chamber is smaller than the middle, and this than the anterior one. The latter is very considerably enlarged immediately behind the above-mentioned tubercle, and is no doubt in free communication with the cavity of the body or the interstices (*lacunæ*) between the organs, and this is very probably the case also with the hinder chamber. In the bottom of each notch there is an opening for the entrance of the returning blood, so that there are four such apertures, arranged in pairs. From this description it is evident that the heart of the Pycnogonidæ agrees essentially in form and structure with that of the higher Arachnida.

The circulation goes on pretty rapidly in a distinctly marked course, and if the nutritive fluid contains a sufficient quantity of blood-corpuscles, may be easily observed. The chambers of the heart contract simultaneously. At each diastole, the blood returning from the organs is taken up by the heart through the four lateral openings and driven forwards at each systole. In this manner a small portion of the blood reaches the proboscis, whilst the greater part takes its course in the form of a considerable stream towards the abdomen. From this principal current, lateral streams are given off to the legs; these pass down one side of the respective legs and up the other, so as to return at last to the heart.

In conclusion I must remark, that Van Beneden has already observed a regular circulation of the blood in the legs of *Nymphon**. He could not discover the heart, and according to him, the impulse is given to this current of blood in the extremities by a peculiar, rhythmically contractile membrane, situated within the base of the legs. But as it is now certain that the blood circulates in all parts of the body by the action of the heart alone, we may very justly doubt the existence of any such arrangement as this in the legs of the Pycnogonidæ.

EXPLANATION OF PLATE VII.

Fig. 7. Sketch of the heart of *Phoxichilus*. The numbers 1–4 indicate the several thoracic segments; *a*, proboscis; *b*, abdomen; *c*, the four eyes; *d*, *d*, *d*, *d*, the legs; *e*, *e*, the stomach with its lateral cæca; *f*, intestine; *g*, the anterior, *h*, the middle, and *i*, the hinder chamber of the heart; *k*, *k*, the constrictions of the heart.

XVI.—*Abstract of a Monograph of the Family* Gorgonidæ.

By M. Valenciennes.

M. Milne-Edwards has shown that the animals of the class of Polypes belong to two great orders. One of these, called *Anthozoa* (Zoanthaires), includes those animals which more or

* Froriep's Notizen, xxxvii. p. 72.

less resemble the *Actiniæ* so abundant on the coasts of all seas, characterized by their simple, conical, hollow tentacles, and by the numerous ovigenous lamellæ which rise in their internal cavity. The second order, to which M. Milne-Edwards has long since given the name of *Alcyonia*—fixing the zoological meaning of this word, borrowed from Pallas, which has been applied by other authors to the most dissimilar creatures—includes those polypes in which the mouth is surrounded only by eight pinnated tentacles, and in which there are only eight internal ovarian lamellæ; each tentacle is a conical tube, furnished on each side with shorter, filamentous secondary tentacles, which are inserted on the primary tentacle in the same manner as the barbs of a feather upon the stalk. All these polypes are united posteriorly to a common sarcoid body, forming true compound animals. This soft tissue, which is often gelatinous in its appearance, is consolidated by numerous calcareous concretions, entirely composed of carbonate of lime, and possessing determinate forms in each species, but often very different in different species, and also frequently exactly similar in very distinct species belonging to different genera. They must not be confounded with the spicules or acicules which also exist in the tissue of several parts of the polypes, principally round the oral orifice, or near the cells through which the body of the isolated animal is exserted. To these bodies I give the name of *sclerites*.

The masses produced by the aggregation of the *Alcyonia* are as varied in their form as the polypidoms of the *Anthozoa*, which have received the general name of Madrepores. The compound *Alcyonia* are sometimes protected by a simple epidermic sclerenchyma, without any solid internal parts; but sometimes there exists an axis, which is variable in its nature, form, and chemical composition.

Amongst the families established in this order by MM. Milne-Edwards and Dana, the family to which the latter has given the name of *Gorgonidæ*, and which has been divided by Milne-Edwards into several subfamilies, includes the species united by Pallas in the genus *Gorgonia*.

A work which I have long been occupied with, upon the numerous species of Sponges, has led me to compare their spicules with the sclerites of the *Gorgonidæ*. The examination of these corpuscles has enlarged the sphere of my observations, and some new researches have become the basis of a new classification of these zoophytes.

All my predecessors, with the exception of M. Milne-Edwards, only describing the *Gorgonidæ* from dried specimens, have founded their characters upon the arrangement of the divisions of the more or less delicate branches of what they call the *axis of*

the Gorgoniæ, and upon the form and arrangement of the cells in the friable envelope of the branches, to which they give the name of *cortex*. M. Milne-Edwards has ascertained that this envelope, when examined upon living animals, is composed of a sort of contractile parenchyma, which is rendered arenaceous by the quantity of calcareous molecules contained in it. His extended knowledge of the organization of the polypes, has shown him the relations which exist between the envelope and the axis; and in order to render his idea more intelligible he has given the name of *sclerenchyma* to the external portion from which the extensible bodies of the polypes issue, and of *sclerobase* to the concealed portion, which he still regarded as composed of a horny matter.

It appears from what I have just stated, that a *Gorgonia* is a body formed by the union of numerous polypes upon a common body, enveloped by an arenaceous sclerenchyma surrounding another dendroid secretion, the sclerobase; just as a *Veretillum* is composed of numerous polypes protruded from a soft fleshy sclerenchyma. The sclerenchyma of the *Gorgonidæ* contains numerous sclerites. These, which are often microscopic, but are sometimes as much as 2 millimetres in length and consequently visible to the naked eye, occur in all the genera of this family. The following are some of the principal forms:—

1. The corpuscles have two small circles of tubercles at a distance from one another on a short axis; the tuberculate extremities resemble a small branch of cauliflower. These occur in *Junceella juncea*, *surculus* and *elongata*, *Gorgonella sulcifera*, *Ctenocella pectinata*, *Rhipidigorgia umbraculum*, *cribrum*, *arenata*, &c., and in the common coral of the Mediterranean.

2. Other sclerites are fusiform, with four or six circlets of tubercles. These occur in *Pterogorgia simplex*, *Plexaura virgea* and *petechizans*, *Phycogorgia foliata*, *Rhipidigorgia reticulum*, *Gorgonella cauliculus*, &c.

3. A third form is that of the clubbed sclerites, in which a single extremity is dilated, and furnished with ridges, like some ancient maces. These are found in *Gorgonia crinita*, *papillifera* and *placomus*, *Gorgonella betulina* and *ceratophyta*, *Plexaura homomalla*, *pensilis*, *parvula*, &c.

4. A fourth and new form is seen in the muricated sclerites with four or several points, and entirely covered with spines, which occur in *Plexaura aurantiaca*, *Plexaurella dichotoma*, *Gorgonia vermiculata*, &c.

5. A fifth form consists of larger or smaller scales, more or less covered with small spines. These are found in *Cricocella verticillaris* and *plumatilis*, *Primnoa lepadifera* and *antarctica*, *Gorgonia fungifera*, &c.

These sclerites exhibit the most agreeable colours: some are white and transparent like a fine crystal of Iceland spar, others violet like amethyst, others red or yellow. Their transparency has led to the supposition that these corpuscles were composed of small crystals, but M. Senarmont after the examination of several sorts has been unable to recognize any crystalline form in them, and does not hesitate to say that they are not crystals. Their similarity in such different species of *Gorgonidæ* proves that these sclerites cannot be employed in characterizing the genera, as has been supposed by some very excellent zoologists: they can only be taken into account in the diagnosis of the species.

The sclerenchyma thus formed is perforated with cells, which sometimes project from the surface like small warts, whilst in other species they are pierced as though with the point of a needle. These cells are sometimes margined with a small expansion which may be called a lip; other species have the cells surrounded by small scales.

A second organ, the study of which is of great importance, is the axis or *sclerobase*. A fact first established by my researches with the aid of M. Fremy, is, that this axis, notwithstanding its external appearance, does not consist of horn like that of the claws and hoofs of the Mammalia or the horns of Ruminants. It is a substance *sui generis*, which however approaches more closely to horn than to the chitine of the articulated animals. It is insoluble even in hot solution of potash, brought to the greatest possible concentration by boiling. Some species give up a portion of their colouring matter to muriatic acid; others yield nothing. I have met with some sclerobases which became soft, and even began to dissolve in this acid. It is therefore a new substance peculiar to the *Gorgonidæ*, like the conchyoline of the Mollusca, of which the shells of the genus *Pinna* furnish such large and fine specimens. I think we may designate this substance by the name of *corneine*, on account of its resemblance to the material of the hoofs and nails of the Mammalia. The analyses made by M. Fremy prove that it is isomeric with horn.

The sclerobase does not consist of corneine alone in all the species of *Gorgonidæ*. In a great number of species the axis contains a considerable quantity of carbonate of lime. Several species possess an axis which gives a very brisk effervescence with muriatic acid. This physiological fact is very important in the classification of the *Gorgonidæ*, and not less so in explaining the way in which the membranes of the polypes assist in the formation of the sclerenchyma and sclerobase. Those species with a calcareous sclerobase, which I unite under the name of *Gorgonellaceæ*, have the body prolonged into the common sarcoid

mass, and are protected internally by a delicate membrane, which secretes a plate of corneine covered with carbonate of lime. The polypes in adding to their common body secrete fresh plates composed of calcareous matter and corneine, and by treating these axes with an acid which removes the lime, the superposed membranes are separated from each other. When the internal membrane, which is often thick, as in some *Plexauræ* and *Euniceæ*, only deposits corneine, the sclerobase is composed entirely of homogeneous layers of this substance; these have often been regarded as ligneous axes by observers who recognized in their lamellar structure a certain appearance of concentric layers like that of the ligneous layers of vegetables, although in reality there is no resemblance between the organization of these sclerobases and vegetable tissues.

These investigations have led me to revise the classification of these polypes and to arrange them as follows :—

Family I. Gorgonaceæ.

Axis not effervescing with muriatic acid.

Genus Gorgonia. Cells opening upon a small tubercle of the sclerenchyma, projecting from the stalk.

Sp. *verrucosa*, Pal., *placomus*, Linn., *graminea*, Pall., *palma*, Pall., and 11 other species.

Genus Plexaura. Cells opening by a simple hole pierced in the sclerenchyma, without projections or lips.

Sp. *virgulata*, Lamk., *sanguinea*, Lamk., *rosea*, Lamk., *flavida*, Lamk., *flexuosa*, Lamk., *homomalla*, Lamk., *friabilis*, Lamk., *vermiculata*, Lamk., *multicauda*, Lamk., *alba*, Lamk., *laxa*, Lamk., *petechizans*, Pall., and 13 other species.

Genus Eunicea. Cells placed in tubular prominences of the sclerenchyma, and opening under a sort of lip.

Sp. *plantaginea*, Lamk., *mammosa*, Lamk., and 6 other species.

Genus Pterogorgia. Cells opening in series on the two sides of a compressed stem.

Sp. *anceps*, Ehr., and 3 other species.

Genus Phycogorgia. Sclerobase dilated into membranous laminæ like a Fucus; sclerenchyma covered with cellular pores.

Sp. *fucata*, Val. (Mazatlan.)

Genus Hymenogorgia. Sclerenchyma dilated into foliaceous laminæ, supported on a sclerobase with simple, branched, rounded, slender, separate stems.

Sp. *quercifolia*, Val. (Guadaloupe.)

Genus Phyllogorgia. Sclerenchyma with foliaceous expansions; branches of the sclerobase with frequent anastomoses.
Sp. *dilatata* and *foliata*, Val.

Genus Rhipidigorgia. Branches of sclerobase rounded, frequently anastomosing to form a flabelliform network.
Sp. *umbraculum*, Lamk., *flabellum*, Linn., and 6 other species.

Family II. Gorgonellaceæ.

Axis effervescing with muriatic acid.

Genus Junceella, Val. Stems straight, covered with polypiferous cells scattered upon the sclerobase.
Sp. *juncea*, *surculus*, *vimen*, *elongata*, *calyculata* and *hystrix*, Val.

Genus Ctenocella, Val. Sclerobase forming straight rods, pectinated on one side only of the principal stem.
Sp. *pectinata*, Val. (China.)

Genus Gorgonella, Val. Sclerobase much divided, forming fine branches.
Sp. *violacea*, Lamk., *sarmentosa*, Lamk., and 3 others.

I have extended my researches to other polypes of different families, and they have given me the opportunity of observing several facts which have escaped previous observers, and which will serve to rectify some faulty diagnoses. The coral-fishers agree in saying that the extremities of the branches of coral are soft when first taken from the sea, and that they only become hard by desiccation. The truth of this may be ascertained by examining coral preserved in spirits.

On dissecting the *Melitæa ochracea*, Lamk., the parenchyma of the sarcoid envelope of the common body is seen to extend along the stems, and between the calcareous masses, of which the articulations of the sclerobase are composed. But it is incorrect to say that this sclerobase is composed of a series of joints separated by a corky tissue: it is the desiccation of the parenchyma that renders the separation of the joints too easy. Lamarck only examined dried individuals.

The sclerites of the *Melitææ* are small, scarcely measuring from 0·08 to 0·10 of a millimetre. They are smooth, cylindrical, rounded at both ends, and of a fine orange colour. These are mixed with others, of a longer form, and pointed at the two extremities; their colour is yellow and they measure 0·15 of a millimetre. With these sclerites I have seen others much smaller, measuring only 0·04 to 0·06 of a millimetre, of a fine orange-yellow colour, and furnished with two whorls of tubercles.

The articulations which separate the calcareous pieces of the sclerobase of *Isis*, consist of corneine. The sclerites of *Isis* are 0·18 to 0·20 mill. in length, with a swelling at each extremity; they are of a fine white colour.

The substance of the axis of *Pennatula phosphorea* has been analysed by M. Fremy. It contains a considerable quantity of phosphate of lime with the carbonate of lime. These are the only Radiated animals containing phosphate of lime, and this pecularity was the less expected as the axis of *Virgularia* and *Pavonaria* contain only carbonate of lime.

XVII.—*On the Genus* Assiminia.

By Dr. J. E. Gray, F.R.S., V.P.Z.S.

To the Editors of the Annals of Natural History.

Gentlemen,

In the preceding Number of the 'Annals' Mr. Clark thinks he has proved that Dr. Leach's genus *Assiminia* is only a species of *Truncatella* of Risso. Mr. Clark's description proves the converse of his position. *Truncatella* should have a subcylindrical shell with a slender tapering tip, which falls off when the shell approaches adult age; hence the name of the genus: *Assiminia* has a broad conic shell with an acute tip which does not fall off; if it is to be a species of the same genus, the name of the latter ought to be changed.

The foot of *Truncatella* is small and peculiarly formed, and the eyes of all the species, according to Mr. Clark's observations, are large with a white iris; now this is not the case with *Assiminia*, and yet Mr. Clark regards it as a *Truncatella*.

Every naturalist has the right to restrict his genera as he pleases. I have only to observe that Mr. Clark's notions on this head are not those usually held by modern zoologists, and this must explain the proposed union; it is not so extraordinary as that of the species which he has combined together under the generic name of *Murex* in his late work, species which are by other authors referred to six distinct families. If we were to extend the views of Mr. Clark as applied to the British Mollusca to the exotic species, that is to say to the Mollusca known, many of our genera would contain from 500 to 700 species, which certainly would not facilitate the study of these animals. But the whole of Mr. Clark's theory is so opposed to sound logic, that I shall not proceed further.

I am, Gentlemen, yours truly,

J. E. Gray.