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GUIDE
TO THE
REPTILES AND BATRACHIANS
EXHIBITED IN THE
DEPARTMENT OF ZOOLOGY
OF THE
BRITISH MUSEUM (NATURAL HISTORY),
CROMWELL ROAD, LONDON, S.W. 7.

ILLUSTRATED BY 50 FIGURES.

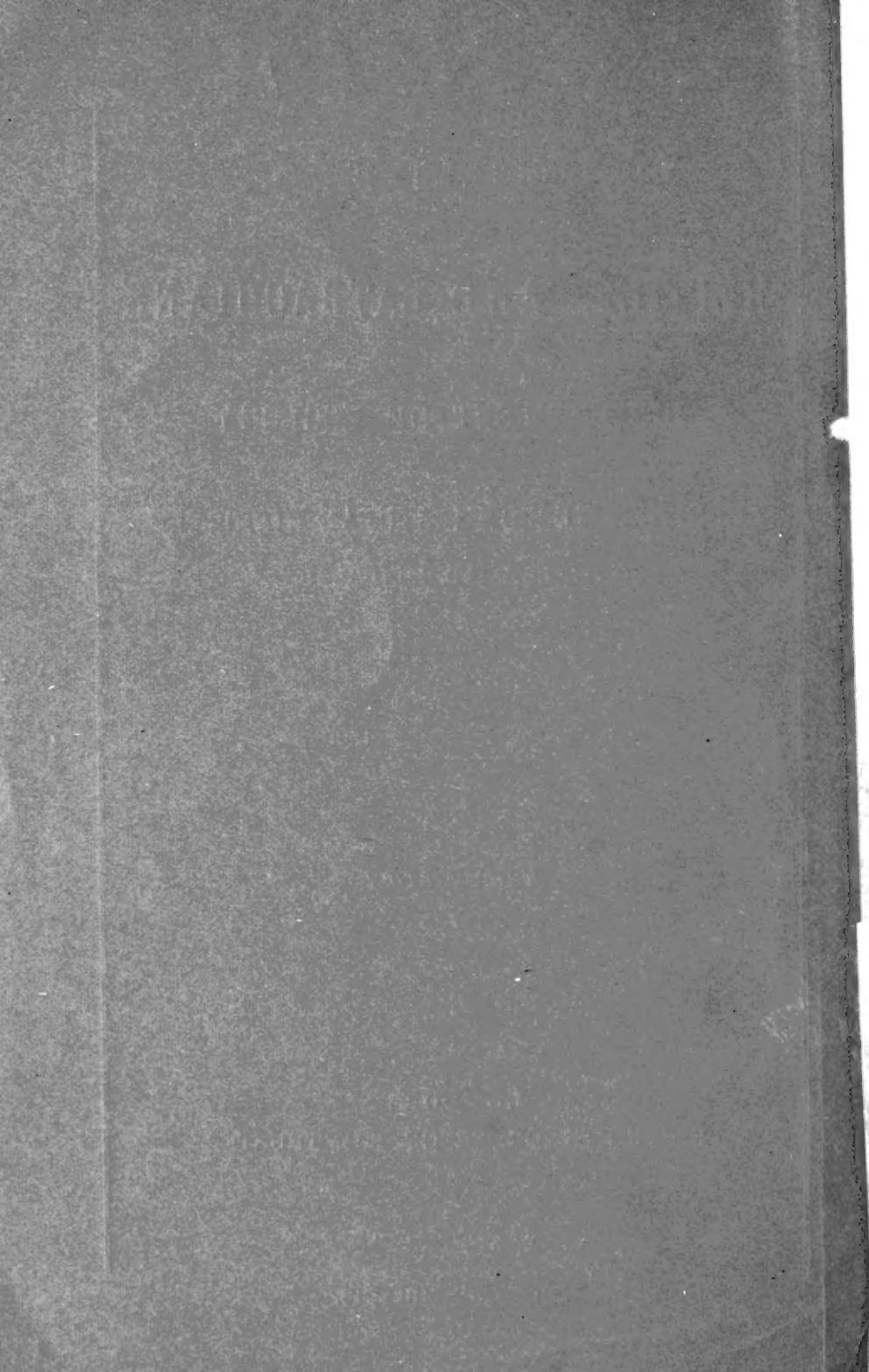
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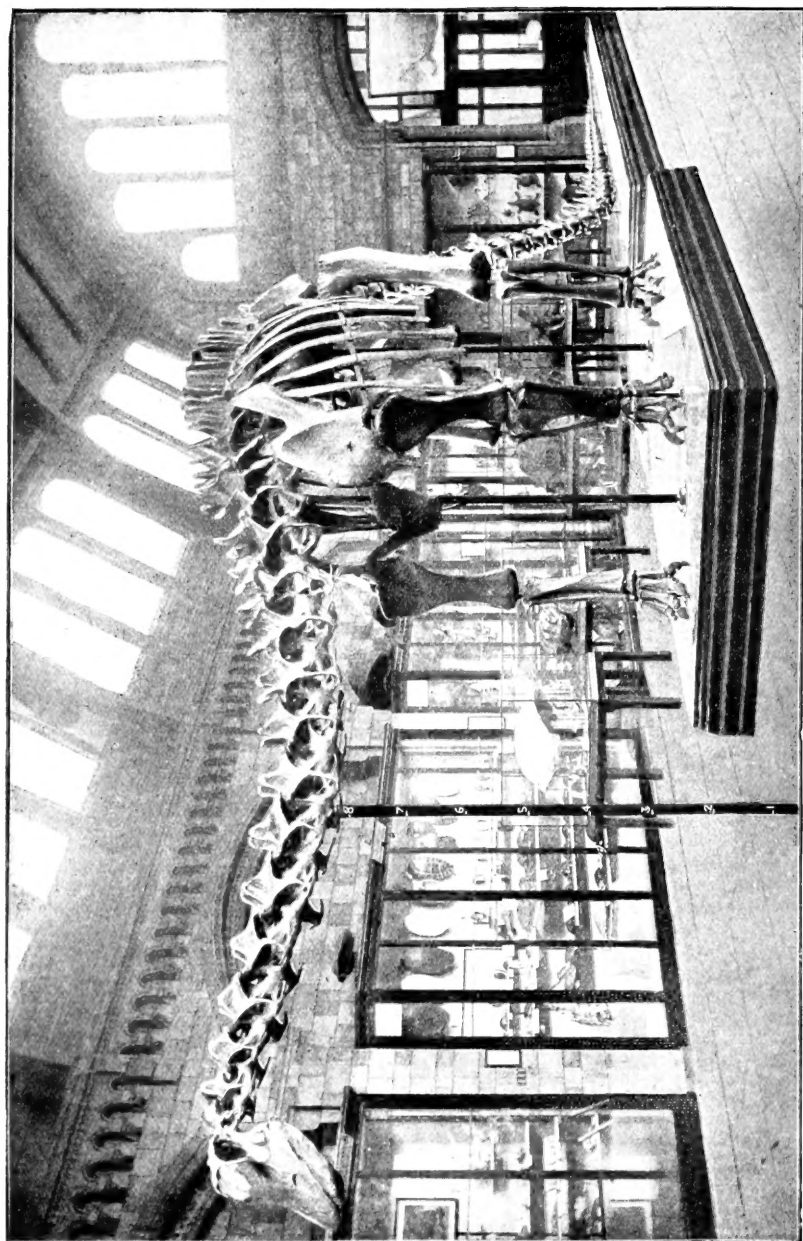
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THE REPTILE GALLERY, VIEWED FROM THE SOUTH-EAST, SHOWING THE MODEL OF THE SKELETON OF *Diplodocus carnegii*.
[Frontispiece.]

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PRINTED IN ENGLAND
AT THE OXFORD UNIVERSITY PRESS
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PREFACE.

THE Reptile Gallery is mainly devoted to the exhibition of recent Reptiles and Batrachians, but a few characteristic examples of each of the more important extinct groups are included. In addition the great Dinosaurs *Diplodocus*, *Iguanodon*, and *Triceratops* are placed here because room could not be found for them in the Gallery of Fossil Reptiles.

The National Collection of Reptiles and Batrachians comprises about 70,000 specimens, representing most of the known species, which number nearly 9,000. The majority of these specimens are preserved in spirit, and examples of selected species only are shown in the Gallery.

Thanks are due to Messrs. Macmillan & Co., Ltd., for permission to reproduce a number of illustrations from the *Cambridge Natural History*: the process-blocks are from photographs of specimens in the Museum.

C. TATE REGAN,

Keeper of Zoology.

BRITISH MUSEUM (NATURAL HISTORY),

LONDON.

March 1922.

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GUIDE

TO THE

REPTILES AND BATRACHIANS.

BATRACHIANS.

(Table-case near south end of Gallery.)

THE class Batrachia, or Amphibia, includes Frogs, Newts, &c. The earliest members of the group, found in the Carboniferous strata, closely approximate in structure to the bony fishes of the extinct order Rhipidistia, from which they were doubtless derived; but they differed from them, and from all other fishes, in several characters, of which the most important is that instead of paired fins they were provided with legs ending in five-toed feet. These were the earliest terrestrial four-footed vertebrates, from which have arisen not only the modern Batrachians but also the Reptiles, and through the latter the Birds and Mammals. A few examples of these primitive Batrachians are exhibited; they were mostly newt-like in form, but had the skull roofed by dermal bones: hence the ordinal name Stegocephala.

Modern Batrachians agree with modern Reptiles in being cold-blooded, but differ from them in having the skin naked instead of scaly, and by the skull articulating with the first vertebra by two knobs, 'occipital condyles,' instead of one.

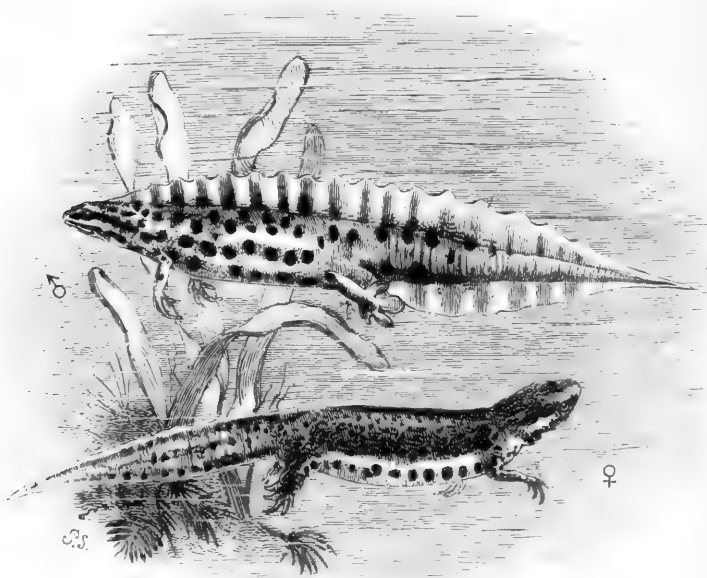
Batrachians generally commence their life as truly aquatic creatures, breathing the air dissolved in the water by means of gills, and later become terrestrial, breathing atmospheric air by means of lungs, whereas Reptiles breathe by lungs throughout their life. A few Batrachians, however, are permanently aquatic and retain their gills throughout life, and there are some which, when adult, manage to breathe without either gills or lungs; moreover, there are forms in which the young make their first appearance in an advanced stage of development and pass through the gilled larval stage in the egg or within the body of the parent. Batrachians inflate their lungs by swallowing air, having no mechanism for expanding the chest.

The number of living species of Batrachians does not greatly exceed 2,000. These are placed in three orders, Urodela or Tailed Batrachians (Newts, Salamanders, &c.), Apoda or Limbless Batrachians (Coecilians), and Anura or Tailless Batrachians (Frogs, Toads, &c.).

Order I. **URODELA.**

The Urodela, or Tailed Batrachians, are characterized by having a tail and at least the front pair of limbs. The young are provided with uncovered gills, which generally disappear in the adult, but in some permanently aquatic forms may be retained throughout life. The group is a small one, numbering about 200 species, mostly from Europe, Northern Asia, and North America; a few species occur in Central America and in the

FIG. 1.



The Common Smooth Newt (*Molge vulgaris*). Male and female.

Andes, extending southwards to Peru. Not many species grow to a greater length than 6 inches.

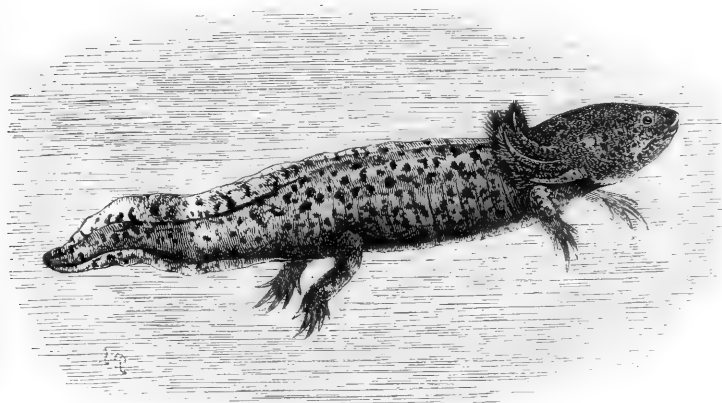
Nearly all the Urodela belong to the family *Salamandridae*. These have two pairs of limbs, teeth in the jaws, and movable eye-lids; with one remarkable exception there are no gills in adults. A curious feature of several members of the family is the absence of lungs, respiration being effected by the skin and the pharynx.

Newts (*Molge* or *Triton*) are found in Europe and Northern Asia; they have the tail strongly compressed and often furnished

with a fin. There are three British species, in all of which the breeding males develop a high crest on the back. Newts are terrestrial : they prefer cool and moist places, and feed on insects, worms, &c. ; in winter they hibernate. At the breeding season they make their way to ponds and become aquatic for a time ; the eggs are laid and the young live in the water.

The genus *Salamandra* includes three species, the Spotted Salamander (*S. maculosa*) from Europe and Asia Minor, the Alpine Salamander (*S. atra*) of the Alps, and the Caucasian Salamander (*S. caucasica*) ; they have a rounded tail. The Spotted Salamander is noteworthy for its black and yellow

FIG. 2.



The Axolotl ; the egg-laying larval form of *Amblystoma tigrinum*, Mexico.

coloration and for the poisonous properties of a fluid which exudes from its skin. The Salamanders prefer hilly country, where they hide under moss or stones ; they are viviparous. In the Spotted Salamander the mother partly enters the water in the spring to produce her young, which may number up to 50 and are about an inch long when born ; they lose their gills and become terrestrial before the winter. Embryos of the Alpine Salamander are exhibited ; this species produces only two young at a birth, which are much larger than the young of the Spotted Salamander and are essentially similar to their parents.

Amblystoma includes a number of species from North America ; they bear a general resemblance to the European Salamanders and live in much the same way. The famous Axolotl of the lakes near the city of Mexico is thoroughly aquatic, and is provided with three pairs of external gills and a well-developed median fin

both above and below ; it may grow to a length of one foot. Specimens brought to Europe laid eggs which developed into Axolotls, some of which lost their gills and fins, left the water, and were found to have changed into the common terrestrial

FIG. 3.



The Three-toed Salamander
(*Amphiuma means*).

FIG. 4.



The olm (*Proteus anguinus*),
from the caves of Carniola.

species *Amblystoma tigrinum*, of which the Axolotl was thus proved to be a permanent larval form.

Other important American genera are *Desmognathus*, *Plethodon*, and *Spelerpes*, the last being represented in Europe by *S. fuscus*

of Italy and Sardinia, which lives in shady places, lying in wait for insects, which it catches by the sudden protrusion of its long tongue.

The *Amphiumidae* differ from the *Salamandridae* in having no eye-lids. The Giant Salamander (*Megalobatrachus maximus*) of China and Japan grows to a length of 5 feet; it is strictly aquatic, inhabiting small mountain streams, where it often lies hidden under rocks; it feeds on fishes, worms, &c., and as it will readily take a bait it is caught for food. An extinct Giant Salamander is known from the Miocene of Baden. The North American 'Hellbender' (*Cryptobranchus alleganiensis*) is very similar to the Asiatic species, but differs in having a gill-opening; it grows to only 18 inches long. *Amphiuma* includes two species from North America, which differ from the preceding in their eel-shaped body and small limbs, with only two or three toes; these animals inhabit swamps and often burrow in the mud.

The *Proteidae* differ from the *Amphiumidae* in having no maxillary bone and in the persistence of the gills throughout life. *Necturus maculatus* is found in the Mississippi and the Great Lakes; it has well-developed four-toed limbs and functional eyes; its colour is brown, with irregular blackish spots. The other two members of the family are subterranean and differ from *Necturus* in being white, and in having their eyes concealed beneath the skin. *Typhlomolge rathbuni* of Texas has rather long and slender limbs, the front pair with four and the hind pair with five toes; all the known specimens have come up with the water of an artesian well. *Proteus anguineus*, the 'Olm', from the subterranean waters of the Eastern Alps and Dalmatia, has shorter limbs, with three front and two hind toes. There can be little doubt that *Typhlomolge* and *Proteus* have evolved independently from *Necturus*-like ancestors, the concealed eyes and the absence of pigment from the skin being due to their life in total darkness.

The *Sirenidae* retain their gills throughout life, but are distinguished from the *Proteidae* by their eel-shaped body, the absence of hind-limbs, and the toothless jaws. *Siren lacertina* is the Mud-eel of the south-eastern United States; it lives in ponds and ditches, burrowing in the mud.

Order 2. APODA.

The Limbless Batrachians, or Coecilians, are worm-like in appearance and in their mode of life, burrowing in moist ground; they feed on worms, &c. The skin is slimy and forms a number of transverse folds or rings; it may contain small embedded scales. The eyes are small and subcutaneous, but between the eye and the nostril is a soft protrusible tentacle, probably tactile in

function. The scales in the skin, and certain features of the skeleton, indicate that if the Apoda are derived from the Urodela they have arisen from some group more generalized in structure

FIG. 5.



A Limbless Amphibian
(*Uraeotyphlus africanus*).

than the living members of that order. About 200 species are known, from tropical America, Africa, and Southern Asia; most of these are small, few attaining a length of 18 inches. Their life-history is imperfectly known, but the species studied include viviparous forms and others in which the gilled stage is passed through in the egg. In *Ichthyophis glutinosa* of Southern Asia the female coils herself round the eggs, which are laid in a hole near running water, to which the young take when they are hatched, although they have lost their gills; they are, however, provided with a tail-fin which disappears before they become terrestrial. The species exhibited are *Coecilia gracilis* and *Siphonops annulatus*, both from South America.

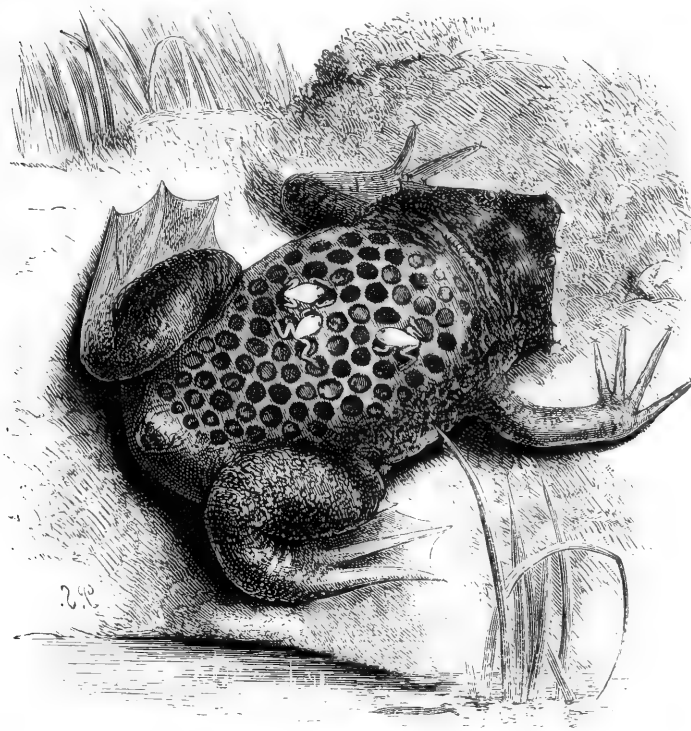
Order 3. ANURA.

The Anura, or Frogs and Toads, are characterized by the absence of the tail; they have well-developed limbs, the hind ones being the longer; the front pair generally have four toes and the hind pair five. In the skeleton the vertebral column is very short and the posterior vertebrae are fused to form a long spine, which lies between the elongate and backwardly directed iliac bones. Nearly all Frogs and Toads have a long protractile tongue, with which they catch the worms, insects, &c. on which they feed, and most of them produce croaking sounds in the larynx, intensified in the males by the distension of the vocal pouches, which are connected with the mouth and act as resonators.

As a rule the eggs are laid in water, often in masses or strings, which either float or may be attached to weeds or stones; the larvae develop into tadpoles, in which the head is not marked off from the swollen body, which contains a long intestine coiled like a watch-spring, the tail is well developed, the gills are covered by an opercular fold, the small mouth is surrounded by funnel-

shaped lips studded with horny teeth and the jaws are provided with horny beaks. The transformation of the aquatic tadpole into the terrestrial adult form involves the development of the limbs and lungs, the reconstruction of the intestine, the loss of the tail, gills, lips, and horny beaks, the widening of the mouth, &c. A tadpole of *Pelobates* is exhibited and a series of specimens of

FIG. 6.



A Female Surinam Toad (*Pipa americana*) with young emerging from the brooding pouches of the back.

Pseudis paradoxa illustrate the change from a tadpole into a frog. In some forms the eggs are relatively few and large and are protected by the parents, the young emerging at an advanced stage of development, sometimes even as miniature frogs.

The number of known species of Frogs and Toads is nearly 2,000; they are found in all tropical and temperate countries. The Anura may be divided into three main groups, Aglossa, Arcifera and Firmisternia.

The Aglossa are characterized by the absence of a tongue, which is connected with their aquatic habits, a tongue not being needed by creatures which seize their prey under water. There are three genera, *Xenopus* and *Hymenochirus* from Africa and *Pipa* from South America. The species of *Xenopus* are known as 'Clawed Toads' from the sharply pointed nails of the first three hind-toes. The Surinam Toad (*Pipa americana*) is remarkable in that the female carries the eggs on her back, where they are placed in position by the male and sink into the soft spongy skin, so that each egg occupies a pouch, in which the development takes place, until the young emerge as fully formed Toads.

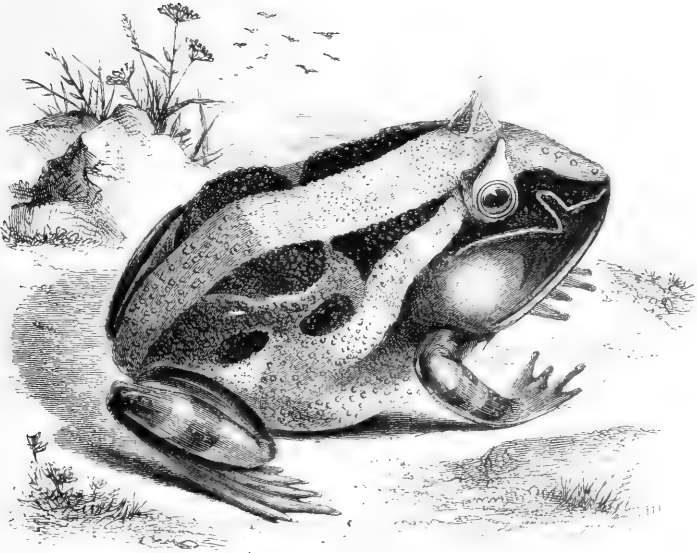
The Arcifera are characterized by the presence of a tongue, and by the overlapping of the coracoid bones on the chest. The most primitive family is the *Discoglossidae*, which agree with the Aglossa in having ribs, and differ from all other Anura in having the tongue round and non-protrusible. The half-dozen species of this family are the remnants of an old and widely distributed group; *Liopelma* is the only Batrachian found in New Zealand; the rest occur in Eurasia and North America. European examples are the Fire-bellied Toad (*Bombinator igneus*), a poisonous species with bright 'warning' colours, and the Mid-wife Toad (*Alytes obstetricans*), the male of which carries the strings of eggs round his hind-limbs; when the eggs are ready to hatch, he takes to the water.

The Arcifera without ribs, with a protractile tongue, and with the terminal bones of the digits not claw-shaped, have been grouped into several families, *Buфонidae*, *Pelobatidae*, *Cystignathidae*, &c., but these are badly defined and unnatural. There are two British Toads, the Common Toad (*Bufo vulgaris*), which ranges throughout Europe and Northern Asia, but is absent from Ireland, and the Natterjack (*B. calamita*), which is found in Western Europe, in some parts of England and Wales, and in Kerry in Ireland. The skin of the Common Toad is studded with wart-like prominences, from which a poisonous slime may exude; this makes it distasteful to eat, but is not used for offensive purposes. *Bufo marinus* is a very large Toad, attaining a length of six inches; it inhabits Central and South America.

The Spade-footed Toad (*Pelobates fuscus*) of Europe is provided with a sharp spur on each hind-foot, which it uses for digging, concealing itself in the sand very quickly. The Horned Toads (*Ceratophrys*) of South America have the eye-lids produced into a pair of appendages which resemble horns. *Leptodactylus* of Tropical America has long and slender legs.

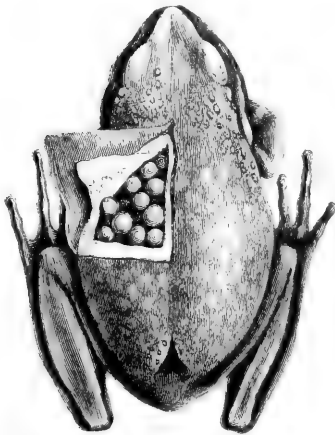
The *Hylidae*, or Tree-Frogs, differ from the *Buфонidae* in having adhesive disks at the ends of the digits; these disks are supported by the claw-shaped terminal phalanges. Most of the *Hylidae* are American or Australian, but three species of *Hyla* are found in Europe and Northern Asia. The characteristic colour of these

FIG. 7.



The Horned Toad (*Ceratophrys cornuta*), Brazil ; reduced.

FIG. 8.

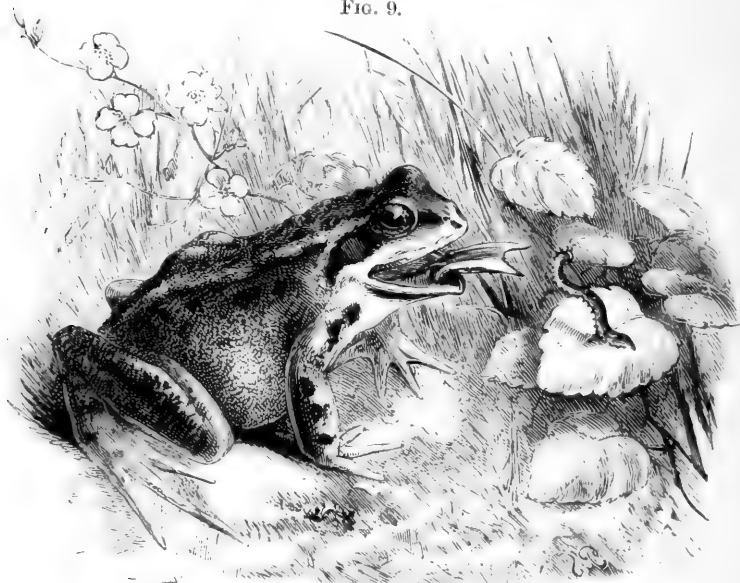


The Pouched Frog (*Nototrema marsupiatum*), with eggs in pouch. Ecuador.

arboreal Frogs is green. In *Nototrema* of South America the female carries the eggs in a pouch on the back.

In the Firmisternia the coracoids do not overlap, but meet and are firmly united in the middle line of the chest. Ribs are absent and the tongue is protractile. Several families have been recognized, *Ranidae*, *Dendrobatidae*, *Engystomatidae*, &c., but they are not yet satisfactorily defined.

FIG. 9.

The Common Frog (*Rana temporaria*).

The genus *Rana* includes the Common Frog (*R. temporaria*), the Edible Frog (*R. esculenta*), and the North American Bull-Frog (*R. catesbiana*), which takes its name from the loud roaring noise produced by the assembled males in the breeding season. *R. guppyi* of the Solomon Islands is a large frog which feeds on crabs, but *R. goliath* of W. Africa is still larger, attaining a length of nearly a foot (not including the limbs). The Horned Frog (*Ceratobatrachus guentheri*) of the Solomon Islands is remarkable for its enormous mouth, with teeth in both jaws. *Rhacophorus* includes a number of species from Madagascar and Southern Asia, arboreal frogs with adhesive disks at the ends of the digits, which are webbed; some species with large and completely webbed feet are said to use them as parachutes. The *Engystomatidae* have a small toothless mouth and a sharp snout; they eat ants and are found in tropical countries. The *Dendrobatidae* are arboreal.

REPTILES.

REPTILES may be defined as cold-blooded vertebrates which breathe by lungs throughout life, having no aquatic larval stage. Modern Reptiles are distinguished from modern Batrachians by having the skin covered with scales and by the single occipital condyle. The living Reptiles, although more numerous than the Batrachians, are but a remnant of a group which was once dominant, but has now been replaced by the Mammals and Birds.

The earliest Reptiles, the *Cotylosauria*, made their appearance in Carboniferous times; they were extremely similar to the *Batrachia Stegocephala*, from which they were derived, and from which it is not easy to separate them. The *Anomodontia* of the Permian and Triassic epochs were a large and varied group of

FIG. 10.



Restoration of a Long-tailed Pterodactyle (*Rhamphorhynchus phyllurus*), from the Upper Jurassic Lithographic Stone of Bavaria; $\frac{1}{3}$ nat. size.

terrestrial Reptiles, from which the Mammals originated; some of them, e. g. *Aelurognathus*, are remarkable for their specialized carnivorous dentition. The *Dinosauria* flourished during the Mesozoic or Secondary period of geological history (Triassic, Jurassic, and Cretaceous strata), and included both herbivorous and carnivorous forms. The skeleton of *Diplodocus* is the most conspicuous object in the gallery; this gigantic Dinosaur from the Jurassic of Wyoming measures eighty-four feet nine inches in total length; it was probably too heavy for much activity on land and may have spent most of its time in the water, feeding on water-plants, its long neck and the position of the nostrils at the top of the skull enabling it to breathe when wading at considerable depths. Other large Dinosaurs exhibited are *Triceratops*, with its bony neck-shield, and *Iguanodon*, which walked on its hind-legs.

FIG. 11.



THE TUATARA LIZARD (*Sphenodon punctatus*). New Zealand
(From a specimen in the Museum.)

The Ichthyosaurs and Plesiosaurs were whale-like marine Reptiles, with the limbs modified into paddles. The Cretaceous Mosasaurs also had paddle-shaped limbs, but were snake-like in form ; *Liodon* is estimated to have reached a length of 100 feet, a veritable Sea-serpent. The Pterodauctyles were flying Reptiles, with the membrane of each wing attached to the body and supported by the elongate outermost digit of the fore-limb ; they have no affinity to Birds. Some species of *Pteranodon* had a wing-spread of twenty feet ; a fine example is exhibited on the west wall of the gallery, above the door.

All the orders mentioned above became extinct millions of years ago, long before man appeared. The specimens exhibited in cases 4, 5, 16 and 17 give some idea of the structure and appearance of these inhabitants of the land, the sea, and the air during the Secondary Period, the ' Age of Reptiles ' as it has been called ; they may be studied in more detail in the Gallery of Fossil Reptiles.

About 6,500 species of Reptiles are living at the present day ; they belong to four orders, *Rhynchocephalia*, *Crocodylia*, *Chelonia*, and *Squamata*.

Order 1. **RHYNCHOCEPHALIA.**

(Case 5.)

The Tuatera (*Sphenodon punctatus*) of New Zealand was formerly classed with the lizards, but it differs from them in having two horizontal bony arches on each side of the temporal region of the skull, in the fixed quadrate (the bone with which the lower jaw articulates), and in many other features ; it is now recognized as the most primitive of all living Reptiles and the sole survivor of a group which dates back to Triassic times.

The Tuatera is like a Lizard in appearance, and attains a length of more than two feet ; it has been exterminated on the mainland, but still lives on a few small islands near the coast. It excavates a burrow, which it often allows a petrel to share, without attempting to molest the bird or its eggs and young ; it sleeps most of the day, but at night ventures out in search of food, which consists of small living animals. The eggs have a hard, white shell ; about ten are laid in holes in the sand, in a sunny place ; they do not hatch until a year has passed.

Order 2. **CROCODYLIA.**

(Cases 1 to 3.)

The members of this order are large, four-footed, long-tailed Reptiles, with five toes to the fore-feet and four to the hind ones. The teeth are implanted in separate sockets, the quadrate bone

is fixed, and the bones of the skull are sculptured. The body is covered with horny shields, beneath which, at least on the back, are series of bony plates. The inner aperture of the nostrils is placed far back on the palate, enabling these animals to breathe while holding their prey under water.

There are about two dozen living species; these frequent rivers, but their mesozoic ancestors appear to have been marine, and approximate in structure to the Dinosaurs.

In the genus *Crocodylus* the snout is short or moderately long, and is rounded or pointed; the teeth are large and stout, and the fourth lower tooth fits into a notch in the upper jaw, being exposed when the mouth is closed. Crocodiles occur in America from Florida to Guiana; in the old world they inhabit Africa, Madagascar, and Southern Asia, extending through the Archipelago to the Solomon Islands and northern Australia. Crocodiles are large and ferocious; they are exclusively carnivorous, and generally seize their victims (other than human beings) by the nose as they are drinking. A large number of people—especially women, as they go to the rivers for water—are annually killed in India by these Reptiles. Crocodiles bury their eggs, which have a hard white shell, in the sand.

The Muggar or Marsh-Crocodile (*C. palustris*) of India has the snout very short and broad. *Crocodylus niloticus* is the common African species and the Indian *C. porosus* is notable for its size, attaining a length of 20 feet, and for its habits, as it frequents estuaries and may be met with out at sea.

Alligators and Caimans differ from Crocodiles in that the fourth lower tooth is received into a pit in the upper jaw. Alligators inhabit swamps; there are two species, *Alligator mississippiensis* and *A. sinensis*, the former North American, the latter Chinese. The American Alligator constructs a large nest on the bank, scraping together twigs, leaves, and earth to form a mound about 3 feet high, in which about 30 eggs are laid in layers.

The Caimans of Central and South America differ from the Alligators in having a shield of bony plates in the skin of the under-side of the body; a fine specimen of the Common Caiman (*Caiman sclerops*) is exhibited.

The Gharial (*Gavialis gangeticus*) of India, and the False Gharial (*Tomistoma schlegelii*) of Borneo, have the snout long and narrow, the two halves of the lower jaw united in a long symphysis, and the teeth slender and numerous; they feed chiefly on fish.

Order 3. CHELONIA.

(Cases 6 to 10.)

The Tortoises, Turtles, and Terrapins constitute this order; in them the jaws are toothless and covered with horny beaks, and the body is typically enclosed in a bony case, the upper half

FIG. 12.



SIDE VIEW OF THE HEAD OF THE TIMSA OR NILE CROCODILE
(*Crocodilus niloticus*).

× Fourth lower tooth.

(Photographed from a specimen in the Museum.)

FIG. 13.



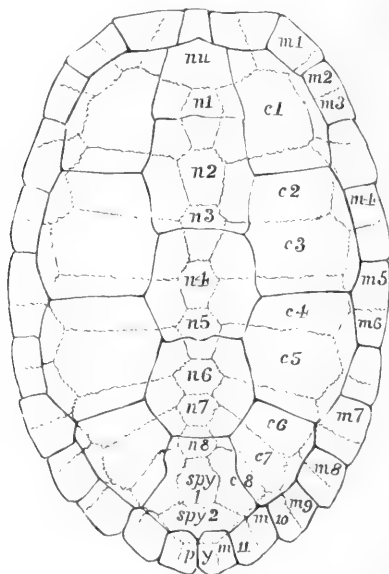
SIDE VIEW OF THE HEAD OF THE N. AMERICAN ALLIGATOR
(*Alligator mississippiensis*).

(Photographed from a specimen in the Museum.)

of which is called the carapace and the lower the plastron. The carapace is supported by the vertebrae and ribs, and in the few forms in which it has been lost its former presence is shown by the modification of these elements.

The carapace consists of a number of bony plates arranged in five series: those of the median series are fused with the neural spines of the vertebrae below them; on each side of them are the costal plates, either supported by the flattened ribs, or, if they ossify at a stage when the ribs are slender and cartilaginous,

FIG. 14.

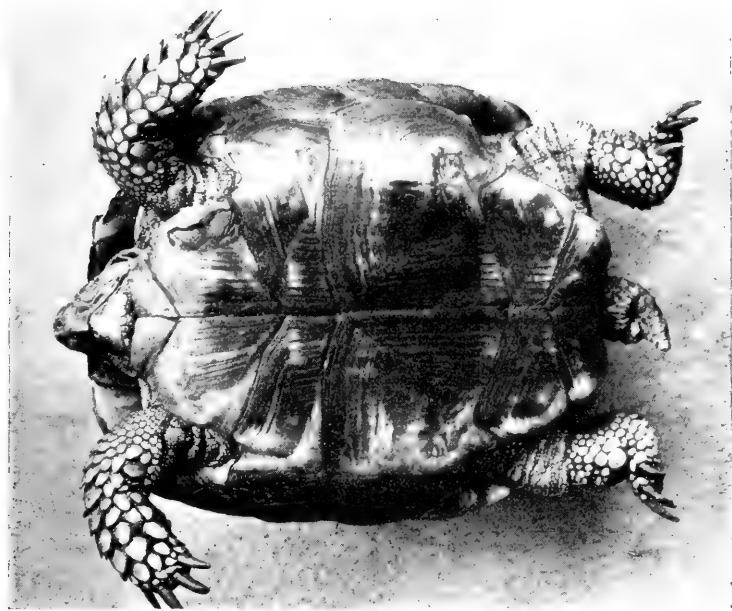


Carapace of the Thurgi Batagur (*Hardella thurgi*). The wavy lines show the divisions (or sutures) between the bones; the firm lines indicate those between the overlying horny shields. *c.* 1-8, costal bones; *m.* 1-11, marginal bones; *n.* 1-8, neural bones; *nu.* nuchal bone; *py.* pygal bone; *spy.* 1, 2, suprapygals bones. Note that the horny plates do not correspond with the bony ones.

enclosing the latter; outside the costals are the marginals. The bones of the plastron are paired. The horny shields which usually cover the carapace and plastron have a somewhat similar arrangement to the bony plates, but do not correspond with them in size or number.

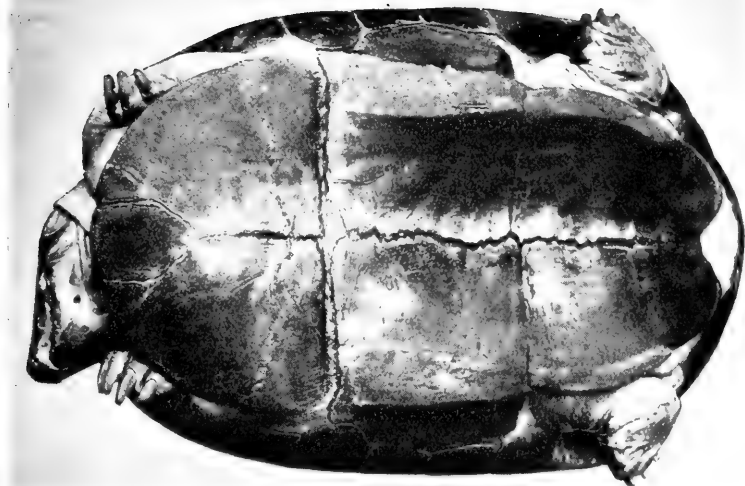
Chelonians date back to the Triassic and many have been found fossil in Secondary and early Tertiary strata; the living

FIG. 15.



A CRYPTODIRAN TORTOISE (*Homopus arcuatus*).
To show how the head is withdrawn by an S-like curve of
the neck in a vertical plane.

FIG. 16.



A PLEURODIRAN TORTOISE (*Sternotherus niger*).
To show mode of retracting the head by a lateral
flexure of the neck

(Both figures from living specimens.)

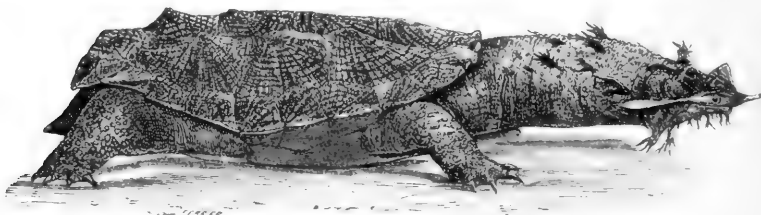
species number about 300. They may be grouped into two main divisions : Pleurodira, in which the head is retracted by a lateral flexure of the neck ; and Cryptodira, in which the head is retracted by the curving of the neck in a vertical plane.

Pleurodira.

The Pleurodira withdraw the head by a lateral movement of the neck. They are fresh-water Tortoises, found in South America, Africa, and Australia.

The Arrau Tortoise of the Amazons (*Podocnemis expansa*) is a source of profit to the natives, who collect the soft-shelled eggs, which are laid in the sand, and extract oil from them ; millions

FIG. 17.



The Matamata Tortoise (*Chelys fimbriata*) ; reduced.

of eggs are thus destroyed annually. The Matamata (*Chelys fimbriata*) of Brazil has the shields of the carapace raised into knobs ; it feeds on fishes and lies in the water waiting for its prey, which it is said to attract by the movements of the fringed appendages which are developed on the skin of the head and neck.

The Pleurodira include the earliest known Tortoises, the Triassic *Amphichelydidae*, and also the large extinct Horned Tortoises of the family *Miolaniidae*, found in tertiary deposits of Australia and Patagonia.

Cryptodira.

This group includes the Chelonians, which bend their neck in a vertical plane. There are three main divisions : in the first, containing the typical Tortoises and Turtles, the carapace is well developed and is bordered by a complete series of marginal bones connected with the ribs. This division includes the families *Chelydridae*, *Cinosternidae*, *Testudinidae*, &c., in all of which the digits are short, as well as the *Chelonidae* or true Turtles, in which the anterior limbs are developed into long paddles.

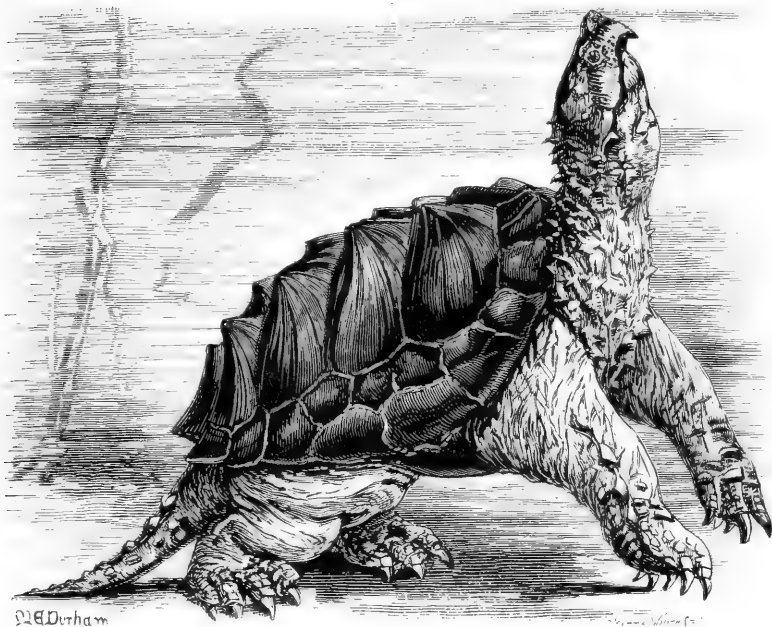
The *Chelydridae* include the Snapping Turtle or Snapper

(*Chelydra serpentina*) and the Alligator Turtle (*Macrolemmys temminckii*) of North America. These live mostly in the water, keeping to the bottom, but rising occasionally to breathe; they feed on fish and waterfowl and are both fierce and greedy.

The *Cinosternidae*, or Mud Terrapins, comprise about ten species of *Cinosternum* from American rivers.

The Burmese Casked Terrapin (*Platysternum megacephalum*) is

FIG. 18.



Temminck's Snapper, or Alligator Turtle (*Macrolemmys temminckii*);
 $\frac{1}{6}$ nat. size.

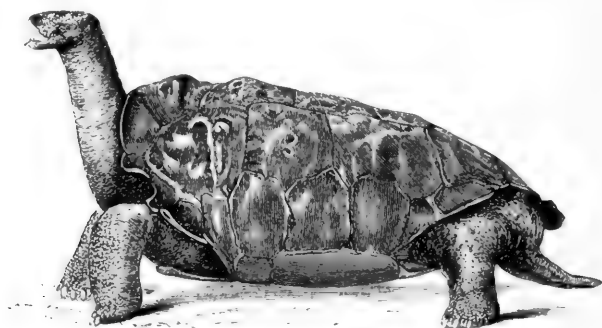
[By permission of Messrs. Macmillan & Co., Ltd.]

the only species of the family *Platysternidae*; it is aquatic and has a flattened carapace, a very large head, powerful jaws, and a long tail.

The large family *Testudinidae* includes a variety of forms, from the terrestrial herbivorous Tortoises to the aquatic carnivorous Batagurs. The typical Land Tortoises (*Testudo*) are found in all warm countries except Australasia and some of the Malay Islands. The carapace is usually dome-shaped and is firmly united to the plastron, the feet are not webbed, and the tail is short. The majority of the existing species of *Testudo* are small

or of moderate size, like *T. graeca* of southern Europe, which is often kept in gardens. Giant Tortoises formerly inhabited most of the continents, but in recent times they have been found only on the Galapagos Islands and on certain islands in the Indian Ocean, namely the Mascarene Islands, the Aldabra group, the Amirantes and the Seychelles. The Galapagos Tortoises still survive in diminished numbers, but elsewhere they have been exterminated by man, South Aldabra alone possessing a small remnant of its original stock. There are several species in the Galapagos; they are vegetable feeders, living on cactuses, leaves and berries; the eggs are round and about two inches in diameter.

FIG. 19.



The Abingdon Island Saddle-backed Tortoise (*Testudo abingdoni*), remarkable for the thinness of its shell, from the Galapagos group.

(From a specimen in the Museum.)

These Giant Tortoises live to a great age; a specimen of *Testudo sumeirei*, brought from the Seychelles to Mauritius in 1766, was still living in 1902. In several of the species the carapace is thin and it may be incomplete, as in *T. ephippium* and *T. abingdoni* of the Galapagos. The largest specimen exhibited belongs to the North Aldabra species *T. gigantea*.

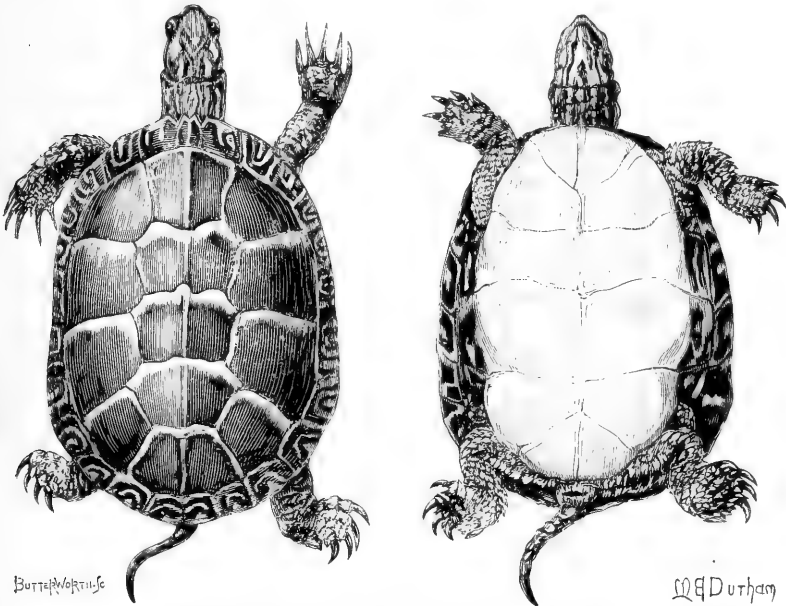
The reduction of the shell in these large island tortoises was no doubt related to the absence of carnivorous animals, and it is of interest to note a still greater reduction in a continental form, the recently described *T. loveridgii* from East Africa. This is a small species, flat in form, with the carapace represented by a mere network of thin bone. It hides in crevices and under rocks, its flat flexible carapace enabling it to make its way into such places and to take advantage of the protection they afford.

The Box-Tortoises (*Cistudo*) of North America take their name from the fact that the plastron, which is attached to the carapace by ligament, is divided by a transverse hinge, so that

it can be closed against the carapace after the head, tail, and limbs have been drawn in.

The Terrapins (*Chrysemys*) are aquatic American Tortoises with a flat carapace and webbed feet; the Painted Terrapin (*C. picta*) takes its name from the yellow and red markings on a dark ground colour. *Malacoclemmys terrapin* is the well-known salt-water Edible Terrapin of the United States, where it is extensively 'farmed', being fed on shrimps and crabs. The

FIG. 20.



The Painted Terrapin (*Chrysemys picta*); $\frac{1}{2}$ nat. size.

[By permission of Messrs. Macmillan & Co., Ltd.]

Pond-Tortoises (*Emys*) include one European and one North American species; they feed on fishes, worms, &c., and bury themselves in the mud during the winter. *Kachuga*, *Batagur*, &c., are aquatic tortoises from India and S.E. Asia. The carapace and plastron are connected by strong bony buttresses, which project inwards as vertical partitions; an example of *Batagur picta* exhibited has been prepared to show this structure.

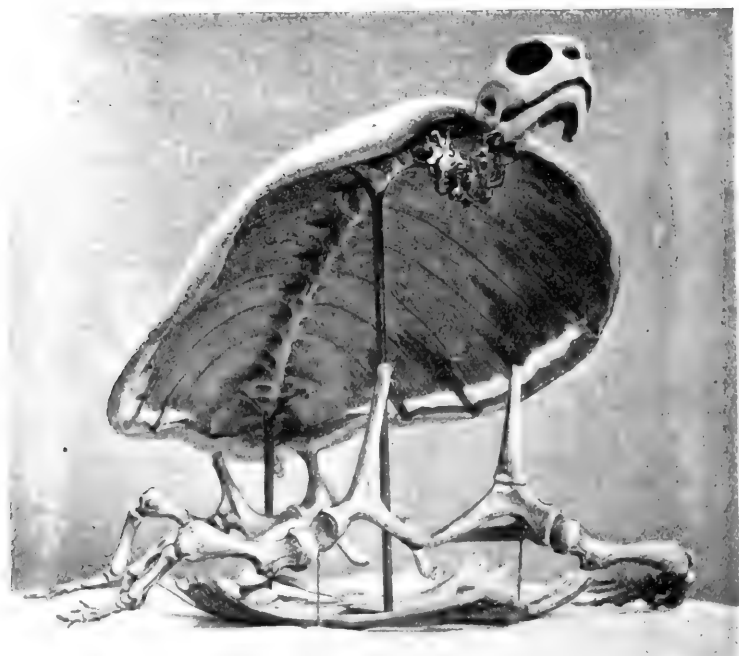
The *Chelonidae* are the true Turtles, with paddle-shaped limbs. They are marine, but the females come ashore on sandy coasts to lay their eggs. The edible Green Turtle (*Chelone mydas*) attains a length of 4 feet; it is found in all warm seas and feeds on sea-

FIG. 21.



SKELETON OF LUTH OR LEATHERY TURTLE (*Dermochelys coriacea*).
To show complete separation of 'shell' from the vertebrae and ribs.

FIG. 22.

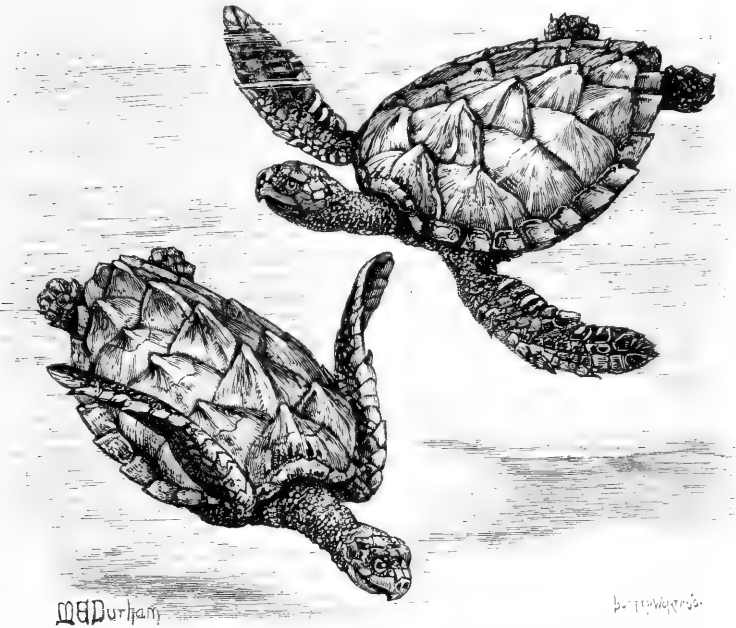


SKELETON OF GREEN TURTLE (*Chelonia mydas*)
To show union of carapace with vertebrae and ribs.
(From specimens in the Museum.)

weeds. | The Hawksbill Turtle (*C. imbricata*) is so called from its hooked beak ; it is carnivorous ; its horny shields are the chief source of commercial 'tortoise-shell'. The Loggerhead (*Thalassochelys caretta*) is a large carnivorous species of no commercial importance.

We now pass to the second division of the Cryptodira, which has only one living representative, the Luth or Leathery Turtle

FIG. 23.



Young Hawksbill Turtles (*Chelone imbricata*) ; $\frac{1}{2}$ nat. size.

[By permission of Messrs. Macmillan & Co., Ltd.]

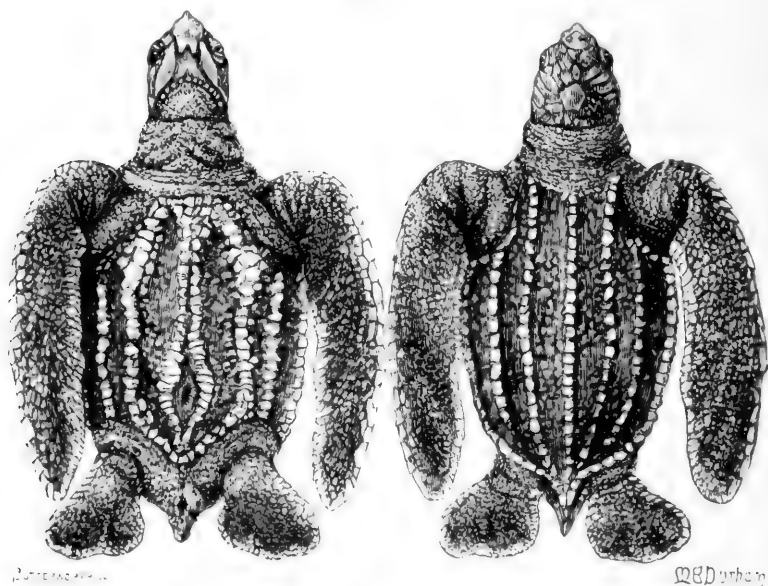
(*Dermochelys coriacea*), which has neither bony carapace nor horny shields, but a thick leathery skin containing a mosaic of small polygonal bony plates ; the limbs are paddle-shaped.

The Leathery Turtle is marine and carnivorous, inhabiting all tropical seas, and laying its eggs on sandy shores. It is the largest existing Chelonian, reaching a length of nearly seven feet.

The following explanation has been given of the remarkable structure of *Dermochelys*. The original Chelonians were terrestrial and acquired a hard bony carapace as a protection against attacks ; in some that took to the sea and became pelagic, the carapace, which was no longer useful, became vestigial (*Archelon*

Protostega, &c., of the Upper Cretaceous); these resorted to the coasts to lay their eggs and gave rise to a shore-living form, which developed a new protective armour of strong polygonal sculptured bony plates (*Cosmochelys* of the Lower or Middle Eocene); from such a shore-living form arose *Dermochelys*, again pelagic, with the bony armour reduced to small thin smooth plates embedded in the skin. It is of great interest to note that this evolutionary sketch was written before the discovery of *Cosmochelys*, the most important link in the chain.

FIG. 24.



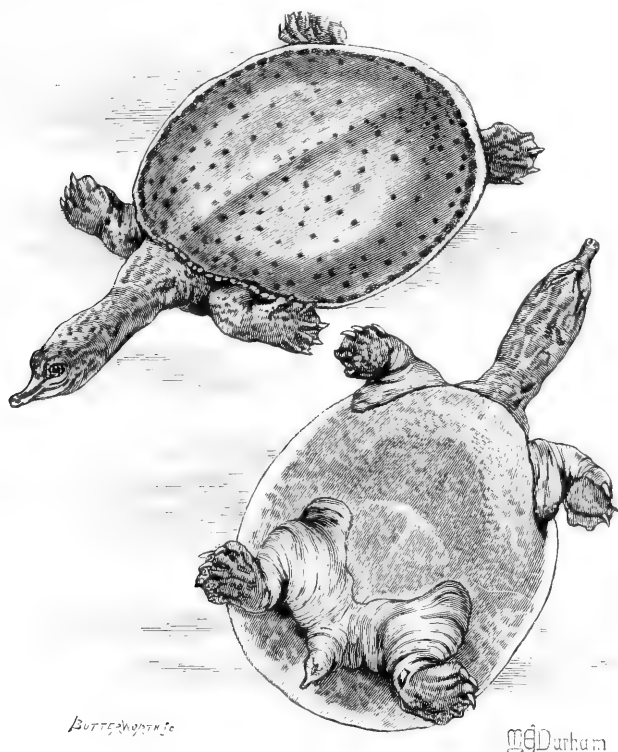
Luth or Leathery Turtle (*Dermochelys coriacea*); young specimens; lower and upper view.

[By permission of Messrs. Macmillan & Co., Ltd.]

The third division of the Cryptodira includes the Soft-shelled Tortoises (*Trionychidae*), characterized by the flat, rounded or oval carapace which does not cover the back completely, the ribs extending outwards beyond the costal plates and the marginals being absent; there are no horny shields and the bones of the carapace are sculptured externally; the toes are webbed. The *Trionychidae* are carnivorous and aquatic, inhabiting North America, Africa, and Asia. It has been observed that in the same species of *Trionyx* there may be individuals with the horny sheaths of the jaws narrow and sharp-edged, and others in which they are broad and flat, the difference being presumably related

to feeding habits, those with sharp jaws catching fish and the others crushing shells. Many species of this family have curious eye-like spots on the back; the larger kinds may be highly dangerous to bathers.

FIG. 25.



Young American Soft Tortoises (*Trionyx ferox*).

[By permission of Messrs. Macmillan & Co., Ltd.]

Order 4. **SQUAMATA.**

This order contains the Lizards and Snakes, which are characterized by having the quadrate bone movably attached to the skull and by the presence of not more than one horizontal bony arch on each side of the temporal region of the skull. The teeth are welded to the jaws. The majority of living Reptiles belong to this order, more than 6,000 species having been described, nearly equally divided between the Lizards and Snakes. There are two sub-orders, Lacertilia and Ophidia.

Sub-order 1. **Lacertilia.**

(Cases 18 to 20.)

In the Lacertilia, or Lizards, the two halves of the lower jaw are firmly united by suture. There are two main divisions, the first, the *Lacertilia Vera*, including the true Lizards, which have a flat tongue, and the second, *Rhoptoglossa*, comprising the Chamaeleons, in which the very long and extremely protractile tongue is cylindrical, club-shaped at the end.

Division 1. **Lacertilia Vera.**

The true Lizards are grouped into about 20 families, one of the characters of most importance in classification being the structure of the tongue, which may be short or long, entire or bifid at one or both ends, and either smooth, villose (covered with conical papillae) or scaly (covered with flat overlapping papillae, which may unite to form oblique folds). The presence or absence of 'osteoderms', little bony plates beneath the scales of the body, is also of use in classification. In the more typical Lizards each orbit is surrounded by bone, and from it a bony bar or 'temporal arch' runs backwards; but the orbit may be open behind and the temporal arch may be absent, these conditions being used in defining the families.

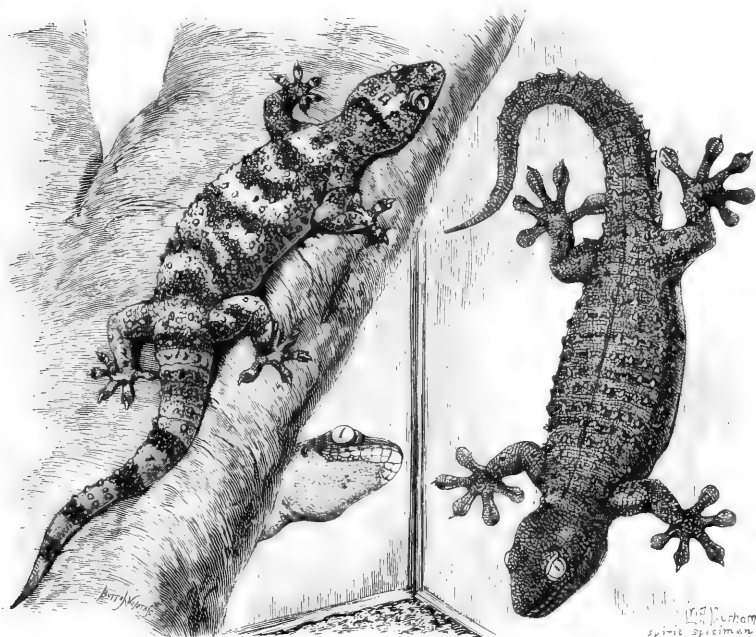
Most Lizards are terrestrial or arboreal and have well-developed five-toed limbs, but some are snakelike in form and are limbless, and there are some degraded burrowing forms which are also nearly or quite scaleless and look like worms. Some Lizards are herbivorous, but the majority are carnivorous, the smaller kinds feeding on insects, worms, &c., and the larger on other animals. As a rule Lizards lay eggs, but a considerable number are viviparous.

The *Geckonidae*, or Geckos, take their name from the fact that many species utter sounds such as *yecko*, *chucko*, &c. They are Lizards with a smooth or villose tongue, which is slightly notched in front, with the orbits open behind, without temporal arches, and with biconcave vertebrae. This is a large and widely distributed family, Geckos occurring in all tropical and sub-tropical countries, even on oceanic islands. Some species live in deserts, sometimes burrowing in the sand; others are arboreal, and others live on rocks; some kinds have acquired the habit of living inside or outside houses, and it has been observed that in a house one species may inhabit the cellars, another the roof, and a third crevices in the walls. The arboreal and rock-climbing species have the toes expanded and provided on the under side with transverse lamellae, forming adhesive pads, which are so effective that Geckos in houses may be seen walking upside down

on the ceiling. In most Geckos the tail is very brittle, and when it is broken off a new one is quickly reproduced. The majority of the species are nocturnal, concealing themselves in the day-time under stones or under the bark of trees, and at night coming out of their hiding-places in quest of insects.

Of the species exhibited *Tarentola mauritanica* is the Common Gecko of Southern Europe, *Uroplates fimbriatus* of Madagascar

FIG. 26.



A, Turkish Gecko (*Hemidactylus turcicus*), and B, Common Gecko (*Tarentola mauritanica*).

[By permission of Messrs. Macmillan & Co., Ltd.]

is remarkable for its resemblance to the bark of the trees on which it is found, and *Ptychozoon homocephalum* of the Malay countries has the body bordered by expansions of the skin, which act as parachutes.

The *Eublepharidae* is a small family which is distinguished from the *Geckonidae* only by having the vertebrae procoelous (concave in front and convex behind), as in all other Lizards except the Geckos.

The *Pygopodidae* of Australia appear to be related to the Geckos, but are snake-like in form, without fore-limbs and with

FIG. 27.

A.



B.



MALAGASY BARK-GECKOS (*Uroplates fimbriatus*).
(From specimens in the Museum.)

the hind-limbs visible externally as a pair of scaly flaps. Examples of *Pygopus* and *Lialis* are exhibited.

The *Zonuridae* of Africa and Madagascar have the tongue short, villose, scarcely protractile, entire or feebly notched ; the orbit is surrounded by bone and the temporal arch is present, the space between it and the skull being roofed over by dermal bone ; osteoderms are present in *Zonurus*, the principal genus, in which the tail is covered with rings of scales ending in sharp spikes.

FIG. 28.

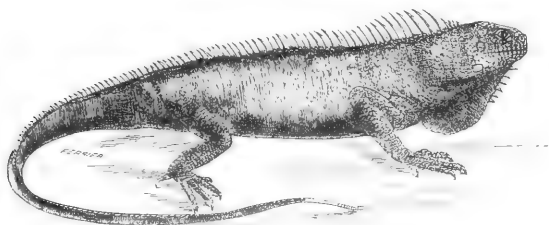
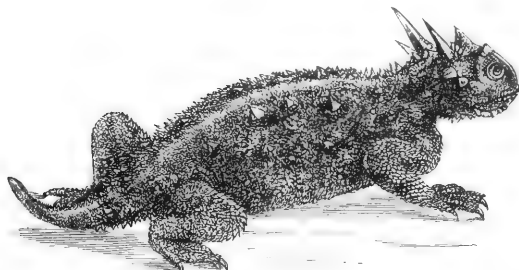
Iguana (*Iguana tuberculata*).

FIG. 29.

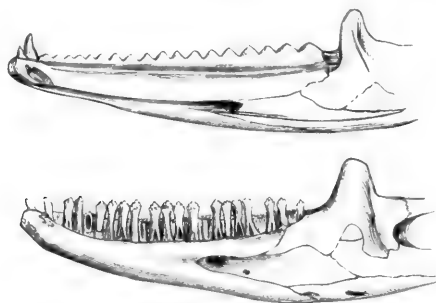
Spiny Iguana, or Californian Toad (*Phrynosoma cornutum*).

The *Iguanidae* differ from the *Zonuridae* in that the space between the temporal arch and the skull has no bony roof ; osteoderms are absent. This is a large and varied family, mainly American, but with representatives in Madagascar and Fiji. *Iguana tuberculata* of tropical America is a large herbivorous arboreal lizard, with a crest of spines along the back ; it grows to a length of six feet ; it is edible and is highly esteemed as food. *Basiliscus* is noteworthy for the high fin-like crest on the back of the male, and *Polychrus* for its chamaeleon-like power of changing its colour. *Phrynosoma cornutum* of California, which lives in dry and sandy places, has the body covered with spines. *Amblyrhynchus cristatus* of the Galapagos spends much of its

time in the sea and feeds on sea-weed. More than a hundred species of *Anolis* have been described; these are arboreal and insectivorous lizards, with adhesive pads on the digits.

The *Agamidae* of Africa, Southern Asia, and Australia are the old-world representatives of the *Iguanidae*, from which they differ in the 'acrodont' dentition, i. e. the teeth are attached to the summits of the jaws, whereas in the *Iguanidae* and most other Lizards the dentition is pleurodont, i. e. the teeth are attached on the inner side of the jaws. In the *Agamidae* the teeth may usually be divided into three kinds, incisors, canines, and molars.

FIG. 30.

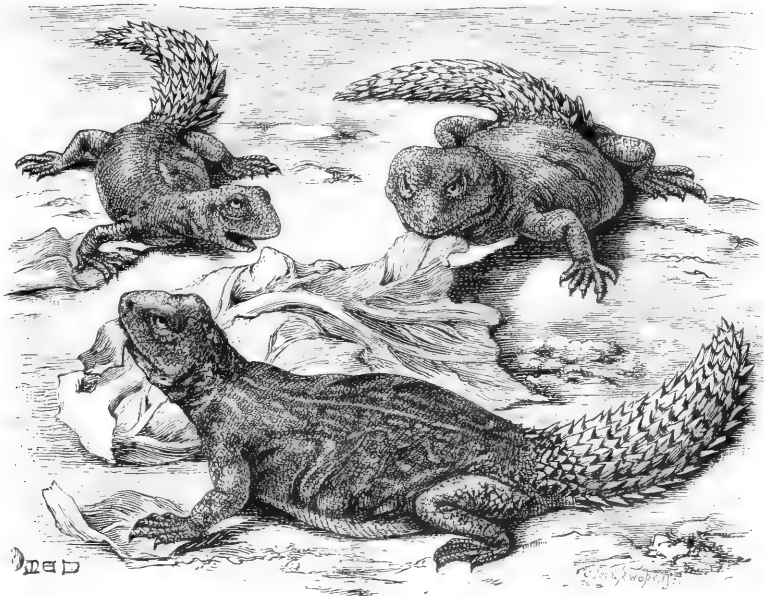


Right half of the Lower Jaw of a Stellion Lizard (a), to exhibit the acrodont dentition, and of an Iguana (b), to show the pleurodont type of dentition.

Uromastix is found in the desert regions of Africa and Asia; the short tail is covered with large spiny scales and the strong curved claws are used for digging burrows in the sand; it feeds on fruits and herbs. *Moloch*, of the Australian deserts, is an extraordinary type, with spines on the head, body and tail. Another interesting Australian form is the Frilled Lizard, *Chlamydosaurus Kingi*, which, if chased, runs away on its hind-legs, with the frill round its throat folded up, but when it is likely to be overtaken will stand and try to frighten away its enemy by spreading the frill and opening the mouth, which is red inside. In the Flying Dragons (*Draco*) of India and Malaysia the long ribs extend outwards beyond the body to support the membranous 'wings', by means of which they sail from tree to tree.

In all the Lizards so far considered the smooth or villose tongue is entire or slightly notched in front; the next two families are characterized by a tongue which is mainly villose, but has a smooth anterior bifid protractile portion. The *Helodermatidae* include the genus *Heloderma*, the only poisonous Lizard known: its fang-like teeth are grooved for the passage of the poison, which is secreted by glands inside the mouth. The

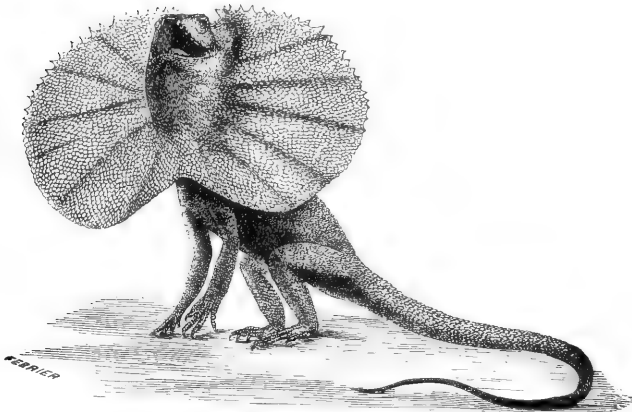
FIG. 31.



Spiny-tailed Lizards (*Uromastix acanthurus*); $\frac{1}{4}$ nat. size.

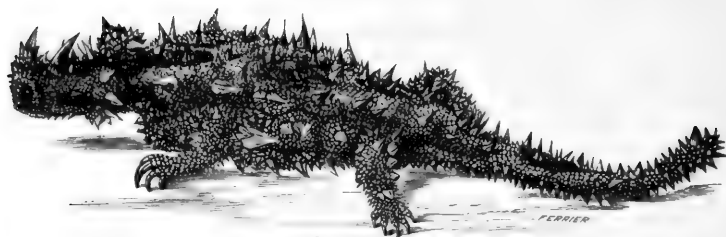
[By permission of Messrs. Macmillan & Co., Ltd.]

FIG. 32.



Australian Frilled Lizard (*Chlamydosaurus kingi*), with the frill expanded in the 'terrifying' attitude.

FIG. 33.



Australian Moloch Lizard (*Moloch horridus*).

FIG. 34.



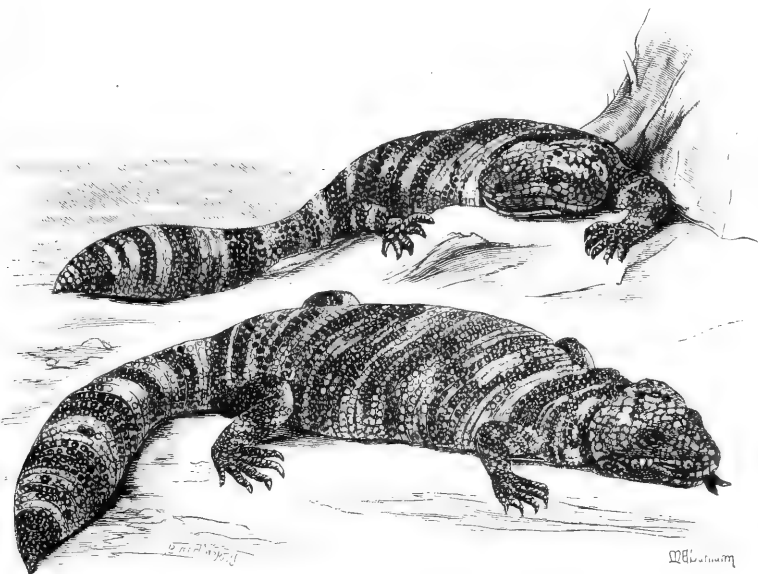
A Flying Lizard, or 'Flying Dragon' (*Draco taeniopterus*).

Gila Monster (*H. suspectum*) of Arizona and New Mexico is a stout, thick-tailed lizard, with the skin spotted or banded with orange or yellow on a dark ground, a common type of 'warning' coloration. The rare *Lanthanotus* of Borneo is allied to *Heloderma*, but its teeth are not grooved.

The *Anniellidae* of California contain but a single genus, *Anniella*, snake-shaped limbless lizards.

The *Anguidae* are characterized by the structure of the tongue, which is divided into a thick villose posterior portion and a thin

FIG. 35.



The Gila Monster (*Heloderma suspectum*); $\frac{1}{2}$ nat. size.

[By permission of Messrs. Macmillan & Co., Ltd.]

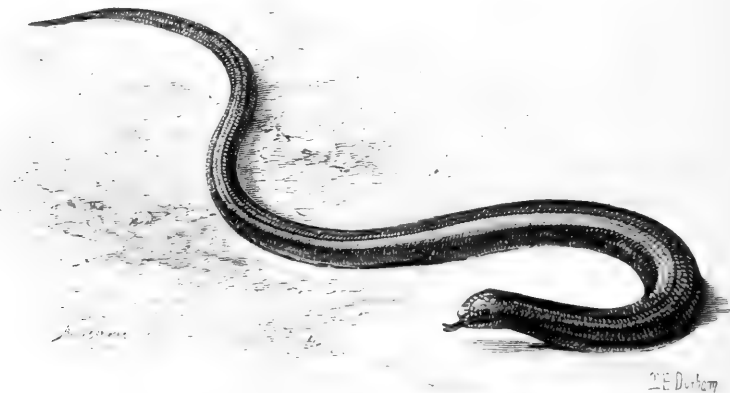
scaly forked anterior portion which can be extended and retracted. Osteoderms are present on the body, and the space between the temporal arch and the skull is roofed over by dermal bone. These are terrestrial and carnivorous lizards, mostly American, but with representatives in Europe and Asia; their long tail is brittle and readily replaced. The genera show a transition from *Diploglossus*, with the limbs well-developed and pentadactyle to *Anguis*, which has no trace of limbs; the Slow-worm (*Anguis fragilis*) is a British species.

The *Xenosauridae*, with a single species from Mexico, differ from the *Anguidae* in having no osteoderms on the body or head.

The *Varanidae* or 'Monitors' are characterized by the long, smooth protractile tongue, which is forked at the end; all the species are included in the genus *Varanus*, which occurs in Africa, Southern Asia, and Australia: some of them reach a length of seven feet, but still larger kinds are found fossil. The Monitors are mainly terrestrial, but most of them are quite at home in the water, which perhaps accounts for their wide distribution; all are carnivorous and many are fond of birds' eggs.

We now pass from the Lizards with the tongue wholly or mainly smooth or villose to those in which it is covered with scale-like papillae. Of these the most generalized family is the *Scincidae*, in which the tongue is feebly notched in front, the

FIG. 36.



The Slow-Worm (*Anguis fragilis*); $\frac{1}{2}$ nat. size.

[By permission of Messrs. Macmillan & Co., Ltd.

body is protected by bony plates underlying the scales, and the space between the temporal arch and the skull is roofed over by dermal bones. The Skinks are cosmopolitan, being especially abundant in Africa, Malaysia, and Australia; like the Geckos they are found in all the islands of the Pacific Ocean. They are carnivorous and terrestrial, showing a preference for dry and sandy regions: the species of several genera may be arranged in series showing the gradual reduction and ultimate loss of the limbs connected with their burrowing habits; this is illustrated by a series of specimens of *Chalcides*. *Trachysaurus rugosus* of Australia is remarkable for its large rough scales and short tail. *Scincus officinalis* is the common Skink of the deserts from the Sahara to Sindh. *Lygosoma* is widely distributed and has nearly 200 species. The *Anelytropidae* of Africa and Mexico are

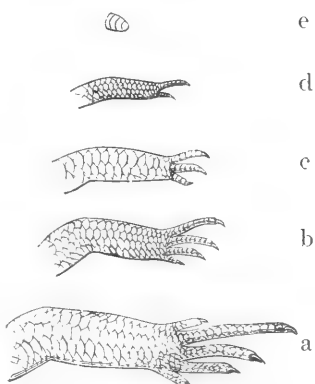
worm-like limbless burrowing forms closely related to the *Scincidae*, differing in having the orbits open behind and in having no temporal arches.

The small American family *Xantusiidae* differs from the *Scincidae* in having no osteoderms.

The *Gerrhosauridae* of Africa and Madagascar differ from the *Scincidae* in the structure of the tongue, which is bifid behind. The *Dibamidae* include *Dibamus novae-guineae*, which has a tongue like that of the *Gerrhosauridae*, but is a limbless vermiform burrowing type.

The *Lacertidae* are found in Europe, Asia, and Africa; the long scaly tongue is bifid both in front and behind, the temporal region of the skull has a bony roof, but there are no osteoderms on the body. These Lizards are terrestrial and insectivorous. *Lacerta* includes the Common Lizard (*L. vivipara*), in which the young burst the eggs just before or just after they are laid, the Sand Lizard (*L. agilis*), the Green Lizard (*L. viridis*), the Wall Lizard (*L. muralis*), and the Eyed Lizard (*L. ocellata*); these are European species, the first two of which occur in England.

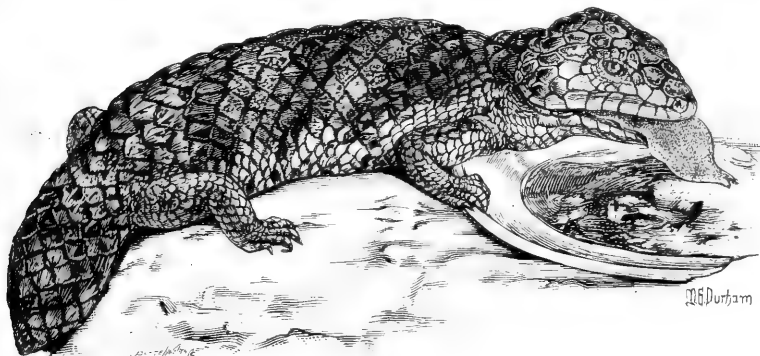
FIG. 37.



Hind-legs of Skinks, to show the gradual abortion.

- a, *Chalcides ocellatus*.
- b, *Chalcides mionecton*.
- c, *Chalcides tridactylus*.
- d, *Lygosoma linco-punctulatum*.
- e, *Chalcides guentheri*.

FIG. 38.



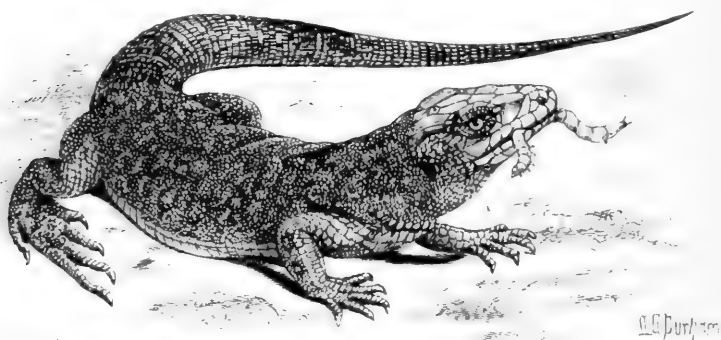
Stump-tailed Skink (*Trachysaurus rugosus*); $\frac{1}{2}$ nat. size.

[By permission of Messrs. Macmillan & Co., Ltd.]

The *Teiidae* are American Lizards with a scaly tongue, which ends in front in two long smooth points. There are no bony plates in the skin; the orbit is complete, the temporal arch is present, and the space between it and the skull is not roofed by bone. This family includes arboreal, terrestrial, and burrowing forms, the last being worm-like and limbless. The Great Teju (*Tupinambis teguixin*) of South America reaches a length of three feet; it is strong and active, living on all kinds of animals. *Dracaena* has the lateral teeth very broad and rounded.

The *Amphisbaenidae* of America and Africa differ from the *Teiidae* in having the orbits open behind and the temporal arches

FIG. 39.

The Eyed Lizard (*Lacerta ocellata*); $\frac{1}{3}$ nat. size.

[By permission of Messrs. Macmillan & Co., Ltd.]

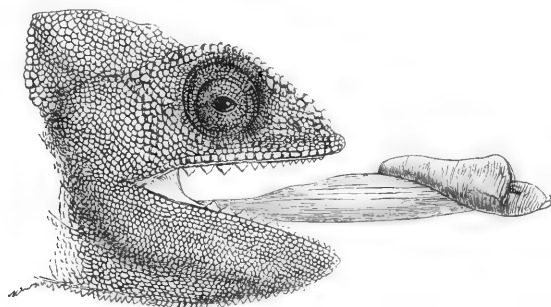
absent. They are worm-like and for the most part limbless; the body is covered with soft skin, which forms numerous rings; the scales are mere vestiges. These burrowing lizards bore narrow galleries in the earth and are distinguished from all other limbless Reptiles by their method of progression, moving either forwards or backwards in a straight line, by slight vertical undulations and not by lateral movements. They feed on worms and insects.

Division 2. Rhiptoglossa.

Chamaeleons are distinguished from the true Lizards by a number of peculiarities. The tongue is cylindrical, club-shaped at the end, and can be extended to a great length. The limbs are long and two of the toes are opposed to the other three, forming a grasping foot. The head is ornamented with crests or tubercles, the neck is short, the compressed body is covered with granules, and the tail is long and prehensile. The large eyes are covered with a thick granular lid pierced by a small central opening for the pupil.

These arboreal Reptiles are unique in their slow and deliberate movements, the mobility and independent action of their eyes,

FIG. 40.



Head of the Common Chamaeleon (*Chamaeleon vulgaris*), with the tongue partially protruded.

FIG. 41.



W. B. Durham

The Common Chamaeleon (*Chamaeleon vulgaris*); $\frac{2}{3}$ nat. size.

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and the rapid projection of the tongue to a length of several inches in order to catch the insects on which they feed. They are

famed for their power of changing the hues of their skin, but this is shared with many other Lizards.

Nearly all the species inhabit Africa or Madagascar ; one is Indian, one Arabian, whilst the Common Chamaeleon (*C. vulgaris*) is found in Spain and in the countries south and east of the Mediterranean.

Sub-order 2. Ophidia.

(Cases 11-15.)

Snakes differ from Lizards in having the two halves of the lower jaw united by ligament. The body is elongate and the limbs are vestigial or absent, but these are characters shared with many Lizards.

The essential feature of a typical Snake is the apparatus for distending the mouth ; the lower jaw bones are long and are connected together in front by an elastic ligament, whilst behind they are articulated with the long, movable quadrate bones, which are attached to the long and backwardly directed squamosals ; the long pterygoid bones are connected with the maxillaries in front and are loosely attached to the quadrates behind ; the teeth are pointed and curved backwards. This apparatus enables a snake to swallow a prey several times its own diameter.

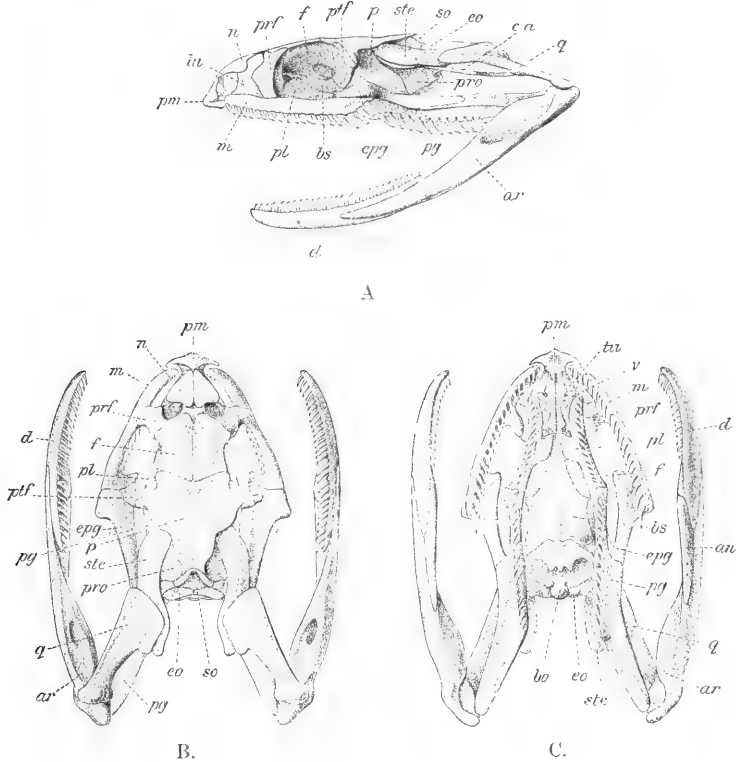
The first family is that of the *Boidae*, in which the mouth has the structure just described, the prefrontal and nasal bones are in contact, and vestiges of the pelvis and hind-limbs are present, the latter appearing externally as a pair of claws. None of the members of this family is poisonous ; the larger kinds inhabit forests and feed by choice on warm-blooded animals, which they crush in their coils before swallowing them. The Pythons are found in Africa, Southern Asia, and Australia. *Python reticulatus* is the common Malay species : it attains a length of 30 feet. The Australian Carpet-Snake (*P. spilotes*) has beautiful markings. *Boa constrictor* is a well-known South American Snake. The huge Anaconda (*Eunectes murinus*) of tropical America is both arboreal and aquatic ; it is said to grow to a length of more than 30 feet.

The next five families include snakes of burrowing habits, which agree with the *Boidae* in having the prefrontal and nasal bones in contact, but differ in the smaller size of the mouth, in relation to a diet of insects, worms, &c.

In the *Xenopeltidae* (*Xenopeltis unicolor* of India and Malaysia) the squamosal is short and does not carry back the quadrate behind the skull. In the *Ilysiidae* the squamosal is very small, but in other characters of the skeleton they agree with the *Boidae*, even to having vestiges of the pelvis and hind-limbs, the latter appearing externally as a pair of claws. The head is small

and the tail is very short and blunt. The Coral-Snake (*Ilisia scytale*) of South America is red with black rings; the few other members of the family inhabit Ceylon and Malaysia; *Cylindrophis rufus* is exhibited.

FIG. 42.

Skull of the Grass Snake (*Tropidonotus natrix*).

From the left side (A), above (B), and below (C).

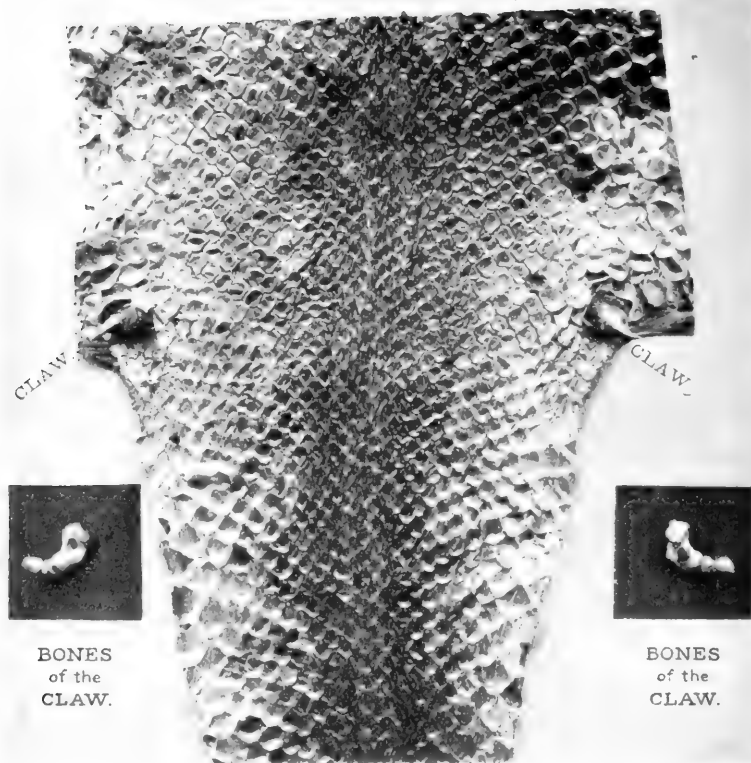
an. Angular.
ar. Articular.
bo. Basisphenoid.
bs. Basisphenoid.
ca. Columella auris.
d. Dentary.
eo. Exoccipital.
epg. Ectopterygoid.

f. Frontal.
m. Maxillary.
n. Nasal.
p. Parietal.
pl. Palatine.
pm. Praemaxillary.
prf. Praefrontal.

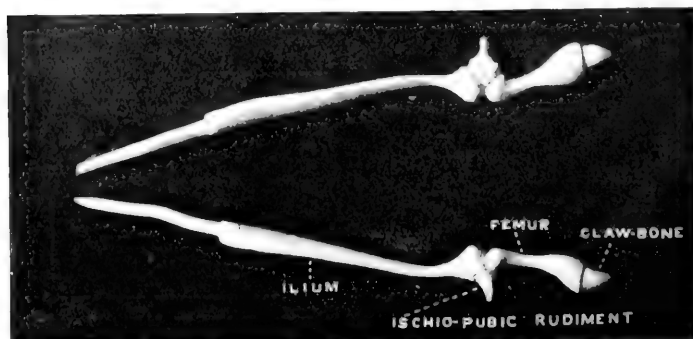
pro. Prootic.
pg. Pterygoid.
ptf. Postfrontal.
q. Quadrate.
so. Supraoccipital.
ste. Squamosal.
v. Vomer.

The *Uropeltidae* are small burrowing snakes of India and Ceylon; they differ from the *Ilisiidae* in having the small quadrates directly attached to the skull, the squamosals having

FIG. 43.



A.—PART OF THE FLATTENED SKIN OF AN AFRICAN PYTHON (*Python sebae*). Showing Claws representing Hind-Limbs, together with their supporting bones.

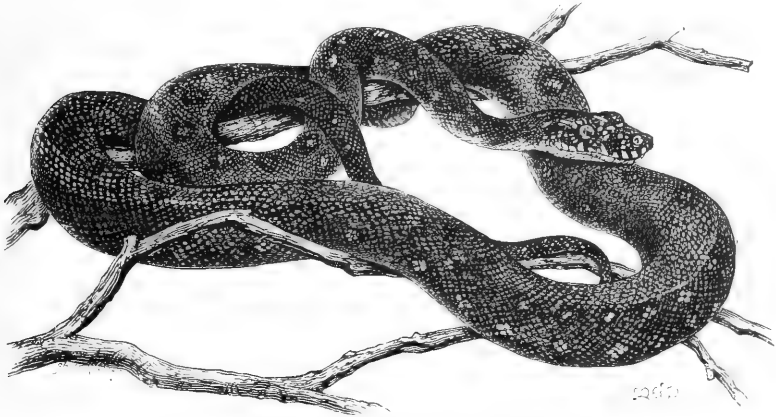


B.—COMPLETE BONES OF THE HINDER LIMB-GIRDLE OF ANOTHER SPECIMEN.
VESTIGIAL LIMBS OF PYTHONS.

been lost ; the pterygoids do not reach the quadrates and there are no traces of pelvis or hind limbs : the tail ends in a shield.

The *Glauconiidae* and *Typhlopidae* form a group apart, retaining vestiges of the pelvis, but in other respects showing the most complete adaptation to a burrowing life ; the quadrate bones are rather long and slender and are directed obliquely forwards ; behind they are attached to the skull directly, there being no squamosals. The body is covered with uniform cycloid scales, the snout projects beyond the small mouth and the minute eyes lie under the shields of the head. In the *Typhlopidae* the lower

FIG. 44.

Australian Carpet-Snake (*Python spilotes*).

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jaw is toothless, and the teeth in the upper jaw form a transverse series ; in the *Glauconiidae* teeth are present in the lower jaw only. *Typhlops* is a large genus, found in all warm countries ; *Glauconia* inhabits America, Africa, and S.W. Asia.

The large family *Colubridae* includes the great majority of living Snakes, in fact all the normal or typical Snakes which are neither *Boidae* nor *Viperidae*. The mouth has the structure described above as typical, i.e. the pterygoids reach the quadrates, which are attached to the long backwardly directed squamosals ; the features which distinguish this family from the *Boidae* are that the praefrontals are not in contact with the nasals and there are no traces of pelvis or hind-limbs.

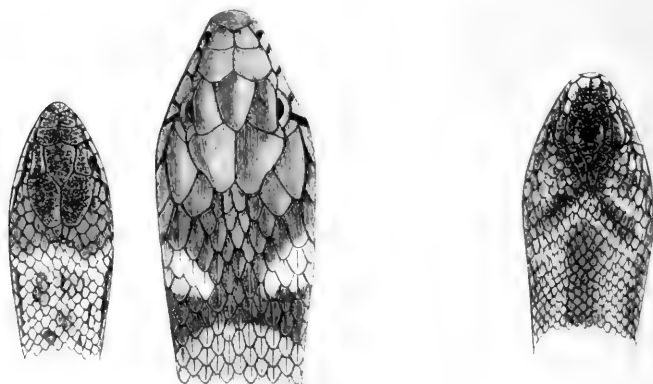
The *Colubridae* have been divided into eight sub-families, not all of which are natural ; these have been grouped into three series, *Aglypha*, with the teeth solid or ungrooved, *Opisthoglypha*, with the hinder upper teeth grooved, and *Proteroglypha*, with the front upper teeth grooved or perforated. The *Aglypha* are

mostly harmless, the *Opisthoglypha* venomous but not dangerous, the *Proteroglypha* deadly.

The principal sub-family of the Aglypha is the *Colubrinae*, which includes the Grass Snake (*Tropidonotus natrix*) and the Smooth Snake (*Coronella austriaca*), both found in Britain; these harmless snakes are distinguished externally from the venomous Adder (*Vipera berus*) by the large shields on the head (fig. 45).

FIG. 45.

FIG. 46.



Heads of the Smooth Snake (*Coronella austriaca*), A,
and the Grass Snake (*Tropidonotus natrix*), B.

Head of the Viper
(*Vipera berus*).

Heads of the three British Snakes.

The Black Snake (*Zamenis constrictor*) of North America is slender in form and is very active on land as well as in climbing trees; it feeds on mice, frogs, birds, &c. *Coluber quadrilineatus* is a handsome European species. *Dendrophis* and *Liophis* are Tree-snakes.

Dasypeltis of Africa and *Elachistodon* of India are interesting; they have no teeth in the front of the jaws, but their most remarkable peculiarity is that the lower spines of the neck vertebrae pierce the gullet, forming a series of tooth-like knobs, which are used for crushing the eggs on which they feed.

The sub-family *Elapinae* includes terrestrial snakes with a cylindrical tail; the front upper teeth are grooved or perforated for the passage of the poisonous secretion; all the venomous snakes of Australia belong to this group. The Cobras (*Naia*) of Africa and Southern Asia are characterized by the power of expanding the neck to form a hood by an outward and forward movement of the ribs (fig. 48). These snakes are very deadly, as are the Kraits (*Bungarus*) of India, which have no hood. *Elaps* is an

American genus with several species, most of which are banded with red and black.

The *Hydrophiinae* are Sea-snakes; they differ from the Elapines in having the tail compressed for the purpose of swimming. They inhabit the Indian and Pacific Oceans, and as a rule are not found far from land; they feed on fish and are viviparous. Indian fishermen are sometimes bitten by these snakes, and the bite may prove fatal.

FIG. 47.



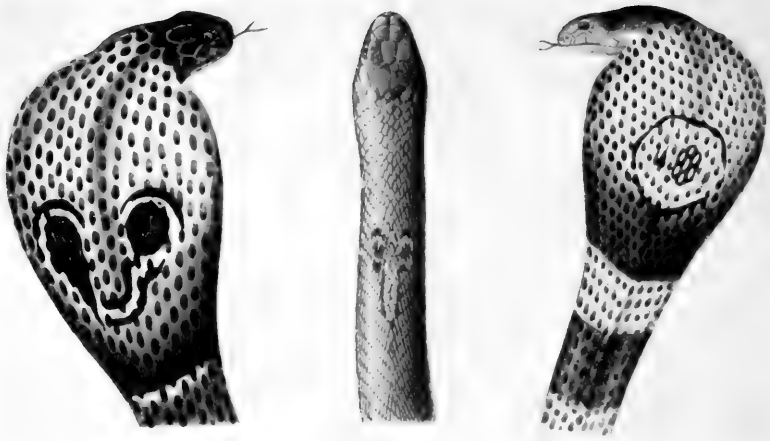
African Egg-eating Snake (*Dasypeltis scabra*); $\frac{1}{2}$ nat. size.

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The *Amblycephalidae* of South America and Malaysia stand in much the same relation to the Colubridae as the *Ilysiidae* do to the *Boidae*.

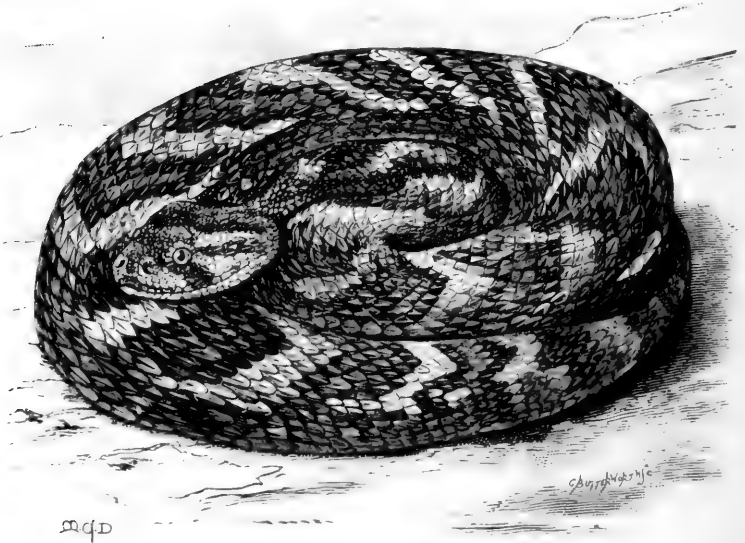
The *Viperidae* (Vipers, Rattlesnakes, &c.) differ from the *Colubridae* in having the maxillaries short, each bearing only a single poison-fang, which is perforated for the passage of the poisonous secretion. The true Vipers have solid maxillaries and no pit between the eye and the nose; they are found in Europe, Asia, and Africa. *Vipera berus* is the Common Viper, or Adder, of Europe; its bite is generally not fatal to man. *Bitis arietans* is the Puff Adder of Africa, which reaches a length of 4 or 5 feet; when disturbed it raises the head, inflates the body, and hisses loudly. The Horned Puff Adder (*B. nasicornis*) has two or three horn-like projections on the snout, whilst the Horned Viper

FIG. 48.



Heads of Indian Cobras (*Naja tripudians*); $\frac{1}{4}$ nat. size.

FIG. 49.



The Puff-Adder (*Bitis arietans*); $\frac{1}{4}$ nat. size.

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(*Cerastes cornutus*) has one above each eye. The last-named species inhabits the desert and has a dull uniform coloration, whereas most Vipers possess handsome markings.

The Pit-Vipers of America and Asia have a sensory pit on each side between the eye and the nose, lodged in the hollowed out maxillary bones. This group includes the American Rattlesnakes (*Crotalus*), which have at the end of the tail a rattle made up of a number of bells which fit into one another; these 'bells' are really the successive horny sheaths of the tip of the tail, a new one being added at each moult, when the rest of the skin is cast off. Other American species are the Water Viper (*Ancistrodon piscivorus*), which feeds chiefly on fishes, and the deadly Fer-de-lance (*Lachesis lanceolatus*). *Lachesis* is also represented in Asia, a well-known species being the Indian Green Viper (*L. gramineus*), which lives in trees.



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