

THE
C A B I N E T
OF
N A T U R A L H I S T O R Y.

CONDUCTED BY THE
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ASSISTED BY
EMINENT SCIENTIFIC MEN.

ON THE
N A T U R A L H I S T O R Y A N D C L A S S I F I C A T I O N
OF
F I S H E S , A M P H I B I A N S , A N D R E P T I L E S .

BY
W I L L I A M S W A I N S O N , A . C . G .
F. R. S. L. S. ETC.

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ception of a single genus, are all characterised by possessing fins or paddles instead of toed-feet,—a structure altogether unique in this class, except in the marine turtles, by which this order is unquestionably connected to that of the *Chelonides*. These aquatic turtles, in short, are chelonian reptiles, with the feet of an *Ichthyosaurus*. But there is another form in this order, which appears, at first sight, altogether anomalous, and as such has been considered by all our predecessors: this is the *Plesiosaurus* of Conybeare, an extinct reptile, having the body and fins of the *Ichthyosauri*, but the head and neck of a serpent. And thus do the two extremes of the series we have been tracing, meet. We began with the serpents, and have ended with the *Enalosaures*. The *Plesiosaurus* unites the structure of both, and thus leaves us without any further doubt on the grand outlines of the reptile circle.

CHAP. IX.

ON THE THREE ABERRANT ORDERS, OR THE EMYDOSAURES, THE CHELONIDES AND THE ELANOSAURES, OR THE CROCODILES, TORTOISES, AND FISH LIZARDS.

(113.) THE first order of reptiles which meets us, after leaving the amphibians, is that of the EMYDOSAURES, or crocodiles. They are the most bulky and voracious of all those which are now in existence; and although in outward form they have much of the general aspect of lizards, they are yet very dissimilar in many important points. They differ, in the first place, by their tongue, which is thick, fleshy, flat, and attached to the mouth so much, that the ancients believed this member was altogether wanting. Being aquatic animals, the power of swimming is manifested by palmated feet—a structure not to be found among the lizards—and by

the lateral compression of the tail, which thus acts as a large and powerful fin : the tail is no doubt used also as a means of defence, since it is armed with a serrated ridge of strong square scales. The lower jaw is rather longer than the upper, and both are armed with a single row of pointed teeth. The crocodiles are all inhabitants of the rivers and fresh waters of warm countries, and their mode of feeding is very peculiar. They do not swallow their prey upon seizing it, or is it ever eaten while fresh : the victim is first drowned, and then conveyed to some hole at the edge of the water, where it is suffered to putrify before it is devoured. The recent species are more numerous than was formerly imagined, and they are now arranged under the three genera of *Ramphastoma* Wag., *Crocodylus* Cuv., and *Champsä* Wag. The first comprise the Oriental species, having the mouth or muzzle very long and narrow : the second, or true crocodiles, have this part oblong and greatly depressed ; while the third, or American caymans



(fig. 29.), differ from the last chiefly in having the feet only semipalmated. The true crocodiles are found in both hemispheres, but the caymans are peculiar to the New World.

All these agree in certain general characters, which have long induced modern naturalists to keep the three types of the crocodiles distinct from the lizard reptiles, and arrange them not far from the chelonians or tortoises. To these latter, indeed, the crocodiles evince a strong affinity in the coverings of their bodies, for both are defended, not by scales like those of the serpents and lizards, but by plates or shields ; with this difference only, that in the one these plates are compactly united at their edges, while in the other they are sufficiently wide apart to admit the free motion of all parts of the body and limbs. The tail of these reptiles is perhaps the most remarkable feature in their structure : it is very long, greatly

compressed, and armed, like the back, with very strong, upright plates, which form sharp ridges or crests in their centre. With this weapon they can inflict terrific wounds upon their enemies, while it enables them to swim with rapidity. By a peculiarity, however, in the vertebra of their neck, these monsters cannot turn about with much facility; hence they are not difficult to be avoided on those rare occasions when, upon quitting their natural element, they pursue a man upon land. The snout of the crocodiles and caymans is very broad, unusually depressed; the eye small, and the mouth enormously large.

(114.) Crocodiles and caymans have a different geographic range: the first are inhabitants of the Old World, the latter of the New; but both are most abundant in those latitudes which approach nearest to the equinoctial line. The crocodiles of the Nile have furnished much for the admiration of the credulous, and much that is really interesting. It appears that they formed one of the innumerable idols of the ancient Egyptians, and that certain individuals, from being caught when young, could be so tamed as to follow in the train of their religious processions. They are particularly abundant in certain localities, and have been sometimes killed of the length of thirty feet. It is only in the imagination of the painter, that combats between these animals and the elephant, or rhinoceros, have ever existed: the crocodile, in fact, is only dangerous when in the water: upon land it is a slow-paced and even timid animal, so that an active boy, armed with a small hatchet, might easily despatch one: there is no great prowess, therefore, required to ride on the back of a poor cayman, after he has been secured, or perhaps wounded; and a modern writer might well have spared the recital of his feats in this way upon the caymans of Guiana, had he not been influenced in this, and numberless other instances, by the greatest possible love for the marvellous, and a constant propensity to dress truth in the garb of fiction. In Egypt, as well as in the

rivers of Senegal, the crocodiles are less numerous, but more dangerous than those of America; and yet it is a common thing, of every day occurrence, for the negroes to attack them without fear. As soon as they perceive a crocodile out of the water, they go up boldly to him, and either kill him with spears, or strike into his mouth, when he opens it, an iron harpoon, which at once pins him to the ground. Some, continues the same writer, are even bold enough to attack these animals in their native element, by diving beneath, and stabbing him in the belly; this, indeed, requires a degree of courage not to be looked for among civilised Europeans. Bosc, the well-known naturalist who travelled in North America, says that he often met numerous troops of crocodiles or caymans when upon some of the rivers, and in the marshy savannahs of that country. He says, without the least pretension or bombast, that he used to amuse himself by making them issue from their retreats, and run towards him, by causing his dog to bark and yelp on the banks. Sometimes he would suffer them to approach near enough to strike them with a stick, but although this did not appear to scare them, they never attempted to attack him; on the contrary, if they did not perceive any of their usual prey in the vicinity, they would slowly and gravely walk back again into the water. On the Carolina negroes perceiving any of these reptiles upon land, they endeavour to intercept their retreat, and proceed to kill them with their iron tools or hatchets, in order to feast upon the tail. They are, in short, when upon land, decidedly timid animals, and so far from attacking man, they fly from his presence. We often met with them in the same country as Mr. Waterton, but they were so timid, that had we been disposed to perform such ridiculous feats as that traveller narrates, our compassion for the poor animals would have prevented us.

(115.) The tortoises and turtles generally (*CHELONIDES*) have such a peculiar form, that they must be known to

every one (*fig. 30.*) . They may be likened to frogs, so



enveloped in horny armour, as to restrain them from jumping. Their gait is proverbially slow, their faculties dull, and they

seem the least intelligent of all vertebrated animals. The head (*fig. 31.*) is not unlike that of a serpent's ; and although not furnished with teeth, the edges of the jaws are so sharp, and their muscular force so strong, that they are capable of separating a finger by their bite. This, in short, is their only means of offence, while they are protected from all enemies but man by the hardness and compactness of the shell, into which they withdraw on the approach of danger. The food of these curious reptiles is as various as their forms and habits. We shall therefore shortly enumerate the principal divisions of the whole tribe, arranging them in the following order :

—1. The *Testudinidæ*, or land tortoises ; 2. The *Emydæ*, or freshwater tortoises ; 3. The *Chelydridæ*, or crocodile tortoises ; 4. The *Trionidæ*, or soft tortoises ; and 5. The *Chelonidæ*, or sea turtles. This series, founded upon what we consider to be the natural or continuous affinities of each, we shall now enter upon in more detail.*

(116.) The true *Testudinidæ*, or land tortoises, feed only upon roots and vegetables : during the summer they live in woods or among herbage, and pass the winter, in cold climates, beneath the earth, where they burrow and sleep : the feet are short and clubbed, shaped somewhat

* The quinary arrangement of Mr. Gray, contained in his valuable *Synopsis Reptilium*, is somewhat different from this ; the groups are there arranged in the following order : *Testudinidæ*, *Emydæ*, *Chelydæ*, *Trionidæ* and *Chelonidæ*.

like those of the elephant; and the toes are furnished with short blunt claws. They are generally dispersed in all the warm and temperate latitudes, but do not extend so far north, in Europe, as our island. Their tails are short and thick, and their shell is of a more or less globular form. Of seventeen described species enumerated by Mr. Gray, thirteen belong to the typical genus; the others are placed in the genera *Chirsina*, *Kinyxis*, and *Pyxis*. 2. The *Emydæ*, or freshwater tortoises, are much more numerous than the last; and they are eminently distinguished from the land tortoises by living almost entirely in water. Rivers, ponds, and clear running streams, seem to be their favourite haunts. They have been correctly described as most active and rapid in their movements; for although we frequently saw these animals in the shallow rivulets of the Peloponnesus, we never succeeded in capturing them by the hand: when disturbed, they bury themselves in the mud, and the discolouration of the water thus deceives their enemies. They feed not only upon aquatic worms, insects, and shells, but even upon carrion; thus differing, by their carnivorous habits, entirely from the land tortoises: to

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assist them in swimming, they are furnished with webbed or palmated feet (*fig. 32.*), the toes are distinct, and the claws not unfrequently are very long.

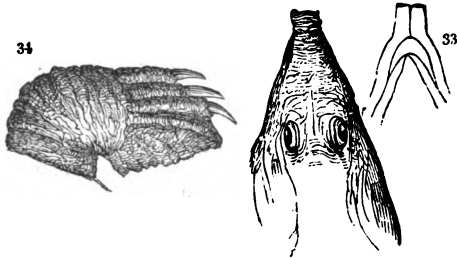
The neck is contractile into the body of the shell, and, as Mr. Gray observes, the caudal pair of plates are separated by a distinct suture: the shell generally is much more depressed than that of the land tortoises. A great number of genera have been recently proposed in this group, chiefly founded upon very trivial modifications in the structure of the shell, which we do not, however, adopt.

(117.) The marine turtles (*Chelonidæ*) are few in number: the feet, as before remarked, now assume the form and office of fins or paddles; hence they live almost entirely at sea, feeding either upon marine plants, or on mol-

luscous animals. The green turtle (*Chelonia mydas*), so well known to epicures, belongs to this group, and is abundant in the tropical latitudes of the Atlantic Ocean. The logger-head turtle (*Chelonia caretta*), on the contrary, is nearly confined to the Mediterranean; and although its flesh is stated to be rank and disagreeable, we can assert the contrary from personal experience: it is, in fact, fully equal to that of the green turtle. This group is very limited, there being only seven species of the genus *Chelonia*, and one of *Sphargis*. The shells of the different marine turtles are singularly varied: in some, the scales are imbricated, or laid over each other in the manner of tiles; in others, they are fixed, with their sides joining each other in the same manner as we see in the land tortoises; while in the *Sphargis*, or coriaceous turtle, the shell is covered by a thick leather-like skin. This latter structure is very important, because it shows us plainly which group succeeds in the scale of nature. The coriaceous turtle grows to an immense size, and has been captured on the British coast.

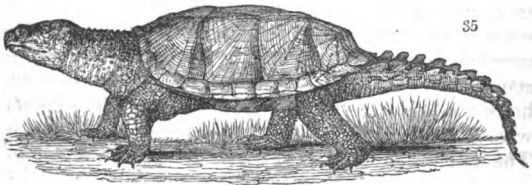
(118.) The next group is formed of the *Trioncidae*, or soft tortoises. They derive this name from the shell being thin and soft; they have in fact no external plates, both sides of the body being covered with a cartilaginous skin, through which, when dry, the rugged and granulated structure of the ribs is seen. The horn of their beak is clothed externally with fleshy lips; and their nose, unlike the other tortoises, is prolonged into a small proboscis, having the nostrils at the tip (*fig. 33.*): the sternal plates, as in the sea tortoises, are partly indented. The feet (*fig. 34.*) are palmate, and usually furnished with five toes, but three only of them have sharp and incurved claws. The tail is very short, and in some almost wanting. As they live entirely in fresh water, they are provided with an additional power of swimming besides that of their palmated feet, for the loose skin of their body forms a thin narrow flap round the edges of the shell, and thus performs the office of a fin. They seem to be entirely carnivorous, or at least the Indian species,

observed by general Hardwicke, are constantly seen eating the bodies of the natives which are floating in



the Ganges.* Those of America appear to have some peculiarities. The fierce tortoise (*Trionyx ferox*), common both to the rivers of Florida, Carolina, and Guiana, lies in ambuscade under the reeds, from whence it darts upon small birds and reptiles, particularly the young alligators. It is vigorous and active, defending itself, when disturbed, with remarkable fierceness, by raising itself upon its legs, darting upon its assailant, and biting with uncommon violence. It grows to a large size, and its flesh is excellent.

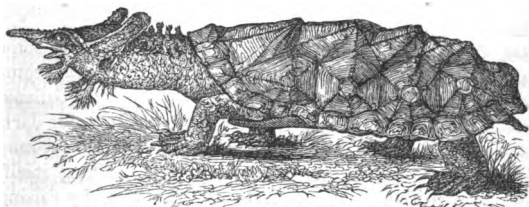
(119.) The next and last group of the tortoises has never yet been characterised. We have named it the *Chelidridæ*, in conformity with that which seems to be the type of the whole, namely, the *Chelidra serpentina*, or the alligator tortoise (fig. 35.). In these sin-



gular animals we have a complete union of the tortoise

* Synop. Reptilium, p. 45.

and the crocodile; the body and limbs being those of the former, while the tail is long, and sharply serrated, as in the latter. A similar length of tail is found in the genus *Platysternon* of Mr. Gray; and there is reason to believe that other forms, imperfectly indicated by the old writers, will be ultimately added to this group.* That these singular animals are likewise connected to the soft tortoises, belonging to the last division, is placed beyond doubt by the structure of the *Chelys fimbriata*, or fimbriated tortoise,—an animal which has the lengthened muzzle of the *Trioncidæ*, and the firm and plated shell of the *Chelidridæ*. This singular species (*fig. 36.*) in-



habits the rivers of South America, and its shell, as in all the other alligator tortoises, is much too small to receive the head and feet: the nose is prolonged into a short thin proboscis, the mouth opens crosswise; while the jaws, instead of being horny, like its congeners, are covered with a soft skin, "much resembling," observes Cuvier, "some of the frogs, particularly the *Pipa*, or Surinam toad." The head and neck are large, thick, and more than half the length of the shell; the skin in these parts is not only warty, but has several fimbriated or membranaceous appendages, particularly two, which stand nearly erect above the ears, and thus resemble horns: other appendages are on the neck, so that the whole animal has a most singular and grotesque aspect. The tail is like that of the *Trioncidæ*, being but an

* Particularly the *T. squamata* of Linn., which at present rests only upon the short account and rude figure of Bontius, who describes it from personal knowledge. He says that the whole body, as well as the neck, legs, and tail (the latter much lengthened), is covered with scales re-

inch long ; yet the toes, the claws, and the shell, resemble those of the *Chelidridæ*. Such are the prominent distinctions of the families of chelonian reptiles ; to enter into the different generic characters will in this place be unnecessary, since they will be found in the systematic arrangement of the work.

(120.) The analogies resulting from the series in which we have arranged these animals are highly curious, since we thus find representations not only of the primary divisions of the whole class, but of many other groups of animals, whose affinities are yet regulated by the same laws. Some of these we shall now glance at. The *Testudinidæ*, or land tortoises, from the peculiar shape, hardness, beautiful regularity, and highly-finished workmanship of their shells, evince the greatest perfection of that structure which nature has given to this order of reptiles. Like all other typical groups of animals, they are completely terrestrial, and in their slowness of motion, powers of abstinence, and tenacity of life, show the least affinity of all others of their race to the neighbouring groups. We look, therefore, upon this family as the most typical of the chelonians ; and we place them opposite to the *Ophides*, or serpents, these latter being unquestionably typical of the entire class of *Reptilia*. The *Emydæ*, or freshwater tortoises, stand next in the series : these, like the lizards, are remarkably active in their movements, and it is in these two analogous groups, also, that the greatest variations, or, in other words, the greatest number of genera, are to be found. The long-tailed, or alligator-tortoises, forming our *Chelidridæ*, have hitherto been classed with the *Emydæ*, just in the same manner as many authors, even to this day, continue to unite the crocodiles

sembling those of a carp, but stronger and thicker ; yet that the under parts are soft and smooth. Bontius says he had two of these animals, one of which he kept for some time in water ; that it inhabits the rivers of Java, and burrows in its banks to deposit its eggs. The head is small like that of a snake, with small moveable eyes and sharp teeth. I have no doubt but that this refers to some animal still more closely connecting the tortoises to the crocodiles than even the *Chelidra serpentina*.

with the true lizards. The analogy, therefore, of these to the *Emydosaures*, is most striking and beautiful. Following these, we have the *Trionnicidæ*, as not only representing tortoises, but more especially the class *Amphibia*, by the naked and soft external covering of their bodies, one of the most striking characteristics of that class. Lastly, come the *Chelonidæ*, or sea-turtles, having the fin-like feet of the *Enalosaures*. No analogies can be stronger than these, and by exhibiting them in a tabular view, we shall bring them all, at one glance, before the eye.

Analogies of the Families of TORTOISES to the Orders of
REPTILES.

Families.	Orders of Reptiles.
<i>Testudinidæ.</i>	{ The most dissimilar and typical of their respective circles; feet imperfect, or none. } OPHIDES.
<i>Emydæ.</i>	{ Sub-typical in each circle; feet well-formed; active. } SAURES.
<i>Chelidridæ.</i>	{ Tail long, armed with crested plates; feet palmated. } EMYDOSAURES.
<i>Trionnicidæ.</i>	{ Peculiarly orbicular, and least developed of their respective circles. } CHELONIDES.
<i>Chelonidæ.</i>	{ Scaly fins or paddles instead of feet; marine. } ENALOSAURES.

We have said, that if a tortoise was to be likened to any other reptile, in the common acceptation of the word, it resembles nothing so much as a frog or toad encased in the natural armour of its own shield. This remark applies to the whole group generally, but more particularly so to the *Trionnicidæ*, or soft tortoises. These, instead of having the outer surface of their bodies covered by hard and naked plates, are enveloped in a soft granular skin, the shell beneath being so slight as to be flexible, and often merely coriaceous or leathery. Secure, therefore, in this analogy, we may compare the two groups on a larger scale.

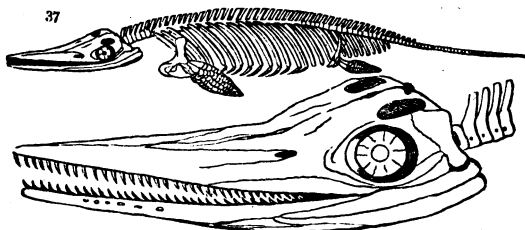
*Analogies of the CHELONIAN REPTILES to the
VERTEBRATED CLASSES.*

Families of Tortoises,	<i>Analogies.</i>	Classes of the Vertebrata.
<i>Testudinidae.</i>	{ Typical of their respective circles; move slowly.	} Quadrupeds.
<i>Emyde.</i>		
<i>Chelidridae.</i>	{ Tail excessively long, covered with scales.	} Reptiles.
<i>Trioncidae.</i>		
<i>Chelonidae.</i>	Feet transformed into fins.	} Fish.

On showing this and the preceding table to an intelligent friend, but who was no naturalist, he observed that such expositions would carry conviction of their truth to every mind, because they exhibited a degree of unity in all branches of the creation hitherto unimagined, and yet on principles so simple, that they could be comprehended by any one, whether naturalist or not, who merely knew the leading points of our theory. To naturalists, indeed, who are unprejudiced, nothing, as we conceive, can be more definite than the circular succession of the tortoises, and the representation they thus give of the primary types of all other animals. Having now taken a rapid view of two out of the three aberrant groups of the class, we shall treat of the third in more detail, on account of its important relation to reptiles, to fishes, and to birds.

(121.) The *ENALOSAURES*, or fish-lizards, form the third and last aberrant division of the reptiles. Of these wonderful animals, whose fossil remains distinguish the older strata of our globe, no living example has been discovered: they all belonged, apparently, to a former state of the world; yet their determination is of very recent date. Before we investigate the relations which these monsters seem to bear to existing reptiles, we shall notice two of the most striking, which will give the reader a tolerably good idea of the typical characters of the whole; these are the *Ichthyosaurus* and the *Plesiosaurus*.

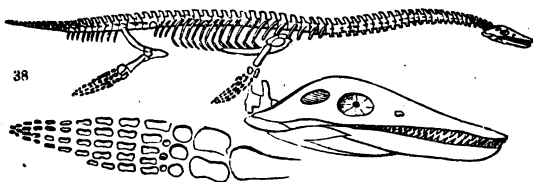
(122.) The general form of the *Ichthyosauri*, or fish-lizards (for there appear to have been many species), is not unlike that of a crocodile, but provided with four fins in lieu of feet (*fig. 37.*). The head is lengthened into a narrow pointed muzzle, the jaws being armed with sharp and formidable teeth; two eyes of enormous size



must have given to its head an aspect altogether extraordinary, and have enabled it to see, with perfect ease, during the night. Although, unquestionably, an aquatic animal, it must have moved more upon the surface of the waters than in the depths, since its structure was such, that it could not breathe, as fishes do, under water. Its short, but strong paddles, or fins, prevented it, likewise, from frequenting the shore, otherwise than in the same manner as the seal or walrus, who scramble awkwardly upon dry land for the mere purpose of repose: when, by violent storms, the *Ichthyosauri* were cast high upon the beach, they must have remained, like whales or porpoises, perfectly unable to regain their native element. They all seem, in fact, to have been entirely marine animals, and in all probability fed upon those immense and innumerable Cephalopodous mollusca, or cuttle-fish, whose shells are so abundant in the rocks wherein the bones of these reptiles are found. The size of these animals varied both in regard to species and to their progressive stages of growth. The skeleton of the slender-beaked species (*I. tenuirostris* Cuv.) usually measures three feet and a half, the head

and tail each occupying a foot; but detached portions of the flat-toothed sort have been found, proving they belonged to individuals which measured from twenty to one and twenty feet long. We have no means of ascertaining the nature of its external skin, whether it was naked as in frogs, or hard, as in crocodiles. The first conjecture, however, seems most probable, as there appears not to have been any external ears, and the skin passed over the tympanic bone, without becoming thinner,—a structure similar to that seen in the cameleon, salamander, and pipa. The remains of *Ichthyosauri* are more frequent in England than in any other country of Europe: they occur in the oolites, or grey sandstone, and the lias, or blue slate of the older beds (denominated by Cuvier the formation of Jura). The quarries of Lyme and Charmouth, in Dorsetshire, have produced the most perfect specimens: but they likewise occur in Warwickshire, and many other parts of the kingdom.

(123.) The *Plesiosaurus*, or serpent-lizard, is even a more wonderful reptile than the last. Without enter-



ing into the minute details of its anatomy, the above cut (*fig. 38.*) will be sufficient to give the reader a good idea of its shape. Let him, then, suppose a lizard-shaped animal, full ten feet long, with an enormously long neck, like the body of a serpent, occupying near half the total length, and surmounted by a head disproportionably small to the bulk of the body; four enormous paddles or fins occupy the place of feet, while the tail is short, stout, and pointed. Such is the extraordinary reptile discovered in the year 1824, by an accomplished and

enthusiastic female geologist, Miss Anning, in the blue lias of Lyme Regis, and subsequently described with great ability by Mr. Conybeare. This skeleton is almost entire, and is now, by the munificence of the duke of Buckingham, deposited in the collection of the geological society of London: a still finer specimen has since been found in the same locality, and is placed in the British Museum; both these, however, are of one species, the *Plesiosaurus dolichodeirus*, or long-necked snake-lizard of Conybeare. The habits of this reptile, when alive, have thus been conjectured by M. Cuvier, and the theory of that able anatomist is fully supported by the extraordinary structure of the animal: to these particulars we shall subsequently refer. "The *Plesiosaurus* in its movements, and in some degree in its figure, must have resembled the chelonian reptiles or sea-turtles: for supposing the turtle to be stripped of its shelly armour, the resemblance would be tolerably exact. There can be no doubt, from the nature of its paddles, that it was an aquatic animal; and that it was marine is equally to be concluded from the débris by which its remains are invariably accompanied. It is probable, that, like the turtle, to whose extremities there is a strong analogy in the *Plesiosaurus*, it may occasionally have visited the coast, where, however, its mode of locomotion must have been exceedingly awkward; neither was it by any means so well fitted for swimming as the *Ichthyosaurus*, as its long neck must have presented a considerable impediment to its progress through the watery element. It is the conjecture of Mr. Conybeare, that, as it breathed the elastic air, and had frequent need of respiration, it generally swam upon, or near the surface of the water, arching back its long neck like the swan, and plunging it downwards at the fishes that passed within its reach: he also thinks it might have lurked in shallow water near the coast, concealing itself among the weeds: thus, raising its nostrils to the surface like the cayman, it might have found a secure shelter from its enemies, and a place of ambush from which to dart

upon its prey. By the suddenness and quickness of its attack, it must have proved a formidable foe to all less powerful animals, and more especially to those of the finny tribe."*

(124.) The *Pterodactyli*, or flying-lizards, another race of antediluvian reptiles, but very distinct from those we have just described, will nevertheless be introduced in this part of our work, for the reasons subsequently stated. The fabulous monsters of antiquity are not more dissimilar in shape from all existing creatures, than are those of which we shall now speak: their forms, indeed, are so strange and unearthly, that they seem more fit to be represented as inmates of a wizard's cave, or to find a place among the chimeras in Teniers's painting of the Temptation of St. Anthony, than as ever having had a real existence upon this our planet. In the *Pterodactyli* we have, in short, the head of a lizard furnished with the ample wings of a bat, together with the long neck and beak of a bird; the latter, however, being armed with distinct teeth (*fig. 39.*). Such is the general impression which a glance at the figure of this wonderful fossil is calculated to give; nor does a more minute



examination lessen our astonishment. The size of the *Pterodactyli*, indeed, had it been at all equal to that of

* Grif. Cuvier, p. 377.

the swimming lizards, would have rendered it perfectly terrific; but they were comparatively small animals. Of two well-ascertained species mentioned by Cuvier, one seems to have been about the size of a thrush, and the other of that of a common bat. Fragments, however, have been found, which are supposed to have belonged to a third and a much larger kind; while, more recently, M. Oken has made known a fourth reptile of this race, which he states to have been covered, not only with hair, but with feathers! The remains of all these flying-lizards are found only in limestone slates of old formation, mixed with those of numberless other reptiles, gigantic tortoises and crocodiles, huge *Megalosauri*, and monstrous swimming lizards of the genera *Ichthyosaurus* and *Plesiosaurus*. The famous limestone quarries of Germany, particularly those near Maestricht and Aichstedt, are the chief deposits of these fossils; and there, no doubt, are yet buried many others of extinct monsters, no longer existing on the surface of the earth.

(125.) The relations of affinity between the swimming lizards and the existing orders of reptiles, deserve much consideration. When it is considered that these animals possessed the exclusive power of swimming, not by a slight modification in the structure of their feet, but by having these members changed, as it were, into absolute fins, we cannot but be struck with their total and essential difference from all other reptiles, so that we need no further proof that they constitute one of the primary divisions of the whole class. The question therefore is, in what part of the natural series do they find a place, so that all their complicated resemblances may be explained, either by their affinity or their analogy to other reptiles. We have already intimated our belief that the *Enalosauri* most probably occupied a station between the tortoises (*Chelones*) and the serpents (*Ophides*), in proof of which we shall now submit the following considerations to the reader.

(126.) If we admit the *Enalosauri* to be a group of

themselves, it follows that this group must be aberrant, and of equal rank with the *Emydosaures*, or crocodiles, and the chelonians, or tortoises. We have already seen that these latter, that is, the crocodiles and the chelonians, are also aberrant, since the first leads to the class *Amphibia*, and the latter to the *Cephalopoda* or cuttlefish. It follows, therefore, that as one of the great divisions of reptiles should lead to fish, the *Enalosauri*, by the above theory, precisely occupy that station in the circle of *Reptilia*, which should blend into that class of animals. Hence we have the body of a reptile with the fins of a fish; hence the peculiarly expressive name of *Ichthyosaurus*, or fish-lizard; and hence the strong impression on the judgment of sir Everard Home for near two years after the first discovery of this fossil, that it belonged to some gigantic fish allied to the sharks. Now all these circumstances tend to show, that not only in general appearance, but in anatomical detail, the structure of these aquatic reptiles much more resembled fish than they did crocodiles. Both sir E. Home and M. Cuvier have proved this affinity by a series of the most minute and valuable comparisons, although the latter is not very precise on the inferences to be drawn from these researches. Sir Everard observed that the shoulder, in the first specimen he examined, exhibited some relation to that of the crocodile; but the position of the nostrils, the circle of osseous pieces surrounding the sclerotic tunic of the eye, and more particularly the structure of the vertebræ, induced that able comparative anatomist to decide on the approximation of the *Ichthyosaurus* to fishes. M. Cuvier, indeed, seems to infer that this wonderful reptile, upon the whole, was more allied to the saurians, yet he is obliged to confess that "as much as the *Ichthyosaurus* resembles the lizards in the form of its osseous head, so much does it differ from them in the conformation of its vertebræ, and in this respect it decidedly approaches the fishes and *Cetaceæ*, as," continues our author, "sir Everard has well remarked." The joint opinion, therefore, of two such

eminent observers, on the affinity of the *Enalosauri* to the class *Pisces*, seems to us conclusive on the subject; more especially as this affinity receives full confirmation from our own theory of the principle of variation in this, and in all other natural groups. Hence it follows that these extinct reptiles united the three aberrant divisions of vertebrated animals into one circle; namely, the reptiles, the *Amphibia*, and the fish. But the situation which we have assigned to the *Ichthyosaurus*, may be tested in other ways; thus, for instance, every natural group has one of its aberrant divisions entirely aquatic: fish among vertebrated animals, whales among the *Mammalia*, and the swimming order (*Natatores*) among birds, are some among innumerable proofs that this principle is universal; each of these groups, in short, symbolically represents the other, and sometimes this is carried so far, that we do not know whether the resemblance is one of analogy or of affinity. As to the supposed connection between the *Ichthyosaurus* and the crocodiles, the two groups correspond to each other in being typical of their respective circles, and they should therefore, from theory, possess some few characters in common; but we must always recollect that the one, like quadrupeds, are walking animals; and that the other, like fishes, are provided with fins: they cannot therefore be brought together, or, at least, following one another.

(127.) The preceding remarks will serve also to explain much of what appears anomalous in the structure of the *Plesiosaurus*. The affinity which this extraordinary reptile bears to the marine tortoises, as we have already seen, has been observed both by Cuvier and Conybeare; while its close relation to *Ichthyosaurus* is perfectly unquestionable. Now if we were called upon to imagine some animal which was to connect the fish-lizards to the ophidians or serpents, we could not devise any form better calculated to fill up the gap than that which nature presents to us in the *Plesiosaurus*: it seems, in fact, compounded of three distinct animals—a turtle, an

Ichthyosaurus, and a snake ; it has the fins of the first, the body of the second, and the serpent-like neck of the last. It is no argument against this theory to urge that there is a wide chasm between our fossil reptile, provided with large paddles, and a true serpent ; for chasms, little inferior to this, occur in every department of nature ; and we must recollect that, in the *Enalosauri*, we are treating of an order of animals whose former existence we only know of by their fossil remains. The remark of M. Conybeare, that the *Plesiosaurus*, from its structure, must have had many of those habits which distinguish the swans, is fully confirmed by comparing the circle of reptiles with the circle of the *Natatores*, or swimming birds, which they in fact represent ; nay, so beautifully and accurately do these groups typify each other, that even the circle of the *Anatidæ*, or ducks, corresponds to that of the reptiles so far as this, that the *Enalosauri* represent the *Anserinæ* ; thus actually bringing the *Plesiosaurus* and the swan into parallel relations of analogy. If an arrangement, in short, is natural, it will stand any test ; and there, in the present instance, are so many, and of such a diversified nature, that by heedfully following this great principle of natural affinity, we shall be guided through difficulties which would otherwise be insurmountable.

(128.) The station in nature of those wonderful reptiles, the flying-lizards, or *Pterodactyli*, may be now considered. Were it not that natural groups are definite, we might be tempted to think that in the class of reptiles, at least, there was one more primary division than in any other department of nature ; and that this, which would make the sixth, would be composed of the *Pterodactyli*. But we cannot for a moment seriously entertain this belief ; opposed, as it is, to that uniform plan upon which we see Nature has invariably proceeded in every instance where her works have been sufficiently studied. Rejecting, therefore, the hypothesis, that the flying-lizards constitute one of the primary divisions of reptiles, our next question is, to which

of the five already enumerated does it seem to bear the greatest affinity? The apparent anomalous structure of these extraordinary animals renders this a most perplexing inquiry. If we look to the shape and character of their enormous head, we fancy a resemblance both to the crocodiles and to the *Ichthyosauri*; but the former are perfectly four-footed animals, walking on the earth as quadrupeds, while the latter are aquatic, and their feet are fin-shaped. Still, however, our choice must be between these two, since it is perfectly clear that the *Pterodactyli* evince a much nearer resemblance to the crocodiles, and the *Ichthyosaurus*, than either to the lizards, tortoises, or the serpents. Now it must be remembered that the crocodiles are connected to the most perfectly-formed of all the orders of reptiles, namely, the *Saures*, the distinguishing character of which is, that, like quadrupeds, they have four feet perfectly developed, and formed for rapid motion. This sort of perfection is not seen among the *Enalosauri*; their organs of locomotion are less perfect, that is, formed upon a less elaborate plan, and only adapted for one particular office — that of swimming in the water. Now the *Pterodactyli* are very much in this situation; they have, indeed, four feet like the lizards, but then they are so peculiarly formed, that two of them, as M. Cuvier observes, could be of little or no use in walking; their feet, therefore, may justly be characterised by the same term, and in the same sense as we designate those of the *Ichthyosaurus*; that is, they are imperfect. If, then, the *Pterodactyli* are admitted to have an affinity either with the recent crocodiles, or with the fossil order of reptiles (*Enalosauri*), it follows that their approximation to the latter is, upon the whole, more than to the former; and that, consequently, they constitute an aberrant group in the order *Enalosauri*, — an order with which they further agree in being exterminated from the existing tribes of reptiles. It may indeed be urged that animals which swim by fins cannot well be placed in a group with others which fly like bats; but let us recollect that

among the tortoises, or chelonian reptiles (one of the best marked groups in nature), we have precisely the same variation. The true tortoises walk only upon dry land, while the marine turtles are entirely aquatic, and have their feet converted into fins. The turtles are aberrant in their own family, so also are the flying lizards in theirs; nevertheless the difference, after all, between a *Pterodactylus* and an *Ichthyosaurus* is so great that many other forms must have intervened between them.

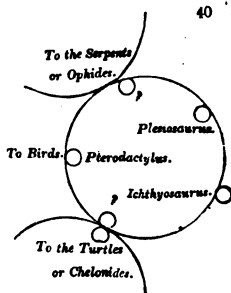
(129.) We have hitherto discussed this question without any reference to analogies, or to that theory of representation which we have so often employed to illustrate a uniformity of plan in the creation. Let us therefore now see how far the foregoing views on the situation of the *Pterodactyli* will bear analogical tests. We have already shown that the group of reptiles in which we have placed the flying lizards, is that which leads to the fish, thereby forming one circular group of the aberrant vertebrated animals. But, as by this disposition of the *Enalosauri*, they will also occupy that part of the reptile circle which comes nearest to birds, we should have been totally at a loss to conceive how this affinity could be established, had it not been for the discovery of these winged reptiles. The dragon lizard, it is true, from being provided with dilated processes in the shape of wings, might be supposed to constitute one link in the chain between reptiles and birds; but in that animal the resemblance is merely analogical; for all its four feet are perfectly formed, like the rest of the lizards, and these wing-like processes, although evidently intended to assist the animal as it springs from one branch to another in search of insects, are yet totally incapable of carrying it through the air. No one would think of fixing upon the flying squirrels of America, or the flying fish of the Atlantic, as animals intervening between their own classes and that of birds. The dragon-lizards (*Draco*), of which we are now speaking, are precisely in the same relationship, and they, no doubt, represent

those to which we have compared them. But the structure of the *Pterodactylus* is altogether different. It not only, in its general form, has so much the aspect of a bird, that M. Blumenbach thought that it really belonged to the feathered class; but its anterior extremities, beyond all doubt, were actually a pair of wings. A single glance at the figure of the *Pterodactylus longirostris*, will prove this, were we even inclined to doubt the accurate deductions and the unequivocal opinions expressed by all naturalists. Nor does the similarity here cease; for the hinder feet, like those of birds, were so elongated, that the animal, when walking, must have stood nearly erect. This power, denied to all other known reptiles, is, nevertheless, what we should look for in such animals as would connect lizards to birds. In the present instance, as M. Cuvier has well observed, this erect position would be almost essential to the equilibrium of the body, which was comparatively very small, yet had to sustain a long neck, added to an enormous prolongation of muzzle. Birds alone exhibit similar proportions, and we find the vertebræ of the neck, like that class of animals, are large and prismatic. Finally, we may even establish this affinity by the words of M. Cuvier: — “In the *Pterodactyli*,” observes his translator, “we find an animal which, in its osteology, from the teeth to the end of the claws, presents us with all the essential characters of the lizards. But, at the same time, it was an animal provided with the means of flying, and one which, in a stationary position, would make but little use of its anterior extremities, if, indeed, it did not keep them folded up, as birds do their wings. It could not employ its little fore toes to suspend itself to the branches of trees, but its tranquil position would be ordinarily on its hind feet, like birds. Like them, too, it would keep its neck straightened and curved back, to prevent its enormous head from destroying its equilibrium.”*

* Griff. Cuv. 330.

(130.) In what way the skin of the *Pterodactyli* was covered, is a question of no easy solution, since nothing could be traced in the fossil skeletons of the long-beaked species, calculated to throw light upon this interesting inquiry. It seems, however, as Mr. Kirby obligingly informs us, that a new species of these wonderful reptiles has very recently been discovered by Professor Goldfuss of Bonn, in the Solenhofer slate. From the account which M. Oken has just published of this fossil, it appears that there is sufficient reason to conclude it was not only covered with hairs, but also with feathers! If this supposition is well founded, it confirms, in a most remarkable manner, the position which we have assigned to these animals in the circle of the vertebrata, and incontestably proves that they formed the true link of connection between the class of reptiles and that of birds. We shall now show that this theory receives a confirmation equally strong, by the analogies which result from assigning this station to the *Pterodactyli*.

(131.) It necessarily follows from the foregoing line of reasoning, that if the *Pterodactyli* compose that group which leads more immediately to birds, they are the most aberrant division of the *Enalosaures*; and as every aberrant group has three of these divisions, the two others remain to be discovered. One of these must have intervened between the sea turtles (*Chelonides*), and the fish-lizards (*Ichthyosaures*), while the other must have conducted us to the true serpents (*Ophides*), by some form which blended *Plesiosaurus* with the aquatic serpents. The *Pterodactyli* will thus have on each side an hiatus, as may be better understood by the annexed diagram or circle of the order *Enalosaures*.



(132.) On looking to those birds which, in their own circles, occupy an analogous station to that of *Pterodactylus* among the *Enalosaures*, we cannot fail to perceive several remarkable analogies between them. Let us, therefore, compare the structure of these flying lizards with the tenuirostral and grallatorial types of birds, which, by our present theory, they should represent. Of all the reptiles yet discovered, the *Pterodactyli* have the longest head or muzzle; and among birds we find this to be the chief character of tenuirostral types, as the name in fact denotes. The humming birds, the hoopoes, and the promerops among perching birds, are all so characterised. Their bills, in proportion, are double the length of all others in their own order. If we turn to the wading birds (*Grallatores*), which represent those just mentioned, the enormous length of their bill is very striking. Not to mention the herons, the woodcocks, and the snipes, where this organ is greatly developed, we see it of still greater length in the curlews and the different groups of the old genus *Ibis*. All these, likewise, have very long necks, so also have the flying lizards, yielding only in this respect to the *Plesiosaurus*. The power of flying and the consequent superiority of motion enjoyed by these reptiles above all their class, are beautifully illustrated by this analogy. The swiftest flying birds are, undoubtedly, among the tenuirostral and the wading types; for we hesitate not to consider the motion of all the humming birds through the air as more rapid (or at least apparently so) than even that of swallows, while the peculiar length and structure of the wing, in all the typical groups of wading birds, sufficiently shows that this superiority of flight is also one of the principal distinctions of that order. The tail of these lizards, also, was remarkably short, so also is that of all the waders, and in both do we find the tarsus or leg considerably longer than the toes. This analogy, in fine, is as complete as can possibly be expected between two groups belonging to different

classes, so that, however anomalous the structure of the *Pterodactyli* may appear at first sight, we see that in their general structure they in nowise deviate from those primary laws which respectively characterise all natural groups of living animals.

(133.) Having now enlarged more than usual upon the aberrant group of the class *Reptilia*, we shall only add a few words upon the union of the crocodiles, the turtles, and the swimming lizards. This union, notwithstanding the obvious extinction of many of the forms, is placed beyond all doubt, when we refer to the numerous opinions expressed by writers that the *Ichthyosaures* were but marine crocodiles; when we observe the frequent reference made by Cuvier to the analogous points of resemblance between the two; and when we see, even in some of the modern systems, that these two orders are actually united, we can have no doubt of their being really so in nature, although each forms a distinct division of its own. We shall now proceed to a more rapid survey of the two typical orders of reptiles, viz. the Serpents and the Lizards.

CHAP. X.

ON THE OPHIDES, OR SERPENTS.

(134.) THE true serpents form a natural and obvious order, typical in every way of the great class of reptiles; in this assertion we are supported by the authority of M. Cuvier, who observes that the ophidians, "of all reptiles, are those which best merit this name." The form with which nature has invested those elegant but proverbially insidious creatures, could the mind be divested of their hurtful qualities, would be viewed as highly graceful; clothed, as it is, with innumerable