XVII.—*On the Parasitic Vegetable Structures found growing in Living Animals.*

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(Read 17th January and 7th February 1842.)

THAT the eggs of numerous parasitic animals may be deposited in the textures of living beings, and that these develop themselves in such textures, and draw thence their nourishment, has been long known. But that, under particular circumstances, certain cryptogamic plants are capable of germinating and fructifying in the living tissues of animals, and especially in man himself, is a discovery of recent date.

As these growths are not only interesting to the naturalist, but, inasmuch as they are connected with disease in animals, ought to arouse the attention of the pathologist, I was induced to make them a subject of observation, and have now the honour of laying the results before the Society.

The following are the objects of the present memoir.

1*st*, To confirm and extend the observations and experiments of M. GRUBY concerning the mycodermatous vegetations found in the crusts of the disease named *Tinea favosa*, or *Porrigo lupinosa* of BATEMAN.

2*d*, To announce the occasional existence, and describe a plant found growing on the lining membrane or cheesy matter of tubercular cavities in the lungs of man.

3*d*, To describe the structure of a plant found growing on the skin of the gold-fish.

And, 4*th*, From a review of all the facts hitherto recorded in connexion with this subject, to draw certain conclusions respecting the pathological state which furnishes the conditions necessary for the growth of fungi in living animals.

I.

Observations on the Mycodermatous Vegetations constituting the crusts of the Tinea favosa, or Porrigo lupinosa of BATEMAN.

In the Comptes Rendus des Séances de l'Academie des Sciences for July and August 1841, there will be found abstracts of observations made by M. GRUBY on the crusts of the disease named *Tinea favosa*, or *Porrigo lupinosa*, according to

BATEMAN. He shews, 1*st*, That this disease consists in the aggregation of millions of mycodermatous plants. They are formed of articulated filaments of a diameter from $\frac{1}{1000}$ to $\frac{1}{250}$ of a millimetre; they spring from an amorphous mass of which the periphery of each capsule of Tinea is composed, and give off towards its centre oblong or round homogeneous corpuscles, which are the reproductive spores. The longitudinal diameter of the sporules is from $\frac{1}{300}$ to $\frac{1}{100}$ of a millimetre, and the transverse is from $\frac{1}{300}$ to $\frac{1}{150}$. The cells of the tubes sometimes contain small round transparent molecules, of a diameter varying from $\frac{1}{10000}$ to $\frac{1}{1000}$ of a millimetre. 2*dly*, The seat of these vegetations is in the cells of the epidermis. The true skin is compressed, not destroyed; and the bulbs and roots of the hairs are only secondarily affected. 3*dly*, The disc of the capsule, which is not at the commencement perforated, opens by a small hole in the centre. This enlarges, and the plants push through it, so that, at a more advanced period, instead of there being a central depression in the capsule, there is a convexity, and its edges disappear. 4*thly*, He inoculated 30 phanerogamous plants, 24 silk-worms, 6 reptiles, 4 birds, and 8 mammifera, but only induced the disease once, and then in a plant. The human arm was inoculated five times, but, independent of a slight inflammation and suppuration, no effect was produced.

On reading the above observations last autumn, I examined the crusts on the head of a boy who laboured under the disease, and immediately detected the cylindrical and ramified appearances described by M. GRUBY. With a view of determining the real nature of this affection, and observing the manner in which the fungi germinated, I was desirous of making a few observations on this case, and Dr HENDERSON, who had charge of it, obligingly consented to suspend for a time all active treatment.

Observation 1*st*. All the crusts were removed from the head by the application of poultices. In a few days the scalp was quite clean, presenting here and there anteriorly patches about the size of half-a-crown deprived of hair. In these bald portions of the scalp the skin looked somewhat injected and glossy on the surface; but there was no pain on pressure, no abrasion in the skin, or other symptom of inflammation or local lesion. The disease was now allowed to take its natural course, and I watched its development daily. In two days, minute pustules were observed to be thinly scattered over the surface, the contents of which, when examined under the microscope, were found to consist of normal pus. In two days more, the number of pustules had considerably increased, and those formerly observed had become larger. I surrounded several of the latter with a ring of ink, in order that there might be no difficulty in following the changes they underwent, and distinguishing them from others. In another day two of them broke, and the matter exuded formed a scab, which, under the microscope, was found to be composed of epidermic scales and irregular amorphous masses, without any trace of vegetable structure. In the interstices of these scabs,

the scalp was covered with a furfuraceous desquamation, consisting only, as shewn by the microscope, of epidermic scales. On the sixth day, the scabs were of a dirty yellow colour, but not of the peculiar tint or form of the porrigo crust. Only a few pustules remained, and the injected appearance of the skin was gone. On the tenth day, the head was covered with irregular agglomerated scabs, similar to those produced from impetigo. The separation of numerous epidermic scales, constituting a furfuraceous desquamation, also continued. On the twelfth day, I detected for the first time, at the posterior part of the scalp where the hair was most abundant, small bright yellow spots, the size of a pin's head, somewhat depressed below the surface. On removing one of these spots with the point of a lancet, and examining it by means of a biconvex lens of an inch focus, I found a smooth, cupped-shaped, bright yellow capsule, the diameter of which was about $\frac{1}{20}$ of an inch. Its margin was continuous with several epidermic scales, which it was necessary to cut or tear through before the capsule could be removed. Having done this, it was readily separated from the parts below, except where the hair which usually perforates these crusts connected it inferiorly with the dermis. On pulling this out, or cutting it through, the capsule could be removed entire, leaving behind it a reddened inflamed concave depression, corresponding to the convexity of its inferior surface. Its removal gave rise to the effusion of a thin greyish looking serum, which soon concreted on the surface. On placing this capsule in a drop of water, pressing it between two slips of glass, and examining it with a magnifying power of 300 diameters, it was found to be composed of an amorphous mass, in which were numerous long-jointed filamentous tubes. These were seen coming from the edge of the capsule, as M. GRUBY has described. (Plate VI. fig. 3.) At this time there was no appearance of beaded filaments, composed of round or oval globules. These did not appear until three days later, at first isolated, and then in groups and chains. (Plate VI. figs. 5 and 6.) The further development of the plants, and of the disease, appeared to be exactly as M. GRUBY has described it.

Observation 2d. In a boy of well marked scrofulous habit, labouring under the Porrigo lupinosa in its most characteristic form, the crusts over the two anterior thirds of the scalp, where it was for the most part bald, were numerous, round, and isolated, but matted together posteriorly where the hair was still abundant. When examined microscopically the mycodermatous vegetations were immediately detected as in the last case. All the crusts were removed by the application of poultices, and the head rendered perfectly smooth and clean. In three days, a furfuraceous desquamation of the cuticle appeared, which became more and more abundant until the eighth day, when the small bright yellow spots of the porrigo made their appearance, not having been preceded by the formation of any pustules. The crusts were removed several times in succession, and the disease again allowed to appear ; but in this case the appearance of the peculiar porrigo crusts was never preceded by that of pustules.

In several other cases which have come under my observation, I have satisfied myself that the formation of pustules is not essential to the disease, although they are often present. Hence the mistake of those pathologists who classified Porrigo lupinosa amongst the Pustulæ. M. GRUBY says that pustules are *never* present, which is equally erroneous, although they appear to be a secondary result, attributable to the irritation the disease produces in some individuals. On the other hand, I have never seen the disease produced without having been preceded by desquamation of the cuticle, an observation which appears to me of some importance, inasmuch as, if true, the disease ought to be classed amongst the *Squamæ*.

According to M. GRUBY, the plants grow in the substance of the epidermis. I have made observations to determine the correctness of this statement, and found that the whole inferior surface of the capsule is formed of epidermic scales, thickly matted together. These are lined by an amorphous, finely granulated matter, from which the plants appear to spring, and which unites the branches and sporules together *en masse*. Superiorly, however, the epidermic scales are not so dense; and I have always found them more or less broken up, and not continuous. The observations just described are here valuable, as indicating the probable mode in which these plants, or the sporules producing them, are deposited on the scalp. It will be seen that the appearance of the peculiar porrigo capsule was invariably preceded by a desquamation of the cuticle, that is, a separation or splitting up of the numerous external epidermic scales which constitute its outermost layer. Hence, it is more probable that the sporules or matters from which the vegetations are developed insinuate themselves between the crevices, and under the portion of epidermis thus partially separated, than that they spring up originally below, or in the thickness of the cuticle.

M. GRUBY accurately describes the mode in which the capsule is formed by the continual growth of the mycodermatous plants, but he says little regarding the manner in which the plants themselves are developed. According to my observations, as soon as the small yellow crust becomes visible, it consists of the outer capsule, formed by epidermic scales, with a layer of amorphous, very finely granulated matter within it, from which spring numerous jointed tubes. Sporules do not appear until later, varying from two to four days; and their presence in any quantity may be detected by the eye, from their presenting a whitish colour, as M. GRUBY pointed out. In order to examine the development of these vegetations microscopically, it is necessary to make a very thin section of the capsule, completely through, embracing the outer layer of epidermis, amorphous mass, and light friable matter found in the centre. It will then be found, on pressing this slightly between glasses, that the cylindrical tubes spring from the sides of the capsule, proceed inwards, give off branches which in turn terminate in round

or oval globules. Fig. 1, plate VI. represents a portion of such a section, and fig. 7 shews how these globules or sporules are given off in various ways. I have seen some oval bodies about twice the size of the others, and some round, both distinctly nucleated. (Fig. 6, *a*.) The long diameter of the former measured $\frac{1}{75}$ of a millimetre. The sporules agglomerated in masses are always more abundant, and highly developed in the centre of the crust. The cylindrical tubes, on the other hand, are more readily found near the external layer. I have occasionally seen swellings on the sides of the jointed tubes, but whether these are sporules, or the commencement of branches, remains still undetermined.

Remembering the ill success of M. GRUBY'S inoculations, I thought it right to try whether the disease could be propagated in another part of the individual already affected; because, if not susceptible of extending in a person already predisposed, it was not likely to be caught by one in perfect health. I accordingly made a small puncture in the neck of the boy first spoken of, about an inch below the occipital protuberance, and an inch and a half from the large masses of crusts connected with the scalp. I introduced through this puncture, under the cuticle, some of the broken down yellowish-white friable matter found in the centre of the capsules, which consists principally of the sporules of the plant. The wound healed up in a few days without presenting any thing abnormal. I also inoculated my own arm in the same manner, but without any result. I repeated these inoculations twice on the boy and on myself with the matter of the pustules, instead of that of the crusts, but in every case without success.

It then occurred to me that, as the disease usually appeared in the hairy scalp, it might be more readily produced in that part of the integuments. I therefore had my own scalp inoculated in two places with the pus taken from one of the pustules. It excited inflammation, suppuration, and ulceration. The matter discharged formed hard scabs, which, however, in no way resembled those of the porrigo, or exhibited vegetations when examined with the microscope. After continuing three weeks, during which period one of the sores extended to the size of a shilling, and both ulcerations still spreading, they were destroyed by the frequent application of caustic. I subsequently had my head inoculated with the sporules of the mycodermata, but the wound healed up completely without producing any appreciable result.

I subsequently rubbed a mass of the white friable matter, constituted of the sporules, upon the arm, so as to separate several of the epidermic scales, and induce erythematous redness. Slight superficial abrasions were produced, which healed in a few days, without presenting any evidence of the mycodermata having germinated. I also sprinkled the sporules over an extensive accidental abrasion on the leg, which, however, healed up in the usual manner.

Thus, in none of these experiments, performed in various ways, on different portions of the surface, and frequently repeated so as to avoid fallacy, could I

succeed in causing the plant to germinate on parts different from those which originally produced it. In other words, I could not communicate the disease to other individuals, or from one part of the same individual to another, although it is generally conceived to be of a highly contagious nature.

I am not aware that this peculiar disease has ever been shewn to exist on any other animal than man, and we shall hereafter see, that whilst parasitic vegetable growths have been described as occurring on insects, fishes, reptiles, and birds, their occurrence in the inferior mammals has, with one exception, escaped notice. It is important, therefore, to mention, that I have observed crusts upon the face of a living common house-mouse, similar in every respect to those which constitute the Porrigo favosa in man. The crusts were of a more irregular form, prominent in the centre, not forming distinct capsules or perforated by a hair. They formed a prominent whitish friable mass on the left side of the face of the animal, about the size of a small bean. Examined microscopically, they presented the cylindrical tubes and sporules *en masse*, in every respect identical to those which grow on the scalp of man.

It has been noticed by every writer on the subject, that the odour of the crusts of Porrigo favosa is similar to that of mice, and this is so peculiar as not readily to be mistaken. It is singular, then, that the mycodermatous plant, constituting this disease, should be found growing on these animals. Whether the disease be peculiar to Man and the Rodentia? whether it be communicable from one to the other, or among the latter class of animals? are questions only to be answered by future researches.

II.

Description of a Cryptogamic Plant found growing in the sputa and lungs of a man who laboured under Pneumothorax.

In numerous microscopic examinations of tubercle, tuberculous sputa, and the lining membrane of tubercular cavities in the lungs of man, I had often observed long filaments, which were evidently the softened shreds of the cellular tissue constituting the natural texture of the lung. On some occasions, however, I observed fragments of tubes, somewhat larger, more or less matted together, which appeared distinctly jointed, and which led me to suppose that a vegetable structure must occasionally be developed in the matter of tubercle found in the lungs. I am now enabled to put the truth of this supposition beyond doubt, whilst circumstances render it highly probable, if not certain, that in the individual to whom I am about to refer, these fungi were developed before death.

In examining the sputa of a man in the Royal Infirmary, the most beautiful and regular vegetable structure was observed. The individual laboured under phthisis in its last stage, with pneumothorax. On simply placing a drop of the inspissated purulent-looking matter, discharged by expectoration, between two

slips of glass, and examining it with a magnifying power of 300 diameters, long tubes, jointed at regular intervals, and giving off several branches, could be seen. They varied in diameter from $\frac{1}{100}$ to $\frac{1}{200}$ of a millimetre, and appeared to spring, without any root, from an amorphous soft mass. Their edges were distinctly defined, and the joints composed of distinct partitions, the tubes being in that part constricted somewhat like certain kinds of bamboo. They were very transparent, and some management with the diaphragm of the instrument was necessary to shew them distinctly. They did not appear to contain granules or nuclei. (Plate VII. fig. 1.)

Interspersed amidst these tubes were numerous round and oval globules, often $\frac{1}{75}$ but generally $\frac{1}{100}$ of a millimetre in diameter, which here and there assumed the form of bead-like rows. (Fig. 5.) On one occasion I found a perfect branch of the jointed tubes connected with a bunch of these, but this was evidently accidental.

Both the jointed filaments and sporules were developed in great abundance on the sides of the spit-box containing the man's sputa, which, in this situation, was inspissated, and presented a yellowish coherent and viscous layer. Here they were often matted together, and presented the appearance drawn, Plate VII. fig. 2.

Two days afterwards the man died, and the left lung was found studded with cavities of different sizes, some of which communicated, by fistulous openings, with the cavity of the pleura. Several of the smaller cavities were partly filled with soft tuberculous matter, readily separable from the lining membrane. On examining this matter microscopically thirty-six hours after death, exactly the same appearances presented themselves as have been described. Numerous jointed transparent tubes, here matted together, there isolated, were readily observed, mingled with round or oval corpuscles, which, however, were larger and more developed. Some of these were of an oblong or truncated shape, and appeared to be separated joints of the tubes. (Fig. 6.)

I have no doubt that these vegetations existed in the man's lungs during life; *first*, Because they were apparent in sputa freshly expectorated, and, *secondly*, Because they could not have reached such a state of development, as has been described, in thirty-six hours. They continued to grow and develop themselves in the tubercular matter, after the removal of the lungs from the body, as well as in the matter discharged before death, by expectoration. They appeared to me somewhat analogous to the Penicilium glaucum of Link, or those fungi so often found covering disorganized animal matter; although the form of the plant, and the mode in which the branches are given off, shew that they are not identical.

III.

On the Structure of a Cryptogamous Plant found growing on the Skin of the Gold-Fish,
(Cyprinus auratus.)

For such notices as have already been published connected with the growth of vegetations on living fishes, I must refer to a subsequent part of this memoir. As in no case, however, are details entered into, I am ignorant whether the vegetations or confervæ alluded to are the same as those which I have myself personally examined.

Mr GOODSIR was the first who examined microscopically the vegetations found growing on the gold-fish. The fish he examined was observed to be in a languishing state for some time before death, and to be covered with a white efflorescence, of considerable length, which sprung principally from the dorsal fins and tail, and floated in the water. The animal was dead before being put into his possession. Some days afterwards, he kindly placed at my disposal some of these filaments, which I examined microscopically, and the following are the results.

Viewed with a power of 300 diameters, two very distinct structures were observed. One of these might be called Cellular, the other Non-cellular.

The cellular structure was composed of elongated cells, which varied in thickness $\frac{1}{100}$ to $\frac{1}{50}$ of a millimetre, presenting the appearance of long jointed tubes, which often extended twice across the field of the microscope. They were frequently branched, generally in a dichotomous manner, although sometimes three branches were given off from one joint. Some of the cells were empty, and appeared very transparent; others were full of granules, which varied in size from $\frac{1}{600}$ to $\frac{1}{150}$ of a millimetre in diameter. Every possible degree of variation existed in the quantity of the cellular contents, some being full of granules and opaque, others being partially so, and others again empty and very transparent. In most of the cells, a distinct nucleus existed, which appeared as a transparent vesicle about $\frac{1}{100}$ of a millimetre in diameter. Some contained two nuclei. (Plate VII. fig. 10.) The nuclei were generally (not always) placed at the proximal end of the cell, from which came off sometimes two other cells, more rarely three, giving a branched appearance to these vegetations. (Fig. 12.) On applying pressure, and by means of a little manipulation, the granular matter within any particular cell could readily be made to flow from one end to the other, or forced out by rupturing its walls. These jointed cellular tubes were often grouped together, forming a mesh-work, in which the cells filled with granules; and those which were empty could readily be distinguished from each other by their opaque and transparent appearance. (Plate VII. fig. 8.)

As regards the substance from which this jointed structure arose, it appeared to be an amorphous mass, composed of very minute granules almost identical with the matter found in the capsules of the Porrigo, and tubercular cavities formerly described. It appeared very abundant below the scales from whence the tubes

appeared to spring, and push through the crevices between them. No roots could be observed, and the cells appeared to come out directly from the above granular mass. I could not satisfy myself in what manner these filaments terminated, whether they bore sporules, or ended in bulbous extremities similar to those described by HANNOVER in the confervæ growing on the salamander. The specimen I examined was already so putrid, and the tubes broke so readily, that this point could not be determined.

Intermixed with these vegetations, were numerous long finer filaments, from $\frac{1}{600}$ to $\frac{1}{500}$ of a millimetre in diameter, and uniform in their size throughout. They were very long, sometimes curved, and sometimes matted together so as to form a mesh more or less dense. (Figs. 11 and 12.) Some of these filaments appeared broken or interrupted, although, on pressing the glasses, the interrupted portion moved simultaneously with the other. On increasing the magnifying power to 650 diameters, these portions were found connected by a very delicate sheath, which invested them externally. (Plate VII. fig. 13.)

It was some time before I could make out the origin of these filaments. I at length satisfied myself that they sprang from the sides of the cellular tubes.

IV.

Facts observed by various Authors connected with the growth of Parasitic Vegetables in Living Animals.

Before we can draw any conclusions regarding the origin or mode of growth of fungi in living animals, it will be necessary to inquire into what is at present known on this subject, and see how far the facts already detailed are analogous with the observations of others.

Parasitic vegetables have been found growing in numerous animals, and I shall arrange the facts respecting them according to the class of animals in which they have been found.

Mollusca.—LAURENT[1] has observed cryptogamous vegetations in the eggs of the *Limax agrestis*, which more or less impede the development of the embryo. He has noticed, 1. That the vegetations arise most often from the walls of the internal tunic of the egg, ramify in the albumen, and form in it a net-work, which is sometimes checked and compressed by a vigorous embryo, and sometimes they entwine the embryo in such a way that there is a struggle between the vegetable and animal development. 2. That the vegetable filaments may also be seen to arise from the body of a dead embryo, or of a non-developed vitellus. After having filled the albumen with their ramifications, the vegetations throw out new filaments, which pierce the internal tunic and shell, and prolong themselves from

[1] L'Institut, tom. vii. p. 229.

the egg placed in water, under the form of simple or ramified branches, which are extended to the surface and a little beyond the water. They terminate *en masse*.

VALENTIN[1] also saw confervæ in a state of active growth, for several days, upon the ova of (probably) *Limnius stagnalis*, during which period the embryo was in lively motion, and which did not die till later.[2]

Insects.—LEDERMÜLLER[3] noticed the fact, that on leaving dead flies in water for a certain time, plants spring from the surface of their bodies. Similar observations have been made by WRISBERG,[4] SPALLANZANI,[5] OTTO FRIEDERICH MÜLLER,[6] LYNGBYE,[7] GILL,[8] GÖTHE,[9] NEES VON ESENBECK,[10] and MEYEN.[11]

Parasitic vegetables have also been observed on living insects. On this subject KIRBY and SPENCE[12] justly remark, "that as insects often pass no small portion of their lives in a state of torpidity, in which they remain chiefly without motion, it will not seem strange, should any partial moisture accidentally accumulate upon them, that it affords a seed-plot for certain minute fungi to come up and grow in." Hence, probably, may be explained the phenomenon of the *worm plant*, described by PE'RE PARRENIN and REAUMUR,[13] and of the *vegetable fly* found in Dominica, described by NEWMAN.[14] To this circumstance, also, it seems most rational to attribute the growth on insects of certain species of *Clavaria*, as mentioned by HILL,[15] FOUGEREAUX DE BONDAROY,[16] BÜCHNER,[17] and WESTWOOD;[18] of certain species of *Isaria*, noticed by PERSOON[19] and SCHWEINITZ;[20] of the *Penicillium Fieberi*, figured to exist on the *Pentatoma prasina*, by CORDA,[21] and of the *Sphæria entomorhiza*, noticed by DICKSON, MADIANNA, and HALSEY,[22] and seen by them growing on the *vegetable wasp* of Guadaloupe.

[1] Repertorium, vol. v. p. 44.

[2] See also GRUITHUISEN, Nova Acta, vol. x. p. 445; who gives a description of, and figures confervæ growing from, a dead *Valvata branchiata*.

[3] Mikroskopische Ergötzungen, 1760; pp. 1–90, tab. xlix. fig. 2.

[4] Obs. de Animalculis Infusoriis Satura. Goettingæ, 1765; p. 31, fig. 9–2.

[5] Opuscules de Physique Animale et Vegetale, tom. i. p. 157.

[6] Neue Samml. d. Schriften der Königl. Danischen. Ges. d. Wiss. Copenhagen, 1788; iii. p. 13. And Nova Acta, vol. iv. p. 215.

[7] Hydrophylotogia Danica, p. 79, tab. xxii. See also Flora Danica, tab. 896.

[8] Technological Repository, vol. iv. p. 331. [9] Heften zur Morphologie, i. p. 292.

[10] Nova Acta Physico-Medica, &c. 1831, vol. xv. Pars post. p. 375, tab. 79 and 80.

[11] Idem, p. 381, and WIEGMANN's Archives, 1840, p. 62. [12] Entomology, vol. iv. p. 207.

[13] Mem. de l'Acad. Roy. des Sciences, 1726, p. 426.

[14] Philosophical Transactions, 1764, p. 271. [15] Idem, p. 272.

[16] Mem. de l'Acad. Roy. 1769, p. 591.

[17] Nova Acta, vol. iii. p. 437, tab. 7.

[18] Annals of Nat. History, Nov. 1841, vol. viii. p. 217.

[19] Synops. Meth. Fung. 687. g. 63, s. 12.

[20] Annals of the Lyceum Nat. Hist. of New York, vol. i. pp. 125-6.

[21] Icones Fungorum hucusque cognitorum, Pragæ, 1837, 1840.

[22] Annals of Lyceum, Nat. Hist. Soc. New York, vol. i. p. 126.

On some occasions, it would appear, that the so called fungi observed on insects are, in point of fact, constituted of the stolen parts of flowers or plants. Thus BROWN[1] has determined apparent fungi on certain bees, to be composed of the stamina of orchidiæ, and detected the stamen of aristolochia in a beetle shewn to him by Mr M'LAY. SCHLECHTENDAHL and SIEBOLD[2] have recognised an apparent fungus formation on *Eucera Druriella*, *Zygœna loniceræ*, *Leptura rufipes* and *pubescens*, to be the attached pollen of orchidiæ. BUSK[3] also observed confervæ on the body of a *Dytiscus marginalis*, which had been apparently derived from similar growths infesting some plants of *Valisneria spiralis*, contained in the glass vessel in which it was kept.

The disease in silk-worms, named *Muscardine*, which causes so great a mortality amongst these animals, is characterized by the appearance after death of a white eruption on the body of the animal, which eruption M. BASSI of Lodi[4] shewed to consist of numerous cryptogamic plants. These have received the name of *Botrytis Bassiana*. This fact has been confirmed by ARDOUIN,[5] JOHANNYS,[6] CREVELLI,[7] BONNAFOUS,[8] and TURPIN,[9] whose farther researches, experiments, and observations, have established its contagious nature, not only amongst silk-worms, but amongst insects generally.

Fishes.—In VALENTIN'S Repertorium, it is stated, that EHRENBERG has found *Chœtophora* (*Tremella*) *meteorica* growing on the scales of the *Salmo eperlanus*.[10] Beyond this notice, however, I know nothing of the observations alluded to. VALENTIN remarks, that mouldiness, or colourless confervæ, occurring on the ova of fishes, constitutes a very powerful preventive to their development, and its progress is so rapid, that a single egg infected with it will in a very short time infest many hundreds, and thus destroy them. In the *Cyprinus nasus* also, when kept in narrow vessels, and the water not quite sweet, he observed the same fungus on all parts which might be abraded, as, for instance, the head and tail.

Mr J. T. COOPER has informed the Editor of the Microscopic Journal that he has frequently removed from the gills of gold-fish, kept in a cistern in his garden, a quantity of confervæ, the rapid growth of which over the whole surface of their bodies in every instance caused death.[11]

Reptiles.—VALENTIN[12] has seen colourless confervæ growing on the ova of

[1] KIRBY and SPENCE, Entomology, vol. iv. p. 208. [2] Frorieps Notizen, No. 224–73.
[3] Microscopic Journal, vol. i. p. 149.
[4] Del Mal. del Segno calcinaccio o Muscardino, sec. ed. Milano, 1837.
[5] Annales des Sciences Nat. vol. viii. p. 229, 1837. [6] Idem, vol. ii. p. 81, 1839.
[7] Linnæa, herausgegeben von Schlechtendahl, Halle, 8. 118-23.
[8] L'Institut, tom. vii. p. 154. [9] Idem, tom. vii. pp. 199-200.
[10] Vol. 5. p. 44. See also Frorieps Notizen, No. 218, 314.
[11] Microscopic Journ. vol. i. p. 149. [12] Repert. vol. v. p. 44.

Alytes obstetricans, similar to those which grow on the eggs of fishes. HANNOVER of Copenhagen[1] observed confervæ growing on the living salamander (*Triton punctatus*) when the tail was partly cut off, or the spinal cord divided so as not to occasion death. They sprung from the surface of the wound, and spread more or less over the integuments. Examined with the microscope, they were found to consist of membranous, simple, very seldom or never branched tubes, with corpuscular contents. The tubes varied in thickness, were conical at their extremities, but sometimes swoln and bulbous. There was often present a cellular formation, either springing from the walls of the tube, or from regular notches in the sides. Sometimes the tube was full, at others almost empty, the latter generally when the confervæ were ripe, and then they hung on the outer side of the tube.

STILLING[2] of Cassel saw similar confervæ on the toes of frogs, when the greater part of the inferior half of the spinal cord had been removed. From the first appearance of the efflorescence the animals, previously lively, became evidently weak, and made very slow movements. STILLING considers this structure to be of an animal nature. The granules contained in the cells possess movements, and he conceives them to be ova, from which small infusoria issue. He thinks the tubes are albuminous or fibrinous, and serve as a nidus in which the ova become developed. He states further, that the cellular structures which have been perceived in these tubes are Vorticellæ, and that he has seen them burst and discharge their contents.

I have often seen similar animalculæ to those described by STILLING in fluids which have become putrid by long contact with animal matter. They are often present without any trace of vegetation, so that the latter are by no means necessary for their existence. I think that he is in error in supposing that the granules are ova; that the dichotomous branches are composed of albumen or fibrin; or that the cellular structures are vorticellæ. The granules, tubes, and joints are, in my opinion, in every way analogous to those found in vegetable structures. That animalculæ may occur within them, as well as in the surrounding fluid, there can be no doubt, but their appearance is a subsequent phenomenon.

This opinion of mine is confirmed by more recent observations of HANNOVER.[3] According to him, the movements described by STILLING in the contents of the cell, are of a molecular nature. He denies that they are the eggs of infusoria, and points out that the larger worms described by STILLING, are ascarides from the intestines of the animal. In this memoir, also, he minutely details the mode in which the plants are developed.

[1] MÜLLER'S Archives, 1839, p. 338.

[2] Idem. 1841, p. 279; and Lond. and Edinb. Month. Journ. of Med. Science, October 1841.

[3] MÜLLER'S Archives, January 1842.

I think it more probable, as previously expressed, that the animalculæ alluded to by STILLING are infusoria rather than ascarides from the intestines.[1]

Birds.—OWEN,[2] on dissecting a flamingo, observed a green vegetable mould or mucor, growing on the lining membrane of tubercular cavities in the lungs, and on that of the smaller ramifications of the bronchial tubes. Thus, he remarks, *Entophyta* exist in animals as well as *Entozoa*.

EUDES DESLONGCHAMPS[3] noticed a similar appearance growing in an albuminous layer, which was effused on the membranous lining of the air-passages in an eider-duck. Examined with the microscope, it was found to consist of transparent inarticulate filaments, slightly or not at all ramified, forming an inextricable felt. There everywhere existed throughout this felted mass, a great number of small globular or ovoid vesicles, which were undoubtedly the sporules. Some of the filaments which were isolated were observed to support sporules with a capitulum, whilst others terminated in a flat margined disk, which appeared to be the mode in which those filaments terminated which had lost their sporules.

A vegetable mould has also been observed by ROUSSEAU and SERRURIER,[4] growing on a species of false membrane, effused between the intestines and vertebral column of a male parroquet. Its adhesion was so feeble, that on blowing upon it, it disappeared like the finest and lightest powder. They remark that pigeons (more particularly the hens) are very liable to be affected, if these animals inhabit cold and moist places, and in epochs of the rainy season.

Mammalia.—SERRURIER and ROUSSEAU merely mention having seen a vegetable mould in a hind *(Cervus Axis)*, but its nature, or on what part of the animal it grew, is not stated. With this exception, and that of the mouse alluded to, p. 282 of this memoir, parasitic vegetations amongst the mammalia have hitherto only been found growing in man.

SCHÖNLEIN of Berlin[5] was the first to recognise and figure a vegetable structure in the crusts formed on the scalp, in the disease named Porrigo lupinosa, by BATEMAN. REMAK,[6] however, has claimed the priority of this discovery.

[1] CARUS has figured and given a description of confervæ growing on a dead salamander. (Nova Acta, vol. ii. p. 493.) I may here observe, that similar confervæ may be produced at will, by allowing frogs or gold fish to remain, after death, some time in water without changing it. In a few days they become covered with a white efflorescence, which, examined microscopically, is found to consist of long transparent tubes, jointed at regular intervals. I have frequently examined confervæ thus produced: they are different from those which grow on these animals during life.

[2] Philosophical Magazine, 1833. Vol. ii. p. 71.

[3] Annales des Sci. Nat., Juin 1841, and Jameson's Journal, 6th October 1841.

[4] Comptes Rendus, tom. xiii. p. 18.

[5] Müller's Archives, 1839, p. 82.

[6] Valentin's Repertorium, 1841, vol. vi. p. 58. Med. Zeit., No. xvi. p. 73, 74.

This observation was repeated and confirmed by FUCHS and LANGENBECK[1] of Göttingen, who, it is stated, not only found vegetations in the crusts of the Porrigo lupinosa, but in the majority of skin diseases belonging to scrofulous affections. They have been seen also by TEXTOR.[2]

It is to GRUBY of Vienna,[3] however, that we are indebted for the most perfect description of these vegetations, and for new researches on this subject, the results of which have been condensed in the first section of this memoir.

LANGENBECK[4] observed a high degree of fungus development in the body of a man who died labouring under typhus. It extended from the amygdalæ, and upper part of the pharynx, through the œsophagus down to the cardia, and consisted of cellular non-granular filaments, with superposed nucleated (*gekernten*) sporules. On the intestinal ulcers of the ilium and cœcum, there also appeared to exist isolated filaments and sporules, which last were also present in the intestinal contents. It is not stated that these vegetations occurred during the life of the individual.

MEYNIER of Orleans[5] has put forth the opinion, that warts in man are true *gymnosporanges*, and that other human diseases are equally due to the development of different species of cryptogamous plants. This is the case in many of the dermatose affections, especially those of a scaly form. Certain tubercles appear to him similar to the *lycopodaciæ*, and in other cases it is the *uredines* which produce disease. The facts on which such opinions are founded, however, are unknown to us.

ESCHRICHT of Copenhagen[6] has stated that vegetations sometimes exist in the disease called aphtha. GRUBY[7] has also announced the discovery of another cryptogamous plant, distinct from that found in the porrigo, in a skin disease. No details of these observations, however, are given.

V.

Conclusions deduced from the facts which have been detailed.

Are we to consider, that these fungi draw their nourishment from the living animal tissue, and originate disease, or that they are deposited and grow in the inorganic products occasionally found in the textures, and are the results rather than the cause of morbid actions? In attempting to answer this difficult question, it is not my intention to discuss the disputed subject of equivocal generation.

[1] Comptes Rendus de la Polyclinique de Göttingen. Ann. Hannov. de M. Holscher. 1 cap. 1840. Fuchs, Traité des Maladies de la Peau, Göttingen 1840.

[2] Comptes Rendus, tom. xiii. p. 220. [3] Idem.

[4] Frorieps Notizen, No. 252, p. 145, 47, and Valentin's Repèrtorium, vol. v. p. 46.

[5] Comptes Rendus, vol. xiii. p. 311. [6] Jameson's Journal, October 1841.

[7] Comptes Rendus, vol. xiii. p. 388.

My purpose will be sufficiently answered by alluding to the well-known fact, that cryptogamic plants spring up on such portions of decayed animal or vegetable matter as present certain conditions necessary for their germination. I shall endeavour to shew that the fungi found growing in living animals never spring from the healthy textures, but from certain morbid products which appear to furnish the conditions essential for their sustenance. It is also probable that these morbid products are invariably of an albuminous nature, and that the constitutional disorder predisposing to their production, at least in the higher animals, is scrofula.

In man all the vegetations yet discovered have been found connected with the matter effused into the textures in scrofulous constitutions. The fungi found by myself, for instance, growing in the tuberculous cavities of the lungs, and those discovered by SCHÖNLEIN, and described by GRUBY, constituting scrofulous eruptions on the skin, grew on a finely granular amorphous mass, which presented no evidence of organization. Chemical researches have shewn that this form of tubercular matter is principally composed of albumen, which explains the large proportion of this animal principle present in the crust of the Porrigo or Tinea favosa, according to the analysis given by ALIBERT. The fungi found by M. EUDES DESLONGCHAMPS growing on the membranous lining of the air-passages in an eider-duck, sprung from an "albuminous layer"—"forming the soil on which they grew." The mould or mucor discovered by OWEN growing in the lungs of the flamingo, occupied the same situation as those observed by myself in the lungs of man, viz. the lining membrane of tubercular cavities. The fungi found by MM. ROUSSEAU and SERRURIER in the parroquet, grew on a species of false membrane. What the nature of this membrane was, is not stated, but it is distinctly mentioned that the animal died of laryngeal and pulmonary phthisis. In pigeons, also, the same authors describe it as commonly induced by exposure to cold and moisture, circumstances well known to be the most common cause of scrofula and of tubercular depositions. According to the observations of VALENTIN, the parasitic confervæ found growing on fish are connected with a diseased state of the animal, and are induced by keeping them in narrow vessels and foul water. The gold-fish was evidently unhealthy which furnished the vegetations which I have myself described, and I have shewn that these were connected with a granular, inorganic, albuminous matter, identical with that found in the lungs of phthisical individuals, and in the crusts of Porrigo favosa. The salamanders and frogs in which confervæ grew, as described by HANNOVER and STILLING, were decidedly unhealthy, and induced by circumstances which must necessarily impair the vigour of animal life, and induce a state of cachexia. Vegetations attach themselves to, or grow on, insects generally when in a chrysalis state, that is, when the powers of life are sluggish or dormant. When seen in these animals during the most perfect period of their existence, they evidently laboured under disease and soon perished. This was distinctly observed in the vegetable wasp of Guadaloupe by

MADIANNA, and in the Dytiscus marginalis by BUSK. Lastly, the discovery of M. BASSI has demonstrated that vegetations occur in silk-worms affected with the muscardine, a disease which causes a great mortality among these animals; and the researches of M. ARDOUIN have shewn that these vegetations are formed at the expense of the adipose tissue. Whether tubercular matter was present in the worms is not stated; but we know that the disappearance of fat is one of the constant symptoms attendant upon imperfect nutrition.

It appears probable, therefore, 1*st*, that these vegetations always arise in living animals *previously* diseased; 2*d*, that their presence indicates great depression of the vital powers, and impairment of the nutritive functions of the economy; 3*d*, that the peculiar constitution or cachexia favourable to their growth is the tubercular or scrofulous in the mammalia, birds, and fishes, and most probably in reptiles and insects; and, 4*th*, that the therapeutic indications are, 1. to invigorate the system, and, 2. to apply locally, if possible, such applications as tend to destroy vegetable life.

NOTE.

***On** a cryptogamic Plant found growing in the sordes collected on the Teeth and Gums of individuals labouring under Typhus Fever.*

Since the foregoing Memoir was read to the Society, I have found more than once a vegetable structure in the black deposit which collects on the Teeth and Gums of individuals in the last stage of Typhus Fever. They are similar to those which I have described as springing from tubercular matter, but not so large, the diameter of the tubes being from $\frac{1}{300}$ to $\frac{1}{150}$ of a millimetre. Their mode of development appears also to be similar; the partitions towards their extremities becoming more numerous, and these being terminated by a chain of oval sporules. Distinct mollecules from $\frac{1}{600}$ to $\frac{1}{300}$ of a millimetre in diameter could be distinguished in the cells, and in some of the elongated sporules.

Fig. 8.

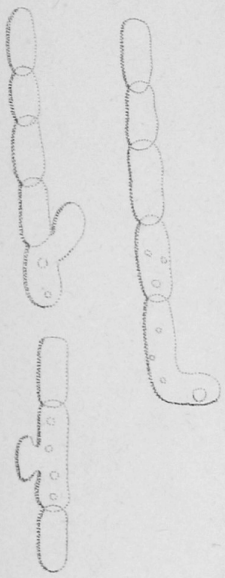


Fig. 1.

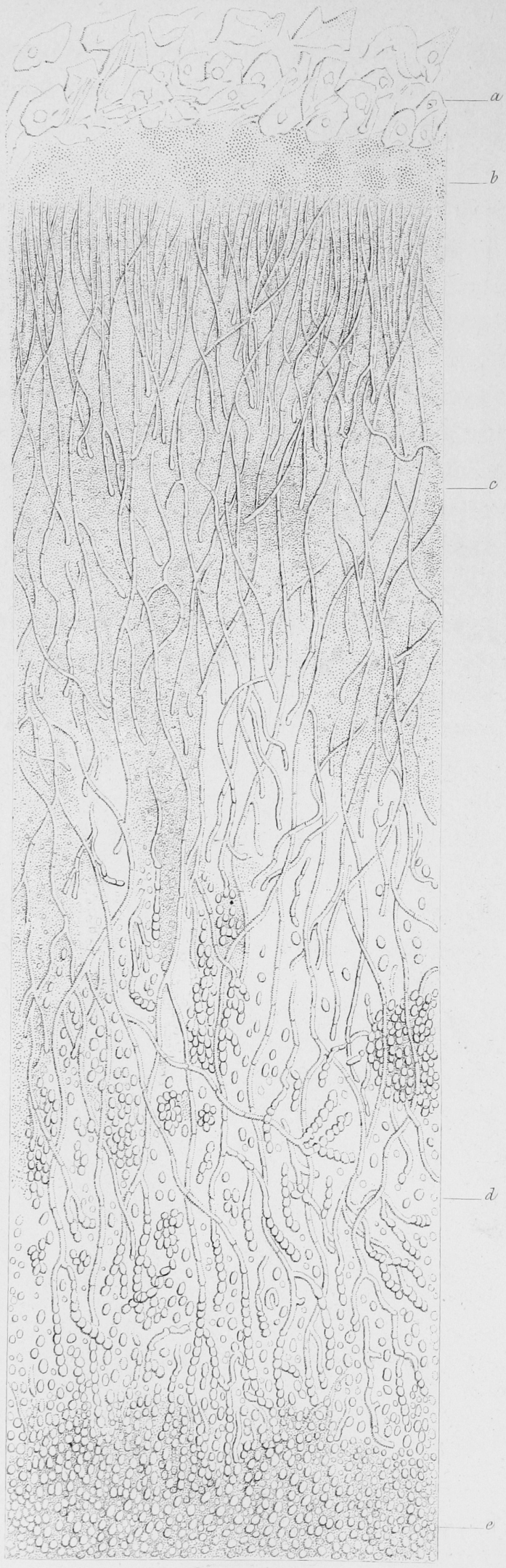


Fig. 2.

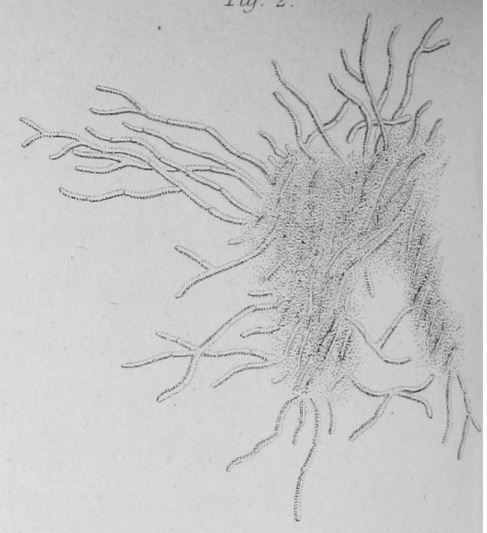


Fig. 3.

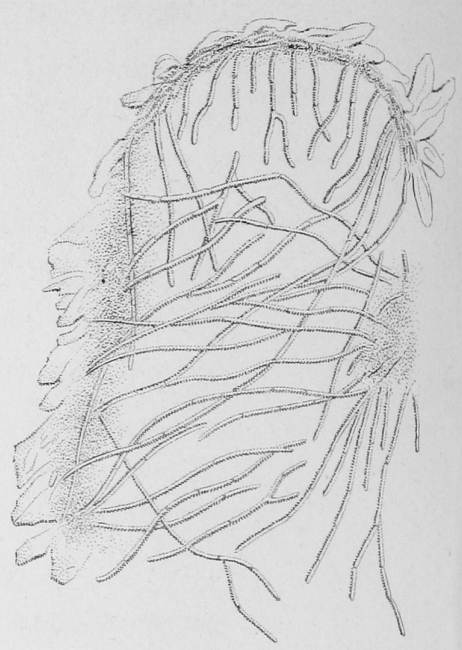


Fig. 4.

Fig. 5.

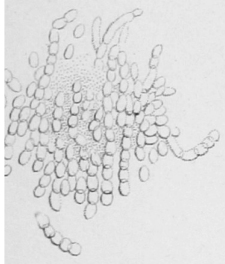
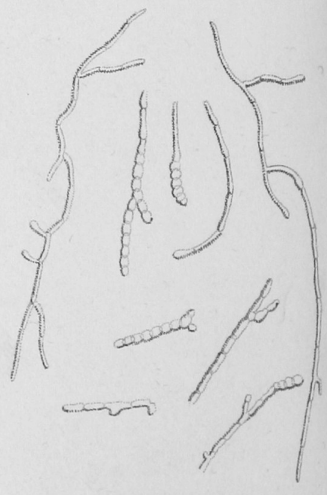


Fig. 6.

Fig. 7.



EXPLANATION OF THE PLATES.

PLATE VI.

This Plate illustrates the mode of development of the mycodermatous vegetations growing in the capsules of the *Tinea favosa* or *Porrigo lupinosa* of Bateman.

Fig. 1. Appearance of the mycodermata in the Porrigo lupinosa, on making a thin section perpendicularly through the capsule. *a* Epidermic scales at the periphery of the capsule; *b* amorphous granular matter, rendered apparently of considerable width from being pressed between glasses; *c* the cylindrical jointed tubes matted together by the amorphous mass; *d* the cylindrical tubes and sporules separated by means of pressure. The former are seen branching and giving off sporules at their extremities. There are also seen numerous loose branches and sporules, isolated or grouped together. *e* Sporules *en masse* towards the centre of the capsule.

Fig. 2. Cylindrical tubes coming from the granular mass, found near the edge of the capsule.

Fig. 3. Similar tubes found at an early period of the development of the capsule. They are seen springing from the edge to which epidermic scales are attached.

Fig. 4. Mass of epidermic scales from the inferior surface of the capsule.

Figs. 5. and 6. A small portion of the whitish friable matter, consisting almost wholly of sporules, found in the centre of the capsule. *a* Larger, round, and oval sporules, having a distinct nucleus.

Fig. 7. Isolated branches, occasionally found floating loose in the field of the microscope, shewing the mode in which sporules and branches are given off from the cylindrical tubes.

Fig. 8. Similar branches, magnified 800 diameters, shewing the molecules occasionally found within the cells.

All the above figures, with the exception of fig. 8., *exhibit the structures as they appear when magnified* 300 *diameters.*

PLATE VII.

This plate gives the appearance of the vegetable structures found growing in the human lung, and on the skin of the gold-fish.

Fig. 1. A beautiful specimen of the plant found in the sputa before death, springing from the amorphous albuminous mass.

Fig. 2. Jointed tubes matted together, mixed with sporules, found in the soft cheesy matter in a tubercular cavity.

Figs. 3. and 4. Other specimens of the plant taken from the lung. In fig. 4. some sporules are seen accidentally attached.

Fig. 5. A mass of sporules, some arranged in bead-like rows.

Fig. 6. Sporules isolated of different forms.

Fig. 7. Branch of the plant giving off sporules.

Fig. 8. Portion of the plant found growing on the skin of the gold-fish. *a* Transparent vesicular nucleus ; *b* cells full of granules ; *c* cells more or less empty ; *d* the non-cellular filaments.

Fig. 9. Portions of cellular tubes more or less matted together ; some full of granules, others empty and collapsed.

Figs. 10. and 11. Other portions of the cellular tubes isolated. In fig. 11. two nuclei are seen in one cell.

Fig. 12. A mesh of the non-cellular filaments. *a* Amorphous, firmly granular, matter ; *b* a filament apparently interrupted.

Fig. 13. Non-cellular filaments, magnified 650 diameters, shewing the delicate sheath which invests them.

All the above figures, with the exception of fig. 13., *exhibit the structures as they appear when magnified* 250 *diameters.*

Fig. 8.

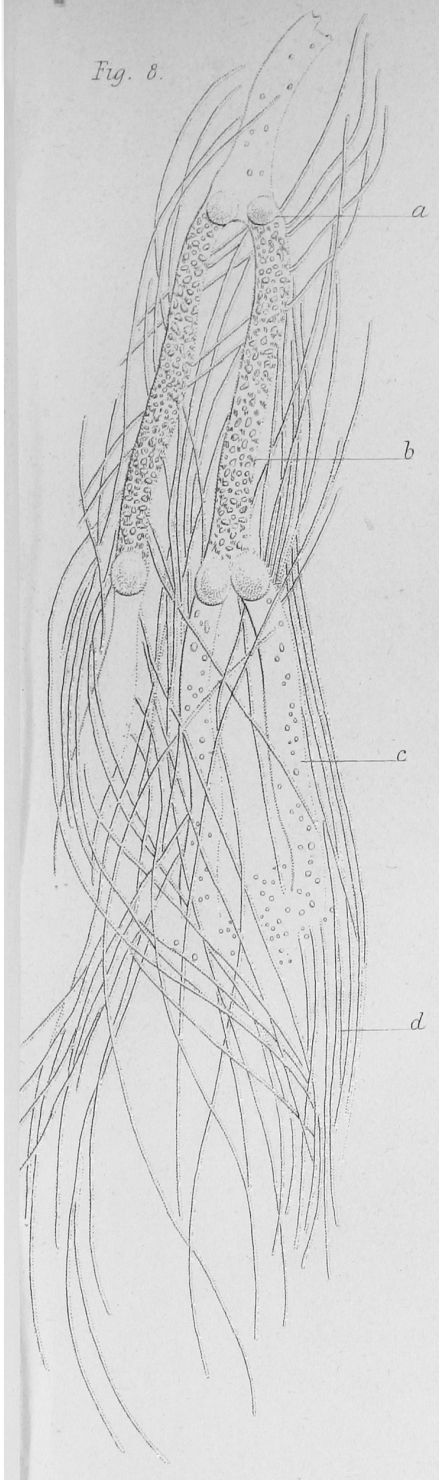


Fig. 1.

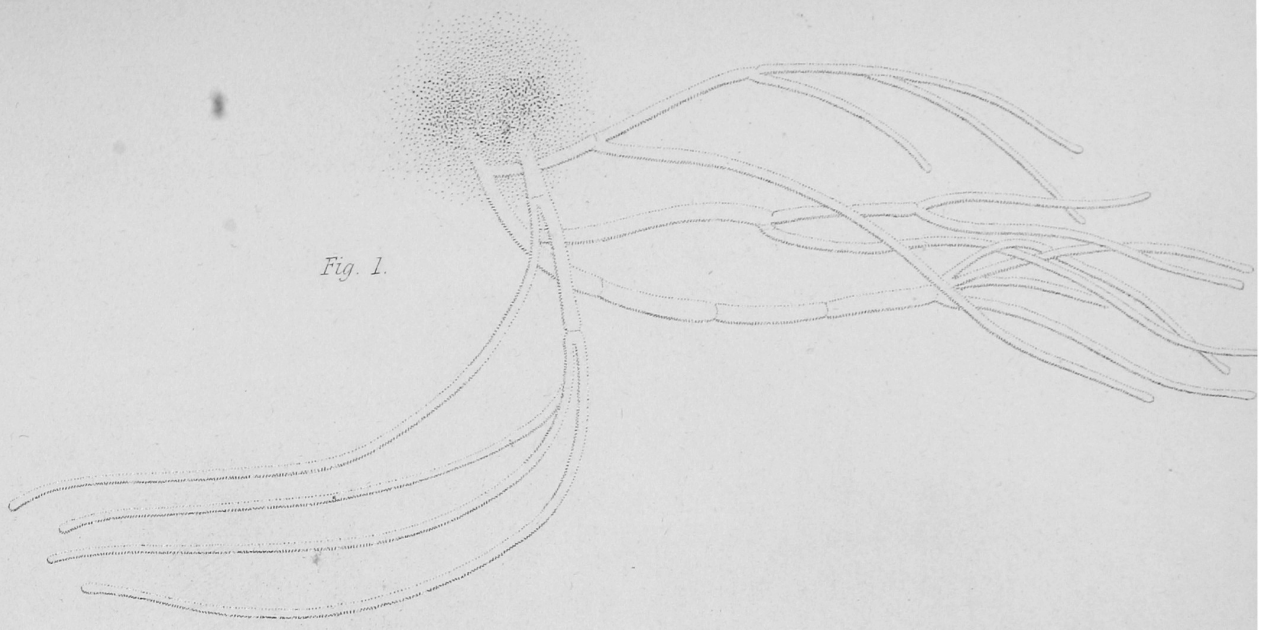


Fig. 7.

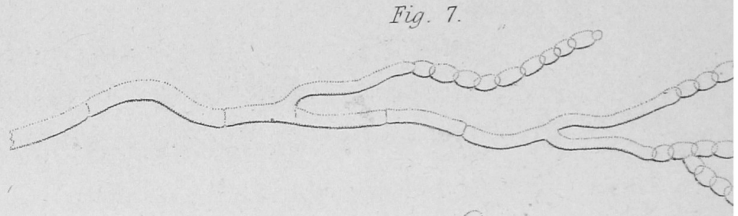


Fig. 9

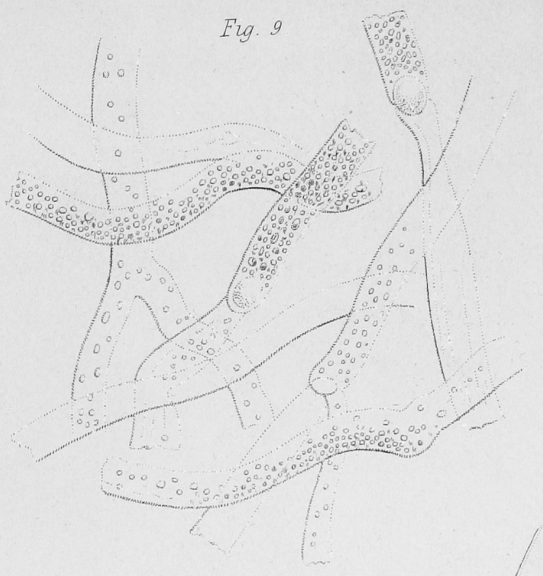


Fig. 6.

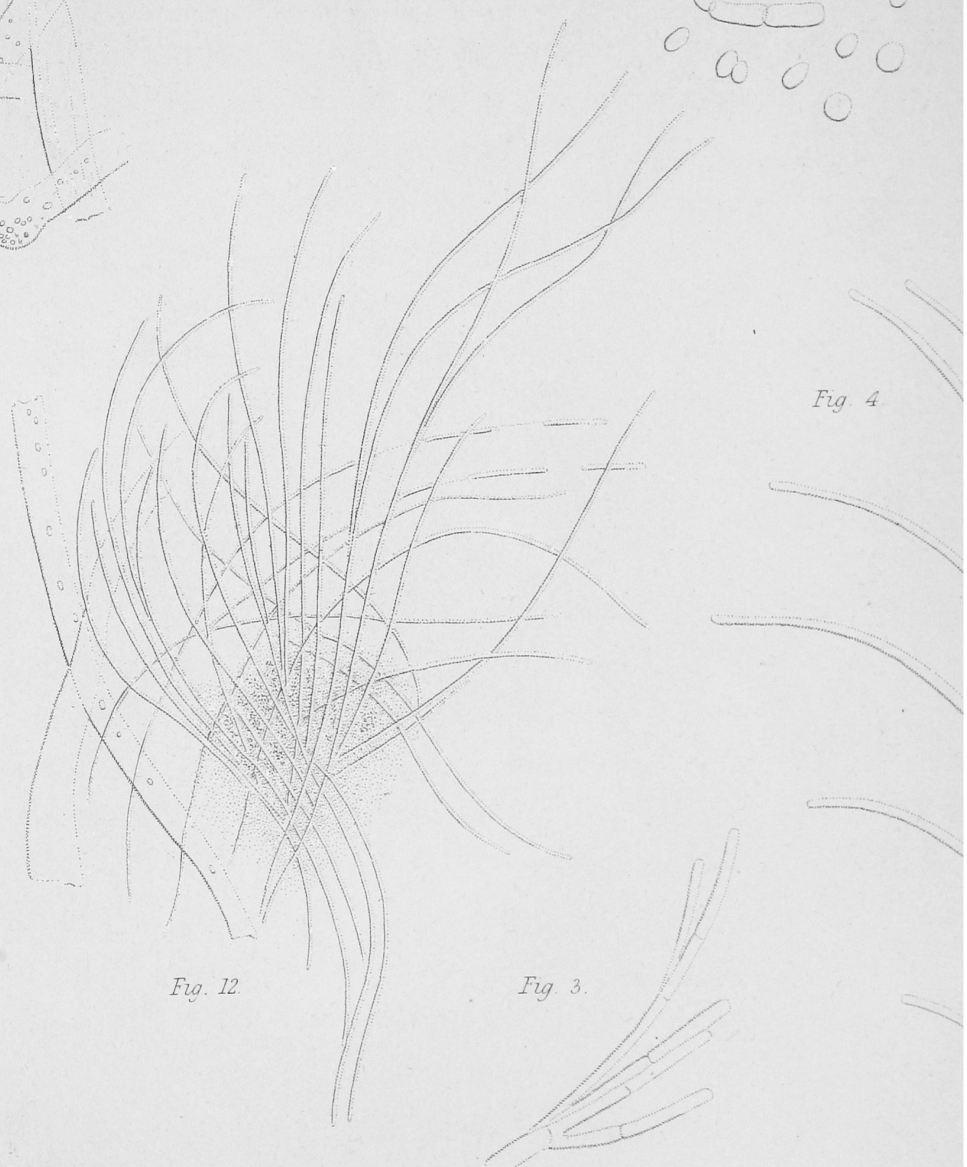


Fig. 4

Fig. 10.

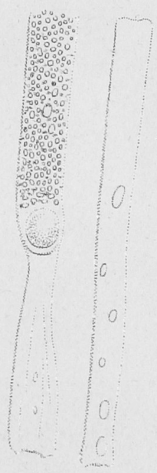


Fig. 11.

Fig. 5.

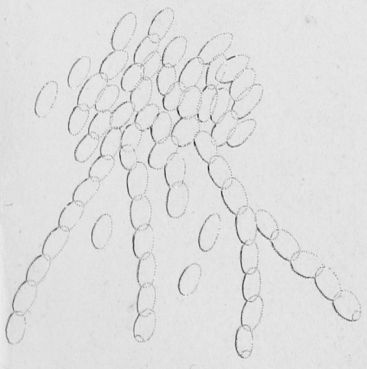


Fig. 12.

Fig. 3.

Fig. 2.

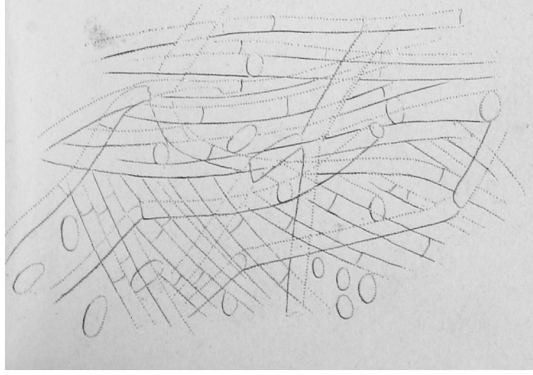


Fig. 13.