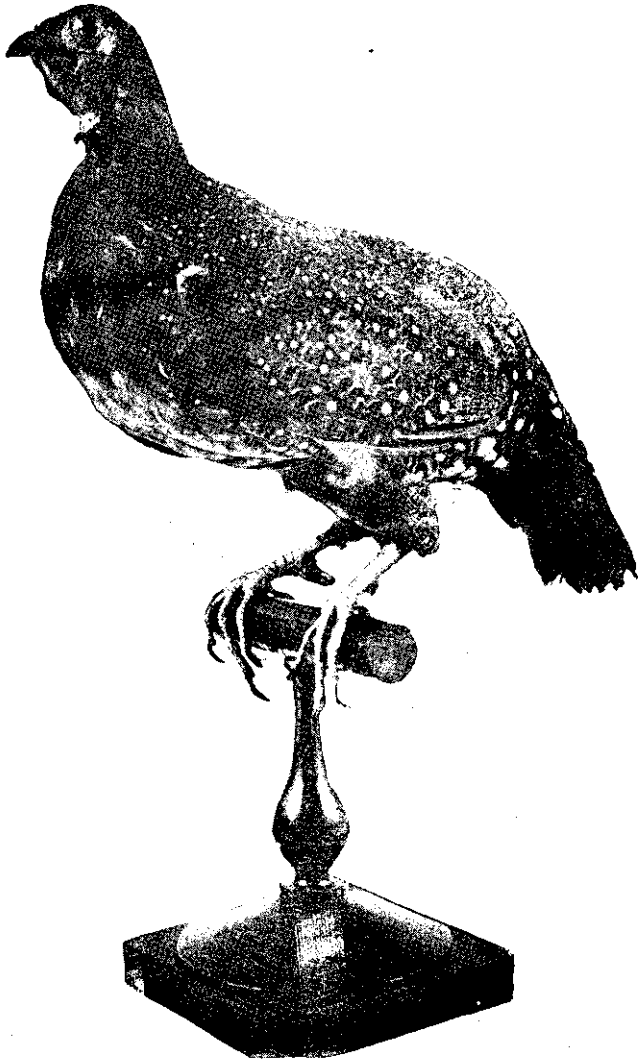


Fig.10. TRAGOPAN BLYTHI BLYTHI : THE GREY-BELLIED TRAGOPAN.

continue to grow throughout life, and enable the animal to dig up the plants growing on the banks of rivers. The animal grows to an incredible length of about fourteen feet. The limbs and tail are short. It is mostly aquatic in its habits, and when it reaches the surface of the water after prolonged immersion, it sponts like a whale. It is often a dangerous animal to encounter, as it will capsize boats and even attack human beings. The Hippopotamus not only swims but can walk along the bottom of a river with great rapidity. A curious fact about the Hippopotamus is that it produces at times a "bloody sweat" a carmine coloured secretion containing crystals, but of course, it has nothing to do with blood.

THE GIRAFFE *(Giraffa camelopardis)* is represented in this gallery by its skull and hoofs, accompanied by a photograph of the animal. Giraffes are restricted to Africa, where they are found only South of the Sahara. They are the tallest of all mammals attaining a total height of about nineteen feet. The front legs are the longest of the limbs, the front part of the body is extraordinarily high and strongly built, and the neck is greatly elongated. Giraffes generally go about in small herds and are often seen in company with zebras, antelopes and ostriches. They feed mainly on the leaves of acacia trees. Giraffes are supposed to be voiceless, but in fact they do occasionally make a feeble bleating noise.

THE GREAT BUSTARD *(Otis tarda)* (Fig. 7) is a widely distributed species, ranging over South and Central Europe, and thence to North Africa and inhabiting also Central Asia to North West India. It is partly migratory and is an occasional visitor to Britain. It is typically an inland bird, frequenting dry grassy and sandy plains or cultivated ground where the crops are low. The Great Bustard rises from the ground slowly, but once on the wing, its flight is prolonged and often rapid. It stalks about rapidly and runs with ease, being shy, wary and keen-sighted. It is omnivorous, feeding on young corn, plantains, berries and seeds as well as insects and their larvae, molluscs, myriapods, frogs or even small reptiles and mammals. The eggs are deposited in an excavation in the soil.

THE OSTRICH *(Struthio camelus)* is a heavy flightless bird found in the dry regions of Africa. Ostriches are known to be the largest of existing birds. They attain a height of about eight feet. They can run at a surprisingly great speed which may exceed even that of a gallopping horse. They are usually seen in groups in deserts and other areas in company with zebras and antelopes. Their food consists chiefly of herbage, including seeds and fruits. They can exist for a long time without water. The specimen exhibited died in the Madras Zoo a few years ago.

A few specimens of birds of bright plumage, mostly from foreign countries and from the Himalayan Region are also exhibited in this gallery.

THE MANDARIN DUCK *(Aex galericulata)* (Fig. 8) is purely an Eastern Asiatic Duck, being distributed throughout Central and Southern China, Formosa and Japan. This beautiful duck is better known in a captive than in a wild state. It keeps to small streams, especially such as those that run through forests. It is usually found in small flocks, seldom exceeding a dozen, and very often less. It is a stout, sturdy little duck, being able to move equally well on water, land and in the air. Its flight is strong and direct, though much slower than that of the Common Teal. They are very shy in the wild state. In China, a pair of these ducks are frequently placed in a gaily decorated cage, and carried in marriage processions and are afterwards presented to the bride and Bridegroom.

THE SILVER KALLEGE PHEASANT OF SOUTH CHINA *(Gennaeus nycthemerus)* (Fig. 9) is another bird of bright plumage exhibited in this gallery. Its plumage is ornamented as a badge on mandarin's dresses. It is remarkable for its extremely long

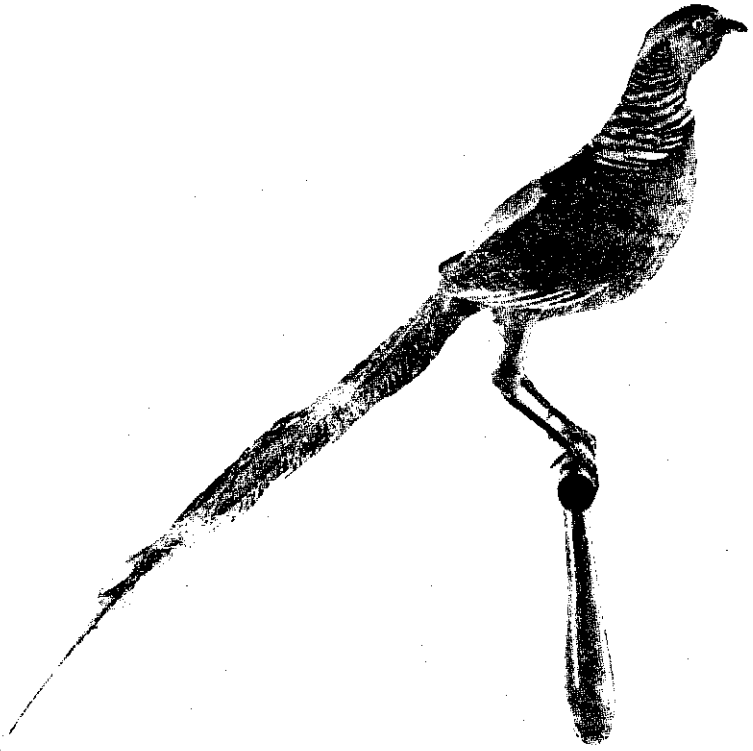


Fig.11. CHRYSOLOPHUS PICTUS : THE GOLDEN PHEASANT

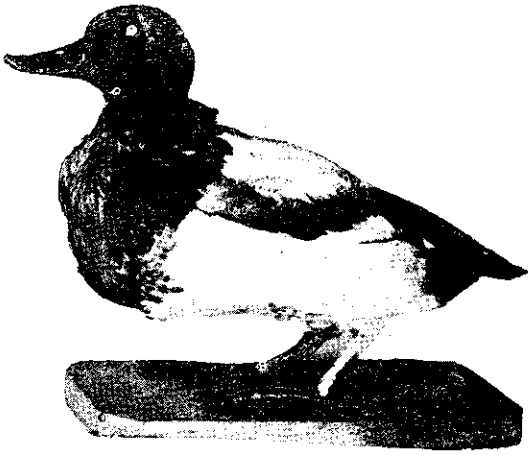


Fig.12. NYROCA MARILA : THE SCAUP DUCK.

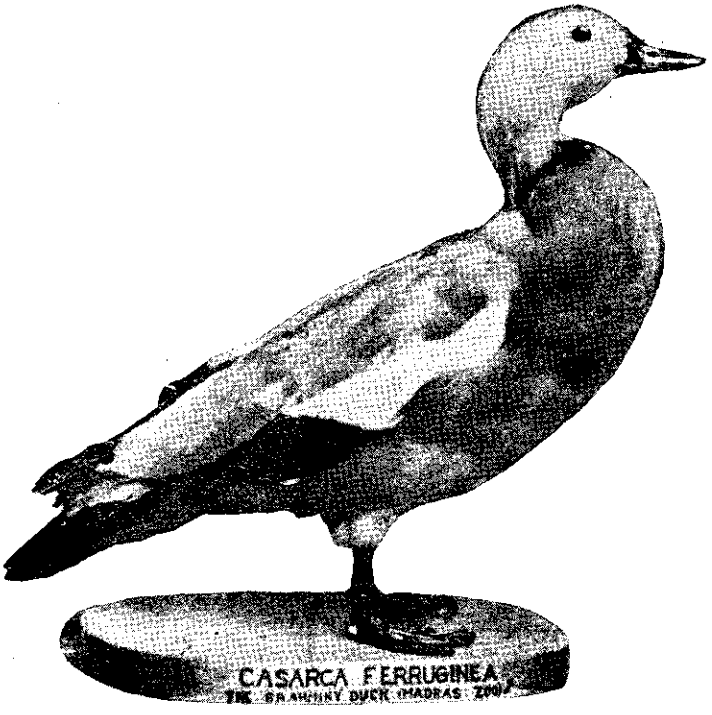


Fig.13. CASARCA FERRUGINEA : THE BRAHMINY DUCK OR RUDDY SHELDRAKE.

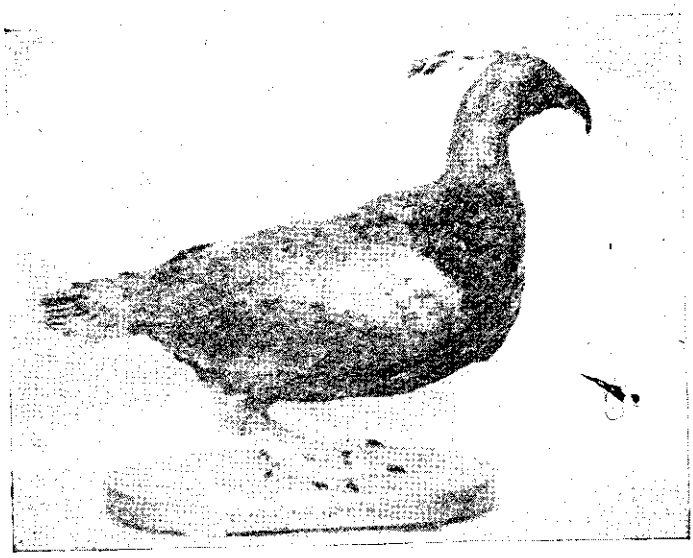


Fig.14. LOPHOPHORUS IMPEJANUS : THE MONAL OR JMPEYAN PHEASANT (MALE).

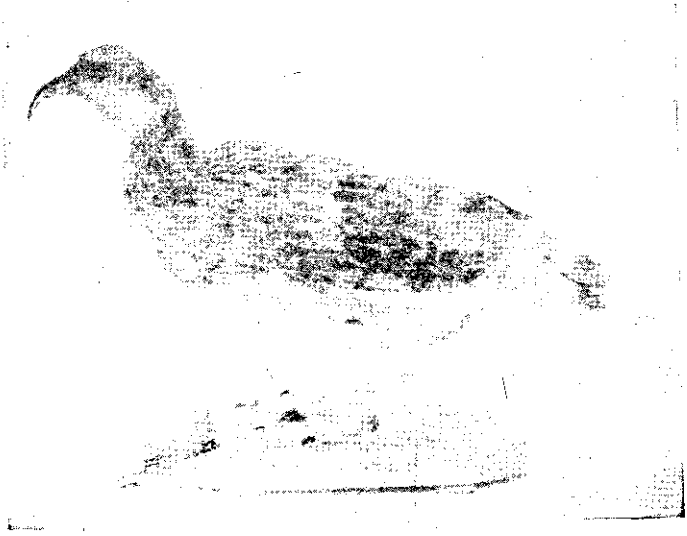


Fig.15. LOPHOPHORUS IMPEJANUS : THE MONAL OR IMPEYAN PHEASANT (FEMALE).

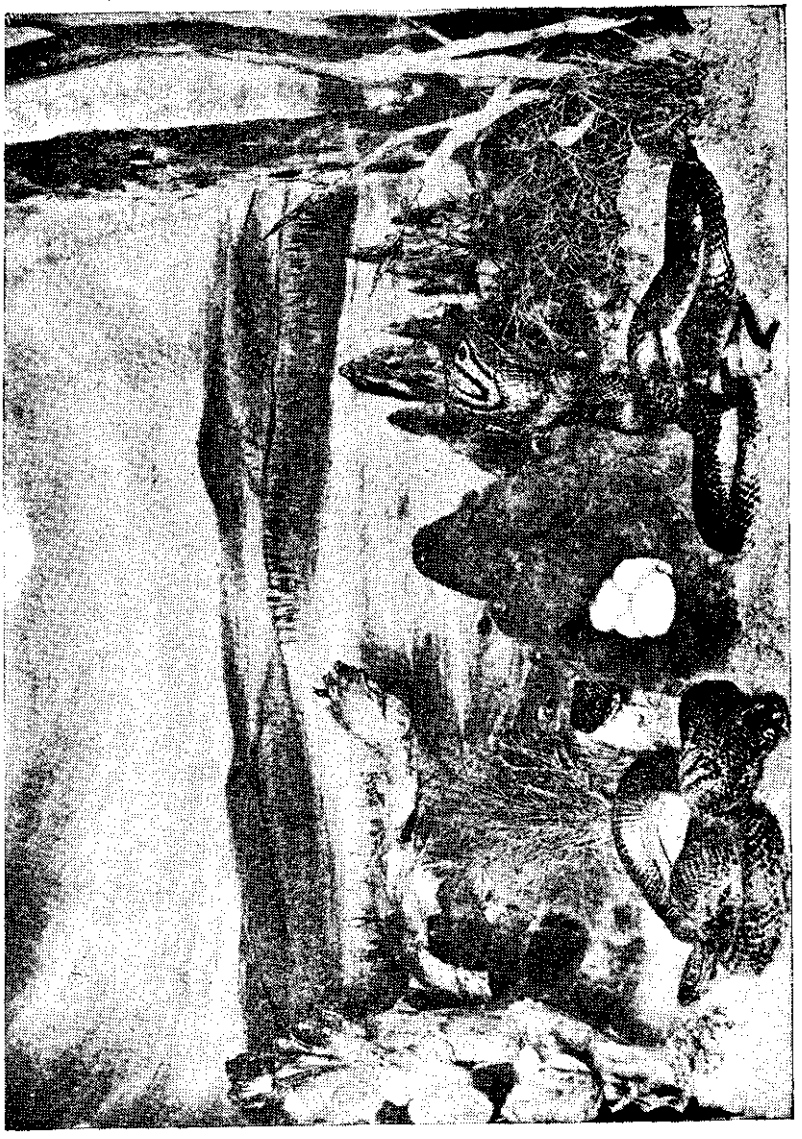


Fig.16. DIORAMA OF THE COBRA, NAJA NAJA WITH EGGS IN TERMITE'S NEST.

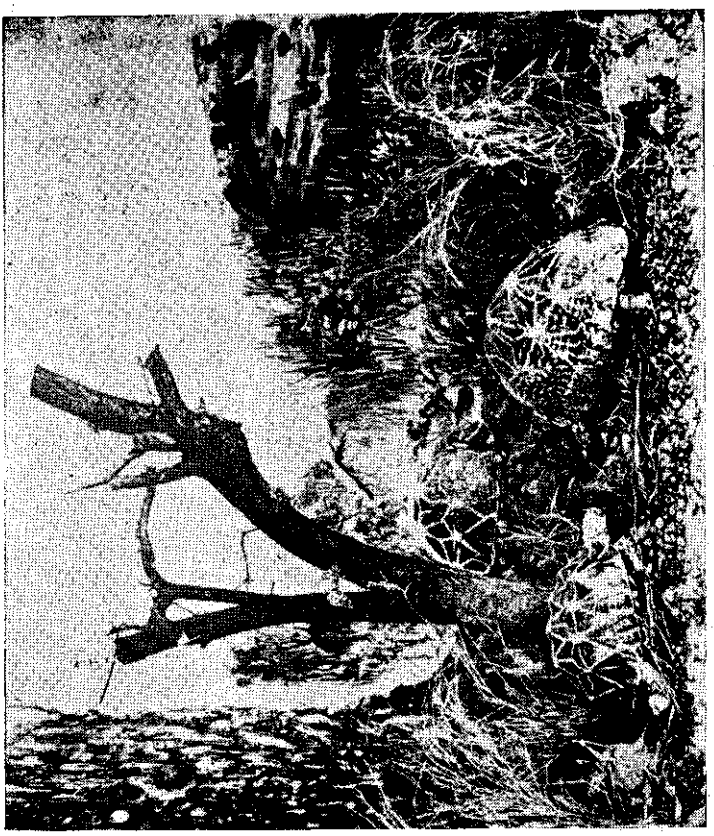


Fig.17. DIORAMA OF THE STARRED TORTOISE : TESTUDO ELEGANS.

white tail, beautifully ornamented with oblique black streaks on the feathers at the sides. and its purplish black crown, crest and lower surface. The Kallege Pheasants frequent thin forests in low valleys, and are only slightly gregarious. They perch on trees and fly short distances when flushed. The pugnacious male is said to strut with outspread tail and to drum with his wings while courting.

THE GREY-BELLIED TRAGOPAN *(Tragopan blythi blythi)* (Fig. 10) popularly known as the Horned Pheasant, is distributed through-out the Indo-Chinese mountains from Kashmir to China. The males are magnificent birds. The Grey-bellied Tragopan is found principally between 6,000 and 9,000 feet in dense evergreen forest in the Himalayas, South of the Brahmaputra, and in the hills of Assam and North-west Burma. It feeds on seeds, berries, fruits and buds and also on insects and worms, In the breeding season the cock displays his inflated horn-like wattles to the hen.

THE GOLDEN PHEASANT *(Chrysolophus pictus)* (Fig. 11) is an attractive bird, with brilliant plumage, inhabiting the wooded mountains in South and West China and East Tibet. It has been introduced into various parts of the United States of America, Canada and Europe. It feeds on grains, seeds, shoots and insects and can fly and run with considerable speed. It lays about a dozen olive brown eggs in a nest built on the ground.

Among the latest acquisitions to this gallery is a pair of Amherst Pheasants *(Ghrysolophus amherstiae)*. These beautiful pheasants inhabit hill forests at elevations ranging from 7,000 to 12,000 feet. The male is larger than the famale, and bears a brilliantly coloured plumage. They are generally noisy and pugnacious. They feed mainly on bamboo shoots, but they also eat seeds of various kinds, roots and insects. The distribution of the Amherst Pheasants ranges over the mountains of Western China, Eastern and South Eastern Tibet, Yunnan, North Shan States and the Kachin Hills in upper Burma

THE SCAUP DUCK *(Nyroca marila)* (Fig. 12) is a bird of very northern latitudes, breeding in the extreme north of Europe and America. In winter it migrates southwards to the Mediterranean, Southern Russia, Central Asia, and as far south as Northern India, South China, Japan and Formosa. It is only a very rare winter visitor to Northern India, where it has been recorded from Kashmir, Kulu and Nepal in the Himalayas, in Karachi and in the plains of India as far south as Bombay. They are more commonly met with on the sea-coast than inland, but when they are found inland, they generally keep to great lakes, such as Lake Baikal, Lake Balkast and the Sea of Urial. They spend most of their time diving for food or resting asleep on the surface of the water and seldom take to land or air, except when they are faced with danger. The specimen exhbited is a male, presented by Mrs. S.D. Inglis, and was procured in Scotland.

THE BRAHMINY DUCK OF RUDDY SHELDRAKE. *(Casarca ferruginea)* (Fig. 13) is one of the most attractive of our winter-visiting ducks. In summer it is found in Spain, and almost in all Northern European countries, as well as throughout Southern Europe and Northern Africa. In winter it migrates to the plainds of India, North Burma, South China, Japan and Formosa, Although it is only a winter visitor to India, it is one of the few ducks that actually breeds within Indian limits in the Himalayas, above an altitude of 10,000 feet.

THE MONAL OR IMPEYAN PHEASANT *(Lophophorus impejanus)* (Figs. 14 and 15) is essentially a bird of high elevations, being generally found between 10,000 and 14,000 feet in summer in thick bush jungle. In recent years, their numbers have greatly decreased, as they have been hunted extensively for their bright plumage which is commercially valuable. During the winter, they are more or less gregarious. The Monal is

rather came and confiding, wherever it is most common, but shy and wary where it is most rare. It is more or less omnivorous, feeding on grubs maggots, roots, leaves and young shoots. The distribution of the Monal ranges over Afghanistan, Chitral and Western Himalayas,. through Kashmir, Gharwal, Nepal, Sikkim, Bhutan, South Tibet and Mishmi Hills. The male is remarkable for its gorgeous plumage.

THE MACAWS OF CENTRAL AND SOUTH AMERICA *(Ara. Spp.)* are large gorgeously coloured parrots with rich yellow and green wing coverts. They are perhaps the most gaudily coloured members of the parrot family. The fight of Macaws is powerful anul their note is harsh and screaming. They crush and eat hard nuts of various kinds, and in common with other parrots, they habitually manipulate their food with their claws, these being of great assistance while feeding. Two specimens of Macaws, belonging to two different species are exhibited.

SELECT ECOLOGICAL EXHIBITS OF INDIGENOUS FAUNA.

Four small dioramas illustrating selected specimens of SouthIndian reptiles and the typical littoral fauna of a coral reef in South Indian set in their natural surroundings are also exhibited in the front part of this gallery .

1. **THE COBRA** *(Naja naja)* (Fig. 16). -The cobra is perhaps the best known among the poisonous snakes of India and is readily distinguished by the characteristic spectacle mark on its hood. Like most snakes, the Cobra is oviparous, laying about ten to twenty eggs in some natural hole in the earth ; they generally take advantage of termites' nests for laying their eggs ; hence Cobras are often common around ant hills. Pairing takes place in January and February, and the eggs are usually laid in May. From the time of pairing until the young are born, the pair remain together, and the male also takes a share in guarding the eggs. Incubation takes about two to three months. The young ones are active and vicious in their disposition, and grow rapidly during their first year. This diorama is intended to illustrate mainly the breeding habits of the Cobra.

2. **THE RUSSELL'S VIPER** *(Vipera russellii)* - Unlike the Cobra and most other snakes, the Russell's Viper is viviparous, bringing forth its young ones alive, although there have been several records of eggs being laid, the young within the eggs being in an advanced stage of development. Mating takes place in the early part of the year and the young are mostly born in June or July, the period of gestation being about six months. The Russell's Viper is a most prolific snake, bringing forth from about twenty to nearly sixty-three young at a time. The newly born specimens vary in length from 8 ½ to 11 inches. The Russell's Viper is another extremely posionous snake of India and is met with almost anywhere, but prefers open country. Its main food consists of small mammals, but it also feeds on lizards, birds and frogs.

3. **THE STARRED, TORTOISE** *(Testudo elegans)* (Fig. 17). - This elegant species is distributed throughout Central and Southern India, and is a common species of land tortoise found over the greater part of the Madras State. It abounds on islands and in localities with brackish water. Their colour and markings harmonize with their surroundings so closely that it is difficult to distinguish them in their natural haunts. During the heat of the day they remain hiding beneath shrubs and tufts of grasses. In the rainy season, they wander about all day feeding and mating. As winter draws near, they select a sheltered spot and remain the concealment under some thick tuft of grass, or bushes. The female digs a pit and buries her eggs in the earth covering them up with wet mud. They feed on grass and herbs, and drink freely.

4. **FAUNA OF A CORAL REEF**. - This small diorama represents some of the more common littoral invertebrate animals such as cowries, whelks, chitons, sea-urchins, starfishes and marine crabs that are generally met with in association with stones and rocks on a dead coral reef, in the inter-tidal zone, as they would appear when they are exposed to the air during the low tide. The species of marine animals represented in this group are those that are commonly found associated with coral reefs in and around Krusadai and Shingle Island near Pamban in the Gulf of Manaar, and are typical of South Indian littoral fauna. The animals living in this zone are built to withstand the most rigorous conditions as they have to hear the battering of the waves, and at other times, should be able to stand drying for considerable periods when the tide recedes, subjecting them to continued exposure. It has been said that the inter-tidal zone is a testing ground for animals in the process of evolution, as they are exposed to the most exacting conditions which they have to withstand, if they are to survive in their struggle for existence.

GALLERY II.

In this gallery, adjoining the preceding one, two series of exhibits, one illustrating the various uses of colouration in animals and the other, the development of the power of flight in the various classes of vertebrate animals, are displayed. In the centre of this gallery, the process of evolution in the animals kingdom is graphically illustrated by an attractive and fully labelled "Tree of Evolution". Accordingly, the exhibits in this gallery may be conveniently grouped into three parts as follows :

PART I-COLOURATION AND MIMICRY AMONG ANIMALS.

Colour is as important to an animal in its struggle for survival as is any of its other characteristics. The many animals, it is advantageous to be as inconspicuous as possible, either characteristics. To many animals, it is advantageous to be as inconspicuous as possible, either in order to escape the notice of enemies that prey upon them or to be able to approach their own prey without being noticed, or both. To others, such as certain bugs and butterflies which are protected by an unpleasant smell or taste, and wasps which are protected by a powerful sting, it is advantageous to be distinguished by conspicuous distinctive colours. Some harmless and palatable forms obtain protection, moreover, by their resembalance in colour and shape to others which are dangerous or disagreeable, which it has thus become their nature to mimic. And others have conspicuous spots or marking so placed as to distract the attack of an enemy from vital parts to less important ones, the "eye-spots" on the wings of certain butterflies and moths being probably the best known examples.

The series of small wall cases on the side adjacent to the Gallery of Foreign animals are intended to illustrate the various types of colouration among animals.

1. **DISTRACTING COLOURATION** (Papilio polymenstor). - The first of these cases, at the extreme left end of the series, contains a pair of brightly coloured swallow-tail butterflies (Papilio polymenstor). This large and handsome butterfly may often be found with pieces nipped out of the margin of its hind wings. As the butterfly flies over bushes, sipping honey from flowers, the predominating pale blue colour makes the hind wings more conspicuous than the black body and predominantly black forewings ; and from the damage done to the hind wings it is evident that they are the parts of the insect most commonly attacked by its enemies whose attention is distracted from more vulnerable parts by their more conspicuous colour.

II. **CONCEALING COLOURATION**. - The majority of animls are darker above than below, for, as most light normally falls on the upper part, the lower part would be conspicuously dark by contrast if the shadow in which it is normally seen were not compensated by a relatively pale colour.

Many animals bear a more or less close, often a detailed resemblance to the background against which they rest.

Leaf-eating insects are often green in colour, usually with stripes or other markings to break the uniformity, thereby heightening the resemblance to their sorroundings, and insects and spiders which habitually live on the trunks of trees are usually of a mottled brown colour as to match almost perfectly with the colour of the tree.

The exhibits in the next four wall cases are typical examples of concealing colouration. the insects being mounted in such a way as to bring out their similarity to their surroundings to the best advantage.

1. **THE LONG-HORNED GRASSHOPPER** *(Sathrophyllia rugosa)*. - Most long-horned grasshoppers live among leaves and are green or brownish in colour. The one exhibited, habitually rests on the trunks of trees and is mottled dark brown like their bark.

2. **THE LEAF INSECT** *(Pulchriphyllium cruiforlium)* - The leaf insect is green in colour to match the leaves on which it feeds, and has its body and legs flattened, and its wings strongly veined in the same way as a leaf. The males of the Leaf Insect are totally different from the females, and their wings do not have any leaf-like appearance. Even in the females it is the forewings that are expanded, flattened and veined like a leaf, while the hind wings are reduced to a minute process. It is said that before death, the leaf insect passes through the different hues of a decaying leaf.

3. **THE STICK INSECT** *(Lonchodes sp.)* - The stick insect is closely allied to the Leaf Insect, and belongs to the same family as the latter (Phasmidae). it is usually brown or green and has its body and legs enlongated so as to resemble twigs. The wings are generally reduced or absent in Stick Insects. When the insect is resting among the branches and twigs of plants, its remarkably long legs and body harmonize so perfectly with its surroundings that it is almost impossible to distinguish its presence.

4. **THE DEAD LEAF BUTTERFLY** *(Kalliima inachus)*. - This is an instance where an insect shows conspicuous colouration when it is active, but instantly disappears on coming to rest. The dead leaf butterfly is brightly coloured above, but the under side resembles a dead leaf. Though conspicuous when flying, it disappears as if by magic when it settles on the ground among the dead leaves, where it usually runs a short distance before coming to rest.

III. **MIMICRY**. - A considerable number of animals, especially insects and spiders, derive protection from enemies which prey upon them, by bearing a resemblance to distasteful or otherwise disagreeable animals to which they are often in no way related. This phenomenon is known as Mimicry. Two kinds of mimicry are recognized, namely Batesian and Mullerian. In Batesian mimicry, the mimic is a species much appreciated as food but avoided by enemies which mistake it for its disagreeable model. In Mulleriann mimicry, both mimic and model are disagreeable.

1. **MIMICRY IN BUTTRFLIES**. - In many species of butterflies which mimic (including both those shown in the wall case), the mimicry is confined to one sex only, that being always the female.

In Papilio polytes, the male is black with a bank of white patches on the hind wings. Some females are of the same colour, but others mimic the black and red Polydorus aristolochiae (Byasaaristolochiae).

In Hypolimnas missipus, the male resembles its allies of the same genus, being black and white, with a purple sheen. But the female is reddish brown, with entirely different white markings, mimicking the common Danais chrysippus.

2. **MIMICRY AMONG SPIDERS**. - Many spiders of the family Attidae, and some of other families such as Clubionidae and Thomisidae closely resemble certain species of ants among which they live the first pair of legs being raised to resemble antennae. The mimicry is close especially in attitude and movement.

Ants are protected by powerful jaws, painful stings and irrigating odours and are therefore seldom attacked. Spiders, on the other hand, are extensively hunted and killed, particularly by certain wasps. Ant-mimicking spiders, therefore, derive considerable protection from their mimicry. In many cases also these spiders hunt and devour stray individuals of the ants they mimic, and thus find a plentiful food supply always ready at hand. A few spiders mimic wingless wasps of the family Mutillidae.

IV. **WARNING COLOURATION**. - Many insects which are poisonous, distasteful or otherwise disagreeable, advertise the fact by their bright colours and colour patterns which make them conspicuous. This is known as warning colouration ; it provides a means of escape, and at the same time warns other animals that are likely to prey upon them. A sclection of such brightly coloured insects is exhibited in the small wall case adjoining the case illustrating mimicry in spiders.

V. **COURTSHIP COLOURATION**. - In the next wall case, which is the last in this series, are exhibited a pair of the Common Garden Lizard of South India, Calotes versicolor, which affords a familiar example of Courtship Colouration. Normlly, both sexes are of a dull brownish colour, but during the breeding season, the male often assumes a more yellowish colour with some black about the neck and legs and with a brilliant red throat, which accounts for the misleading name "Blood-sucker" by which this lizard is most generally known. The intensity of the colour varies greatly even in a single individual at different times and also with the locality. In Madras, even the female sometimes assumes such colours to a certain extent, but they are most markedly devloped in the male.

PART II - FLIGHT AMONG ANIMALS

Occupying almost the entire remaining wall space in this gallery are a series of exhibits, commencing with a large specimen of the White-backed Vulture with outstretched wings, illustrating the varying degrees to which the power of flight has developed in the various classes of vertebrate animals. There is also a small wall case containing diagrams illustrating the development of flight in invertebrates.

Some anlmals, such as the so called Flying Squirrel and Flying Lizard, though they cannot propel themselves through the air, have special membranes which facilitate gliding by acting as supports. Others, such as birds and butterflies, have wings which not only support the body in the air, but also propel it.

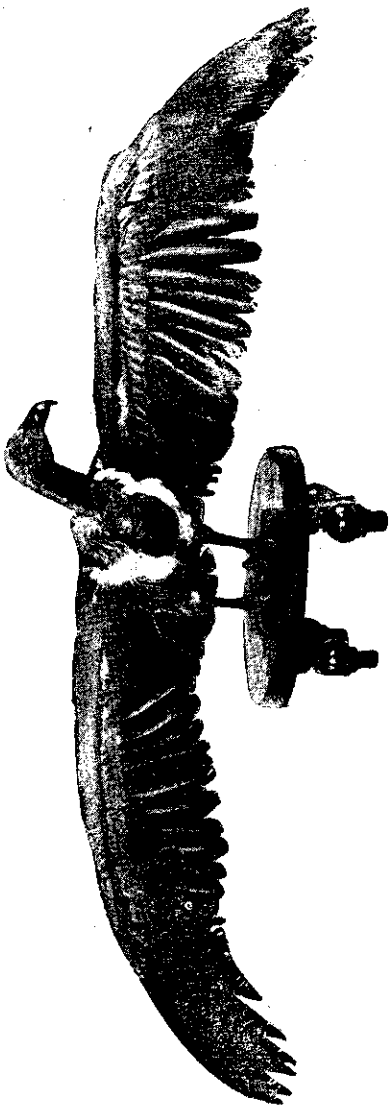


Fig. 18. THE WHITE-BACKED VULTURE SHOWING THE EXPANSE OF ITS WINGS.

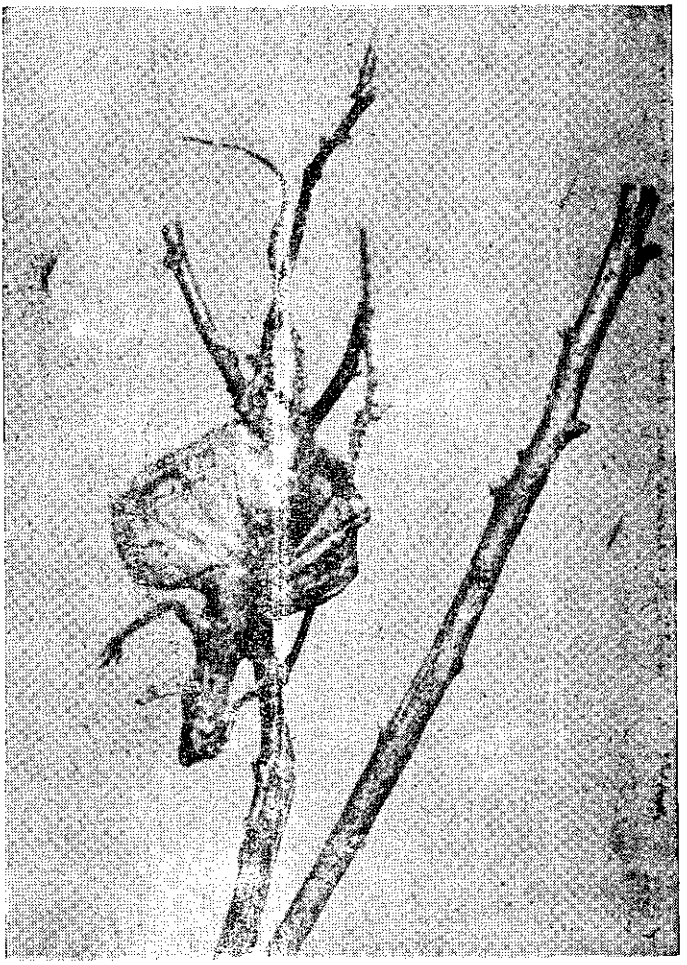


Fig.19. THE FLYING LIZARD.

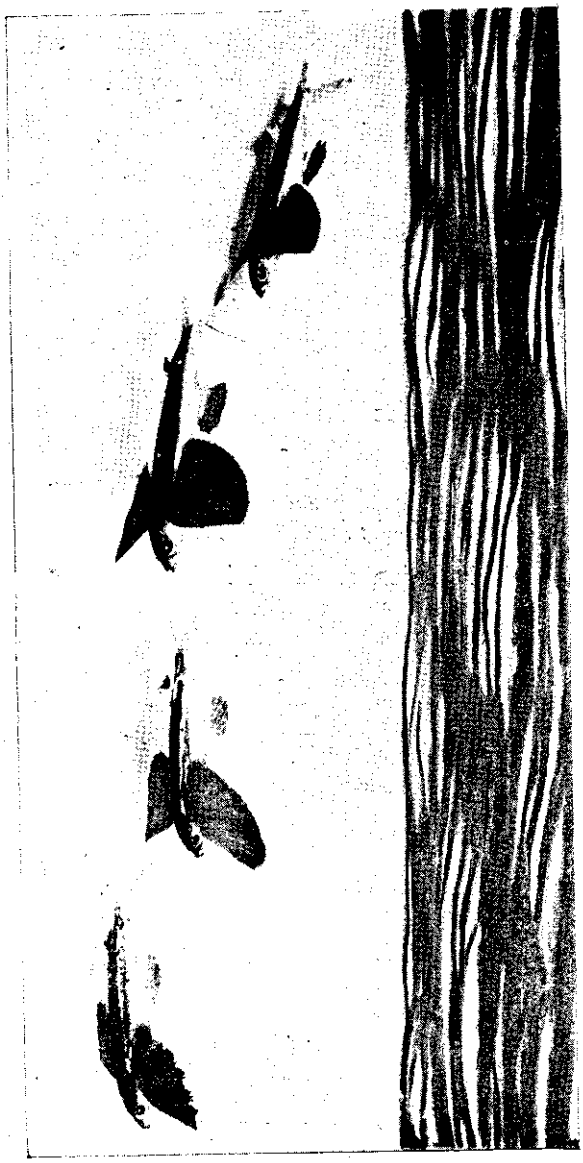


Fig.20. THE FLYING FISH

As these powers have been acquired by different groups of animals independenty, it is not surprising to find that the organs developed for the purpose differ in different groups. Thus among the animals that glide, the Flying Fish is supported by its paired fins (especially the pectorals), the Flying Frog by membranes between the toes, the Flying Snake by the concave expanded under surface of the body and the Flying Lizard and Flying Squirrel by membrances on either side of the body, those of the former being supported by extensions of the ribs and those of the latter between the front and hind limbs.

Among animals that have acquired the power of true flight, insects have two pairs of wings, while vertebrates have only one pair of wings, these being formed from the front limbs. In bats the wing membrane is stretched between the arm bones and the greatly elongated bones of the second, third, fourth and fifth fingers and extends along the body to include the hind legs and the tail. In Pterodactyles, an extinct group of flying reptiles, the wing membrane is supported by the bones of the front and hind limbs and the immense fifth finger, the other fingers being free. In birds no such membrane is present, the organs of fight being the wings formed of the layer of feathers attached to the bones of the fore-limb.

I. **FLIGHT AMONG INVERTEBRATES**. - A small wall case besides the Vulture contains diagrams illustrating flight among invertebrates. Insects are the only invertebrate animals that have acquired the power of true flight. Two pairs of wings are normally present, of which the front pair is often thickened and only the membranous hind wings are used in flight, as in beetles.

Spiders exhibit a sort of passive flight known as "ballooning" most newly hatched spiders resort to this habit which ensures their dispersal far and wide. The young spider climbs to the top of a stalk and faces the wind. Raising its body, it exudes one or more fine threads (gossamer threads) from the spinnerets at the end of the abdomen and allows them to float away freely into the air. When the threads are sufficiently long, the spider lets go its grip and is carried away by the wind. It floats passively, with its upper side undermost, until a suitable resting place is reached. The descent is then controlled by the spider gathering in the filaments with its front legs and rolling them up on the under side of the body until the general buoyancy is lessened, enabling the spider to float down to the ground in the selected area. More often, however, the ballooning is arrested by contact with a tree.

II. **FLIGHT IN BIRDS.** - It is among birds that the power of flight reaches its maximum development. The powerful wings, which are the modified forearms, make long and sustained flight possible in birds ; and these are well displayed in an expanded state in the specimen of the vulture (Fig. 18) exhibited in this gallery. They wing muscles are very strongly developed in all flying birds and are supported by a prominent keel running down the middle of the breast bone. Further, the bones themselves are light and spongy rendering the whole body comparatively light and well adapted for flight. It is interesting to note that in birds which have lost the power of flight, such as the Ostrich and the Emu, the wing muscles are poorly developed and the sternum is smooth, without a keel.

III. **FLIGHT IN MAMMALS** - (1) Bats. - Among mammals, bats are the only animals which are capable of true and sustained flight, and the enormous membranes of the skin (patagium) supported by the elongated finger bones, which make flight possible are well displayed in the large specimen of the Flying Fox or Fruit Bat exhibited in the wall case to the left of the central passage leading to the next hall.

(2) *Flying Squirrels.* - A specimen of the Indian Flying Squirrel is exhibited in a wall case to the right of the central passage. Asiatic Flying Squirrels have a skin fold or patagium extending along the side of the body between the fore and hind limbs, and continued feebly along the neck, and in some for a short distance along the base of the tail. This is stiffened

by a rod of cartilage and enables them to leap greater distances than ordinary squirrels, gliding through the air on the support it gives them. They at first descend in a long swoop, sometimes as much as 60 or 70 yards, after which they are able to rise somewhat again. They are nocturnal in habit, spending the day in hollow trees where they generally associate in large colonies.

African Flying Squirrels belong to quite a different family. That the power of gliding fight has been developed independently in the two families is further suggested by the fact that in the Asiatic family, the rod of cartilage supporting the patagium arises from the wrist, while in the African family it arises from the elbow.

IV. **FLIGHT IN REPTILES** - (1) *Pterodactyle*. - A picture of the Pterodactyle showing its wing membrane expanded is exhibited below the case containing the Fruit Bat, to illustrate flight among extinct reptiles. Pterodactyles are extinct winged reptiles in which the wings are large, and the support of the wing-membrane is afforded by bones of the arm, the greatly enlarged fifth finger and the leg. The digits of the hand, other than the fifth, are slender and the hind foot has four feeble digits furnished with claws, a fifth toe being sometimes present, in addition. The tail is long in some species, and short in others. There is a slight keel to the sternum, far less prominent than in flying birds. In size, the Pterodactyles range from small animals no longer than sparrows to others with a wing span of eighteen feet.

(2) *The Flying Lizard*.-- Beneath the wall case containing the Flying squirrel, a dry-preserved specimen of the Flying Lizard (also known as the Flying Dragon (Fig.19) is exhibited in a small case, accompanied by X-Ray photographs of (1) the Flying Lizard and (2) the Common Garden Lizard, to illustrate the modification of the skeleton of the former in relation to fight.

The Flying Lizard is found in the plantations of coconut and betel nut palms on the low country near the sea on the Malabar Coast and also on the lower slopes of theWestern Ghats in the same region. It possesses a depressed body with lateral wing-like expansions of skin supported by a few elongated ribs. The skin expansions serve the same purposes as the corresponding structures in Flying Squirrels. In leaping, they are stretched out and thus enable the lizard to glide from tree to tree. When the creature is at rest, they are folded like a fan and kept in close contact with the body.

V. **FLIGHT IN AMPHIBIANS**.-- Among Amphibians, the Flying Frogs are the only types that may be said to exhibit a tendency to "fly", although it is, in fact, a very incipient form of flight. A specimen of the Flying Frog is mounted in a jar beside the specimen of the Flying Lizard. The various species of the so called Flying Frog (Rhacophorus), although arboreal in habit, and provided with adhesive discs at the extremities of the fingers and toes, are more nearly allied to the common frogs (Rana) than to the tree frogs (Hyla). The fore and hind feet are so broadly and completely webbed in the species exhibited that they appear to be remarkably well adapted to serve as "planes" enabling the animal to take long flying leaps from branch to branch.

VI. **FLIGHT IN FISHES**.-- Even among fishes, the power of gliding through the air has been acquired by some species. The Flying Fish, represented in this gallery by a group shown leaping through the air with their expanded fins over a modelled fore-ground simulating the surface of the sea (Fig.20), is remarkable for its structural adaptation to flight. The flight of Oxyporamphus, the most primitive flying fish, consists of a low single leap of under ten yards. Exocoetus, in which only the pectoral fins are enlarged, also makes single leaps, but can glide twice as far. In Cypselurus (the species exhibited in this gallery), in

which both pectoral and pelvic fins are enlarged, flight is initiated by surface- skimming movements, propulsive power being provided by the side to side sweeping of the caudal fin, the lower lobe of which is longer than the upper. Once the fish is actually in the air, there is no further acquisition of power, unless it be such as can be derived from the utilization of air currents; but on dropping to the water, further lashing movements of the tail may start it off on a further flight without the rest of the body entering the water. In this way such fish may maintain themselves in flight for nearly half a minute. They may sometimes rise sufficiently high out of the water to be stranded on the decks of ocean-going steamers. This is one of the edible fishes common in the Indian waters.

The muscles at the base of the pectoral fins are not enlarged proportionately to the fins as would necessarily be the case if the fins were used as true wings; but they are considerably larger than the corresponding muscles of allied fishes in which these fins are not enlarged.

PART III- EVOLUTIONARY TREE

The Tree of Evolution exhibited in a large central show case in this gallery is an attempt to illustrate graphically the main lines along which the diverse groups of animals have evolved down the ages, commencing from the simple, one-celled organisms at the base of the tree, to the most complex and highly evolved forms among the upper branches, culminating in the triumph of animal evolution, namely, man himself, who is represented right at the top of the tree. The fundamental principles underlying the theory of evolution are also clearly explained in suitable labels accompanying the exhibit. A photograph of Charles Darwin, the author of "The Origin of Species" , in which he propounded his famous Theory of Organic Evolution forms an appropriate supplementary exhibit in this case. The Tree of Evolution is intended to introduce the visitor not only to the concept of evolution, but also to the immense diversity of animal life and the sequence of these diverse forms in evolution.

GALLERY III

SKELETONS, COVERINGS OF ANIMALS, DENTITION IN MAMMALS, ETC.

The comparatively large rectangular gallery adjoining the preceding gallery of flying animals, etc., is devoted to exhibits of special interest to students, such as specimens illustrating the skeletal and integumentary structures of vertebrates and other interesting features, such as dentition in mammals, adaptation of beaks and feet in birds to different types of environment and feeding habits, variations in the horns of goats and buffaloes, and photographs and specimens relating to the Indian elephant.

The central passage leading into this gallery from the preceeding gallery is flanked on either side by the two massive lower jaw bones of the huge Baleen Whale, which is among the largest of all known living creatures. The enormous size of the entire animals may be easily judged from the size of these imposing jaw bones and the skeleton.

The most impressive exhibit in this gallery is an entire mounted skeleton of the Baleen Whale (Fig.21), otherwise known as the Rorqual or the Great Indian Fin Whale which is suspended from the ceiling along the centre of this hall, and a skull of another specimen of the same species is mounted in the wall space opposite the front end of the entire skeleton of the whale. The specimen of the Whale, the skeleton of which is exhibited

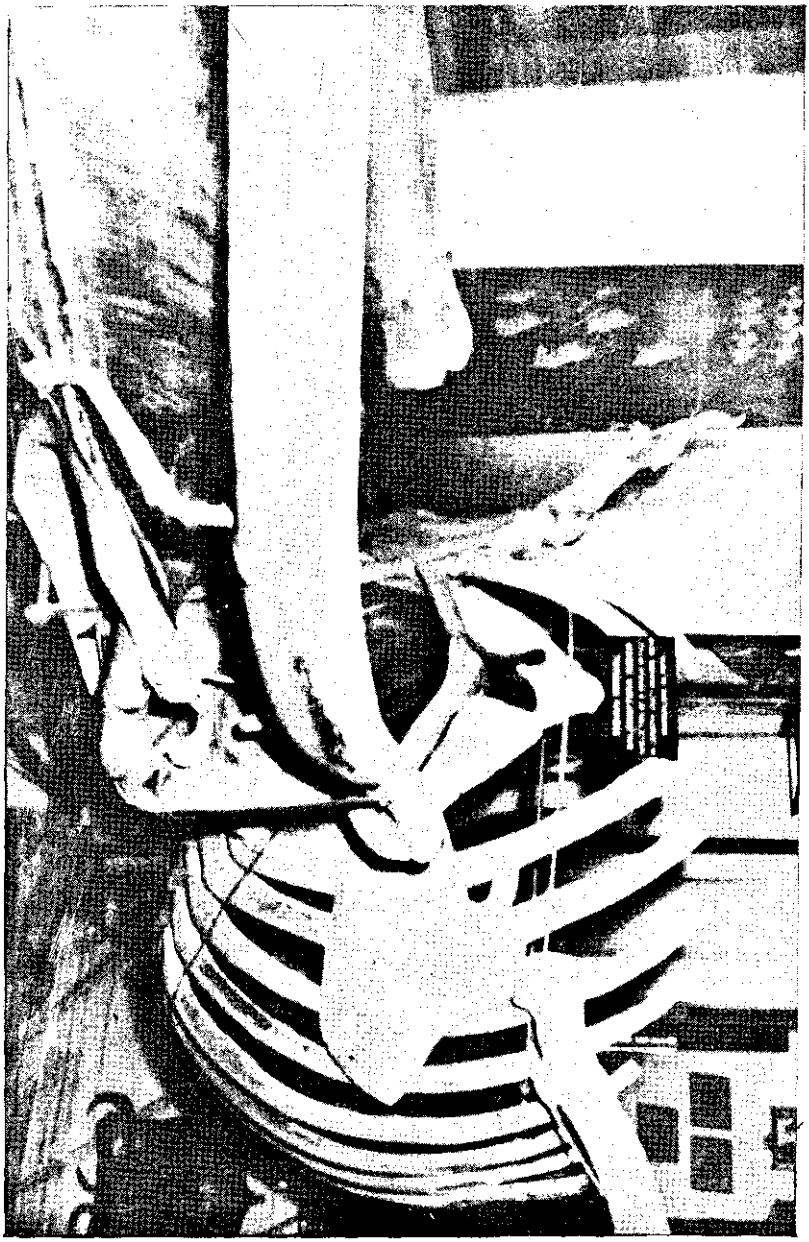


Fig 21. SKELETON OF THE BALEEN WHALE (BALAENOPTERA INDICA)

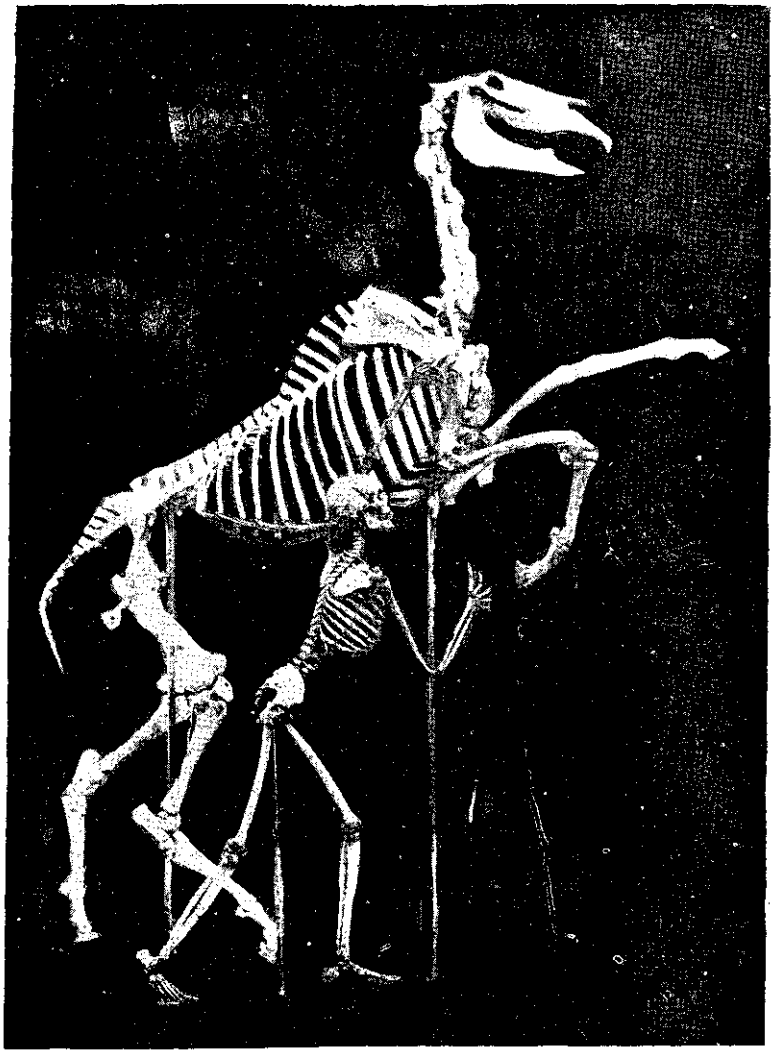


Fig.22. SKELETONS OF HORSE AND MAN

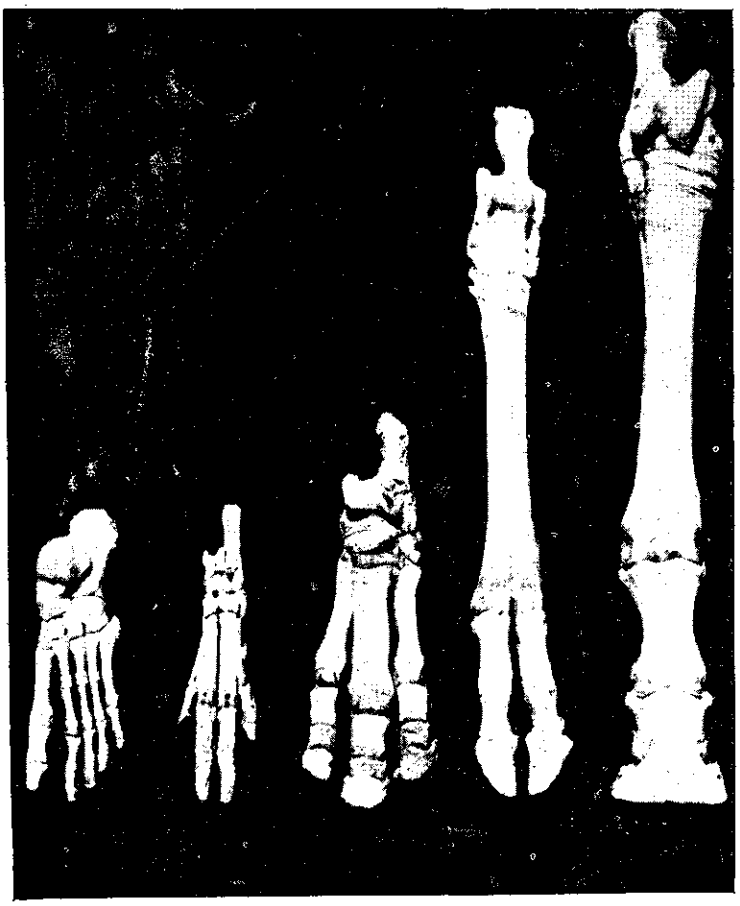


Fig.23. SKELETONS OF THE FEET OF MAMMALS SHOWING GRADUAL REDUCTION IN THE NUMBER OF THE DIGITS : (From left to right : MAN, PIG, TAPIR, OX AND HORSE).

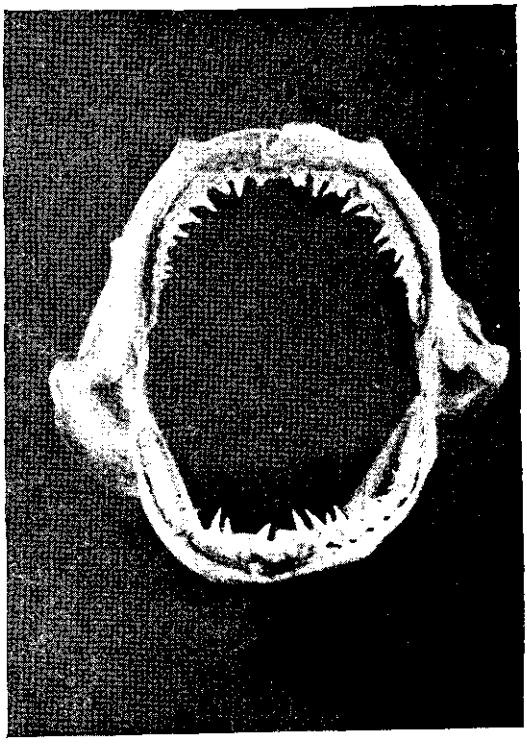


Fig 24. JAWS OF SHARK WITH ROWS OF RECURVED TEETH.

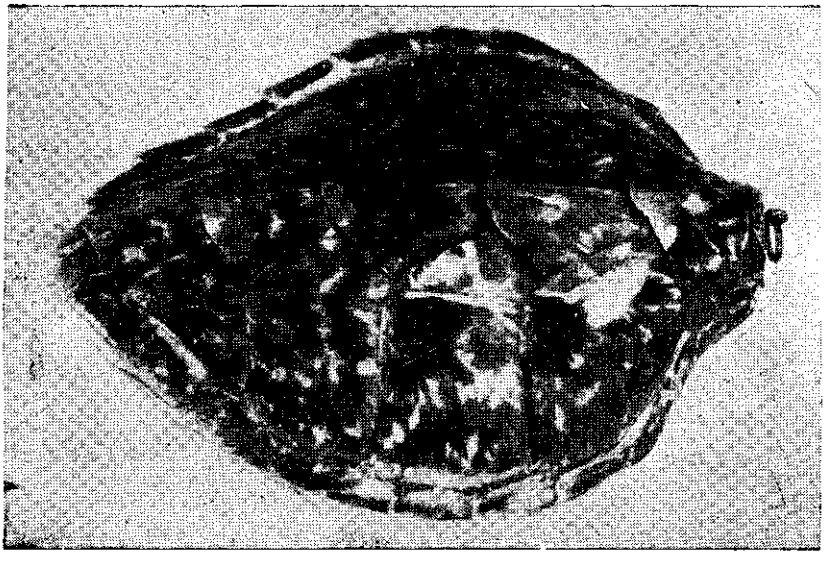


Fig. 25. CARAPACE OF THE HAWK'S BILL TURTLE (TORTOISE - SHELL).

was a medium siezed one measuring over 60 feet in length and was washed ashore in Mangalore in 1874. This species (Balaenoptera indica) The distribution of which ranges over the Bay of Bengal and the Arabian Sea belongs to the great group known as the Baleen or Fin-Whales, characterised by the presence of a brush-like structure composed of numerous plates of baleen or whalebone, serving to strain the water from the small crustaceans and molluses on which these whales feed. Teeth are never present after birth. The 'whale-bone' is of great commercial value, its cost having been estimated at $2,000 even as early as the year 1897. Adult specimens of this species attain a length of about eighty feet or more. Whales are entirely aquatic animals. Though fish-like in appearance, they are mammalian in structure. They are among the largest of all known animals, whether living or extinct. Hair are almost entirely absent, but there is a considerable amount of fat or blubber which takes the place of hair and serves to prevent loss of heat. The thick, fibrous, intervertebral discs are very characteristic.

The Sperm Whale or Cachalot (Physeter macrocephalus) of which a skull and lower jaw are exhibited along the wall in this gallery, belongs to the other group of Whales known as the Toothed Whales, distinguished by the presence of teeth in one or both jaws after birth. In the family Physeteridae to which the Sperm Whale belongs, functional teeth are present only in the lower jaw. Sperm Whales have an enormous head, swollen immensely by the accumulation of fat (Spermaceti). Males attain a length of 55 to 60 feet, but the females are smaller. Sperm Whales are found in nearly all tropical and subtropical seas, generally in herds or "schools" varying from ten or fifteen to a very large number. They appear to feed entirely on cuttle-fishes. Besides spermaceti from the head and sperm oil from the blubber, this whale yields ambergris which is a concretion formed in the intestine and sometimes found floating on the sea. An illustration of the Sperm Whale which accompanies the skull shows the comparatively enormous and swollen head which is filled with spermaceti- a product of considerable commercial value.

Entire mounted skeletons of a few other mammals are also exhibited in the gallery besides skeletal parts of animals, both external and internal.

Of the entire articulated skeletons exhibited, the most notable ones are those of a female Indian elephant, and of a horse, accompanied by a human skeleton. The skeleton of the elephant will be referred to below in connection with the other exhibits relating to the Indian elephant displayed at the rear end of this gallery.

The skeleton of a horse is displayed along with a human skeleton for purposes of comparison (Fig.22). The skeleton of man looks comparatively frail and stunted beside that of the adult, full-grown charger. The horse belongs to the genus Equus, which is one of three living genera (Tapirus; Equues and Rhinoceros) comprising the group of odd-toed Ungulates (Perissodactyla). Although the living forms in this group are very few, it includes a very large number of extinct forms, and fossil remains of several extinct species of horses help us to clearly reconstruct the evolutionary history of the horse, showing, among other features, the gradual reduction in the number of the digits, and specialization of the dentition from a more or less generalized type in the primitive forms.

The skeleton of the dog, with all its parts labelled, is intended to serve as a helpful guide to the student acquainting him with the terminology of the various parts of the mammalian skeleton. The skull and teeth are those of a typical carnivore.

The skeleton of a small specimen of the Kangaroo is also exhibited in an adjacent wall case. The most characteristic feature of this is the presence of two epipubic (or marsupial) bones which support the sac or marsupium in which the young undergo their development in these animals, which are confined to the Australian Region.

Apart from the entire mounted specimens and skeletons referred to above, there are several specimens of various isolated skeletal parts of animals in this gallery, which are exhibited to illustrate certain special features.

A wide range of skulls and horns of buffaloes and goats are exhibited on panels against the walls above the show cases on either side in this gallery to illustrate the extent of individual variation in the form and size of the horns in these animals. The skull and the short, massive horns of the remarkable Gaur or Indian Bison are mounted high on the wall near the rear end of the suspended skeleton of the whale.

In a small wall case adjoining the skeleton of the horse are exhibited a series of skeletons of the feet of a few selected mammals showing the gradual reduction in the number of digits in the limbs (Fig.23). The case contains skeletons of (1) the Pentadactyl foot of man, where all the five toes are well developed; (2) the Tetradactyl foot of the pig, in which only four toes are present, the first being absent; (3) the Tridactyl foot of the Tapir, with only three toes, the first and fifth being absent; (4) the Didactyl foot of the Ox, in which only two functional toes are present the first toe being absent, while the fifth and second are much reduced; and (5) the Monodactyl foot of the horse, in which only one toe is well developed and functional. The first and fifth toes are entirely absent while the second and fourth are vestigial. From a study of these specimens, it will be noticed that the order of disappearance of the digits in Mammals is No.I, V, II, and IV, the third being the persistent digit in the one-toed horse.

In the other adjoining wall cases in this part of the gallery are exhibited (1) a skull of the Jackal showing spurious horns; (2) a hair ball from the stomach of a buffalo; (3) skulls of the Rhinoceros and the Tapir; and (4) Sections of the skulls of man and the horse to show the comparative size of the brain cavity.

The skull of the Jackal bears two bony protuberances on the top near the hind end. These look like false horns and are known by the natives as "Nari kombu". These are used as charms by nomadic tribes in India.

The hair ball from the stomach of the buffalo is a pathological product. It is a solid concretion of undigested fibrous material, occasionally found in the stomach of ruminants and is amazingly hard and almost perfectly spherical and smooth.

The skulls of the Rhinoceros and the Tapir are exhibited individually in separate wall cases on account of their large size, to illustrate their dentition and other skull characters in these two members of the group of odd-toed Ungulates (Perissodactyla) to which the horse also belongs. The skull of the horse, however, is exhibited along with others in the case illustrating dentition in mammals.

In the Rhinoceros the incisors are variable and often fall out early, there are no upper canines, and the peculiar cutting teeth in the front of the lower jaw are probably canines. The grinders are well developed, and have thick walls and strong ridges.

The skull of the Tapir is more or less generalised in its dentition, almost the full complement of incisors, canines and grinders being present, although the animal is herbivorous. The grinding teeth possess two transverse ridges. There is a considerably wide gap between the canines and the premolars.

In a wall case directly above the one containing the skeleton of the Kangaroo are exhibited longitudinal sections of the skulls of man and horse. In spite of the comparatively large size of the skull of the horse its brain cavity is considerably smaller than that in the human skull, illustrating thereby the relatively greater development of the brain in man.

A special feature of this gallery of rather miscellaneous exhibits is the fine series of enlarged photographs illustrating important specimens of Indian wild life, such as the cheetah, tiger, lion, jungle cat, clouded leopard, the Himalayan black bear, the blue bull, sambhar, spotted deer, antelope or black buck, porcupine and the great Indian one-horned rhinoceros. Enlarged photographs of various well known breeds of cattle and poultry reared in India are also exhibited. The breeds illustrated included the following : the Murrah he-and she-buffloes, Sinhi, Kangayam, Halikar and Ongole cows and bulls, Bikaneer Sheep, White Leghorns, Rhode Island Reds and Black Minorcas.

COVERINGS OF ANIMALS

A Series of show cases arranged along the walls in this gallery are devoted to exhibits illustrating the coverings of various classes of vertebrate animals.

The series commences with the case adjacent to the skull of the Sperm Whale on the left side of this gallery.

FISHES

In the first of these cases, various specimens illustrating the integumentary structures of fishes are exhibited. In nearly all fishes, scales are present. In sharks, rays and skates, the scales are small and bear an upright spine of dentine capped with enamels, and are known as placoid scales. In certain fishes, such as the American Gar-pike (Lepidosteus), of which a piece of the skin is exhibited here, the scales are covered by a hard, glistening substance known as ganoin and are therefore known as ganoid scales. In the vast majority of bony fishes, the scales are large, consisting of the boney plate only, and overlap; these are known a imbricating scales. In some bony fishes, the scales unite to form a series of rings round the body as in the pipe fish and the sea horse, or an inflexible box-like armour for the whole body as in the coffer fishes or they may be developed into defensive spines as in the porcupine fishes.

Certain bony fishes (Teleosts) possess definite poison glands associated with spines connected with the gill covers or dorsal fins or both. Among fishes with cartilaginous skeleton only (Elasmobranchs) i.e., sharks, rays, etc., there are some, such as the sting rays, with barbed or serrated spines on the tail that inflict wounds apparently poisoned by the slime secreted by the skin glands generally, since no special poison glands have been found.

In the mouths of fishes, certain scales are specially modified for seizing or chewing food i.e., they are transformed into teeth. In the mouths of sharks certain of the placoid scales are modified into sharp recurved teeth, directed backwards towards the interior of the mouth, being eminently fitted for seizing and holding the prey. Several rows of such teeth are present. This is well illustrated by a specimen of the gaping jaws of a shark (Fig.24) exhibited in this case. In others they are short and more or less flattened for crunching and grinding. Sometimes both types are present. In certain rays, the teeth form broad, flattened, grinding plates. And in some of the bony fishes several teeth fuse together to form a sort of beak as in the puffer-fish and parrot-fish. The bones of the palate may bear teeth as well as those of the jaws.

Fins of fishes arise as folds of the skin and have to be treated as integumentary structures but these will be described later while dealing with the specimens illustrating the general structure of fishes exhibited in the Fish Gallery.

AMPHIBIANS AND REPTILES

In the next case in this series are exhibited specimens representing the coverings of Amphibians (frogs, toads, etc) and Reptiles (snakes, lizards, crocodiles, tortoises, etc.)

AMPHIBIANS.

The skin of the Amphibia is usually soft and moist, being very rich in slime glands, among which special poison glands are present in certain areas, such as the wart-like swelling behind the ear of the common toad. In some forms the skin is covered with warts, and in toads it is dry. The skin in the Amphibia, in addition to being protective in function, serves as on organ of respiration. The uppermost layer of the skin is composed of a dead horny substance which is periodically shed and eaten.

Warty protuberences or prominent folds are often formed in the skin, the latter appearing as thickened elevations on the sides of the back and sometimes even formning hard tubrcles or ridges. The skin of the frog is generally smooth, but that of the toad is often rough and warty. Specimens of both are exhibited in this case. Sometimes special nuptial excrascences such as thickenings on the thumb in the male frog are developed especially in the breeding season.

REPTILES.

The skins of the frog and the toad are followed by several specimens of skins of reptiles, illustrating the characteristic features of the integument in the various orders of reptiles.

The skins of all living reptiles bear horny epidermal scales, rarely vestigial, but skin glands, when present, are restricted to particular areas. Various pigments are often present, and many species of lizards have the power of changing the colour of their skin in accordance with their temperament or surroundings, the Chameleon being particularly noted for this.

In lizards and snakes the horny epidermal coating is periodically shed, peeling off in flakes in limbed forms, but in snakes and other limbless forms, remaining as an entire skin turned inside-out. The scales are usually of the overlapping (imbricate) type, but may be reduced to mere tubercles. On the head they usually take the form of contiguous but not overlapping shields.

In crocodiles, bony matter enters into the composition of the scales on the back (osteoderms) and this renders the integument very tough and rigid; some of the scales on the back are developed into prominent teeth, or into erect plates often arranged so as to form strongly serrate crests; this feature is also seen in certain lizards. In crocodiles, tortoises and turtles, the skin is not shed, both growth and surface renewals being more or less continuous. The skins of crocodiles and some lizards and snakes are used commercially for making ornamental leathers.

In tortoises and turtles an effective box-like armour is developed in the form of a shell consisting of a number of bones to which the vertebrae and ribs are usually fused.

In the Leathery Turtle and mud turtles, it is covered with a leathery skin. In other forms it bears large and symmetrically arranged horny shields. These horny shields constitute the tortoise shell of commerce, but only those of the Hawk's bill Turtle (Fig. 25) are thick enough to be of much value. Specimens of original and commercial skins or lizards and crocodiles, the cast skin of a rat snake and the bony and horny shields of the pond tortoise and the imbricate turtle are exhibited in this case.

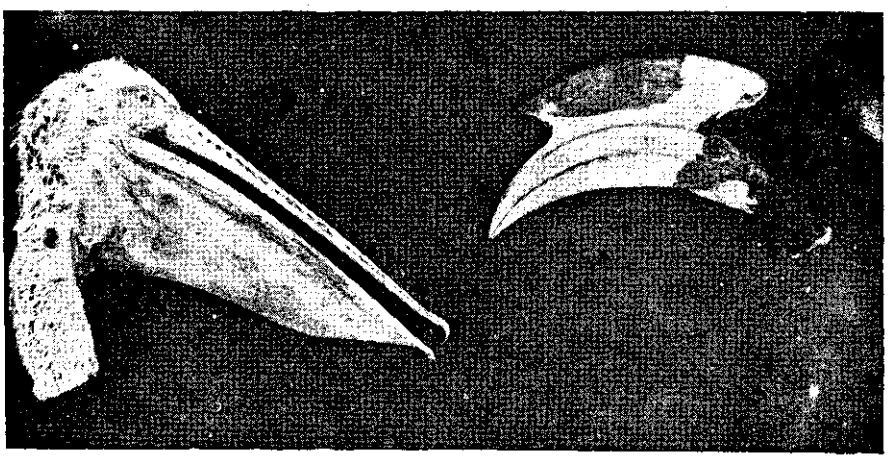


Fig.26. BEAKS OF PELICAN (left) AND HORNBILL (right).

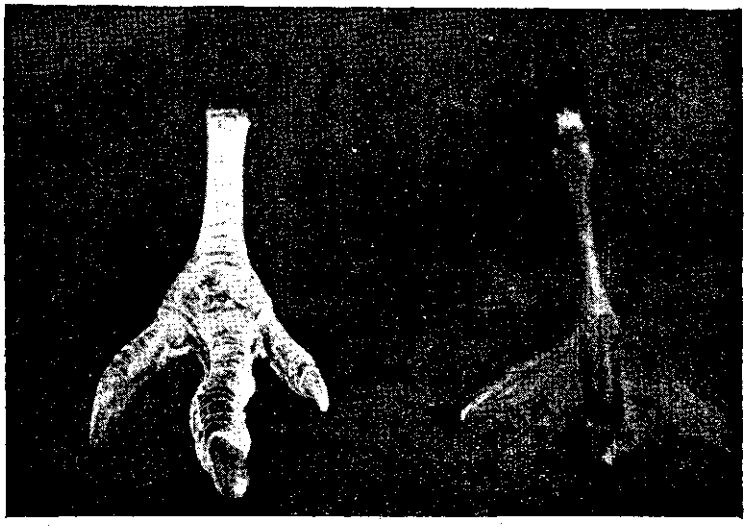


Fig. 27. FEET OF EMU (left) AND PELICAN (right).

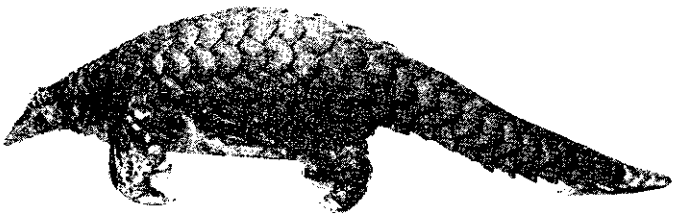


Fig.28. THE SCALY ANT - EATER (MANIS SP.).

Fig. 29. THE SPINY ANT - EATER (ECHINDA SP.).

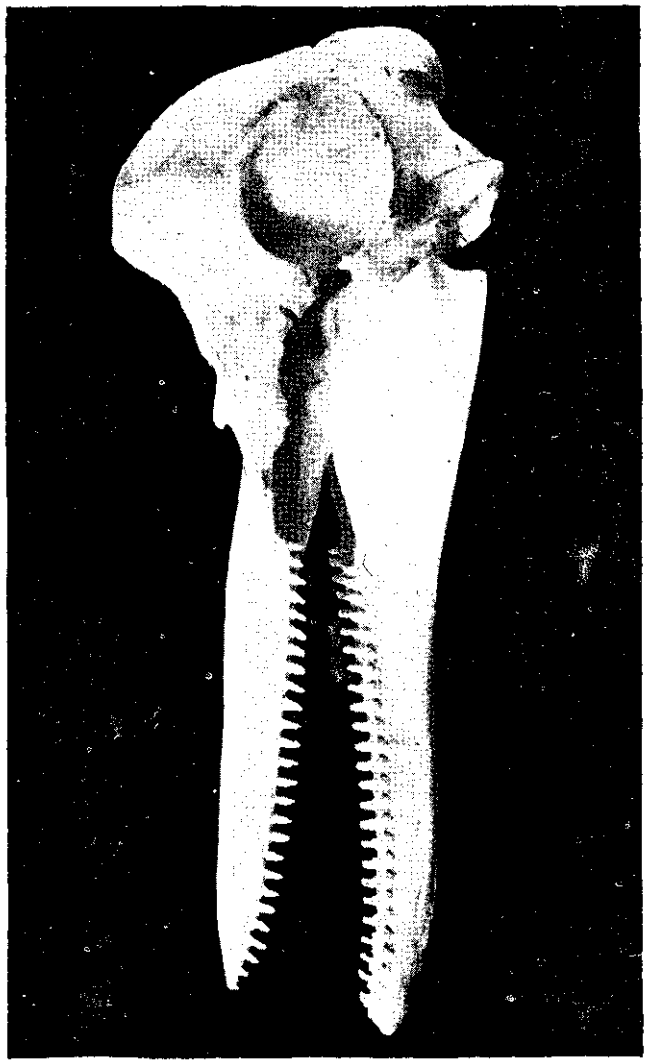


Fig.30. SKULL OF THE DOLPHIN SHOWING HOMODONT DENTITION.

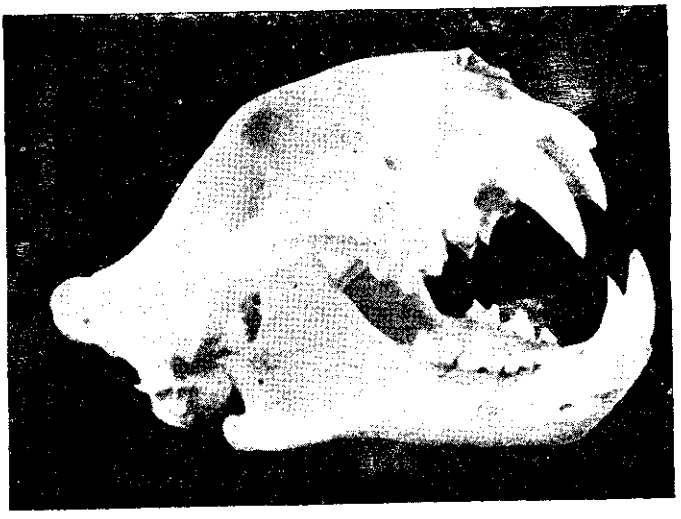


Fig.31. SKULL OF THE TIGER SHOWING CARNIVORE DENTITION

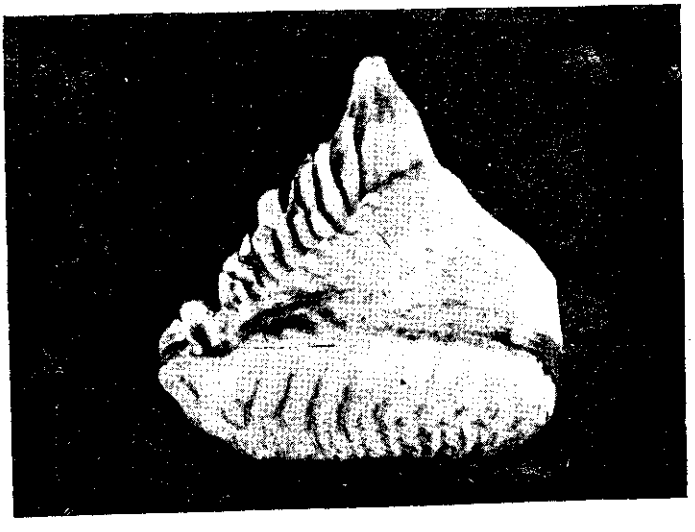


Fig. 32. A SINGLE MOLAR TOOTH OF THE INDIAN ELEPHANT SHOWING THE BROAD GRINDING SURFACE WITH PARALLEL RIDGES

BIRDS.

The skins of the frog and the toad are followed by several specimens of skins of reptiles, illustrating the characteristic features of the integument in the various orders of reptiles.

The next two cases contain specimens of beaks and feet of birds, exhibited mainly to illustrate their adaptation to various types of food and environment, and selected specimens to illustrate the different types of feathers in birds.

A bird's most distinctive character is the presence of feathers, for feathers are found in no other animal. They arise from the skin and are related to scales, which may also be present, especially on the legs. Teeth are replaced by a horny beak in all living birds. The toes are provided with claws, and in many game birds, the leg is armed with a horny spur, particularly in the male.

A typical feather consists of a stiff stem extending troughout its whole length, and an expanded *web or vane*. At the base of the web there is often an *aftershaft* which consists usually of almost a small tuft of filamentous barbs, but in the Emu and the Cassowary, it has a stem about as long as that of the true shaft. A feather of the Emu with the long aftershaft is exhibited along with other specimens illustrating the chief types of feathers. Feathers are of three main kinds, namely, *down feathers,* which are soft and without hooks, *filoplumes*, with a hair-like shaft and few or no barbs, and *contour feathers*, with shaft and vane.

Many feathers are beautifully coloured and some are remarkably modified to suit different needs. The tail feathers of birds are used chiefly in steering their flight, but they are also ornamental in a few birds, especially in the males. A few such ornamental tail feathers such as those of the Peacock, Paradise Flycatcher, Backet-tailed Drongo and the Parrot, as well as tail feathers of different species of snipes (Fantail Snipe, Pintail Snipe, etc.,) and wing feathers of the Flamingo and the Jungle Fowl are exhibited to illustrate the typical arrangement of feathers in the tails and wings of birds.

The beaks of birds vary in size from the tiny ones found in the sparrow and other still smaller birds to the immense ones possessed by the Hornbill (Fig. 26), and they also vary greatly in shape mainly in accordance with the kind of food eaten and the way in which it is obtained. Thus, there are the small pecking beaks of innumerable birds that feed upon seeds, insects, etc., the long, slender beaks of birds such as the hoopoe which probe the ground for worms, the powerful curved beaks of birds of prey, adapted for holding and tearing their victims, the large bill of the Pelican (Fig. 26) with its enormous pouch for storing food, the broad, spatula-like bills of the duck and the Spoonbill for gathering food from watery mud, the remarkable bills of the Flamingo and Shell-Ibis, adapted for feeding upon snails, etc., collected from marshy ground, and many others.

The legs and feet of birds may be broadly classified into two types; (1) walking and (2) wading or swimming, but they show interesting modifictions in special relation to the nature of their environment and their varying habits of life. The specimens exhibited in this series include the webbed feet of swimming birds such as the duck and the albatross, the strong, massive feet of running birds such as the Emu (Fig. 27), the powerfully clawed toes of birds of prey such as the owl, the spurred feet of scratching birds such as the jungle fowls and the perching feet of birds such as the woodpecker and the parrot in which two toes are directed forwards and two backwards to ensure an effective grip.

MAMMALS.

The succeeding cases contain selected specimens of Integumentary structures of mammals. Hair is the most characteristic and constant covering found on the skins of mammals. But in a number of mammals, other integumentary structures such as scales, bristles and spines are developed for additional protection. In the scaly ant-eater (Fig. 28), hard, plate-like overlapping scales are present, with hairs in between the scales. These scales can be erected and constitute an effective armour. The porcupine, the spiny anteater, Echidna (Fig. 29), (which is an Australian egg-laying mammal) and the hedgehog possess strong stiff quills and spines which can be erected and serve as efficient organs of defence. In the Bandicoot rat, the surface of the tail is covered with flat scales and the body with coarse hair. In some mammals hair is greatly reduced or absent altogether as in the whales and sea cows, where the skin is smooth and glistening. In the elephant, the skin is smooth for the most part, but the skin of the foot bears a coarse, papilated surface and the skin of the tail bears very strong, stiff, coarse hair. Sometimes hair is modified into special, stiff structures known as vibrissae or whiskers, which are endowed with special tactile powers, through abundant nerve supply. These are mostly highly developed in nocturnal beasts of prey. Specimens to illustrate all these different modifications are exhibited in the two cases set apart for the Integumentary structures of mammals.

Specimens of different types or horns, such as those of the Rhinoceros, sheep and goat, and the antlers of deer, form another interesting series among these epidermal structures. In the Rhinoceros, the horn appears like a mass of agglutinated hairs and is purely an epidermal structure without a bony core. The space between the horn and the bone is filled during life by a soft vesicular matrix, covered with fine papillae which penetrate the minute apertures in the concave surface of the base of the horn.

In the group of heribivores known as the *Cavicornia* (oxen, antelopes, sheep and goats), the horns consist of tapering, hollow caps of hardened epidermis, fitting on the growing from conical projections on the frontal bone, and are arranged in pairs. Specimens of the horn of the sheep and the Four-horned Antelope are exhibited to illustrate the cavity in the horn which fits over the projection of the frontal bone.

The horns and antlers of the deer tribe (Cervidae), however, are solid bony outgrowths without a horny external part. A membrane bone becomes developed in the skin round each process of the frontal with which it fuses. This grows out to form the antler, and, after attaining its full development, the skin covering dries up owing to the development of the "burr" at its base ; this constricts the blood vessels, and the antler being deprived of nutriment, falls off. This occurs periodically at the close of the breeding season. In the young animal, the antlers are simples, but year by year, the become more complicated and branched.

Except in the whales, the extremities of the digits of mammals are protected by hard horny epidermal structure known as hoofs, nails and claws. There is a wide variety in the shape and development of these horny sheaths; a few examples of hoofs, typical of herbivorous animals, and claws, characteristic of Carnivores, are exhibited. The foot of the Llama bears two digits with cushion-like pads, and its hoofs are almost claws in the sharpness of their tips. The feet of the leopard and the bear are exhibited to show the claw-bearing toes, adapted for grasping and tearing. The horny claws of the leaopard are shown both in the retracted and protruded positions. When the claws are not required for use, they are retracted within the soft parts of the foot, the joints of the digits being strongly flexed on each other by the action of elastic ligaments. The capacity to retract and protrude the claws a will is well developed in the family Felidae (including the cats and their allies).

DENTITION IN MAMMALS.

The two succeeding cases are devoted to exhibits of various types of skulls and teeth in mammals illustrative of the different kinds of dentition in mammals. Teeth are entirely absent in the adults of some mammals, e.g., whalebone whales, the duck-billed platypus, the spiny ant-eater, and many species of the order Edentata (Ant-eaters and Armadillos).

In the normal complete mammalian dentition, which is found in only a few living mammals (e.g., the domestic pig), there are on each side and in each jaw three incisors, one canine, four premolars and three molars, amounting to a full complement of forty-four teeth. Frequently, however, the number, of one or more of these four types of teeth.

The form of the teeth varies considerably depending upon the nature of the food. The incisors are generally chisel-shaped, with a cutting edge, the canines conical and pointed, the premolars compressed and either conical or with cutting edges and the molars bear broad crowns for grinding and crushing.

The main functional modifications in the teeth of mammals may be classified as follows, and typical specimens of skulls and teeth of the various orders of mammals to illustrate these adaptations are exhibited in these two cases.

1. **PISCIVOROUS OR FISH-EATING.** - This is illustrated by the skull and lower jaw of the dolphin (Fig. 30) in which, contrary to the usual condition in mammals, all the teeth are uniformly alike, being conical (Homodont). The shape and arrangement of the teeth enables the dolphin to catch and retain slippery prey such as fish.

2. **CARNIVOROUS OR FISH-EATING.** - Examples of mammals bearing this type of dentition are the Carnivores (tiger (Fig. 31), cat, dog, bear, etc.). The most characteristic features of Carnivore dentition are (1) the presence of two powerful pointed canines, projecting beyond the other teeth ; and (2) one of the grinding teeth on each side in each jaw is different from the rest and called the *carnassial* or *sectorial* tooth. In the upper jaw the tooth so modified is the fourth premolar and in the lower jaw it is the first molar. Isolated carnassial teeth of three typical carnivores (tiger, dog and bear) are exhibited.

3. **INSECTIVOROUS OR INSECT-EATING.** - E.g., Hedgehogs and Shrews. Although all the types of teeth are present, in many cases, the incisors, canines and premolars are not clearly differentiated from one another. The incisors are primitive and conical in shape while the canines are not strongly developed. The premolars are usually sharps and pointed. The arrangement and shape of the teeth in these animals are eminently suited to an insectivorous diet.

4. **HERBIVORUS OR VEGETABLE FEEDERS.** - E.g., horse, sheep, buffalo and deer. In these herbivorous animals, as a general rule, the grinders and incisors are well developed, while the canines are reduced or absent and there is generally a wide gap (diastema) in the place where the canine ought to be present, as is clearly seen in the skull of the horse exhibited in this case. Generally the teeth have short crowns and the neck of the tooth, i.e., the junction of the crown and the root lies at the top of the socket (brachyodont) ; but in the horse and its allies, the crowns are much lengthened and the neck of the tooth lies for some time in the socket (hypsodont). The enables the animal to eat habitually harder and drier food than those possessing brachyodont teeth. In the elephant, the molar tooth is enormous, with a broad, elongted grinding surface bearing numerous transvrse ridges, (Fig. 32).

4. **HERBIVORUS OR VEGETABLE FEEDERS.** - E.g., man, many monkeys, pigs, etc. These animals have a more or less complete dentition. The incisors are never more than two, and the canine single, on each side of each jaw. The canines generally project, and there is usually a small gap between the incisors and canines, particularly in the upper jaw. The grinders have well developed cusps.

6. **RODENT, OR GNAWING ANIMALS.** - E.g., rats, squirrels, rabbits, etc. Canines are always absent and the lower jaw has never more than one pair of incisors. The upper jaw also has only two incisors, except in the hares and rabbits, in which there is a second pair of small incisors behind the large pair (Duplicidentata). There is always a wide gap (diastema) behind the incisors. The teeth are eminently fitted for gnawing. They are mostly herbivorous, but a few are omnivorous.

The simplest form of tooth may be exemplified by the tusk of an elephant. It is a hard mass almost entirely composed of dentine, of a conical shape at first, but during growth becoming more and more cylindrical or uniform in width. The pulp at the base continues to grow during the life time of the animal. The tooth therefore continually elongates, but as the wear and tear is proportionate to the growth, it never becomes too unwidely. Such teeth of indefinite growth are said to be "rootless" or to have "persistent pulps".

One of the corresponding front teeth of man may be taken as an example of a very different condition. After its crown is fully formed the pulp, though continuing to elongate, begins to contract in diameter; a neck or slight constriction is formed, and the remainder of the pulp is converted into the root (or fang), a tapering, conical process, which is embedded in the socket of the bone and has at its extremity a minute perforation through which blood vessels and nerves enter the pulp cavity. When the crown of the tooth is broad and complex in character, it may be supported by two or more roots, each of which is implanted in a socket. Such teeth are called "rooted" teeth.

In some species of mammals, the animal possesses a single set of teeth persisting in a functional condition throughout life. These animals are said to be "monophyodont". But in the majority of mammals, certain of the teeth are preceded by others, which may be of only a very transient, rudimentary and functionless character, or may be considerably developed and functionally occupy the place of the permanent teeth for a somewhat lengthened period. As these teeth are, as a general rule, present during the period at which the aninmal is nourished by its mother's milk, they are known as "milk teeth". Animals which possess such teeth are said to be "Diphyodont".

The simplest dentition, as a whole, is that of many species of Dolphin, in which the crowns are single-pointed, slightly curved ones, the roots also being single and tapering, and all of the teeth alike in form. Such a dentition is called "Homodont".

In a very large number of mammals, the teeth of different parts of the series are more or less differentiated in character and perform different functions, the dentition being termed "Heterodont". The front teeth are simple and one-rooted, adapted for cutting and seizing. They are called incisors. The back teeth have broader and more complex crowns, tuberculated or ridged, and are supported on two or more roots. They crush or grind the food and are called "molars" or "grinders". Many animals have, between these sets, a tooth immediately behind the incisor on each side, adapted for tearing or for holding struggling prey. These teeth are termed "canines".

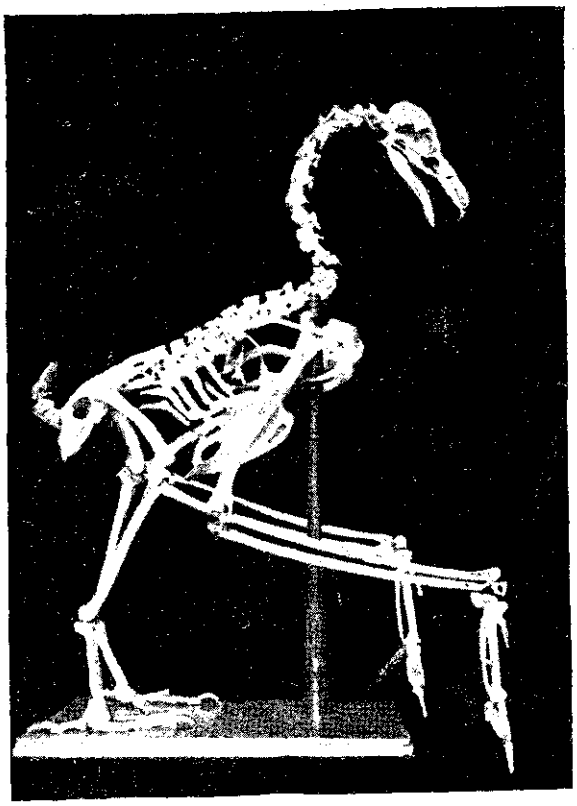


Fig.33. SKELETON OF THE VULTURE

Fig. 34. SKULL OF THE INDIAN ELEPHANT SHOWING THE ENORMOUS TUSKS.

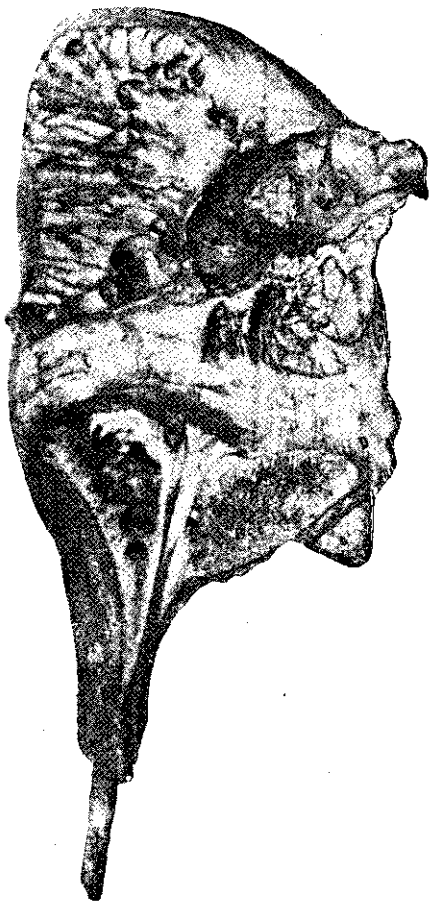


Fig.35. LONGITUDINAL SECTION OF THE SKULL OF THE INDIAN ELEPHANT SHOWING THE AIR SPACES AND COMPARATIVELY SMALL BRAIN CAVITY

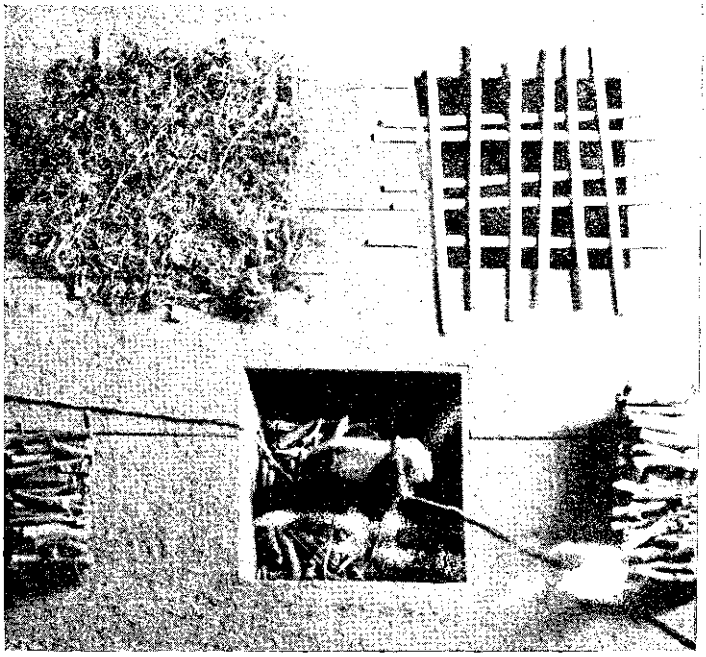


Fig.36. MINIATURE MODEL ILLUSTRATING THE METHOD OF CAPTURING ELEPHANTS IN TRENCHES.

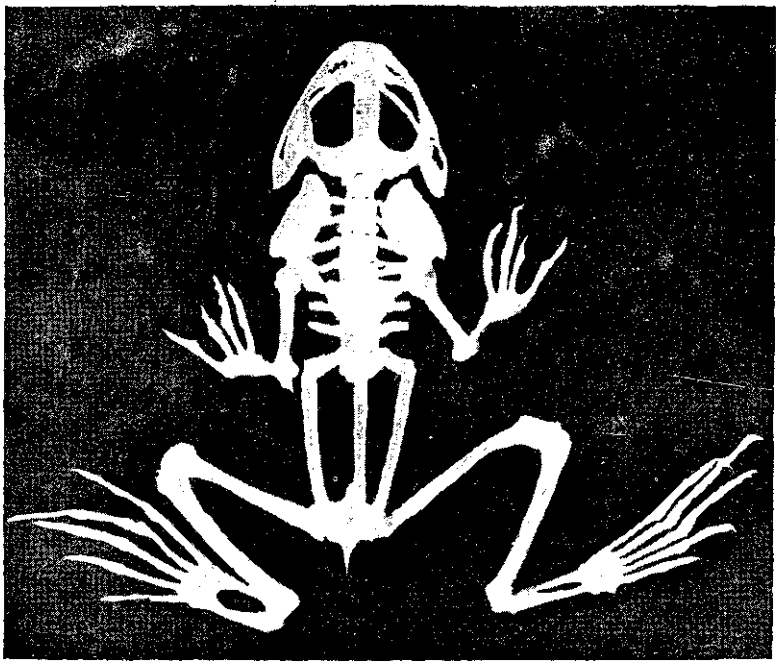


Fig. 37. SKELETON OF THE FROG.

Fig.38. HABITAT GROUP OF THE CHUNAM FROG: RHACOPHORUS MACULATUS.

SKELETAL STRUCTURES OF BIRDS.

A five selected specimens of skeletal parts of birds are exhibited in an adjoining case mainly to illustrate their structural adaptations in relation to flight. Sections of the bones of the Ostrich and the head of the Hornbill show the cancellous texture of the bones in birds rendering them light and at the same time strong. The names of the various individual parts of the skeleton of a bird are indicated in a labelled disarticulated skeleton of the domestic fowl. The sternum or the breast-bone is a broad, bony plate bearing a projecting keel-like crest which serves for attachment of flight is feebly developed or lost altogether as in the *Ratitae* (running birds). Examples of both Carinate and Ratite sterna are exhibited. In the skull of birds, the brain case is arched and spacious, and except in the *Ratitae* and one or two other groups, the bones become fused together at an early stage and the sutures obliterated, and the orbits are very large. The exhibits of bird skulls in this cae include skulls of various flying birds (Carinatae) as well as those of Ratite Birds such as the Emu (without a crest), and the Cassowary (with a dome-like crest), and a selected series of four skulls (Emu, fowl, crow and duck) to illustrate the four different types of arrangement of the palatal bones in birds, namely, the *dromacognathous*, the *schizognathous*, the *aegithognathous* and the *desmognathous* types respectively. These distinctions in the palate of birds are of great classificatory value. An entire articulated skeleton of the Vulture with all its parts individually labelled is also exhibited in this gallery to illustrate avian osteology, (Fig. 33).

BIRDS' EGGS

One of the most characteristic features of birds is that they are all egg-laying, without exception. Eggs of birds vary a great deal in their size and colour. The brightly coloured birds, do not as a rule, lay brightly coloured eggs. As a mater of fact, the reverse is, to some extent true, and many birds of bright plumage, as for instance, the Woodpecker and the Indian Roller or Blue Jay, nest in holes and lay white eggs. This may be due either to the fact that white eggs are more easily seen in dark holes, or, having been laid in these conditions, they have not evolved protective colouration. Among the protectively coloured eggs, the most noticeable are those laid on the bare gound, e.g., Sandgrouses, Lapwings and Plovers. A carefully selected series of birds' eggs intentded to illustrate the above mentioned features are exhibited in an adjoining case in this gallery.

EXHIBITS RELATING TO THE INDIAN ELEPHANT.

The rear end of this gallery is devoted to photographs and other exhibits relating to the Indian elephant. Besides the entire mounted skeleton of a female Indian elephant (which has been referred to earlier in this account), two massive skulls of full grown tuskers, with tusks weighing over 50 pounds each, from Coimbatore District, are exhibited on pedestals on either side inthis part of the gallery (Fig. 34). The tusks are of solid ivory and attain an enormous length, as they continue to grow throughout life. As is well known, they are of great commercial value, and form the raw material for all ivory products. There are also four specimens of the transverse, longitudinal (Fig, 35) and sagittal sections of the skull of the Indian elephant. These serve to illustrate the comparatively small size of the brain cavity and the presence of a large number of air spaces or diploe in the bones of the skull which render the skull so light in proportion to its large size. In the young the air cells are only slightly developed.

In the centre of this section of the gallery is exhibited a miniature model (Fig. 36) illustrating the method of capturing wild elephants in trenches. Elephants have a habit of wandering in herds from place to place and generally keep to the same runs in moving to

and fro, These runs are located and pits are dug on them in groups of three. The pits are 12 feet by 12 feet at the top and 9 feet by 9 feet at the bottom and 10 to 12 feet deep. The sloping sides are intended to break the fall. Brush-wood and bundles of grass are laid at the bottom of the pit as a further precaution against injury. The mouths of the pits are closed by split bamboos laid cross-wise and covered with a layer of grass or leaves so as to conceal their existence.

As soon as the report of a capture is received, two, three or four decoy elephants (depending on the size of the captive) are marched off to the pit. The captive is noosed in the neck and in the hind leg below the knee and above the ankle by soft cords of fibrous barks or Manilla hemp. When the noose is ready, it is opened out to its widest extent and flung over the neck of the elephants. On the noose round the neck, two pieces of cord, about two yards long, are attaches, one on either side, for the decoy elephants to hold. Billets of wood and twigs are thrown into the pit to lessen the depth and thus enable the captive elephant to ascend, and as soon as he is out, a ring of decoy animals is formed ; the cords on either side of the neck noose are seized by two elephants and the end of the noose cord by another elephant in front, while one remains in the rear. The leg cord is held by a number of coolies and the captive is thus marched off to the Kraal.

Elephants are also captured by driving them with the help of tame elephants into enclosures known as the Keddah. These operations are illustrated by a series of photographs in this section. Another set of photographs show the various phases of the life of a tame elephant in a zoo. The basal part of the foot of the elephant with the broad, plate-like nails and the bones of the digits in the feet of the elephant illustrating the internal five-toed structure, are exhibited to show that although the foot of the elephant is externally toeless and undivided, yet internally the normal pentadactyle digital structure is evident.

GALLERY IV.

AMPHIBIANS (FROGS, TOADS, ETC.)

A passage from the preceding gallery,adjoining the mounted skeleton and skull of the Indian elephant, leads to a small section at the extreme end of the Reptile Gallery. This section is devoted to specimens of South Indian Amphibia. Near the entrance on the left are mounted the articulated (Fig. 37) and disarticulated skeletons of the frog, with all the individual parts labelled. These exhibits are self explanatory. Beneath these is a small case containing plaster models of the common tank frog which abounds in muddy pools and puddles (Rana cyanophlyctis).

A dissected specimen of the frog, accompanied by an explanatory diagram illustrates the internal anatomy of the frog, showing the heart, lungs, liver, the alimentary canal and the principal blood vessels in their proper positions.

Opposite to this, a small jar containing specimens of the sterna (breast bones) of the frog (Rana) and the toad (Bufo) is exhibited on the wall to illustrate the basic difference in structure between them. In the former, the epicoracoids meet in a central line (firmisternal) while in the latter, the epicoracoids overlap (arciferous). This is one of the main anatomical differences between the frogs and the toads.

A habitat group of the Chunam frog (Rhachophorus maculatus) (Fig. 38), which is exhibited in a small case against the wall in this section illustrates the spawning habits of this common South Indian frog. The female lays a frothy mass of eggs (the spawn) on leaves overhanging water. The eggs hatch and the tadpoles drop directly into the water. thus enabling them to develop and pass through the remaining stages in their life history in the water.

Finally, in the large wall case at the further end of this section are exhibited a series of spirit-preserved specimen of South Indian species of Amphibia, systematically arranged.

COECILIANS

The series commences with a few specimens of Gymnophiona, comprising the Coecilians, which may be easily mistaken for snakes. These are worm-like, limbless Amphibians (sometimes known as blind worms) with reduced eyes and numerous small scales embedded in to skin. They burrow in the surface soil in damp places near streams. *Ichthyophis glutinosus* and *Ichthyophis monochrous* are two common South Indian species of Coecilians, and have been collected at Kambakkam, near Madras. The mother lays the eggs in a burrow and guards them by coiling round them as seen in the illustration accompanying the specimen.

FROGS.

Many of the better known species of South Indian frogs are exhibited, including tadpoles and developmental stages of the common frog. Special mention may be made here of the more interesting forms.

Rana hexadactyla. - This species is very common in tanks and along the banks of rivers throughout Southern India. Its colour in the living state is bright grass green, but this rapidly changes in spirit to chocolate brown or sometimes almost black. These tank frogs serve as food for fresh water fishes such as Cat-fishes and species of *Ophiocephalus*. Rana *hexadactyla* is the species of frog that is commonly dissected in college laboratories.

Rana tigrina. - *(Fig. 39)* : This is the largest of Indian frogs, attaining a length of over six inches from the snout to the vent. It is the familiar "bull-frog", found all over India and Ceylon, extending even to China and the Malay Peninsula. The skin of the back bears strong longitudinal folds. Its characteristic barking voice may be heard during the monsoon. The males, during the breeding season, are pale greenish yellow with dark spots. The Common Indian Otter has been known to feed on frogs of this as well as the preceding species.

Rana limnocharis. - This species is very closely allied to the bull frog, from which it differs in its smaller size and half-webbed toes. It is widely distributed, ranging over China, India, Burma, Ceylon and Malay Peninsula. In life it is greenish, mottled with darker spots. It frequents marshes, inundated paddy fields and meadows.

Rana breviceps. - The hind limb in this species bears a large, sharp-edged, shovel-shaped tubercle with the aid of which it burrows in the ground to a depth of about one and half feet.

The other species of Rana exhibited in this case are less common and most of them are confined to forests in Malabar, Cochin and Anamalais.

Rhaçophorus maculatus is the common "Chunam frog" of Madras. This is the familiar frog which is so often seen in Madras at night, adhering to vertical surfaces such as walls and windows by means of the discs on its fingers and toes. The skin is smooth above, but granulate below. The habitat group showing its spawning habits has already been referred to above.

Rhacophorus malabaricus. - This species is closely allied to the preceeding one and is recorded from Malabar. The skin is finely granular above, and more coarsely granulated on the belly.

Fig.39. RANA TIGRINA : THE BULL FROG.

Fig. 40. BUFO MELANOSTICUS : THE INDIAN TOAD.

Ixalus variabilis is the " Tinkling frog " of the Nilgiris. It is found in grass and among bushes on the Nilgiris, and produces a peculiar, loud, clear, tinkling sound. It is very abundant at Ootacamund where it is frequently heard during the monsoon. As the direction of its call is often difficult to detect, it is not easy to collect this frog. During life it is of a grass-green colour.

Microhyla rubra is a small frog, very common in Madras during the monsoon and is found all over Madras State near rivers and sandy banks. The skin is smooth, reddish brown, sometimes with a dark X-shaped marking on the front part of the back.

Microhyla ornata is an allied species found all over India and Ceylon and is particularly common during the monsoon. It is reddish or greyish olive above with a large dark marking on the back.

In *Callula* the tips of the fingers are dilated into rather well developed truncated discs, but they are by no means arboreal. In Callula triangularis, recorded from Wynaad and Niligiris, there is large, triangular blackish spot on the back.

Cacocpus systoma is the familiar species popularly known as the " Funny-looking frog". It is olive or pinkish brown above, marbled with blackish brown. It bears on its hind limbs two strong, compressed, shovel-shaped tubercles with which it can burrow in the ground. It may be found in large numbers at night in compunds in Madras during the monsoon emitting a characteristic sound. It is also recorded from the Nilgiris and other hills in Mysore.

TOADS.

The family Bufonidae, including the true toads, is distinguished by the jaws being toothless and the transverse process *(diapophysis)* of the sacral vertebrae being dilated.

Bufo melanosticus (Fig. 10) is the commonest species of toad found throughout India, Burma and Ceylon, ascending the Sikkim Himalayas to about 10,000 feet and up to about 7,000 feet in the Nilgiris. It makes a characteristic chirping sound which sometimes approaches a shrill whistle. The upper surface of the body is beset with prominent spiny warts. The belief that they are poisonous dates back to the third century B.C.,although it is unfounded. The forelimbs in the male become swollen during the breeding season. The young are found in large numbers in Madras during the monsoon season.