

THE COMMON FROG *
III.

TO prosecute successfully our inquiry "What is a Frog?" it will be well now to make acquaintance with the more remarkable forms contained in its Order, after which, by considering the other Batrachian orders, we may arrive at a certain appreciation of its Class.

The Frog's own genus (*Rana*), which contains about 40 species, has its head-quarters in the East Indies and in Africa, but extends over all the great regions of the

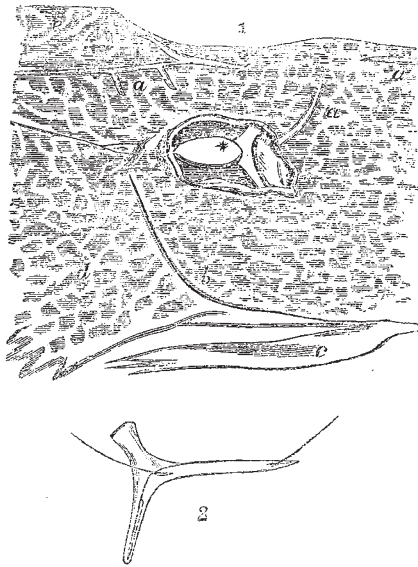


FIG. 7.—Poison Organ of *Thalassophryne reticulata* (after Günther). 1, Hind half of the head with the venom-sac of the opercular apparatus *in situ*. * Place where the small opening in the sac has been observed. a, Lateral line and its branches; b, gill-opening; c, central fin; d, base of pectoral fin; e, base of dorsal fin. 2, Operculum, with the perforated spine.

world, except Australia, and parts more southerly still, and except countries situate above 66° north latitude. In South America, however, but a single species is as yet known to exist.

Amongst the largest species are *Rana tigrina*, of India and the Indian Archipelago, and the bull-frog (*R. Mujiensis*)

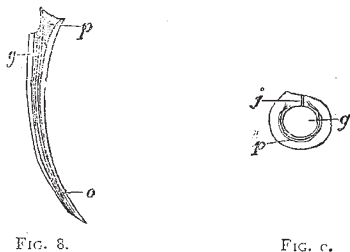


FIG. 8.—Vertical, Longitudinal Section of the Poison-fang of a Serpent (after Owen). g, deep groove; o, its lower termination, which affords exit to the poison; p, pulp-cavity. FIG. 9.—Magnified Transverse Section of a Serpent's Poison-fang (after Owen). g, groove round which the substance of the tooth (containing p, the pulp-cavity) is bent; j, the point where the sides of the tooth meet and convert the "groove" into what is practically a central cavity.

of North America. The latter animal may often be seen in the Gardens of the Zoological Society, where it is fed on small birds—a sparrow being easily engulfed within its capacious jaws.

The Edible Frog, *par excellence* (*R. esculenta*), is found in England as well as on the Continent of Europe. It is as widely distributed over the old world as is *R. tempo-*

* Continued from vol. viii p. 512.

varia, but it is unknown in America. It is easily to be discriminated from the common species (see Fig. 4 on p. 510) by the absence of that dark, sub-triangular patch which extends backwards from the eye in *R. temporaria*.

The male of *R. esculenta* is further to be distinguished from the male of the common Frog by the fact of its having the floor of the mouth on each side, distensible as a pouch—the pouches, when distended, standing out on each side of the head. These pouches are called "vocal sacs," and no doubt aid in intensifying these animals' croak, which is so powerful that (on account of it and

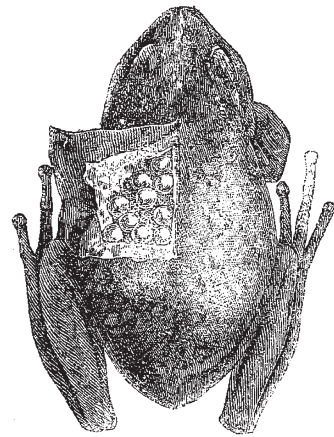


FIG. 10.—The female of *Nototrema marsubiatum*, with the pouch partly cut open (after Günther).

because of the country where they are common) they have been nicknamed "Cambridgeshire Nightingales." Specimens from Cambridgeshire are preserved in the British Museum.

A large South American Frog (*Ceratophrys cornuta*), which devours other smaller Frogs as well as small birds and beasts, is noteworthy on account of the singular bony

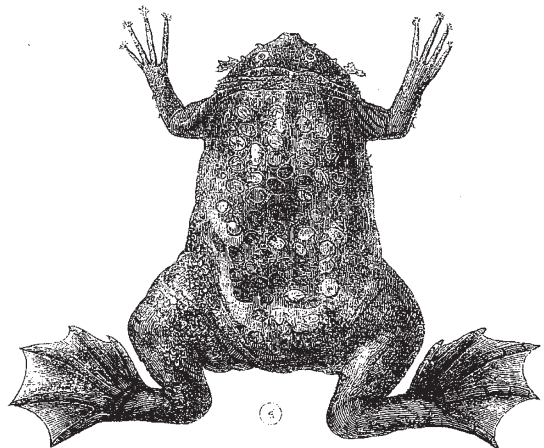


FIG. 11.—The Surinam Toad (*Pipa americana*).

plates which are enclosed in the skin of its back: a character which it shares with a small South American Toad (*Brachycephalus ephippium*), and which we shall hereafter see to be a point of special interest.

A Frog newly discovered* (of a new genus but one allied to *Rana*), called *Clinotarsus*,† has been

* The type of this genus is a species which was in my own collection (with no clue to the locality whence it originally came), but is now deposited in the British Museum. It was first described in the Proceedings of the Zoological Society for 1868, under the name *Pachybatrachus*.

† Proc. Zool. Soc., 1869.

(see Fig. 5, vol. viii. p. 511) represented, in the hope that by the wider circulation of a figure of it, it may be recognised, and its habitat so ascertained.

The common Toad (*Bufo vulgaris*) is as widely distributed over the earth's surface as is *Rana esculenta*. It is less aquatic than the frog, and more sluggish in its motions. In shape it resembles the frog, but is more swollen, with much shorter legs and a warty skin (see Fig. 6, vol. viii. p. 511). The toes are less webbed, and the margin of the upper jaw, as well as the lower, is entirely destitute of teeth. The jaws are similarly toothless in all toads.

The toad is provided with an oblong, elongated gland called *Parotoid*) behind each eye. These glands emit a milky secretion which is acrid and very unpleasant to the



FIG. 12.—*Dactylethra capensis*.

mouth of some carnivorous animals. Those who have observed a dog attacking a toad can hardly have failed to notice the disgust which the former animal seems to exhibit by the copious flow of its saliva, its many head-shakings, &c. The toad's secretion, however, cannot be said to be poisonous, and certainly it is not so in the mode in which the venom of serpents is poisonous, since a chicken may be inoculated with it, and yet appear to suffer no injury whatever beyond the infliction of the slight wound necessary for the performance of the opera-

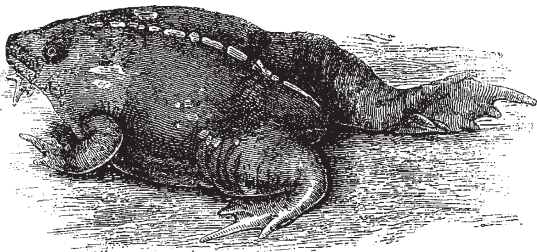


FIG. 13.—*Rhinophrynus dorsalis*.

tion. Nevertheless the secretion exercises a very decided effect upon certain animals, since the tadpoles both of frogs and of salamanders are very powerfully affected by being kept in the same water with a toad, if the latter be specially irritated in order to make it discharge its pungent and irritating secretion.

True poison and organs fitted both to inflict wounds and to convey the venom into them are not indeed found in any animals which are even near allies of the frogs and toads. Nevertheless a very perfect organ for both wounding and poisoning has been discovered by Dr. Günther to exist in a certain fish (*Thalassophryne reticulata*), belonging to a group which, on account of their

superficial resemblances to frogs, are termed "Batrachoid."

He found in the fish no less than four spines each per-

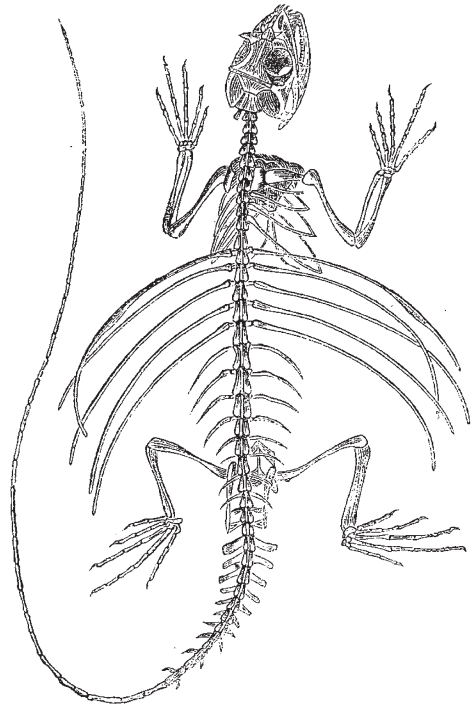


FIG. 14.—Skeleton of the Flying-dragon (Showing the elongated ribs which support the flitting organ.)

forated like the tooth of a viper, and each having a sac at its base. One such poison-spine was situated on each



FIG. 15.—The Flying-frog (from Wallace's "Malay Archipelago")

side of the hinder part of the head in front of the gill opening. Two others were dorsal spines placed one behind the other on the mid-line of the back. These

poison-organs are probably only used for defence. They are formed, however, on the very same type as are the poison fangs of vipers. Unlike the latter, however, they are not modified teeth, nor are they situated within the mouth as they always are in poisonous serpeats.

A Frog (*Pelobates fuscus*) which is common in France (and which is interesting on account of the form of its skull hereafter to be pointed out), though really harmless enough, has a singular power of making itself offensive.

Both males and females of this species utter a kind of croak, and both, if their thigh is pinched, produce a sound like the mewling of a cat. At the same time they emit a strong odour, which is like that of garlic, and becomes stronger as the animals are more disturbed. This emission not only affects the sense of smell, but even makes the eyes water as mustard or horseradish does.

This singular power, together with the acrid secretion of the toad, are the nearest approximation to venomous properties possessed by any members of the order, no toad—not even the giant of the order *Bufo agui*—being really poisonous.

A small Frog, by no means uncommon in France and Germany (*Alytes obstetricans*) has a very singular habit. The female lays its eggs (about sixty in number) in a long chain, the ova adhering successively to one another by their tenacious investment. The male twines this long chaplet round his thighs, so that he acquires the appearance of a courtier of the time of James I. arrayed in trunk hose or puffed breeches. Thus encumbered, he retires into some burrow (at least during the day) till the period when the young are ripe for quitting the egg. Then he seeks water, into which he has not plunged many minutes when the young burst forth and swim away, and he, having disencumbered himself of the remains of the ova, resumes his normal appearance.

Certain Frogs (forming a very large group) are termed Tree-frogs, from their adaptation to arboreal life by means of the dilatation of the ends of the digits into sucking discs, by which they can adhere to leaves. One of them, the common green Tree-frog (*Hyla arborea*) is spread over Europe, Asia, and Africa, in the same manner as *R. esculenta*, except that it is not found in the British Isles. A few toads also have the tips of their digits similarly dilated. Such, e.g., is the case in the genera *Kaloula* of India, and *Brachymerus* of South Africa.

The female of a peculiar American Tree-frog (*Nototrema marsupiatum*) has a pouch extending over the whole of the back and opening posteriorly. Into this the eggs are introduced for shelter and protection. A dorsal pouch also exists in the allied American genus, *Opisthodelphys*. An American species of *Hylodes* has the habit of laying its eggs in trees singly in the axils of leaves, and the only water they can obtain is the drop or two which may from time to time be there retained.

A still more remarkable mode of protecting the egg is developed by the Great Toad of tropical America (*Pipa americana*). In this case the skin of the females' back at the laying season thickens greatly and becomes of quite a soft and loose texture. The male, as soon as the eggs are laid, takes them and imbeds them in this thick, soft skin, which closes over them. Each egg then undergoes its process of development so enclosed, and the tadpole stage is, in this animal, passed within the egg, so that the young toads emerge from the dorsal cells of the mother completely developed miniatures of the adult. As many as 120 of these dorsal cells have been counted on the back of a single individual.

The only instance of a similar cutaneous modification is that pointed out by Dr. Günther* in the skin of the belly of the Siluroid fish, *Aspredo batrachus*. Here he found that "the whole lower surface of the belly, thorax, throat, and even a portion of the pectoral fins, showed

numerous shallow, round impressions, to which a part of the ova still adhered." He concludes that "it is more than probable that towards the spawning time the skin of the lower parts becomes spongy, and that, after having deposited the eggs, the female attaches them to it by merely lying over them." "When the eggs are hatched the excrescences disappear, and the skin of the belly becomes smooth as before. Even in the highest class of animals (*Mammalia*) we are familiar, in the Kangaroo and Opossum order (*Marsupialia*), with a special external receptacle (the marsupial pouch) for the protection and secure development of the young; but nothing of the kind exists amongst birds or reptiles. In fishes, however, the male of the little Sea-horse (*Hippocampus*) is provided with a ventral pouch in which the eggs are sheltered, and the same class presents us with a mode of carrying the eggs still more bizarre than that of *Alytes obstetricans* just related. In the fish *Arius fissus* the male actually carries about the ova in the mouth, protected by the jaws, till relieved of the inconvenience by the hatching of the young fry.

A South African Toad (*Dactylethra capensis*) is interesting, as we shall hereafter see, on account of certain anatomical points[†] in which it agrees with *Pipa*, and differs from all other Anoura. No interesting facts, however, are known as to its habits.

Another noteworthy form is the Mexican *Rhinophrynus dorsalis*, the exceptional characters of which are the tongue, which is free in front instead of behind, and the enormous spur-like tarsal tubercle.

Almost all Frogs and Toads pass the first stages of their existence in water, going through a free, tadpole stage, and all are more or less aquatic when adult. The only exceptions are *Pipa*, *Nototrema*, *Opisthodelphys*, and the *Hylodes* before referred to. Very many kinds, however, are, when adult, inhabitants of trees. The question may suggest itself to some, "Are there any which can be said in any sense to be aerial animals?" Birds are almost all capable of true flight, as also are those aerial existing beasts the Bats, and as were those extinct reptiles the Pterodactyles. Certain squirrels and opossums can take flitting jumps by means of an extension of the skin of the flank, and a similar, though much greater extension, supported by elongated freely ending ribs, is found in the little lizards (*Draco*) called Flying Dragons.

The class of Fishes supplies us, also, with an example of aerial locomotion in the well-known Flying Fish.

Since, then, every other class of vertebrate animals (Beasts, Birds, Reptiles and Fishes) presents us with more or fewer examples of the aerial species, we might perhaps expect that the Frog-class would also exhibit some forms fitted for progression through the air. We cannot say with certainty that such is the case; but Mr. Alfred Wallace, in his travels in the Malay Archipelago, encountered in Borneo a Tree-frog (*Rhacophorus*) to which he considers the term "flying" may fairly be applied, and of which he says, it "is the first instance known of a flying-frog." Of this animal he gives us the following account:—

"One of the most curious and interesting creatures which I met with in Borneo was a large tree-frog which was brought me by one of the Chinese workmen. He assured me that he had seen it come down, in a slanting direction, from a high tree as if it flew. On examining it I found the toes very long and fully webbed to their extremity, so that, when expanded, they offered a surface much larger than the body. The fore-legs were also bordered by a membrane, and the body was capable of considerable inflation. The back and limbs were of a very deep shining green colour, the under surface and the inner toes yellow, while the webs were black rayed with yellow. The body was about four inches long, while the webs of each hind foot, when fully expanded, covered

* See Catalogue of the fishes in the British Museum, vol. v. p. 268.

a surface of four square inches, and the webs of all the feet together about twelve square inches. As the extremities of the toes have dilated discs for adhesion, showing the creature to be a true tree-frog, it is difficult to imagine that this immense membrane of the toes can be for the purpose of swimming only, and the account of the Chinaman that it flew down from the tree becomes more credible."

The great group of Frogs and Toads, rich as it is in genera and species, and widely as it is diffused over the earth's surface, is one of singular uniformity of structure. The forms most aberrant from our type, the common frog, have now been noticed, except that perhaps the maximum respectively of obesity and slenderness may be referred to. In the former respect the Indian Toad *Glyphoglossus* may serve as an example, and for the latter may be selected *Hylorana jerboa*.

ST. GEORGE MIVART

(To be continued.)

A FOSSIL SIRENIAN FROM THE RED CRAG OF SUFFOLK

AT the opening meeting of the Geological Society, Prof. Flower communicated a description of a fine fragment of a skull of an animal of the order *Sirenia*, which is of great interest as affording the first recorded evidence of the former existence of animals of this remarkable group in Britain. The specimen forms part of the very rich collection of Crag fossils formed by the Rev. H. Canham, of Waldringfield, near Woodbridge. It was found in the so-called "coprolite" or bone-bed at the base of the Red Crag, and presents the usual aspect of the mammalian remains from that bed, being heavily mineralised, of a rich dark brown colour, almost black in some parts, with the surface much worn and polished, and marked here and there with the characteristic round or oval shallow pits, the supposed *Pholas* boring.

The fragment consists of the anterior or facial portion of the cranium which has separated, probably before fossilisation, from the posterior part at the fronto-parietal suture, and in a line descending vertically therefrom. This portion has then been subjected to severe attrition, by which the greater part of the pre-maxillary rostrum, the orbital processes of the maxillaries, and other projecting parts have been removed. In consequence of this, what may be called the external features of the skull, which are especially necessary to determine its closer affinities, are greatly marred, though enough remains of its essential structure to pronounce with confidence as to its general relationship to known forms. Fortunately, the whole of the portion of the maxillæ in which the molar series of teeth are implanted is preserved; and though the teeth have fallen from the alveoli in the front part of the series, and in the posterior part are ground down to mere stumps, so that the form of the crowns cannot be ascertained in any, many important dental characters may still be deduced from the number, form, size and position of the sockets and roots that remain.

As the intensely hard, ivory-like rostra of the ziphioid Cetaceans, the tympanic bones of the Balænidæ, and the teeth of terrestrial mammals almost alone remain in these deposits to attest the former existence of their owners; it is, doubtless, to the extreme massiveness and density of the cranial bones, as characteristic of the order *Sirenia*, that we owe the preservation of so large a portion of the skull under the very unfavourable conditions to which it, in common with the other fossils of the formation, must have been exposed.

After a comparison of the characters of the cranium with those of the several existing and extinct members of the order, Prof. Flower referred it to the genus *Halitherium*, and showed its relationship to *H. Schinzi* of Kaup from

the miocene of the Rhine basin, a formation, it will be remembered, in which several of the animals of the Red Crag bone-bed occur. It is, however, of larger size than that species, the teeth are larger, both absolutely and relatively to the cranium, and certain other differences occur, though the imperfect nature of the materials makes exact comparison of fossils only known from fragments not altogether easy or satisfactory. Believing, however, that it does not belong to either the above-mentioned, or any other of the hitherto described species of *Halitherium*, the specific name of *H. canhami* was proposed. It should be mentioned that there are six teeth in the maxillary or molar series on each side, all present at the same time, the first two with single roots, the third with two roots, and the last three with three roots, precisely resembling in form those of the molar teeth in the existing Manati.

ON THE STICK-FISH (*Osteocella septentrionalis*) AND ON THE HABITS OF SEA-PENS

MR. COOTE M. CHAMBERS has most kindly presented to the British Museum a specimen of the Stick-fish, from English Bay, Burrard's Inlet, British America. The specimen was placed alive, immediately it was caught, into a tin tube, filled with a solution of arsenic and salt.

Mr. Chambers observes that the Stick-fish are only to be found in Burrard's Inlet, English Bay, British Columbia. "It has only one bone in it, and appears to live on suction, and is a great prey to dogfish." Further: "I would mention that in summer only can they be caught. They are found to the least depth of from 30 to 40 fathoms, they move about rapidly in the water, and when brought to the surface, move for a few seconds like a snake, then make a dart as swift as lightning, and disappear."—July 23, 1873.

Unfortunately the specimen did not arrive in a good state for exhibition. The greater part of the animal portion had been washed off, probably by the motion of the solution during the transit; only about a foot of the flesh, which was loose on the axis, and the thick, swollen, naked, club-shaped base without polypes remained; but it was in a sufficiently good state to afford the means of determining its zoological situation and of examining its microscopical and other zoological characters.

Mr. Chambers' specimen is the animal of the axis, or stick, that I described as *Osteocella septentrionalis* (Ann. and Mag. Nat. Hist. 1872, ix. p. 406), and it proves that the axis belongs to a kind of *Pennatula*, or Sea-pen, nearly allied to the long Sea-rushes named *Pavonarius quadrangularis*, found on the West Coast of Scotland, and is evidently the same animal as *Pavonaria blakei*, described by R. E. C. Stearns. The idea of its being a fish, which seems so generally entertained by the people of British Columbia, is clearly a mistake, though one of the observers sent a figure of the Sea-pen, with mouth and eyes like an eel (!), which is copied in NATURE, vol. vi. p. 436.

Osteocella.—The complete polype-mass very closely resembles *Pavonaria quadrangularis*, as figured by Johnston ("British Zoophytes," t. xxxi.), from Prof. Edward Forbes' drawings; but the animal is entirely destitute of calcareous spicules, and the axis is cylindrical, hard, and polished.

Two days after I received this specimen, I received by post Mr. Stearn's description of the Stick-fish (*Pavonaria blakei*), from the San Francisco *Mining and Scientific Press*, August 9, 1873.

The description of Mr. Stearn, made from a fresh animal, need not be repeated; but as he does not mention the microscopic structure, I sent a fragment of Mr. Chambers' specimen to Mr. Carter to be examined, who kindly writes:—"The fragment arrived safely, although