that of the spores of many other Fungi, and particularly of the *Uredineæ*, already very well examined in this respect by Messrs. Tulasne several years ago.

This idea of a kind of identity between the structure of the spores of the Truffles and the Truffle itself which they are to reproduce, was founded on an analogy of form and colour which exists only in few species, and on the hypothesis that the spores increased in all directions to form the fungous mass of the Truffle; but as we have seen, this very improbable hypothesis is completely subverted by observation of the germination of the spores of *Balsamia*, and by that of the existence of a mycelium around the Truffles themselves while they are young.

The precise knowledge of the varied and complicated structure of these subterranean Fungi, the observation of the different phases of their life, if not in the same species, at least in plants sufficiently allied to admit of analogy guiding us with safety, enable us now therefore to appreciate the manner of the nourishment, growth, and reproduction of these plants, so imperfect in appearance that their mode of existence was long concealed from the observations of naturalists, and of which, a quarter of a century ago, there was but a distant idea of the variety of organization and the considerable number of species.

Thanks to the extensive and profound researches of Messrs. Louis René and Charles Tulasne, this group of Fungi, which so many causes rendered it particularly difficult to study, may now be considered one of the best known; for to the general anatomy and the physiological facts, of which a brief analysis is above given, are adjoined a detailed monograph of all the species of subterranean Fungi known at this time, and excellent figures representing most of those species and the most minute details of their organization.

III.—*On the Anatomy of* Antiopa Spinolæ, *a Nudibranchiate Mollusk.* By Albany Hancock, Esq.

[With two Plates.]

This paper treats of the anatomy of an animal which was discovered by M. Verany on the shores of Italy, and was described by that naturalist in 1846 under the name of *Janus Spinolæ*. Shortly afterwards it was taken by Dr. Battersby on the Devonshire, and by Mr. Alder on the Cornish coast; and the latter gentleman and I published an account of it in the 'Annals of Natural History' for 1848, where it was named *Antiopa splendida*. At that time we had seen neither the original description nor specimens from the Mediterranean; but have since been

favoured with some from thence through the kindness of M. Verany; and having made careful dissections of them, and of others from the coast of Cornwall, we have satisfied ourselves that no character exists to distinguish the Italian from the English specimens. The anatomy is the same in both, and all the external parts agree.

In 1849 M. Emile Blanchard gave a full account of the anatomy of *Janus Spinolæ* in the 'Annales des Sciences Naturelles,' 3e série, t. 10. My dissections, however, have brought to light numerous and important details which do not coincide with those given by that anatomist, otherwise I should not have deemed it necessary to draw up the present memoir. These differences will be noticed after the description of each organ; therefore it is only necessary to state here, that the most important of them relate to the digestive system and to the reproductive organs.

*Antiopa Spinolæ** (the name by which our animal must be now designated, the generic appellation of M. Verany having been previously used) belongs undoubtedly to the family Eolididæ, as defined in the 'Monograph of the British Nudibranchiate Mollusca,' now being published by the Ray Society, though it exhibits some characters approximating it to *Doris* and *Tritonia*. *Antiopa* differs in many respects from *Eolis*, both externally and internally. The body is upwards of an inch long; it is ovate, a little depressed, and tapers to a point behind, with the sides of the back carinated, indicating the presence of a cloak. The branchial papillæ are arranged along the carinæ and pass round in front of the head; extending posteriorly a little behind the anus, which is placed in the median line of the back, near to the termination of the body. The generative organs open on the right side. The dorsal tentacles are laminated and united at the base by a fleshy crest.

Digestive System.—The oral opening is rather large, and is placed on the inferior surface of the head; it is guarded by a fleshy lip divided behind, and leads by a short canal to the buccal mass (Pls. II. and III. fig. 1 *a*), which is very large, of a lozenge-form when viewed from above, and somewhat depressed. It is very compact and firm, having the jaws exposed at the sides (Pl. II. fig. 2 *c*), and is provided with numerous powerful muscles for their motion, and for advancing and retracting the whole apparatus. The jaws (fig. 3) are of great power, being equal in size to the buccal mass, and give to it its proper form. They are not mere thin plates as in *Eolis*, but are of considerable thick-

* As this paper was passing through the press, I have learnt that M. Delle Chiaje was the first to discover this animal, and that he had described it under the name of *Eolidia cristata*. His specific denomination will therefore have to be adopted.

ness, of a peculiar horny texture, apparently porous within, admitting readily the point of a needle; their form is subtriangular when seen in front, each having attached to the anterior angle a plate or cap (*a*), which is provided with two parallel cutting edges, the outer one (*b*) being denticulated, the inner (*c*) smooth. The denticulations are about twelve in number, very large, compressed and lancet-formed, with their points tipped abruptly with black: their bases being pale have not a little the appearance of forming a second row of teeth. This appearance probably deceived M. Blanchard, who describes two denticulated plates. The inner edge is quite smooth, and separated from the outer one by a deep groove: the function of this edge is rather problematical. The jaws are strongly articulated above in front, at a point (fig. 5 *d*) which is furnished with a projecting process or fulcrum.

The tongue is large, and stands up from the floor of the buccal cavity in front of the œsophagus; it is formed as in *Doris*, being tubular behind (Pl. II. fig. 6, and Pl. III. fig. 2 *b*), with the frontal portion (*a*) turned over, as it were expanded like the mouth of a trumpet. This is the only portion of the organ that can act as a prehensile instrument, the spines being exposed and turned with their points towards the gullet. The spines behind line the tubular portion, and are covered by a soft, delicate membrane. Here they are generated, and retained until gradually pushed forward to make up the deficiency occasioned by the loss of those in front.

The spines are firmly attached to a stiffish membrane, which rests upon a muscular support capable of moving backwards and forwards, and of giving to them the necessary prehensile action. When the tongue is removed from this muscular support and spread out, it (Pl. II. fig. 7) is found to be about twice as long as it is broad, slightly narrowed behind (*a*), and a little rounded at both extremities, with the whole surface covered with transverse rows of plain, stout, recurved spines (figs. 8 & 9) of a deep amber colour, giving to the rows when seen with a low magnifying power a dark purple-brown hue. There are thirty of these rows, each containing eighty spines, one spine being central (fig. 8 *a*), of the same size, plain and recurved like the rest. From this the lateral portions of the rows, on either side, slope forward, giving to the tongue a bipartite appearance.

The œsophagus (Pls. II. & III. fig. 1 *b*) is rather wide, very short and internally plicated; it passes from about the middle of the upper aspect of the buccal mass, and opens into the lower portion of the stomach in front. This latter organ (*c*) is placed far forward in the visceral cavity, a little on the left side. It is transversely elongated, of considerable size, exhibiting through its

upper wall, which is very delicate, internal, longitudinal plicæ. The lower portion of the stomach, towards the left side (Pl. III. fig. 1 *d*), is covered with a thin coating of a folliculated, glandular substance. Here the intestine (Pl. II. fig. 1 *d* & Pl. III. fig. 1 *e*) leaves the gastric pouch, and doubling back upon it passes across to the right side of the body, down which it runs for some distance, and then turning inward dips under the ovary, and shortly reaches the large, tubular anal nipple (Pl. II. fig. 1 *e* & Pl. III. fig. 1 *f*), placed on the median line of the back, not far from the posterior extremity of the animal. The intestine is wide, diminishing slightly in caliber towards its termination; the inner surface being longitudinally plicated throughout.

The hepatic apparatus is extensively diffused in this species, as it is in all the other Eolididæ. Two large anterior hepatic canals open into the upper surface of the stomach, one on each side. These canals on leaving the gastric organ almost immediately divide into two branches (Pl. II. fig. 1 *f*, *f*), one of which curves forward (Pl. III. fig. 1 *g*, *g*), the other backward (*h*, *h*). The two that pass forward stretch along the sides of the back, and turning round in front of the head, are apparently united on the median line. These branches give off from their outward margin numerous ramuscules (*k'*), which divide and subdivide, forming dendritic tufts, some of the twigs of which pass into the anterior branchial papillæ. The two posterior branches (*h*, *h*) of these hepatic canals, turning backward, run down the sides of the back, and communicate, by similar dendritic tufts, with the papillæ on the sides for more than half-way down the body. Here these two latter branches terminate. There is, however, another trunk canal belonging to the hepatic apparatus. This is the great, posterior or central duct (Pl. II. fig. 1 *h* & Pl. III. fig. 1 *i*, *i*); it is a little larger in caliber than the anterior canals, and opens into the lower, glandular portion of the stomach a short way in advance of the pylorus, and passing backward, beneath the anterior ovarian mass, sends a branch which ascends between the lobes of the ovary, to communicate with the papillæ on the left side in front of the anus. The trunk canal then turning upward between the anterior and posterior masses of the ovary on the same side, gives off another branch, which crossing the median line in advance of the anal nipple, subdivides into two portions, one of which bends forward, the other backward; these go to supply the papillæ along the right side near to the anal region. The posterior canal then passes backward above the posterior ovarian mass, and on the left side of the anus. It now assumes a more central position, and after sending two or three branches to either side, terminates in a blind sac a little behind the papillæ.

All the branches of the great posterior canal give off dendritic ramuscules, which communicate with the papillæ in the same manner as those from the anterior canals. The whole of the ramuscules, branches and trunk canals are of a dark chocolate colour when the animal is alive, resembling in this respect the gland of the papillæ. It is therefore likely that all these parts assist in the production of the biliary fluid. The walls of the canals and branches are very firm, retaining their cylindrical form even when completely isolated.

The great posterior canal has entirely escaped the notice of M. Blanchard, who after describing the posterior branches of the anterior trunks to be united by a transverse communication in front of the anus, states that they pass down to the extremity of the body*. This we have seen to be erroneous, the transverse communication (Pl. III. fig. 1 *j*) being, in fact, a branch from the posterior canal. He has committed this error, probably, from having relied too much on the examination of living specimens, in which many of the branches and most of the ramuscules are distinctly seen through the dorsal skin. In spirit specimens there is no difficulty in isolating all the principal canals, their branches, and most of the ramuscules. In this way I have on more than one occasion demonstrated the existence of the posterior canal, and the various other ramifications of the hepatic organ. I have therefore no hesitation in asserting the accuracy of the above description and of the accompanying illustrations. I may state, that only the terminal portion of the posterior canal can be traced through the dorsal skin, the rest being concealed beneath the ovary; and that this portion of it is pretty correctly represented in M. Blanchard's figure, but is erroneously connected with the branches of the anterior canals of each side.

The hepatic gland (Pl. III. fig. 1 *k* & fig. 3) of the papillæ is very simple, being contained within an inner sheath, and extending almost to the apex of the papilla; it is tubular with the extremity bifid (fig. 3 *a*), the portions being folliculated and a little branched. The inner surface is lined with a brown-coloured, glandular matter.

The whole of these glands, together with the numerous dendritic branches and canals, form an exceedingly beautiful example of an unravelled liver, exhibiting as it were, at a glance, the complicated mechanism of this highly organized viscus. These parts, however, do not appear to be the only representative of the biliary organ in this animal. On each side of the lower portion of the body, immediately below the skin and in contact with it, there is a peculiar glandular structure composed chiefly

* M. Delle Chiaje, who has given an account of the anatomy of *Antiopa*, appears also to have overlooked the great posterior canal.

of anastomosing tubes, which form a network (Pl. II. fig. 1 *i* & Pl. III. fig. 4 *d*) across the dorsal aspect in front of the anus. This network inosculates with the minute twigs of the hepatic organ leading to the papillæ, and is apparently connected with a dense gland-like body (Pl. II. fig. 1 *j* & Pl. III. fig. 4 *c*) surrounding the termination of the intestine. There can be little doubt that this network of tubes, which is unnoticed by M. Blanchard, is part of the hepatic apparatus; and from its internal position points out *Antiopa* as one of the intermediate forms connecting the Eolididæ with the other families of the Nudibranchs.

The digestive system of this animal thus becomes of great interest, while it is evident that the hepatic canals are arranged after the type of those of *Eolis*, in which the anterior ones always enter the sides of the stomach from above, and the posterior or central one from behind and below the pylorus:—the stomach being, in fact, perforated by three hepatic ducts in the same manner as it is in *Antiopa*. The chief differences being that in this latter animal the anterior branches are excessively developed, and the central one is below the ovary.

Vascular System.—From deficiency of specimens, I have not been able to investigate the circulatory apparatus to any great extent. The heart is placed about the middle of the back immediately below the skin, having the intestine in front, and the ovary beneath exactly as in *Eolis*. The pericardium is of excessive tenuity, and is of a pretty regular oval form. The ventricle (Pl. II. fig. 1 *k*) lies in front, and when contracted is irregularly elliptical; it is rather large and muscular. The auricle (*l*) is delicate, membranous, and is connected to the posterior margin of the ventricle: at this point the two chambers of the heart communicate. The aorta passes from the front of the ventricle, and dipping almost directly beneath the intestine, gives off branches to the generative organs, to the stomach and to the buccal mass, in the same manner as in *Eolis*. I did not observe the pedial artery, though there can be no doubt of its existence as described by M. Blanchard. The auricle receives in front, on either side, a large trunk vein which communicates with numerous small branches from the skin, and is apparently joined behind, on the median line, by two other large trunks, that on the right side being considerably the smaller. There are several other small vessels, but whether they entered the posterior margin or belonged to the lateral trunks, I could not determine. This is so different from what is observed in the other Eolididæ, that I should have doubted the accuracy of my observations, had not M. Blanchard described numerous vessels entering the posterior margin of the auricle. It would therefore appear that the

efferent or branchio-cardiac vessels are arranged in a peculiar manner in *Antiopa*—differing alike from those in *Eolis*, in *Doris*, and in *Tritonia*.

The capillary portion of the vascular system is undoubtedly as deficient in our animal as it is in the other Nudibranchiata; but I cannot speak from observation on this point; neither have I ascertained how the blood passes to the aërating surface, on its return to the heart, though from analogy we cannot hesitate to believe that it escapes from the arterial twigs into the tissues of the various organs, thence filters as it were into the visceral cavity, and then passing through orifices in the walls of that cavity, it reaches the skin and branchial papillæ on its way to the auricle through the branchio-cardiac vessels.

A small oval vesicle (Pl. II. fig. 1 *m*) lies immediately below the pericardium, and opens into it, through its floor, rather in front and on the right side of the median line. This vesicle is the representative of that described by Cuvier, in *Doris*, as communicating with the liver, and opening externally by a minute orifice at the side of the anus; and is the same which Dr. Embleton and I have designated a portal heart in our communication on the anatomy of *Doris* *. In *Antiopa Spinolæ* this vesicle opens into the pericardium in the same manner as it does in that genus, and in like manner is internally plicated. I have not been able to examine it further in this species; but from analogy suppose that it may throw venous blood into the hepatic network of tubes, and perhaps also within the sheaths that surround the papillary glands. This is, I believe, the first time that this vesicle or portal heart has been observed in the Eolididæ†; and it proves in a striking manner the connexion of *Antiopa* with the other two families of the order.

Respiratory System.—The specialized breathing organ is composed of the papillæ arranged along the sides of the back, and in front of the head. These in *Antiopa* are very large and numerous, their external skin being exceedingly delicate. A portion of the deteriorated blood, on its way to the auricle, will be made to traverse the surface of the papillæ; but doubtless much of the blood will pass at once through the skin to the heart, and on its way be there partially aërated, as is the case in *Eolis*, in *Doris*, and probably in all the Nudibranchs.

No ovate vesicle was detected in the terminal portion of the papilla, similar to that observed in *Eolis*; though Mr. Alder informs me that when the animal was alive, a distinct orifice was visible at the apex, opening and closing at intervals.

* Read at the meeting of the British Association held in Edinburgh, 1850.

† A similar vesicle also exists in *Tritonia Hombergii*; and since writing the above I have likewise found it in *Eolis papillosa*.

Nervous System.—The cephalic or cerebral ganglions are arranged round the œsophagus in the same manner as in *Eolis*; there are five pairs, three supra-œsophageal, two infra-œsophageal; the former are very much the larger and nearly of equal dimensions. Of these the two central pairs, the cerebroid (Pl. III. fig. 5 *a*, *a*) and branchial (*b*, *b*), the latter the "cervicaux" of Blanchard, are almost completely fused, forming two elongated, bilobed masses, one on each side of the median line,—the branchial lying behind the cerebroid, which latter is united by a very short commissure to its fellow on the opposite side of the œsophagus. This is exactly similar to what is observed in *Eolis*; but in this latter genus the masses being less distinctly bilobed, the constituent parts are not so readily made out. External to these masses, and in close contact with them, are two rounded ganglions, the third or pedial pair (*c*, *c*). These lie in a plane a little below the central masses, and are united to them on the under surface.

The first and largest pair of nerves are given off from the upper surface of the cerebroid ganglions in front, next the median line; these are the olfactory nerves. Each immediately divides into two portions,—the inner, generally the larger, of which converge, and go to the crest between the dorsal tentacles, where they divide into numerous twigs; the outer portions diverge a little and enter the bases of the dorsal tentacles, and are there enlarged to form the olfactory ganglions (*d*, *d*), which are quite distinct and round, and very little inferior in size to the buccal. The second, third and fourth pairs come from the under side of the front margin of the same ganglions, and supply the lip and channel of the mouth, and probably the oral tentacles. The fourth pair give off at their roots a nervous trunk; these trunks curve round, one on either side of the œsophagus, and are united to the buccal ganglions; thus forming the commissure (*g*) between the supra- and infra-œsophageal nervous centres. The fifth pair issue from the upper surface of the cerebroid ganglions near to their junction with the branchial; these are the optic nerves; they are very delicate, and are long enough to allow the eye, which is as well developed as in any of the Nudibranchs, to pass a little in front of the ganglions. M. Blanchard represents the eye as almost sessile on the cerebroid ganglion. The sixth, the auditory, I did not detect; they will undoubtedly be found behind the optic, as described by M. Blanchard. The seventh pair of nerves emerge apparently from the pedial ganglions at their union with the central masses, and supply the skin on the sides of the body in front. The eighth and ninth pairs pass from the outer margin of the pedial ganglions, and go to supply the foot. From the posterior margin of these ganglions emerges a stout nervous trunk (*h*), which curving under the gullet, com-

pletes the great œsophageal collar. Another nervous trunk (*i*), but very inferior in size, passes below the œsophagus, and has its extremities attached, at either side, to the under surface of the ganglions near to the point where the pedial are united to the cerebroid and branchial. This is the middle or slender collar, and, as in *Eolis*, it gives off on the right side a nerve, the tenth, which, passing to the generative organs, is I believe united to a ganglion (Pl. III. fig. 6 *l*) which lies on the sheath of the penis. Of this, however, there may be some doubt, as I was unable to verify the observation from the want of specimens. Several nervous twigs radiate from this ganglion, representing pretty accurately the principal parts of the nervous plexus on the same organ in *Doris*, and which has been described, as a portion of the sympathetic system, by Dr. Embleton and myself in the communication before alluded to.

This collar, its nerves, and the ganglion situated on the sheath of the penis have escaped the notice of M. Blanchard, who points out a branch from a small ganglion, which he calls "branchio-cardiaque" in connexion with the right branchial nerve, the "cervico-cardiaque" of this naturalist, as that which supplies the reproductive organs. I have not observed this ganglion and its branch. The eleventh or last pair of nerves, from the supra-œsophageal ganglions, come out of the posterior margin of the branchial, and pass to the dorsal skin, one on each side, and apparently supply the papillæ; these are the branchial nerves.

The two pairs of infra-œsophageal ganglions rest upon the upper surface of the buccal mass below the gullet, and are connected, as before stated, to the supra-œsophageal by a wide, slender commissure. The buccal ganglions (fig. 5 *e*, *e*) are well developed, though very much smaller than the principal cerebral; they are elliptical, and are connected across the median line by a commissure much longer than usual; the commissure from the supra-œsophageal being attached to their outer margin. The twelfth and thirteenth pairs of nerves come from these ganglions; the former issue from their outer margin in connexion with the commissure, and pass into the buccal mass; these are the buccal nerves; the latter come from the posterior margin and dip immediately into the buccal mass behind, and are the same which in *Doris* supply the tongue.

The gastro-œsophageal ganglions (*f*, *f*), though of sufficient magnitude to be readily distinguished, are much inferior in size to the buccal, to which they are united in front by a longish pedicle. The fourteenth, fifteenth and sixteenth pairs of nerves belong to these ganglions; the two former are applied to the upper portion of the gullet, one probably going to supply some minute salivary gland at present undiscovered. The nerves of the

sixteenth pair are larger than those of the other two, and pass down the under surface of the œsophagus, parallel to each other, on their way to the stomach.

The gastro-œsophageal ganglions are undescribed by M. Blanchard, who states that they are not isolated in *Janus* from the buccal ganglions. In my specimens, however, they were as distinct as in any of the Nudibranchs, and further removed from the buccal ganglions than usual. The gastro-œsophageal are named by this naturalist the "ganglions aortiques,"—evidently a false appellation, as all their nerves are distributed to the alimentary organs.

The Reproductive Organs resemble those of *Eolis* and *Doris*, and are of vast volume and complication; they (Pl. II. fig. 1 *n*, *o*, *p*) lie on the right side of the visceral cavity immediately behind the buccal mass. The sheath of the intromittent organ, female channel, and vagina in communication with the spermatheca open into one common vestibule, the lips of which, when the organs are fully retracted, form a nipple-like swelling on the right side, less than half-way down the body. The intromittent organ (Pl. III. fig. 6 *a*) lies in front of the other parts, and in its retracted state appears to be of considerable dimensions, of a clavate form, with the smaller extremity leading to the external opening. The testis (*b*) is a rather short, stout tube forming two or three convolutions, with one end united to the thick or inner termination of the penis, and the other, which tapers a little, to the oviduct.

The ovary is very ample, filling the greater portion of the visceral cavity from the stomach backwards. It is composed of two masses, one (Pl. II. fig. 1 *p*) lying in front and a little to the left of the other (*p'*). They are both made up of large irregular lobules composed almost entirely of eggs. The oviduct (Pl. III. fig. 6 *c*) leaves the ovary as a very delicate, slender tube, and is soon abruptly dilated (fig. 6 *d* & fig. 7 *c*) into at least five or six times its original diameter; and is so continued on, in a tortuous course, to the front of the mucus-gland; then, bending back upon itself, it again becomes excessively contracted, and shortly afterwards receives the duct-like extremity of the testis at a point (fig. 6 *e* & fig. 7 *d*) where the oviduct is once more suddenly bent upon itself. After this it (fig. 6 *f* & fig. 7 *e*) is slightly enlarged just before it unites with a very short duct (fig. 7 *h*) from the spermatheca; then, passing forward, it divides into two portions or branches, one (*j*) of which sinks into the mucus-gland near to the place of its union with the female channel (fig. 6 *i* & fig. 7 *f*) leading to the external outlet close behind the penis. It is by this branch that the mature ova pass on being evacuated. The other branch (fig. 6 *k* & fig. 7 *i*), which

must be considered the vagina, is continued on to the orifice opening externally between and above the male and female outlets. This vagina, or copulatory passage, we thus see, communicates with the oviduct as well as with the spermatheca very much in the same manner as in *Eolis*.

The spermatheca (fig. 6 *j* & fig. 7 *g*), a rather small membranous sac of a globular form, lies half-buried in a fissure which divides the two portions of the mucus-gland, and gives off from its anterior margin the duct above alluded to. The mucus-gland is a large, pyriform mass, a little flattened, lying against the wall of the visceral cavity immediately behind the penis. It is composed of two parts, one (fig. 6 *g*) semi-pellucid and without colour, the other (*h*) of an opake fleshy hue. These parts are formed of a convoluted tube, very large and not much folded in the former, in the latter minute and intricately rolled up. They both open directly into the female channel (*i*). This gland secretes the substance forming the gelatinous mucus-like envelope that covers the eggs.

Thus it is evident that the generative apparatus of *Antiopa* is very complete, exhibiting the same union of male, female and androgynous parts as observed in *Eolis*. Here, as in that genus, the spermatheca will receive the semen of another individual shed during coitus, and will discharge it, when required, into the oviduct; and as the latter is in connexion with the testis, it would appear probable that, in failure of copulation, the ova may be also fertilized by a species of self-impregnation. In *Antiopa Spinolæ* there is only one spermatheca, though perhaps the second dilated portion of the oviduct may act as an accessory receptacle. From this deficiency and from the general arrangement of the androgynous apparatus, the generative organs of this animal more closely resemble those of *Eolis* than of *Doris*; though the form of the mucus-gland approximates nearer to that of the latter.

M. Blanchard has entirely misunderstood these organs; his figure of them is most imperfect, and proves that he has failed to make out the various parts. He has never seen the spermatheca, nor the junction of the testis with the oviduct, and of course knows nothing of the union of the latter with the spermatheca; he calls the mucus-gland, in connexion with the female channel, the testis, and the testis the vas deferens.

After this account of the anatomy of *Antiopa Spinolæ*, there can be little hesitation about its true position in the classification. It must undoubtedly be placed with the Eolididæ, as proved by its digestive apparatus, the hepatic canals being arranged after the type of those of *Eolis*; while the internal network of hepatic tubes, the backward and dorsal position of the anus, the character

of the tongue, the presence of a portal heart, and the form of the mucus-gland, in connexion with the genitalia, show its relationship to the Doridida. It seems likewise to have some affinity with the Tritoniadæ, as evinced by the great size and character of the jaws, by the imperfect development of the cloak, and by the arrangement of the branchial papillæ, which do not extend over the sides of the back as in *Eolis*, but are confined to the ridges representing the mantle.

In this animal, then, we see blended the characters of the three great divisions of the order Nudibranchiata.

EXPLANATION OF PLATES II. AND III.

Plate II.

Fig. 1. General view of the viscera of *Antiopa Spinolæ*, the dorsal skin having been removed: *a*, buccal organ; *b*, œsophagus; *c*, stomach; *d*, intestine; *e*, anus; *f*, *f*, *f*, *f*, branches from the anterior hepatic canals; *g*, *g*, branches from the posterior hepatic canal; *h*, a portion of the posterior hepatic canal; *i*, internal network of tubes connected with the hepatic apparatus; *j*, a gland-like body apparently in connexion with the network of tubes; *k*, ventricle of the heart; *l*, auricle; the oval boundary represents the extent of the pericardium; *m*, portal heart or vesicle opening into the pericardium; *n*, portions of male organs; *o*, portion of mucus-gland attached to the female channel; *p*, *p'*, anterior and posterior ovarian masses; *q*, supra-œsophageal ganglions.

Fig. 2. Side view of buccal organ: *a*, channel of mouth; *b*, œsophagus; *c*, jaw.

Fig. 3. Front view of jaws: *a*, anterior cap or plate; *b*, denticulated cutting edge; *c*, inner or plain cutting edge.

Fig. 4. Side view of jaw: *a*, anterior cap or plate; *b*, denticulated cutting edge.

Fig. 5. View of jaw with the cutting edges seen in front: *a*, anterior plate or cap; *b*, denticulated edge; *c*, plain edge; *d*, point of attachment or fulcrum.

Fig. 6. Tongue removed from the muscular support: *a*, anterior portion exhibiting rows of spines; *b*, posterior tubular portion.

Fig. 7. Tongue spread out, exhibiting the rows of spines apparently interrupted in the centre.

Fig. 8. Central portion of a single row of spines from the tongue: *a*, central spine.

Fig. 9. A single lateral spine more highly magnified.

Plate III.

Fig. 1. Digestive apparatus: *a*, buccal organ; *b*, œsophagus; *c*, stomach; *d*, glandular portion of the same; *e*, intestine; *f*, anus; *g*, *g*, anterior branches of the anterior hepatic canals; *h*, *h*, posterior branches of the same; *i*, *i*, posterior hepatic canal, giving branches to the posterior portion of the body; *j*, branch from the posterior hepatic canal crossing the back in front of the anus; *k'*, ramuscules leading to glands of papillæ; *k*, three glands of the papillæ in connexion with the ramuscules, the rest of the glands having been removed.

Fig. 2. Tongue seen from above: *a*, anterior portion; *b*, posterior portion; *c*, membrane dividing the two portions.

Fig. 3. A gland removed from the papilla, much enlarged: *a*, terminal bifid portion; *b*, lower portion or duct, curtailed.

Fig. 4. A portion of the network of tubes in connexion with the hepatic apparatus: *a*, anus; *b*, intestine; *c*, gland-like body surrounding the termination of the same; *d*, network of tubes.

Fig. 5. Nervous system: *a*, *a*, cerebroid ganglions; *b*, *b*, branchial ditto; *c*, *c*, pedial ditto; *d*, *d*, olfactory ditto; *e*, *e*, buccal ditto; *f*, *f*, gastro-œsophageal ditto; *g*, commissure between the supra- and infra-œsophageal ganglions; *h*, great œsophageal collar; *i*, middle ditto; No. 1, olfactory nerve; 2, 3 and 4, nerves supplying channel of the mouth; 5, optic nerve; 6, auditory ditto; 7, nerve to side of body; 8 and 9, nerves to foot; 10, nerve to generative organs; 11, ditto to skin of the back and branchial papillæ; 12, ditto to buccal mass; 13, ditto to tongue; 14 and 15, nerves to œsophagus; 16, nerve to œsophagus and stomach.

Fig. 6. Generative organs: *a*, sac or sheath of penis; *b*, testis; *c*, oviduct as it leaves the ovary; *d*, dilated portion of the oviduct; *e*, the point where the testis is united to the oviduct; *f*, second dilated portion of oviduct; *g*, semi-pellucid portion of mucus-gland in connexion with the female channel; *h*, opake portion of the same; *i*, female channel leading to external orifice; *j*, spermatheca; *k*, vagina, or copulatory channel leading from external orifice to spermatheca; *l*, visceral ganglion in connexion with nerve No. 10.

Fig. 7. A portion of the generative organs spread out, exhibiting the connexion of the various parts: *a*, penis; *b*, testis; *c*, dilated portion of oviduct; *d*, point where the oviduct is connected with the testis; *e*, second dilated portion of oviduct; *f*, female channel leading to external opening; *g*, spermatheca; *h*, duct of the same; *i*, vagina leading to external orifice; *j*, branch from the vagina leading into mucus-gland.

IV.—*A Catalogue of British Spiders, including remarks on their Structure, Functions, Œconomy and Systematic Arrangement.*

By John Blackwall, F.L.S.

[Continued from vol. vii. p. 452.]

44. *Philodromus Clarkii.*

Philodromus Clarkii, Blackw. Ann. and Mag. of Nat. Hist. Second Series, vol. vi. p. 338.

A male of *Philodromus Clarkii*, having the palpal organs completely developed, was taken at Southgate in June 1849, and is preserved in Mr. Walker's cabinet.

45. *Philodromus variatus.*

Philodromus variatus, Blackw. Lond. and Edinb. Phil. Mag. Third Series, vol. x. p. 102.

In summer, when the sun shines brightly, this species may be seen on rails and gates in the neighbourhood of Llanrwst. Early