

metallic emerald-green streak; an oblique cuneiform trifold green-glossed hyaline-white spot across the middle, two large patches almost filling the interno-median and the abdominal areoles, and a minute spot near outer margin on the second median interspace; thorax blue-black, frons and vertex of head metallic emerald-green; collar above with two large spots of metallic golden green, a triangular dorsal spot of the same colour; posterior half of patagia metallic fiery copper; metathorax and the two basal segments of abdomen metallic golden green: the two following segments deep brick-red edged with black; remaining segments blue-black, banded in front with metallic emerald-green; primaries below purplish towards the base, otherwise nearly as above; secondaries with a broad metallic-green costal stripe from base to apex; pectus bronze-brown sprinkled with metallic-green scales; legs blackish brown, the coxæ of the first pair and the tibiæ of the other pairs with a large white spot; venter blue-black, with two unequal central white spots. Expanse of wings 32-41 millim.

Slopes of Kilima-njaro (*F. J. Jackson* and *Bishop Hannington*).

The examples collected by Bishop Hannington are smaller and have the markings on their wings smaller and narrower than in the type collected by Mr. Jackson.

LITHOSIIDÆ.

12. LEPISTA LIMBATA.

Near to *L. pandula*, Boisd. (*Dyphlebia trimenii*, Feld.); larger, of a deeper orange-ochreous colour: the black border wider, that of primaries occupying two fifths instead of less than one third of the external area, its inner edge more oblique, that of secondaries about one third wider. Expanse of wings 24 millim.

Kilima-njaro (*F. J. Jackson*).

We have *L. pandula* from Delagoa Bay.

Two interesting species of *Chalcosiidæ* collected by Mr. Jackson have been separately described. Of the *Liparidæ* one species, *Aroa discalis*, Walk., is in the collection; hitherto we have only received it from the Cape and Natal. Amongst the Noctuites *Eurhipia bowkeri* and *Asymbata roseiventris*, or species scarcely distinguishable from the latter, were obtained, as also the handsome but common *Hypopyra capensis*.

3. On certain points in the Visceral Anatomy of the Lacertilia, particularly of *Monitor*. By FRANK E. BEDDARD, M.A., Prosector to the Society, Lecturer on Biology at Guy's Hospital.

[Received February 7, 1888.]

The present paper contains the results of some investigations into the visceral anatomy of the Lacertilia; the specimens were in every

case from the Society's collection. The points which I have particularly studied are two:—(1) the bile-ducts, which are curiously complicated in *Varanus*, (2) the relations of the peritoneum to the enclosed viscera. In respect of both these points the Varanidæ differ very strikingly from all other Lacertilia; but as the number of genera which I have been able to investigate is small, I can at present only put forward tentatively a suggested emendation in the current schemes of classification of the Lacertilia.

1. *Peritoneum.*

In *Iguana* the body-cavity is a spacious pleuroperitoneal cavity lined by peritoneum, which, as in *Lacerta*, is deeply pigmented posteriorly; this cavity is partially divided into two, right and left, halves by the umbilical ligament (fig. 1); the heart is surrounded by a special serous sac, the pericardium; beyond this there is no subdivision of the body-cavity. It is commonly stated that the diaphragm is unrepresented in the Lacertilia; the attachment of the pericardium to the parietes may, however, as has been suggested, be an indication of such a structure.

In *Monitor* (fig. 2) there is some little difference; when the body-walls are cut open and reflected, the alimentary viscera are not exposed as they are in *Iguana*. A loose membrane covers these viscera; the membrane looks as if it were simply the lining peritoneum of the abdominal cavity which had got separated and detached from the abdominal parietes; this is, however, not the case; an examination by the aid of the microscope showed clearly that a layer of peritoneum covers the abdominal musculature, and is quite distinct from the horizontal membrane; in *Varanus griseus* the peritoneal layer was particularly distinct, for the reason that it contained numerous pigmented corpuscles. For the greater part this membrane is free from the ventral parietes; anteriorly it is attached to the median ventral line; dorsally it is attached along the spinal column; here and there it is also attached to the lateral parietes by membranous bands. It passes over the lobes of the liver and the stomach, and shuts off the lungs from the abdominal cavity. The umbilical ligament dividing the two liver-lobes is present as in *Iguana*, and is attached to the dorsal side of the horizontal membrane. This horizontal membrane also separates the kidneys from the reproductive glands; the latter lie internally to it; the kidneys are placed outside it. The ventral surface of this membrane bears a vein of some size, the anterior abdominal vein. The fat-body when present lies below the membrane, and is therefore shut off from the abdominal cavity.

I found this membrane present, with the general arrangement that has been above stated, in

- Monitor gouldi.*
- Monitor bengalensis.*
- Varanus salvator.*
- Varanus niloticus.*
- Varanus griseus.*

On the other hand a large number of *Lacertilia* agree, in the structural features that have been referred to, with *Iguana*.

I have had the opportunity of examining the following genera and species:—

Lacerta.

Uromastix hardwickii.

Uromastix spinipes.

Teius teguexin.

Cyclodus gigas.

Iguana tuberculata.

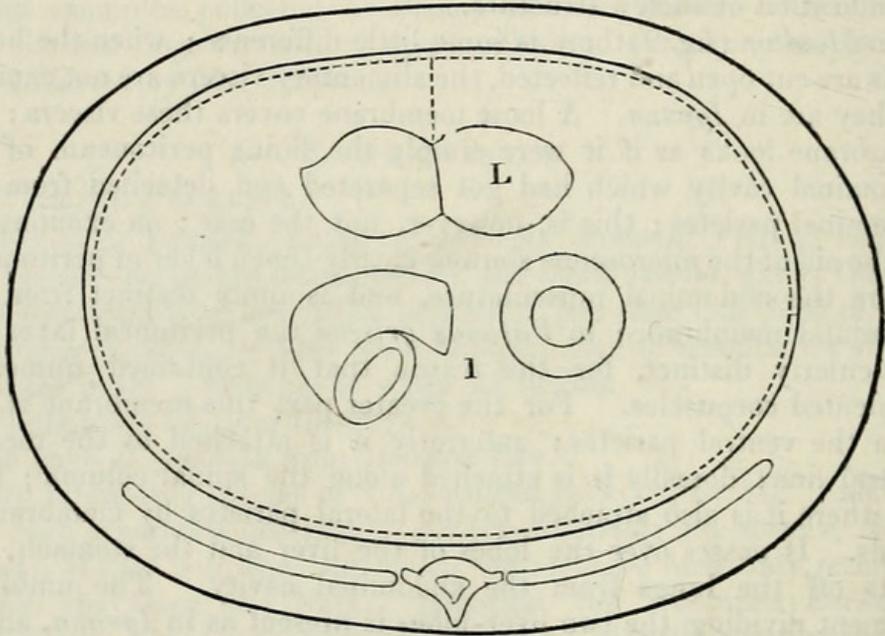
Cyclura nubila.

Plestiodon auratus.

Trachydosaurus rugosus.

In all of these there is a general agreement with *Iguana*; the

Fig. 1.



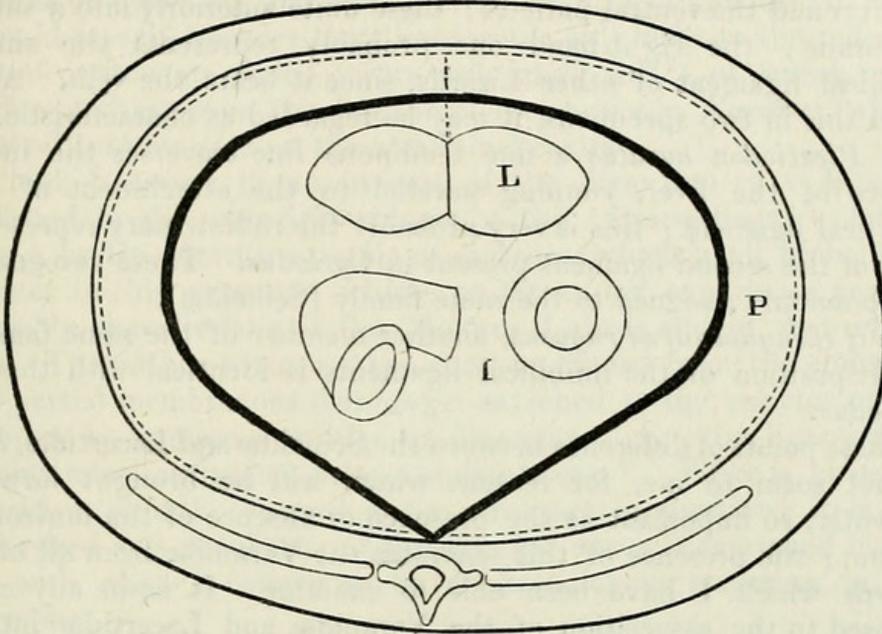
Diagrammatic section through body of *Lacerta*.

L, Liver; I, intestines; parietal layer of peritoneum and umbilical ligament indicated by a dotted line.

horizontal membrane is absent for the greater part; when the fat-body is present it lies in the hinder region of the abdomen, from which, however, it is cut off by a membrane; this presumably represents the posterior region of the horizontal membrane in *Varanus* and *Monitor*. Other than this there is no trace of the horizontal septum in any of the Lizards whose names are given in the second list.

In *Lacerta*, *Cyclura*, *Uromastix*, and *Teius* the umbilical ligament is present with the same relations as in *Iguana*; it only varies in the greater or less extent of its attachment to the ventral median line.

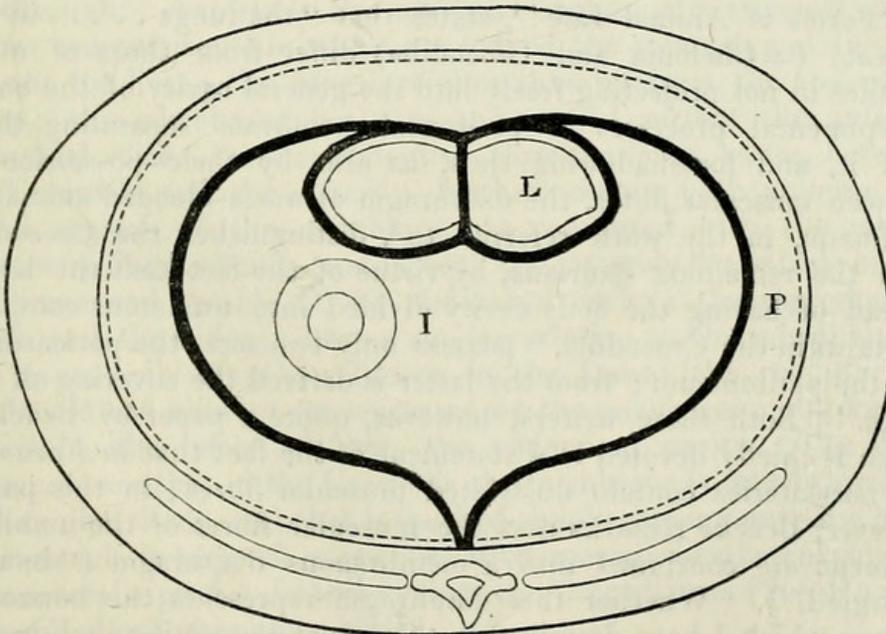
Fig. 2.



Diagrammatic section of *Monitor*.

P, Peritoneal fold circumscribing abdominal cavity; other letters as above.

Fig. 3.



Diagrammatic section through body of a *Crocodile*.

P, Peritoneal fold, continuous with serous sacs enveloping lobes of liver; other letters as above.

In *Cyclodus gigas*, however, there is a curious difference; the umbilical ligament is double, two distinct membranes passing between the liver and the ventral parietes; these unite anteriorly into a single membrane; the right-hand one probably represents the single umbilical ligament of other Lizards, since it bears the vein. As I found this in two specimens, it may be regarded as characteristic.

In *Plestiodon auratus* a fine tendinous line traverses the lower surface of the liver, running parallel to the attachment of the umbilical ligament; this is very probably the rudimentary representative of the second ligament present in *Cyclodus*. These two genera are commonly assigned to the same family (Scincidæ).

In *Trachydosaurus rugosus*, another member of the same family, the disposition of the umbilical ligaments is identical with that of *Cyclodus*.

These points of difference between the Scincidæ and Lacertidæ, &c., do not seem to me, for reasons which will be brought forward presently, so important as the presence or absence of the horizontal septum; the presence of this separates the Varanidæ from all other Lizards which I have been able to examine. It is, in any case, opposed to the association of the Varanidæ and Lacertidæ into a suborder Fissilinguia.

I can find no statement about this structural feature, which separates the Varanidæ from other Lacertilia, in any text-books to which I have had access; there is nothing, so far as I can ascertain, in the Treatise on the Lacertilia, by Prof. Hoffmann, which occupies part of Volume vi. of Bronn's 'Thierreichs.' Prof. Rolleston, in his 'Forms of Animal Life'¹, states that "the lungs in the Loricata (=Chelonia and Crocodilia) differ from those of other Reptiles in not projecting freely into the general cavity of the body, dissepimental processes of peritoneal membrane separating them from it, and foreshadowing thus, as also by their possession of intrinsic muscular fibres, the diaphragm of warm-blooded animals." Hoffmann, in the work referred to², distinguishes the Crocodilia from the remaining Saurians, by virtue of the fact that the latter, instead of having the body-cavity divided into numerous compartments, as in the Crocodilia, "possess only two sacs, the pericardium and the peritonæum; from the latter is derived the covering of the lungs." Both these writers, however, quote a paper by Brücke³, which is chiefly devoted to a statement of the fact that in *Varanus*⁴ the mesenteries contain unstriated muscular fibres; in this paper, however, Brücke remarks that the muscular fibres of the umbilical ligament are continued into a membranous diaphragm ("häutige Zwergfell"). Whether this diaphragm represents the horizontal septum which I have described in this paper as existing in *Varanus*, I am unable to say, as there is no further description of it. Evidently, however, Profs. Rolleston and Hoffmann have not interpreted Brücke's

¹ Introduction, p. lx.

² P. 922.

³ Wiener Sitzungsber. vii. (1852), p. 246.

⁴ Leydig has subsequently shown that this holds good in the case of other Lizards.

statements in this way, unless, indeed, the last half of the sentence from Hoffmann, quoted above, may be held to imply that the lungs are shut off from the abdominal cavity by a membranous partition. I should myself consider that these words only refer to the reflected layer of peritoneum which covers each lung; this is, of course, quite a different thing from the horizontal membrane in *Varanus*, which shuts off *both* lungs from the abdominal cavity.

I find, however, in an account of the dissection of a *Monitor* published in the very first volume of the 'Proceedings'¹ of this Society, by Dr. Martin, a couple of sentences which in all probability do refer to this structure, which, so far as my experience goes, is so highly characteristic of the Monitor Lizards and of that group only. The author writes: "the chest is divided from the abdomen by a partial membranous diaphragm attached to the parietes of the abdomen by numerous strings or filaments the liver lies in the abdominal cavity just below the diaphragm." There is, however, no further remark concerning the structure in question; it is not emphasized as a peculiarity of the Monitor nor is it compared in any way with what I believe to be an homologous structure in the Crocodilia.

This horizontal septum closely resembles a structure in the Crocodilia (fig. 3) which has been described by Prof. Huxley² as well as by others: this consists of a membrane, partly muscular, which is attached to the pubis and to the abdominal parietes behind, and in the median dorsal line to the backbone; it entirely envelopes the coils of the intestines, so that they are not visible when the body-wall is cut through. Anteriorly this muscular expansion is attached to the fibrous compartments in which are lodged the stomach and the two lobes of the liver; the lungs are thus shut off from the abdominal cavity; this membrane bears on the ventral surface the anterior abdominal veins: there is evidently a close similarity, so far, between the Crocodile and the Lizard; furthermore in both animals the lateral regions of the membrane are connected with the lateral parietes by fibrous bands, and in both the fat-body lies outside of the membrane and outside of the abdominal cavity; the reproductive glands and the kidneys have a similar relation to the membrane in both types; in the Crocodile as in the Lizard the reproductive glands and the kidneys are separated by the membrane; the former lie within, the latter without, the abdominal cavity. The only differences are that in the Crocodile the membrane is largely covered by muscular tissue, and that instead of simply passing over the liver and stomach, it becomes connected with special sheaths enveloping these several organs. In these points the Crocodile, as Prof. Huxley has pointed out, resembles birds.

The above considerations point, in my opinion, to an unmistakable resemblance between the Monitor Lizards and the higher Sauropsida, a resemblance which is, perhaps, a little unexpected. There has never, so far as I am aware, been any doubt as to the thoroughly Lacertilian nature of the Varanidæ; in all the schemes of classifica-

¹ P. Z. S. 1831, p. 138.

² P. Z. S. 1882, p. 568.

tion of the Lacertilia with which I am acquainted there is no tendency to separate the Varanidæ from other Lizards, although it is true that Mr. Boulenger remarks upon them as forming "a perfectly isolated group"¹. He does not, however, lay weight upon this opinion by separating the family in any way; it is, indeed, particularly associated in his scheme with the Helodermatidæ, Zonuridæ, Iguanidæ, &c. I have not yet had an opportunity of studying the structure of *Heloderma*; and such papers as have been published upon the anatomy of this genus do not touch upon the points to which I have directed attention in this communication. I cannot, however, agree to such a close association of the Varanidæ and Iguanidæ as is proposed by Mr. Boulenger; and other facts, to which I shall direct attention presently, point unmistakably to the isolation of the Varanidæ, and perhaps to affinities with the Crocodilia.

There is little reason to doubt that the Sauropsida form a group which have been derived from a single Reptilian ancestor; this is allowed by Cope² except in so far as regards the Ichthyosauria. Dr. Baur³ derives all the Sauropsida from the Carboniferous Proganosauria, which, in his opinion, is a group of Reptiles, though Cope with some uncertainty assigns this same group to the Amphibia. Both these writers concur in the belief that the Rhynchocephalia (*Hatteria*) are the most generalized of all living reptiles, and most nearly represent the primitive stock from which all existing as well as extinct orders of Reptiles took their origin.

Dr. Baur is of opinion that the existing Lacertilia (and Ophidia) come nearer to this primitive stock than do any other orders of the Sauropsida, while Prof. Huxley⁴ thinks that the differences between *Hatteria* and other Lacertilia have been made too much of. The visceral anatomy of *Hatteria* is certainly much nearer to that of *Lacerta* than to any other Sauropsidan, and the Lacertilia as a whole are decidedly at a much lower grade of organization, as regards the viscera, than are either the Crocodilia and Aves on the one hand, or the Testudinata on the other.

These considerations render the existence of Crocodilian affinities in *Monitor* more intelligible than might at first sight appear; they also point to the conclusion that the difference in structure between the Varanidæ and other Lizards to which attention has been here directed must have existed in the ancestral Reptilian stock which gave rise to the existing Lacertilia, Crocodilia, and Aves; I would argue, in fact, for the extreme age of a Reptilian type closely allied to *Varanus* and *Monitor*. Can this type be *Protosaurus*? It is a Permian Reptile undoubtedly with near affinities to the existing Lacertilia, though with thecodont teeth as in the Crocodilia; it has been stated that this Lizard approximates closely to the living Monitors⁵.

¹ Ann. & Mag. Nat. Hist. xiv. (1884), p. 117.

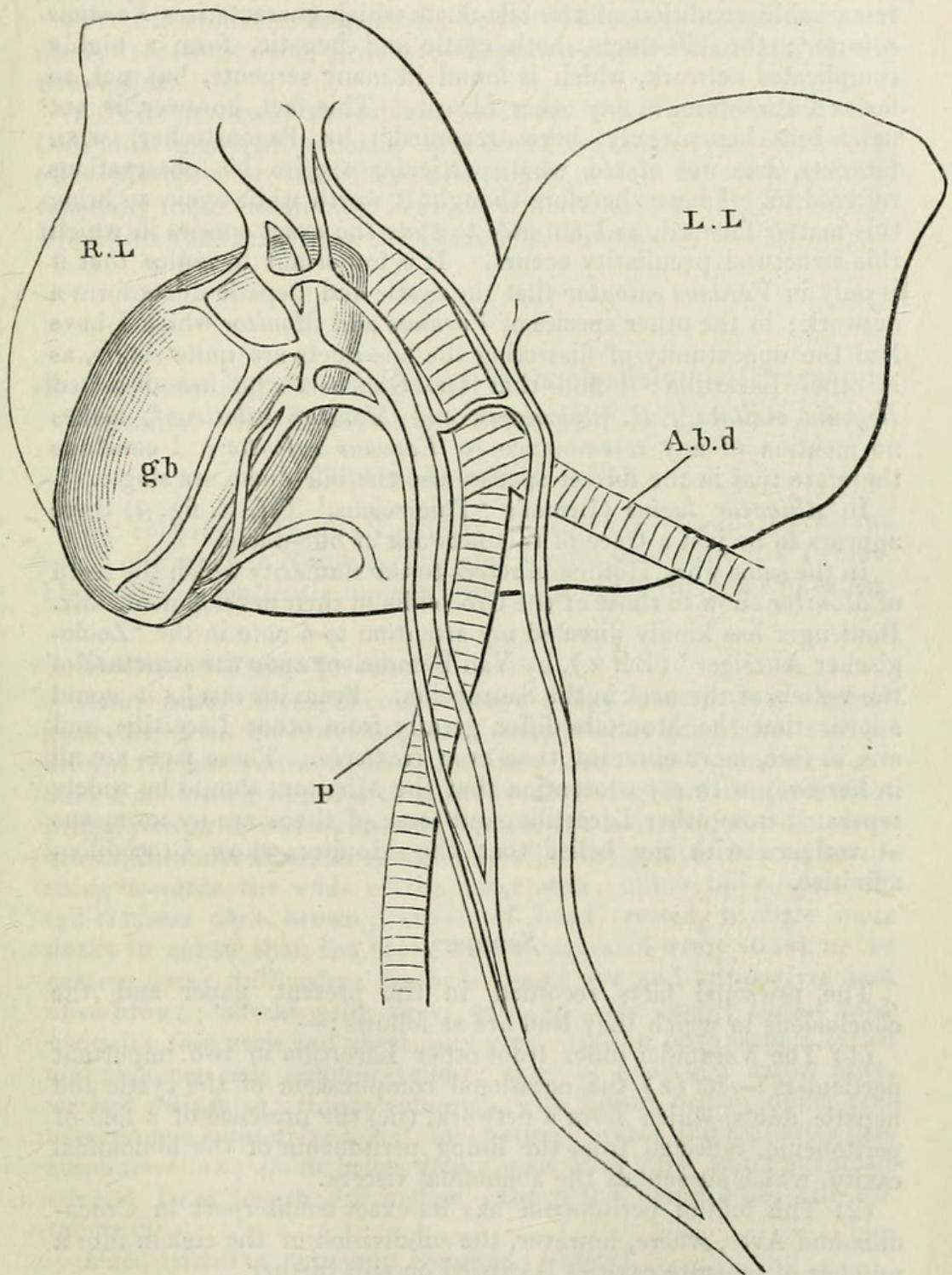
² American Naturalist, 1885, p. 245.

³ Journal of Morphology, vol. i. p. 93.

⁴ Quart. Journ. Geol. Soc. 1887.

⁵ See, however, a paper on *Protosaurus* by Seeley (Phil. Trans. 1887), who does not allow any special Lacertilian affinities.

Fig. 4.

Liver, bile-ducts, &c. of *Varanus salvator*.

L.L, R.L, Right and left lobes of liver; *g.b.*, gall-bladder; P, portal vein;
A.b.d., abdominal vein.

2. *Bile-ducts.*

The accompanying drawing (fig. 4, p. 105) illustrates the very remarkable condition of the bile-ducts which characterizes *Varanus salvator*; the bile-ducts, both cystic and hepatic, form a highly complicated network, which is found in many serpents, but not, so far as I am aware, in any other Lizard. This fact, however, is not new, but has already been recorded¹ by Pagenstecher, who, however, has not stated what particular species his observations referred to. I have therefore thought it worth while again to bring this matter forward, as I am able to state the exact species in which this structural peculiarity occurs. It is important to notice that it is only in *Varanus salvator* that the cystic and hepatic ducts form a network; in the other species of *Varanus* and *Monitor* which I have had the opportunity of dissecting the bile-ducts are quite single, as in other Lacertilia: I find that Dr. Günther, who has dissected *Regenia ocellata*², *R. albigularis*, and *Monitor niloticus*³, makes no mention of any resemblance to *Varanus salvator*; I conclude therefore that in the former species also the bile-ducts are single.

In *Alligator lucius* (Bronn's 'Thierreichs,' Taf. C. fig. 4) there appears to be just a trace of this network of bile-ducts.

In the same work Hoffmann refers to the similarity which the teeth of *Monitor* show to those of the Crocodilia in their development. Mr. Boulenger has kindly directed my attention to a note in the 'Zoologischer Anzeiger' (Bd. x.), by Van Bemmelen, upon the structure of the vessels of the neck in the Sauropsida. From his results it would appear that the Monitors differ greatly from other Lacertilia, and are, in fact, more aberrant than even *Hatteria*. These facts are all in harmony with my contention that the Monitors should be widely separated from other Lacertilia, and some of them are by no means at variance with my belief that the Monitors show Crocodilian affinities.

Summary.

The principal facts recorded in the present paper and the conclusions to which they lead are as follows:—

(1) The Varanidæ differ from other Lacertilia in two important particulars:—in (i.) the occasional complication of the cystic and hepatic ducts, which form a network, (ii.) the presence of a fold of peritoneum, reflected from the lining peritoneum of the abdominal cavity, which surrounds the abdominal viscera.

(2) This fold of peritoneum has its exact counterpart in Crocodilia and Aves, where, however, the subdivision of the cœlom into a number of separate cavities is carried on still further.

(3) The Varanidæ, therefore, alone (?) of existing Lacertilia show the first beginnings of the subdivision of the cœlom, which reaches its extreme in the higher Sauropsida.

¹ Würzburg Naturwiss. Zeitschr. i. p. 248.

² P. Z. S. 1860, p. 60.

³ P. Z. S. 1861, p. 109.

(4) These facts necessitate the separation of the Varanidæ from the true Lacertilia into a group equivalent to that of, *e. g.*, Rhynchocephalia.

(5) It is probable, as generally believed, that the Lacertilia more nearly represent the primitive Reptilian stock than any other Sauropsida.

(6) The particular resemblance between the Varanidæ and the Crocodilia renders it probable that some Reptilian type existed in early Mesozoic or late Palæozoic times, which in many points, especially those enumerated in (1), resembled the existing Varanidæ. From this type originated the Crocodilia, Dinosauria, and Aves.

4. On a new Species of *Elainea* from the Island of Fernando Norohna. By R. BOWDLER SHARPE, F.L.S., F.Z.S., &c.

[Received January 18, 1888.]

My colleague Mr. H. N. Ridley, during his recent visit to the island of Fernando Norohna, procured several specimens of a Tyrant-bird, which is evidently undescribed. I propose therefore to call it

ELAINEA RIDLEYANA, sp. n.

Adult male. General colour above dusky olive-brown, slightly paler brown on the lower back and rump; lesser wing-coverts olive-brown, the lower ones edged with white; median and greater coverts dark sepia-brown, tipped with white, forming wing-bars; bastard-wing, primary-coverts, and quills dark brown, the latter edged with whitish brown, the inner secondaries with white like the greater coverts, broadening towards the ends of the outer web; upper tail-coverts and tail-feathers dark brown; crown of head crested, a little more dusky in colour than the back, with a concealed white streak in the centre; lores dull ashy; feathers round eye and ear-coverts dark olive-brown; cheeks ashy grey, with an olive tinge; throat ashy whitish; fore neck and chest ashy grey, with an olive tinge; breast and abdomen pale sulphur-yellow; sides of body and flanks ashy, washed with olive; thighs yellowish, with brown bases; under tail-coverts pale sulphur-yellow; under wing-coverts and axillaries pale sulphur-yellow; quills below dusky, pale ashy olive along the inner edge. Total length 6·7 inches, culmen 0·6, wing 3·25, tail 2·9, tarsus 0·8.

Hab. Island of Fernando Norohna (*Ridley*).

This species approaches *Elainea pagana* (Licht.) in general appearance, but is a much darker bird, with dusky brown head and ear-coverts, and is at once to be recognized by its conspicuously longer bill.



Beddard, Frank E. 1888. "On certain points in the Visceral Anatomy of the Lacertilia, particularly of Monitor." *Proceedings of the Zoological Society of London* 1888, 98–107. <https://doi.org/10.1111/j.1469-7998.1888.tb06682.x>.

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