On the Respiratory Apparatus of the Ampullariæ.

By M. A. Sabatier.

In a note inserted in the 'Comptes Rendus' of the 12th of May last, M. Jourdain described the arrangement of the respiratory apparatus of the *Ampullariæ*. Having already occupied myself with this subject in 1877*, and having pursued my researches, I am able to make known some new facts which had escaped the observations of my predecessors.

The venous blood, returning from the different parts of the body, divides into three parts :—1, one passes to the right into a cavernous sinus, which accompanies the terminal intestine; this is the *rectal sinus*, which is a diverticulum of the general cavity of the body: 2, the second part comes from the anterior region of the body (head, pharynx, stomach, anterior margin of the palatine arch) and forms on the right the *proper afferent vessel* of the lung, which it circumscribes to the left and in front; this vessel presents a double series of orifices for the afferent branches of the roof and of the floor of the pulmonary chamber: 3, the third part, which is far more important, comes together in a large deep vessel with muscular walls, which soon ramifies on the lower surface and in the thickness of the large gland, to which I have already alluded. From this network the efferent vessels take their origin, the greater part of which reunite in a large trunk with muscular walls which carries the blood to the renal organ: this is the *deep afferent vessel of the renal organ*, which is peculiar to the *Ampullariæ*. The other vessels which originate from the large gland discharge themselves successively into a superficial vessel of no great size placed on the posterior margin of the renal organ, and which is its *superficial afferent vessel*, corresponding, in all respects, to the single afferent vessel of the other Pectinibranchiata. Hence the blood which has traversed the large gland in a true portal system is not, as M. Jourdain thinks, mingled with the blood returning from the organs of respiration, to be *immediately* poured into the heart, but it does not reach this latter organ until after it has traversed the renal organ first and the respiratory organs afterwards.

From the anterior margin of the renal organ there originates, by successive roots, an efferent vessel of the renal organ, which, after having anastomosed with the afferent vessel of the same organ, continues forward on the right margin of the principal branchia, of which it constitutes the afferent vessel. This vessel receives, in passing, some affluents proceeding from the rectal sinus.

On the left margin of the branchia, between this latter and the lung, is a large trunk which terminates at the auricle, and which is not simply, as M. Jourdain thinks, an efferent vessel of the branchia and of the lung. This vessel contains, in fact, a series of fissure-like orifices, which pour into it the blood from the branchia, and two

* Assoc. française pour l'avanc. des Sciences, session du Havre, 1877, p. 623.

series of circular orifices, of which the upper are the *efferent* orifices of the pulmonary arch, and the lower are the *afferent* orifices of the floor of the lung. On this floor, in fact, the vessels which originate from these orifices ramify in a network of which the efferent branches converge into a large trunk, entirely overlooked by M. Jourdain, and which, collecting the blood of the whole of the floor of the lung, empties itself directly into the auricle. From this results the fact, entirely exceptional in the Pectinibranchiata, that the auricle receives two totally distinct afferent veins. The one is branchial and pulmonary, the other exclusively pulmonary. This is a remarkable peculiarity of the anatomy of the *Ampullariæ*, which is in connexion with the double respiration of these animals, and with the alternations in function of the double respiratory apparatus.

The afferent vessel of the branchia and the proper afferent vessel of the lung meet in front in such a manner as to form an anterior arch. The intermediate trunk meets this arcade very obliquely and under a very sharp angle open to the left. There is thus formed between the two vessels a valvular spur, which plays an important part in several respects. When, during sojourn in the water, the pulmonary respiration and circulation are suspended by the want of air and the collapse of the lung, the blood of the proper afferent vessel of the lung, being unable to traverse the pulmonary network, arrives in abundance at the level of the mouth of the intermediary trunk, to which it applies the valvule and which it thus stops. It is thus obliged to pass entirely into the afferent vessel of the branchia, and, consequently, into the branchia, of which the activity is thus greatly increased. When, on the contrary, during sojourn in the air, the collapsed branchia does not act, the blood of the afferent vessel of the branchia, arriving *en masse* on the edge of the spur, there divides into two currents, one of which penetrates into the proper afferent vessel of the lung, and the other into the intermediary trunk, of which it augments the tension, and which distributes a part of it to the floor of the lung, and reconducts the rest to the heart. By this means the activity of the pulmonary circulation is increased during the repose of the branchia. Hence results this interesting fact, that the *Ampullariæ*, which are Pectinibranchiata in which pulmonary respiration has made its appearance, have the respiratory vessels disposed in such a manner that, when this newly-introduced function suspends its activity, all the blood which should have traversed the pulmonary network is constrained to traverse the branchial system, where its hæmatosis is assured. This curious arrangement may suffice to explain the preservation of the branchia in Gasteropoda, in which the lung has attained so remarkable a development, and which might have become purely pulmonary animals.

The distribution of the vessels in the pulmonary walls merits special mention. They form a double system of portal veins ; that

is to say, the vessels form on their journey two successive networks separated by intermediary trunks. This arrangement, a little less accentuated on the floor than on the roof, added to the presence of a fine vibratile epithelium on the course of the pulmonary vessels, proves the active part of this apparatus as an organ of hæmatosis.—*Comptes Rendus*, June 23, 1879, p. 1325.

On the Zoantharia Malacodermata *of the Shores of Marseilles.*

By M. E. Jourdan.

The anatomical plan of the Actiniadæ is well known ; it may be compared to a cylindrical body, furnished at one end with a buccal aperture surrounded by a circlet of tentacles, and hollowed by a mesenteric cavity (gastric cavity of the larva), which is connected with the mouth by an œsophageal region of ectodermal origin, formed by a short and wide tube. Between the œsophageal tube and the walls of the body are the septa, which terminate freely by the lower part of their inner margin in the mesenteric cavity.

We have successively studied these different regions in the types which presented peculiarities appreciable by the naked eye, and we will here give a summary of the principal results that we have obtained.

The walls of the body contain three layers—an external cellular layer or ectoderm, a fibrous mesodermic layer, and an internal cellular layer or endoderm.

The ectoderm is formed of glandular elements, vibratile cells, epithelial elements, which are probably sensitive (analogous to those of the chromatophorous sacs of *Actinia equina*), and, lastly, neuro-muscular elements, which we have distinctly observed in the above species. In *Phellia* this cellular layer secretes a viscous mucus, which, by agglutinating fragments of all sorts, gives a peculiar aspect to the body.

In *Bunodes* the glandular elements of the ectodermic layer group themselves together and form the little organs which adorn the column of these animals.

Cerianthus is remarkable for the structure of its mesodermic layer, and thus constitutes a distinct type among the Zoantharia Malacodermata. This layer is composed of a thick muscular region included between two planes of connective tissue. The longitudinal muscular fibres composing it are smooth and arranged in radiating laminæ. Beneath the inner fibrous plane there exists another layer of circular fibres.

In the *Actiniæ* the mesoderm is represented by laminæ of connective tissue, clothed internally by a layer of circular muscular fibres, which occur throughout the height of the column. *Calliactis* possesses a fibrous layer of exceptional thickness and density, traversed by persistent pores, and sprinkled in its upper part with