ART. XXX.—*On the System of the Batrachia Anura of the British Museum Catalogue;* by E. D. COPE.

UNTIL 1858 the Batrachia Anura was a group of animals to which but little attention had been turned, and for which no detailed system based on any general investigations, had been proposed. It was, therefore, a considerable addition to knowledge when the catalogue of the British Museum appeared in that year, and nearly doubled the number of species already known, and arranged them in a system which went into some detail of structure. This detail was, however, almost entirely with reference to external characters. This fact is sufficient to excite question as to the coincidence of the system adopted, with that of nature, and a full examination into the general anatomy of the order, has answered such question unfavorably to it in a very decided manner.* But as authors who have subsequently written do not seem to be at all aware of the demerits of this system, it is proposed here to point out some of them.

*See the writer on the classification of *Batrachia Anura*, Nat. History Review, 1865, and Jour. Acad. Nat. Sci. Phila., 1866–67.

In the first place the order Anura is divided into three suborders, the Aglossa without tongue, the Opisthoglossa with tongue free behind, and the Proteroglossa, with the tongue free in front. The first group is natural, having been already established by Wagler and Duméril; while the value of the character used to distinguish between the two last is not more than generic at most. Several genera possess the peculiarity of the "Proteroglossa," which in this system are placed among the Opisthoglossa, while the general affinities of the genus Rhinophrynus, the only one of this supposed suborder, are clearly shown by its structure to be those of the family *Bufonidæ* or the toads, on a very slight examination.

The division of Aglossa is supposed by our author to be represented by two series, *Haplosiphona* and *Diplosiphona*, the first including the previously known representatives of the order, the last, the genus *Myobatrachus* Schlegel. Now this last, as I proved by examination of the type specimen at Leyden in 1863, is a dried example of *Chelydobatrachus Gouldii;* an Australian *Bufonid*, with the tongue shrunken away by drying.*

If we now turn to his primary division *Opisthoglossa*, its principal groups are based on one of the most subordinate characters in the order, viz: the *Oxydactyla* and *Platydactyla*, on the presence and absence of the digital dilatations on the ends of the last phalanges; in other words, tree and terrestrial frogs. As all subsequent writers have repudiated these groups, I will pass them with the remark, that the author's reasons for establishing them,—that the characters are so important in the life history of the species—are abundantly sufficient for suspecting their value.

The further subdivision of these groups is based on a variety of characters, some of importance, having been introduced by Müller and Gray, and others newly introduced of very little value. The manner in which they are used is remarkable, and contrary to what would be expected from an examination of the relations of other animals. That is, the characters are treated as of equal importance in all cases, producing a kind of dichotomous system, each group being equal and similar to others, and presenting none of that successional relation which we know so well characterizes nature's groups. The unfavorable impression is strengthened by a further examination into the structure, and the system is found to be little better than if it had been based, dictionary-fashion, on the first letters of their names.

If we mix thoroughly Günther's groups of tree-frogs and not tree-frogs, as the subdividing characters used by him are the same in each, a criticism of the latter will cover both.

* This error is perhaps not due to the author of the catalogue, as he has seen no specimens.

The presence and absence of maxilliary teeth is an important character, much more so than the conditions of the digital dilatations,—though the esteem in which I formerly held it has been much diminished by the discovery of the genera *Colostethus* Cope and *Eupemphix* Steindachner. Their presence or absence, together with the perfection or imperfection of the ear, as to tympanum, vestibule and eustachian tubes gives our author occasion for dividing each of his series dichotomously into four groups—or three, in the case of the tree-frogs, since the diagnosis of one of them has no answering group in nature. But the presence or absence of the different parts of the auditory apparatus is a character of far less importance than is here assigned to it. The two nearly allied genera *Scaphiopus* and *Pelobates* are separated into two different primary divisions by it, the last to be associated with the *Bombinator* and the first with *Alytes* and *Helioporus*, two genera quite remote in affinities, as well as from the most widely separated regions of the earth. Thus *Helioporus* is Australian, *Alytes* European, and *Scaphiopus* American, and each has sundry allies in its own country, with which it should be arranged. Other most remotely allied genera are associated because of agreement in the structure of the ear. Thus *Discoglossus* is placed in the group *Ranina*, though it represents the family of all others in the *Batrachia anura*, the most remote from the Ranidæ, and which includes beyond a shadow of doubt the genus *Bombinator* which Günther makes not only the type of a different family, but of a distinct primary series, his *Bombinatorina*. Many other instances of the same want of appreciation of natural affinities might be adduced here, but I pass to the toothless or Bufonoid series. Here we find Phryniscid genera separated from their true allies the Engystomidæ, while the latter are placed with much remoter relatives the Bufonidæ, merely because a lesser grade of imperfection of the auditory organs characterizes them.

To come to the characters used to distinguish the families, the same window-pane arrangement prevails. Those employed are the presence or absence of parotoid glands, of palmation of the toes, and of dilated or non-dilated sacral diapophysis. The latter character, noted by Bibron and Gray, is of family value, and the only one of the above to be so estimated. The palmation of the toes is only a generic feature, hardly that in some cases. As this is now agreed to by all good herpetologists, I give it no further notice. The presence or absence of parotoid glands is quiet as worthless in this connection. Thus *Scytopis venulosus* has or has not an immense "parotoid" covering the head and back indifferently, as both Steindachner and myself have observed independently. *Alytes* and *Bombinator*, two European genera of Discoglossidæ little known to our author, but most closely allied, have, the one a small parotoid, the other little

separated collections of crypts over the dorsal region, and are hence placed in different families by Günther. *Schismaderma* of South Africa is a true Bufo without parotoids, and Paludicola another member of the true Bufonidæ differs from Bufo in this respect, as Bombinator does from Alytes. *Calamita*, a genus of Hylidæ from the Australian region embraces two species, *C. cyanea* Daud. and *C. dolichopsis* Cope. The first of these has a large glandular mass on the scapular and even cranial regions (and as such the type of a peculiar family of Günther, his Pelodryadidæ) while the second has no glandular enlargements whatever; yet Günther (Zoological Record, 1868) states that they are mere varieties of one species.

To go over all the families in detail, would be unnecessary, as published works have already corrected them. Suffice it to say, that of the fifteen into which the non-tree-frogs are divided, but eight appear by their names to represent natural families, though in character not one of them has a good foundation. Of the nine into which the tree-frogs are divided, but two coincide in extent with modern families, and none in characters. One of the latter embraces but one genus, and is called the *Hylaplesiidæ*, though as Peters has shown by autopsy, the *Hylaplesia* of Boie is a Bufonid, probably a true Bufo. The number of families and subfamilies which might have been constructed on such bases as the above, on genera discovered since the publication of this catalogue, would be considerable, but naturalists have, with one exception* not availed themselves of the privilege.

If we examine the genera of this system the extent of the work of reformation already marked out, becomes more apparent. Thus in his Ranidæ, of thirteen genera, but five belong with Rana, and one of these, Heteroglossa, would be a Polypedatid according to Günther's system. Another, *Stenorhynchus natalensis* Smith, was subsequently redescribed as the type of a new genus and species (*Phrynobatrachus Natalensis*) by the director, although generically undistinguishable from another genus of the same author, *Dicroglossus*. The *Cystignathidæ* contains nothing but members of that family, or rather relations of *Cystignathus*, but is a mere fragment compared with the cohorts that really belong to it. The greater part of all the remaining families of tooth-bearing series belong to it, whether tree-frogs or not. The genus *Plectromantis* Peters, with small digital enlargements on the fingers only, should be placed here, as it is very near to, if at all distinct from the type genus *Cystignathus*. The great extent of this family is paralleled by other Neotropical forms, as the *Formicariidæ*, the *Tyrannidæ*, *Characinidæ*, *Chromididæ*,, etc.

* Mivart, Proc. Zool. Soc. London, 1869, 280. The writer in one or two instances did the same.

As to the "Discoglossidæ," fragments of four families are represented by its five genera, one of which immediately follows, viz: the *Asterophrydidæ*. In the "Brachycephalidæ" there are placed three genera, Pseudophryne, a true Bufonid, and scarcely distinguishable from the genus Epidalea Cope, which embraces the old *Bufo calamita* of Europe; second, Brachycephalus, which is near Phryniscus and belongs to the Phryniscidæ; and third, *Hemisus*, which is nearer by much to *Engystoma*, but probably forms the type of a distinct suborder?

It is not necessary to examine the genera further, but I turn to the species, where it is proper to express more favorable views. Thus science owes to Dr. Günther a debt of gratitude for the collections, in his British Museum catalogues, of convenient diagnoses of species, with references to many works and authors not accessible to all. His books thus become manuals, and indispensable as the last compilation of an extensive and scattered literature. But it is not only as a compiler that his works are valuable. His usual conscientiousness in attempting the accurate discrimination of species is most praiseworthy, though we cannot help thinking that his estimate of the value of species is sometimes a little interfered with by national and personal predjudices. English, French, and American authors fare the worst at his hands, and we freely admit that in the latter case his criticisms are often deserved, so far as they relate to some of the naturalists of a generation or two ago. These will, however, compare favorably with those who commenced the work in Europe, as Klein, Merrem, Laurenti, Shaw, etc. His countrymen do not, however, escape, and Wagler comes in for the charge of having described, after the much and unjustly criticised work of Spix, "a badly-figured specimen of *Ceratophrys ornata*"* as a new genus, *Hemiphractus*. Now *Hemiphractus* is one of the most remarkable and distinct genera of *Arciferous Anura* of South America, the type of a peculiar family, and Spix's figure represents the type species very well. Prof. Peters first restored the genus.

A serious drawback to the merits of the species work, not only of this, but of Dr. Günther's ichthyological works, is his tendency to ignore species.† This view approaches those expressed by Prof. Schlegel in the field of ornithology. Thus distinct species are continually united, and even good genera are not unfrequently found involved in the undigested mass. This probably results from the very poor opportunities of studying the Reptilia and Fishes enjoyed by the author, except

* One of the Cystignathidæ.

† I do not allude to his "doubtful-species" which he puts to one side as too briefly described, often very justly.

in an alcoholic condition; for the European, of all the faunæ, is the most poorly provided with these forms of life. The North American, one of the best provided in these respects, is almost unknown to Dr. Günther, for it is unfortunate for American students that his works in respect to our fauna are of less value than in any other department. It must, however, be added, that some of the older American authors in this field have been quite as bad in another direction, and in respect to furnishing *well contrasted* specific diagnoses, exceedingly derelict. This has been especially apparent in those who indulge in the execrable practice of publishing preliminary descriptions to "secure priority." This, unless reduced to a system of analytic keys, is nothing but a hindrance to science, and results in warning all students off the ground but the writer, an object which it is safe to presume, he generally has in view.

The system then, presented by the Catalogue of the Batrachia Salientia (Anura), is a phenomenon in the history of our science, and is to my mind one of the least successful of the attempts of *skin-zoology* to interpret nature. That I intended my remark made on a former occasion,* that it was a "complete and practically useful system," in a euphemistic, if not a pickwickian sense, would, I should think, be sufficiently obvious to any who should compare my system with it. But it is neither euphemistic nor pickwickian for subsequent authors to follow me in abolishing nearly all its leading features and in newly defining all the groups, and then to declare that they adopt Günther's system with a few modifications introduced by me.

In accordance with Günther's system, he was compelled to conclude that the Anura do not display any of the remarkable geographical relations exhibited by other groups of animals, but are rather varied in relation to latitude. This conclusion I have shown to be most erroneous, and that the Anura of all groups, represent the wonderful faunal relations of geographical areas in the strongest light,—in a way not less distinct than any known order of animals or plants.

As opposed to these valuable results, we have the position, that "zoological classification" should "repose on more external and readily ascertainable characters," and that it is "well to turn to such other (characters) as can easily be observed;† all which we suppose will only interfere with the progress of knowledge where sincerely believed and held.

* On Primary divisions of Batrachia Salientia, Nat. Hist. Rev., 1865.

† Mivart, Proc. Z. S. London, 1869, 281–2. This author makes some curious objections to the definitions of some of the groups for example, that of the Arcifera, the parietal fontanelle, etc. The objection is, that these characters mark immature stages of other groups! a point which I have considered in an essay on the "Origin of Genera" subsequently published. It will suffice to state here, that this relation indicates for a character a certain fixed grade of systematic value. The lowest (specific) and some highest, are those that appear earliest in embryonic life.