

XXXIX.—On the Tongues of Mollusca. By J. E. GRAY, Ph.D.,
F.R.S., V.P.Z.S. &c.

LISTER, Leeuwenhoek, Swammerdam, Poli, Cuvier, Fleming, Berkeley (Zool. Trans. iv. 278), Osler (Phil. Trans. 1832), Quoy and Gaimard*, Delle Chiaje, Alder and Hancock, and some other naturalists, have at varied and distant periods described and figured the tongues of different isolated species of Mollusca.

In 1836 Dr. Troschel (Wiegmann's Arch. 1836, 257. t. 9 & 10) published an essay, describing in systematic order and figuring the jaws and tongue of various species of the land and freshwater Mollusca of Germany; unfortunately the figures are very small and indistinct.

In the volume of the same work for 1839 (v. 177. t. 5. f. 8) he described and figured the teeth on the tongue of *Amphipeplea* of Nilsson, and proposed to form the family *Lymneadae* into two groups, according to their teeth, thus: A. *Physa* and *Amphipeplea*, B. *Planorbis* and *Lymnea*; and in the volume for 1845 (xi. 197. t. 8. f. 6) he gives a description of the anatomy of the animal, and especially of the teeth on the tongue of *Ampullaria urceus*.

It is to be observed that all these observations are confined to, and give a very good connected view of, the teeth in the terrestrial and fluviatile Mollusca.

In 1847 Dr. Lovén (Öfversigt af Kongl. Vetensk. Acad. Förhandl. 1847, 175) describes and figures the teeth on the tongue of the several orders, families, and genera of Mollusca. The figures are all drawn on the same plan, and with great distinctness and accuracy. He divides the tongues he has seen into fourteen groups, and separates the genera into families and sections characterized by the position and form of the teeth.

The groups he has formed are exceedingly natural, and this paper, like his work on the Scandinavian Mollusca, opened a new field of observation to the naturalist.

In the following year Dr. Troschel, in the third edition of Wiegmann and Ruthe's 'Handbuch der Zoologie,' Berlin, 1848 (a work, only the first edition of which has come into my hands; there is however an abstract of the arrangement in Wiegmann's Archiv, 1849, 84), proposed a new arrangement of the Gastropodous Mollusca, characterized by their sexual peculiarity, the

* The figures of the teeth by these authors are, like many details in French scientific works, not given with sufficient care to be of much use. They figure the teeth of the male and female *Strombus Lambis*, t. 49. f. 20 ♀, t. 50. f. 8 ♂, quite unlike each other; and their figures of the teeth of *Ampullaria*, *Mitra*, and other genera are so indistinct as to be of little use for scientific purposes.

In S. Wyman (Boston Jan 1848)
described the teeth of *Lebenaephora* &c

respiratory organs, and the structure of the tongue; the latter characters of the marine kinds being evidently taken from Dr. Lovén's paper. He proposes to form the group of genera which Dr. Lovén named *Trochina*, into an order under the name of *Rhiphidoglossa*, and divides the Pectinibranchous Mollusca, after the above group has been abstracted, into three suborders, according to the disposition of the teeth on the tongue, thus:—

1. *Tanioglossa*. Tongue band-like, with seven rows of teeth, without a retractile proboscis.

This suborder contains the first eight families of Gasteropods in Lovén's paper.

2. *Toxoglossa*. Tongue with two rows of teeth often barbed at the end. Equal to the *Pleurotomacea* and *Conina*, the eleventh family of Lovén.

3. *Proboscidea*, with a retractile proboscis and tongue with only three rows of teeth. This group is equal to the ninth (*Buccinea* and *Muricinae*) and the tenth family (*Volutacea*) of Lovén.

This division of the tongues into three kinds is very useful, to abbreviate the technical descriptions of the families, but I fear that it fails as a natural division of the families into groups. First, for I cannot consider that a natural system which separates the *Strombidae*, *Cypræadae* and *Coriocellidae* from the other Zoophagous Mollusca, and places them in a different suborder from the other zoophagous families.

Secondly, the characters are not sufficiently distinct; for example the zoophagous genera, *Aporrhais*, *Struthiolaria*, *Dolium* and *Coriocella*, and the zoophagous tribes of *Naticidae*, *Velutinidae*, which have seven rows of teeth, of the *Tanioglossa* suborder, have a very long retractile proboscis, the character of the *Proboscidea*.

Thirdly, these suborders do not provide for the genera of operculated ptenobranchous Mollusca, *Scalaria* and *Tornatella*, and the peculiar floating genus *Ianthina*, which have numerous series of teeth on the tongue like the *Pulmonobranchia* and many *Nudibranchia* and *Potamobranchia* (this kind of tongue may be designated *Ptenoglossa*); or for the genera like *Eulima* which have no teeth on the tongue.

Since this paper appeared Dr. Troschel has continued his observations, and published descriptions and figures of the tongues of several exotic genera of terrestrial Mollusca (as *Bulima* and *Nanina*), (Wiegmann's Archiv, 1849, 225, t. 4), and of sundry genera of marine Mollusca found on the coast of Peru (Wiegmann's Archiv, 1852, 152).

M. Oersted has figured and described the teeth of *Sycotypus*

or *Pyrula reticulata*, and MM. Eydoux and Souleyet (Voy. de Bonite) have figured the tongue of *Pyrula tuba* and other marine Mollusca; and more lately Mr. Thomson (in the Annals and Mag. Nat. Hist. 1851, vol. vii. p. 86. t. 3) has published a most interesting account of the dentition of British *Pulmonifera*.

Dr. Troschel in his system, for some reason which I cannot understand, places the family *Ampullariade* with *Cyclostoma* and *Helicina*, among the operculated *Pulmonifera*; the families *Ancylodea* and *Siphonariacea*, which have distinct lungs and no gills, with the plumose-gilled *Pleurobranchidæ*, characterizing the order *Monopleurobranchiata*, in which he arranges them, as having a plumose gill. In his former paper (Wiegmann's Archiv, 1836, 277) he referred the genus *Ancylus* to the order *Hypobranchia*, which is quite as remarkable, since that order is generally confined to the genus *Phyllidia*.

After studying these papers and examining the tongue of many specimens of some species of Mollusca, I am satisfied that the tongue offers a very permanent character of the species, and is very rarely liable to variation. Characters of such permanence in the species afford one of the best means to divide the species into natural genera; and when we consider the important function the teeth have to perform in the œconomy of the animal, one may be convinced that any important alteration in the form or position of the teeth must be accompanied by some corresponding peculiarity in the habit and manners of the animal; hence they must afford good characters to bring together the genera into natural groups or families. To carry out these views will require a very much more extended series of observations on these organs than we at present possess, though we know enough at present to show that an examination of the kind will produce most extensive changes in our existing system, and explain many points which are now involved in much obscurity.

One result of the study of these papers and the personal examination of the tongue of various molluscs has been, to establish more firmly the theory which I have long entertained, that no species of gasteropodous molluscan animal can be properly placed in the system unless we are enabled to examine the animal, the shell, the operculum, and the structure of its tongue; and as none of these parts but the shell can be examined in the fossil species, their position in the various genera must be always attended with more or less uncertainty.

I have repeatedly observed, that there are many genera of Mollusca which cannot be distinguished by the examination of the shell unless it is accompanied by the animal. There are several genera of marine univalves so alike in form and character of the mouth of the shell, that they cannot be distinguished from

each other with certainty without the examination of the operculum; and Dr. Lovén has shown that there are some genera,—*Buccinum* and *Trichotropis* for example, which have the animal, shell, and operculum so like each other, that the latter genus is only to be known by a certain prolongation of the periostraca on the keel of the last whorl,—which have the tongue so unlike, that I believe they ought to be considered as the types of different families; and Dr. Troschel in his system would place them in two distinct suborders, the genus *Buccinum* being referred to *Proboscidea*, and *Trichotropis* to *Tenioglossa*.

Dr. Troschel gives a striking instance. *Triton succinctum* has been considered as a typical species, having the usual animal and operculum of the genus, yet Dr. Troschel describes and figures the tongue as having the seven series of teeth of his *Tenioglossa*.

The similarity of appearance of the animal and shell of *Ancillaria* and *Oliva* are great, yet Dr. Lovén has figured the teeth of the former as very like those of *Nassa* and *Buccinum*, the typical genera of the *Buccinidæ*; but Dr. Troschel has very lately figured the teeth of *Oliva peruviana*, and they are so different, that he thinks I have inaccurately referred these two genera to that family, and proposes to form for them a separate family (see Wiegmann's Archiv, 1852, 166).

The same similarity of the animal and shell exists between the genera *Cypræa* and *Ovula*, yet Dr. Lovén and Troschel have described and figured the teeth of different species of *Cypræa*, showing them to be nearly typical *Tenioglossata*; and the latter has very lately figured the teeth of *Ovula tuberculosa* (Wiegmann's Archiv, 1852, 163. t. 7. f. 6), which are so unlike those of any mollusc before known, that they must belong to a peculiar family; however, the specimen he examined was in such an imperfect condition, that he was not able to describe their position on the tongue. Several other instances of the kind might be cited.

In the outline of the system of Gasteropodous Mollusca, appended to the explanation of the plates of Mrs. Gray's 'Figures of Mollusca,' I have attempted to combine the labours of Dr. Lovén with my own observations on the animal and operculum, but every day adds to our knowledge of these animals, and renders constant revision necessary.

Dr. Troschel in a late paper (Wiegmann's Archiv, 1852, 166) observes on this essay: "Mr. Gray, in his systematic arrangement of the Gasteropoda, has proceeded exactly upon my principles, and being assisted by rich materials and a perfect knowledge of bibliography has done much that is excellent, although in particular instances many errors have slipped into his work. He has,

for example, frequently described the parts of the mouth of a single species as giving family characters, when, by the examination of several species, he would have been placed in a position either to form several families, or to have circumscribed the characters of his families differently." I have only to observe, that Dr. Troschel and I have gone on the same principles, because we have worked from the same source, viz. Dr. Lovén's memoir; for I have not been able to see a copy of Dr. Troschel's work, and had overlooked the abstract in the 'Archiv,' until my attention was called to the divisions in Dr. Troschel's paper above quoted, and I was desirous of finding out when they were first characterized.

In the outline of the system I took care to consult my own observations, and to combine in it all the accounts of the teeth of the different species of Gasteropodous Mollusca which had then (1850) been published, and regret, as much as Dr. Troschel can, that there were not more materials derived from different species of the same genus and family to be used. I do not find the necessity of making any alterations in that system from the genera and species since described, except that of separating *Ovula* from *Cypræadæ*,—unfortunately, however, Dr. Troschel's paper does not afford me the means of characterizing the family *Ovulidæ*; and removing the genus *Sycotypus* from *Muricidæ*, and placing it provisionally as the type of a new family differing from *Lamelariadæ* in the want of a trunk or proboscis.

While on the subject I may further observe, that if there is this difficulty of distinguishing the genera unless we have the shell and the animal, with its operculum, tongue, and other organs complete, we can well understand that there must exist a similar difficulty in distinguishing species except under similar circumstances.

This is especially the case with the shells which, like the *Patellæ*, *Emarginulæ*, *Fissurellæ*, *Calyptrææ* and *Crepidulæ*, have large apertures, the animals of which rest for a long time in a particular station.

In such instances, I am induced by experience to believe that geographic situation is a character of much importance. The very great variations which *Patella vulgata* and *P. pellucida* exhibit on our coast, *Patella saccharina* on the coast of the Cape, and *Patella zebrina* on the coast of South America, would scarcely be believed, if we did not know that they all came from the same localities, and did not sometimes find specimens which exhibit two or more varieties or nominal species on the same individual, the animal having changed its place twice or more during its life.

I believe that it will be utterly impossible to make a proper description of the species of these genera of Mollusca, until we

have a collection of them formed with great care, with all their habitations most accurately marked and arranged strictly geographically, or rather in natural geographic stations; and when this has been done, we shall be surprised to find how we have been manufacturing species which nature never intended; and on the other hand, equally surprised how we have associated specimens together as one species which are most distinct from each other. As an instance of the latter kind, I may cite *Crepidula unguiformis* of authors. This shell is said to be found in the Mediterranean, on the north-east coast of America, the West Indies, the southern and the tropical portions of the west coast of America. In all these localities it is found on the inner surface of shells; being attached to a concave surface, it is flat or slightly concave externally, and is always of a white colour, like most shells which live in a situation where they are not exposed to the light. Believing that this form and colour are caused by the situation in which it is found, I feel convinced that the *Crepidula unguiformis* of Sicily is an accidental variety of the usual-shaped *Crepidula* of the Mediterranean seas; and that the same is the case with the specimens which have been called *C. unguiformis* from other seas; and if the natural-formed species of these countries are distinct, which I believe is now universally admitted, the flat, uncoloured varieties of them are equally distinct; though I am quite willing to own that I know no character or mark on the shell by which the monstrosities from the different localities can be distinguished from each other when placed side by side in the cabinet.

Many conchologists, especially those who collect the specimens from their native habitat, assert that certain specimens are a most distinct species, because they are always found in a peculiar locality, when it is the locality to which they are attached which gives them the peculiarity of form or colour: thus, the *C. unguiformis* must be a species because it is found on the inside of the shell, is flat and is white, whereas the colour and form depend on the locality. Specimens are, however, rarely found which were flat or concave externally, and white when young, and are convex and brown-rayed when adult, or *vice versâ*; the animal having changed its locality during its life. In the same way, others assert that *Crepidula incurva* is very distinct, because it is very convex with a narrow base, and is always found attached on shells, and is generally crowded together one on another; the narrow shape being produced by the shape of the shell, and the convexity of the back by the convexity of the back of the shell entering into and pushing up the cavity of the specimen which is attached to it.

These are treated by many conchologists as theories, but they

are proved to be facts, by some specimens of these shells combining in one individual what have been regarded as two or more species. If, in such cases, all the *Crepidulæ* and *Calyptrææ* from one geographic district were arranged together, we should see that the species of each of those districts exhibit similar varieties, and that the species which have been made on the form of the shell are in fact varieties, from similar causes, of different species.

Unfortunately the animals of these genera show themselves so little beyond the shell when the animal is alive, and afford so few characters as they come to us preserved in fluid, that we can expect but little assistance from them in the determination of the species. They have no operculum to help us; yet we may hope that the examination of the tongues of the different kinds may help in determining the distinctness of the geographic species; but as yet no attempt has been made, except by Dr. Lovén and Mr. Thomson, to use the teeth for this purpose. It would be an admirable subject for a young malacologist who can use the camera lucida on the microscope to take up, as by so doing he would be rendering most important assistance to the study of Mollusca.

XL.—*Description of Carterodon sulcidens, Lund.* By JOHN REINHARDT*. Translated from the Danish by Dr. WALLICH, F.R.S., Vice-Pres. L.S.

Lagoa Santa, 19th July 1851.

AMONG the heaps of small bones, so frequently met with in the limestone caves of this part of the Brazils, and which owe their existence to *Strix perlata*, Licht., are often found skulls, more or less broken, of a small animal, belonging to the family of Pig-rats, but distinct from the cognate forms, in having on each side of the upper incisors, along the middle, a projecting ridge, with a lateral, rather deep furrow. Dr. Lund founded on these crania his *Echinomys sulcidens*, in his first treatise on the extinct animal creation in Brazil†, which he subsequently thought could be referred to the genus *Nelomys*‡, on account of certain peculiarities in the dental system, and at last to *Aula-*

* From a letter to Prof. L. Steenstrup; communicated to the Association of Natural History at Copenhagen, at the meeting on the 14th Nov. 1851.

† Blik paa Brasiliens Dyreverden, &c. (View of the Animal World of Brazil before the last Revolution of the Globe.) First memoir. Introduction, p. 23.

‡ *Loc. cit.* Third mem. p. 30.
Ann. & Mag. N. Hist. Ser. 2. Vol. x.



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