1851

Entophytes found on Man.

by

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March 1851.

To

John Hutton Balfour, M.D., F.L.S., F.R.S.E., &c. &c.,

in admiration of his eminent position as

a Botanist, and

in remembrance of his uniform kindness to the

Author, this Thesis is

dedicated.

Index.

Introduction.

The lower orders of vegetation are small and in-
-significant things when viewed relatively, but every-
day experience teaches us that we must not
measure the works of the Creator by rule and weight,
and that a living cell, with its wondrous powers
of evolution, bears as much significance to the
reflecting mind, as any of the vast expanse of
stars "which deck the brow of night".

Our fathers gazed with astonishment at the
great system of worlds the telescope opened to their
view, and while lost in speculations as to the in-
-finitude of God's creative power almost forgot that
they were men. But in our own time the microscope
has taught us that evidences of a power not less
wonderful abound in every atom of our globe.

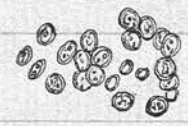
The one teaches us that the earth and all it
contains is but a cell in the vast circulation of
the Universe; - the other that the air we breathe
bears with it a thousand animated forms, that

"Where the pool
Stands marbled ice with green, invisible
Amid the floating verdure millions stray".—

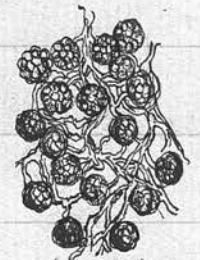
and we learn that there is nothing small in Nature.
The one makes us tremble at man's insignificance,
and human intelligence seems unequal to grasp with
truths so complex and infinite;— the other brings
us to the commencement of the theory of organization,
and we behold the same laws which keep the planets
in their course regulating the movements of a
microscopic cell. For the simple cell is a type
of the whole vegetable and animal kingdoms, and
in its functions of assimilation and growth, in its
reproductive powers, and final death, we have before us
a miniature example of what takes place in all
organisms however complicated they may appear.

As familiar examples of the importance of the
class of parasitic fungi, we may enumerate some of
the diseases to which the order Uredineæ is liable.
How often do the promised harvests of our fields

(Fig. 1.)



(Fig. 2.)



(Fig. 3.)

Fig. 1. Portion of straw attacked by Puccinia graminis. (125 diam).

Fig. 2. Spores of Uredo segetum magnified 575 diameters.

Fig. 3. Group of the spores of U. fœtida, with the mycelium, this is interesting as being one of the supposed Cholera fungi.

droop beneath corrosive blights? To the common observer these appear disgusting and shapeless, and the farmer invests them with uncouth names, without suspecting their true nature. But the microscope reveals their wonderful organization, and their varied and often fantastic forms. To this class belongs the dreaded "mildew", caused by the puccinia graminis, it attacks the stem leaves of wheat, & by appropriating the nutriment of the embryo, leaves it shrivelled & deficient in flour. Fries tells us that he calculated in one plant ten millions of sporules, & they are so infinitely minute that they arise like thin smoke into the air by evaporation, no wonder therefore that under favourable circumstances they should cause such extensive damage to the farmer.

The Uredo segetum (smut), U. fatida, & Erysibe, attack the flowers, & convert the young embryo into an abortive mass. Another of this class the Penicillium glaucum is a well known but not very welcome visitor; it finds its way into the housekeepers jar of preserves, luxuriates among old books, and shews a partiality for cheese by

visiting the collections of the Naturalist & Botanist.

Merulius vastator, Thelephoralis, cause the "dry-rot" in wood, often destroying in a short time massive beams which it has taken a century to mature.

But the importance sometimes attached by these tiny despoilers cannot be better illustrated, than by stating that the Potatoe disease which so lately spread famine and pestilence through the land, was caused by a fungi, the Botrisporium solani, a striking comment on the words of Thomson:- "A feeble race, yet ill

The sacred seat of vengeance, on whose course
Corrosive famine waits, and kills the year".

I might multiply instances innumerable to shew the importance of this order, but the above taken from the vegetable world are sufficient; and in future pages I shall have occasion to mention the diseases they cause in the lower animals, & more especially their occurrence on the human body, and the pathological changes they give rise to.

(1). Memoires de l'Academie des Sciences de Paris, 1726. p. 426.

(2). Philosophical transactions, 1764 (Hill & Newmann).

(3). Wiesberg (Obs. de Animalculis infusoriis natura). P. 31. fig. 2 V g.

(4). Nova acta physico-medica Curiosorum naturæ, V. XV. p 575. 1831.

(5). Helfen zur morphologie, t. 1. p 292.

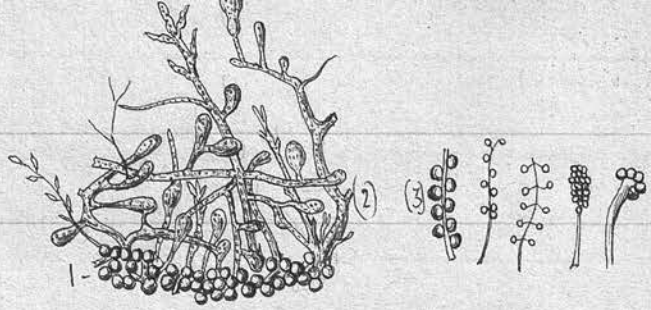
(6) Archives de Wiegmann. 1835. p. 354.

History of the Vegetations found on Man and Animals.

The annals of antiquity furnish nothing, on this subject, indeed with the exception of a few imperfect notices scattered through various journals, the history of vegetable parasites belongs to our own time.

Although this Paper only professes to treat of those found on man, I have thought it better to add also a short Bibliographical account of the several species occurring in animals.

(1) Parrenin and Reaumur (1726), first record instances of fungi developed on insects during hybernation; (2) Fitch writes (1764) on Sphaeria found on larvae at Martinique. Lebermuller (1760), Neumann (3) Wintera, (1765), & Spallanzani (1767), noticed the occurrence of vegetations on the dead bodies of insects placed in water. Subsequently Muller, (4) Reez at Ezenbeck, (5) Kjaerbe, and others, observed Achlya prolifera on dead flies. (6) Meyen (1835) says he has seen the fungus common on flies in Autumn, produced by spores which were floating in water, this proved to be the Achlya prolifera. Kirby & Spence (1828) give



Appearance of the Muscardine (Botrytis Bassiana).

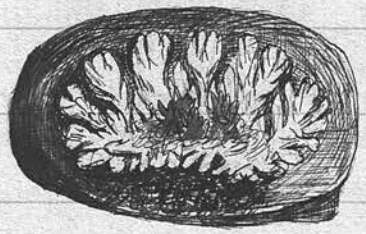
1. Superficial fat-cells of the caterpillar, among which it takes

cont. 2 & 3. fantastic appearance of this entophyte and its sporules.

1. Bassi, (Del mal del segno, calcinaccio, o muscardino. Milan 1835.

2. Comptes Rendus 1836. & Annales des sciences naturelles, 1837.

3. Microscopical Journal, Vol. 1. p. 149.



Spiraculum of Dytiscus, obstructed by confervoid growths.

4 — Icones fungorum hujusque cognitorum. A.C. Corda. 1837. 40.

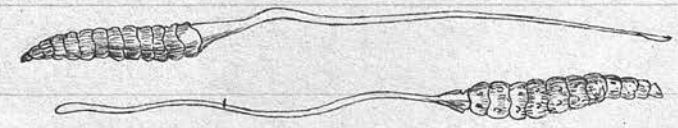
5 Observations on Parasitical growths on living animals. By G. Busk.

(Microscopical Journal, 1841.)

descriptions of several fungi found on living insects.

(1) In 1835 M. Bassi proves that the disease called Muscardine which produces great fatality among silk-worms was of vegetable origin. The labours of Balsamo, Montagne and Audouin[2] complete the history of this disease. Dutrochet gives an abstract of works published on the Muscardine in the Annales des Sciences Naturelles 1838.

(3) Westwood (1841), exhibited at the Entomological Society of London dried specimens of Chinese larva, from the back of the neck of each grew a slender fungus (Sphaeria sinensis) about twice as long as the insect; this constitutes a celebrated Chinese drug. (4) M. Corda gives a figure of Penicillium fibrii growing on Pentatoma prasina. (5) Busk has seen conferva communicated to Dytiscus marginalis and causing its death, it was kept in a vessel with Valisneria spiralis on which the conferva grew. Various species of Sphaeria attack other insects mostly in the larva state. S. Robertsii is developed on the larva of Hepialus vinescens in New Zealand, when it becomes affected it buries itself in the ground, and the interior of its body is filled with spores, one of these.



The Larva of Hepialus virescens attacked by Sphæria.

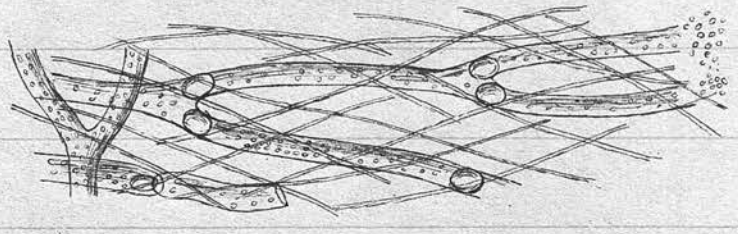
* See also Kirby and Spences Entomology, Vol IV. & Westwood in the Annals of Natural History Vol 3. p 217. 1841.

(1). Hannover (Archiv. für Anat. und Phys. 1839). and Valentins Repertorium, 1840.

(2) Monthly Journ. Med. Science, Oct. 1841.

(3). L'Institut, t. vij. p. 200. 1839. (A) Ehrenberg, in Horiep's Notizen, 1839.

(4). Pennant British Zoology, Vol. 3. p. 256. 1766.



Conferva developed on the scales of Cyprinus auratus.
See Bennett in Trans. of the Royal Society of Ed. 1842.

(5). Verschimmelung lebender Körper. Archiv. für Physiol. vol 1. J. Meckel. 1815.

sprouts out behind its neck, and forms a long, slender fungus. Sphaeria Taylori is found on an Australian caterpillar, and S. Entomorrhiza on wasps at Guadaloupe. *

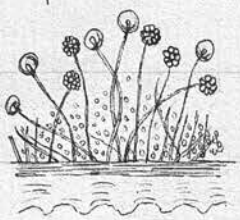
Passing from Insects we find Carus (1823) giving a detailed account of disease produced in young Salamanders by Achlya prolifera. (1) Hannover (1840) found the same plant on Triton punctatus, and succeeded in transforming it to frogs. Stilling observed that frogs deprived of their Spinal marrow were similarly affected. (2)

Laurent (3) & Valentin found certain fungi destroying the ova of molluscs & fish. (4) Ehrenberg notices Tremella meteorica on the scales of Salmo Eperlanus. Long before this Pennant (4) and Conferva spinosa on the Roach; and Bloch (1782) on the carp.

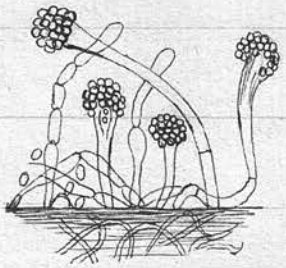
W. J. Corfe, Yarrell, and Bennett, (1842). notice the conferva, causing the death of Gold fish (Cyprinus auratus); and Müller and Retzius dissected a haddock with a slender tail, known to the fishermen as unfit for food, in the air bladder of which they discovered Conferva. (Müller's Archiv. 1842.)

Among Birds several instances of parasitic vegetations are recorded. (5) Mayer (1815) found moulds in the air cells of a jack-daw.

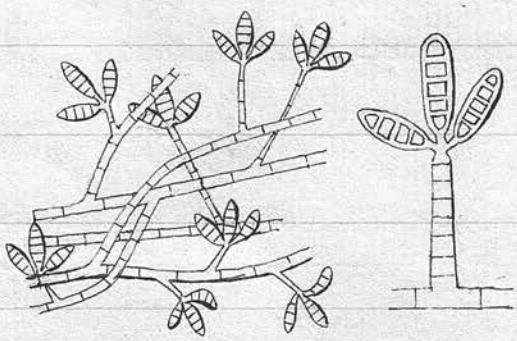
(†) Owen in Philosophical Magazine 1853. vol 2. p. 71 -

Fig. 1.   (2)

(1) Fungi occurring in the lungs of the Eider duck.
(2). Collections of spores -
(†) See, Annales des Sciences naturelles, 1841 -



Fungi of the genus Aspergillus (Mich:) found in the Lungs of Strix Nyctea - † See, Comptes Rendus, 1841.
(*) Comptes Rendus 1841 - p. 18.



Dactylium ovogenum.

Jaeger (1816) others in the air-cells of a Swan. But none of the cases hitherto given appear to have excited much interest until Mr. Owen‡, in 1832, stated before the Zoological Society of London, that he had found patches of greenish mould or mucor lining tuberculous cavities in the lungs of a Flamingo. "I concluded", he says, "that internal parasites are not derived exclusively from the animal kingdom, but that there are Entophyta as well as Entozoa". (†) Delonschamps records similar growths in an Eider duck (Anas mollissima) whose breathing had been long affected. ‡ Muller & Retzius found mushroom like bodies of the genus Aspergillus in the lungs of Strix nyctea, and Falco rufus, both were affected with tubercles. (*) Rousseau & Serrurier a different kind of mould as not unfrequent in sick pigeons & fowls; they found the same in a Parroquet which died of Phthisis. Lastly Rayer & Montagne discovered a very beautiful vegetation (Dactylium oozenum, in hens eggs which had been long kept, & most probably undergone partial decomposition. (Archiv. de Medecine comparée. p. 59. 1843.)

* Froriep's N. Notizen 1841. See also Henle Pathologische Untersuchungen 1840. † Comptes Rendus, 1841

$ Op. Cit.

(*) Degner, Annal: physic. medic. Vratislaviens. Tentam 28, p. 643

N.B. Lange in 1666 however records a case of this kind in the Miscellanea Medica te, Edited by J. M. Centurione, Leipsick.

Repertorium of Valentin. 1840. † Froriep's Neue Notizen, 1839.

‡ Muller's Archiv. 1839. ¶ Medicinische Zeitung, 1840.

The only cases of Entophytes occurring on Mammalia, (with the exception of man,) which I find recorded are the following; * Langenbeck states that conferva abound in the mucus of glandered horses, but Wagl & Henle say this is not a constant appearance. † Rousseau & Bernier mention having seen vegetable moulds in Cervus axis & Gestras Indien; — and Bennett an eruption like Favus on the mouse. §

Lastly on Parasitic fungi found on Man we have the following observations. Despres (*), quoted by Hannings, was the first to observe vegetations in a case of gangrena senilis. Horn (1739) reports a similar case where a whitish green mould appeared several days before death; also of vegetations attacking blistered surfaces, & foul ulcers. Hannings (1821) gives detailed cases of the same kind. # Langenbeck (1839) found vegetations on the tonsils & pharynx of a man who died of typhus. # Schoenlein the same year indicated the presence of fungi in the crusts of Tinea favosa, although Remak (‡) says he noticed them in 1836. Gruby (1841) gives a much more detailed account of this plant, see also J. K. Bennett's papers in the Trans: of the Royal Society of Ed: Vol XV.

* Müllers Archiv. 1842. p. 294

Goodsir (1842) discovered a new plant (the Sarcina ventriculi) in fluid vomited by a patient at regular intervals. It has since been observed by Busk, Schlossberger, & others.

Gruby found a species of contagious mentagra attacking the roots of the beard. * John reports various cases of mould occurring in the exanthemata. Langenbeck similar growths in what he calls scrofulous diseases of the skin. Bennett vegetations in the lungs of phthisical patients: in the sputa of a man affected with pneumonia, & on the gums & teeth of typhoid patients.

Berg (1842) communicated to the Medical Society of Stockholm the vegetable nature of the aphthae of infants, like observations were made about the same time by Vogel & Gruby.

In (1843) Gruby announced Porrigo decalvans to be caused by the growth of fungi, and in the following year Gruby & Malmsten found similar growths in Herpes tonsurans (Cazenave) - and Remak, in hair attacked by Plica Polonica.

Subsequently various cases have been recorded which will be given in the descriptive part of this work. See also, Robin, "Des Vegetaux qui croissent Sur l'homme, &c". (1847).

† See Fenelon's Life of Epicurus.

On the Equivocal Generation of Parasites.

How do these creatures originate? This is a question which has puzzled many an observer. According to the best Pathologists of our day, they are propagated by spherules, germs, or ova. Facts constantly increasing in number make this view of the subject more probable and consistent with the known laws of development. It is not to be wondered however, ~~that~~ considering the infinite minuteness of the germs from which many plants and animals originate — considering that we are unable to distinguish at certain periods, even with the most powerful microscope, the germinal cell of one animal from that of another, nor these again from the spores of many plants, that the history of generation should be surrounded with much mystery.

The ancients traced the origin of all things to spontaneous generation. According to Epicurus† "the primative Earth was fat and nitrous; and the sun, spontaneously warming it soon covered it with herbs and shrubs: there also began to arise on the surface of the ground a great number of small tumours like mushrooms, which

* Aristot. de Part. Animal.

† Quotes in Burton's Anatomy of Melancholy. (16 edition). P. 325 –

‡ Gerarde's Herbal or General History of Plants. 1597.

having, in a certain time come to maturity, the skin burst and there came forth little animals, which gradually retiring from the place where they were produced, began to respire". Aristotle* the greatest of ancient naturalists believed this origin common, even among some of the vertebrate animals. During the dark ages little advance was made upon the old doctrines of development; and the origin of reptiles and serpents from mud; of maggots from putrid flesh; of insects and beetles from dung, - fleas from putrid wine; and a number of equally absurd stories received implicit credit. Cornelius Gemma(†) believed that the immense swarms of locusts which infest eastern lands were conceived by celestial influences; Bodin and others that they are "raised by the illusions of spirits, which are princes of the aire". Gerarde# recounts many extraordinary facts of this kind. "There are found," says he, "in the north parts of Scotland and the islands adjacent called Orchades certaine trees, wherein do grow certaine shells, of a white colour tending to russet, wherein are contained little living

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†. I find the following principal notices on the production of Eels, in Yarrell's History of British Fishes. Vol 2. P. 284. "Aristotle believed that they sprang from the mud; Pliny, from fragments which were separated from their bodies by rubbing against rocks; others supposed that they proceeded from the carcases of animals; Helmont believed that they came from May-dew, and might be obtained by the following process:-'Cut up two turfs covered with May-dew, and lay one upon the other, the grassy sides inwards, and thus expose them to the heat of the sun; in a few hours there will spring from them an infinite quantity of eels'. The fishermen about the mykes of Lincolnshire believe even now they may be produced in any quantity by placing the hair from a horse's tail in water; and strange to say the farmers there suppose the wire-worm to have a like origin. It were easy to multiply instances of this kind without going so far back as the days of Lucretius, or recurring to the Metamorphoses of Ovid. - Bl.

creatures, which falling into the water, do become fowls, which we call Barnacles". And this is believed by the fishermen on these coasts to the present day. So also the generation of sponges was attributed to a fermentation of the sea's serum, or its spontaneous pollutions. Gerarde remarks of these:- "There is found growing upon the rockes neare unto the sea, a certaine matter wrought together of the fome or froth of the sea, which we call Sponges".

The above extracts will shew that the doctrines recently put forth by Lamarck and Oken are anything but original. We are inclined to smile at the ignorance of our progenitors, but let us remember that while every instance recorded by old writers in favour of spontaneous generation has been disproved, this theory has been revived of late to account for the origin of a class of beings of which the ancients knew nothing. Happily for the credit of the 19th century it has found few supporters among men of science. Indeed the researches of Schwann, the Goodsirs, Ehrenberg, Greville, Owen, and many other illustrious men,

have proved that the lowest orders of infusorial animal-
-cules, & the microscopical confervæ hundreds of which crowd
a drop of water, follow the same laws of cell development,
live their short life, procreate their kind, & then die,
like the more bulky plants and animals which people the
earth.

The arguments in favour of spontaneous generation
are briefly these - There was a time when all things
now existing, must have had a beginning, that is to
say, arisen without parents. Geology points out that
in the various phases through which the earth has
passed, successive dynasties of animals and plants,
differing from those now extant, have flourished on it
and become extinct, leaving nothing but their mummy-
-like remains to tell of the past. If this be true
why should not existing organisms which at some
period originated spontaneously and have subsequently pro-
-pagated themselves in a different way, again arise
spontaneously? By supposing that new physical conditions
occur on the surface of the earth, why should we not

have new modifications of being, to meet such changes?

Of the origin of things we know nothing, but what the Old Testament reveals to us, for the endless theories upon this subject advocated by ancient and modern writers leave us as much in the dark as ever. I shall therefore confine myself to the consideration of facts, & some of the more prevalent theories, brought forward in support of equivocal generation.

The Chemist has discovered that the materials from which organic bodies are formed, are identical with those existing in the inorganic world. He has also been enabled by patient research to determine the proportions in which certain elements such as Oxygen, Nitrogen, Hydrogen, & Carbon, unite to form various organic compounds. Furthermore he has already formed artificially several of these, such as urea, oxalic acid, & some of the vegetable alkaloids; although he observed these are products of excretion and disintegration, thrown off from the laboratory of nature, not such as she employs to build up and nourish the tissues. Still why may he not in time succeed in manufacturing fibrin or albumen? Here he pauses, and

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* Ascherson in Muller's Archivis. 1840.

† Medico-Chirurgical Review. 1843. P. 169.

here let us part with him until his work is accomplished.

The Physiologist informs us the fundamental type of being, is the nucleated cell capable of reproducing itself, and that all organisms however complicated they may appear, arise from this apparently simple source.

"Give me a vesicle", said Raspail, "and I will make a man". According by M. Ascherson(*), who was in advance of the chemist inasmuch as the products of organization were at his disposal, discovered that by the mere contact of oil and albumen a delicate membrane was formed very like other homogeneous membranes; and that by triturating the two together, a whole generation of little globules were produced with delicate albuminous envelopes, which under the microscope might easily be mistaken for other kinds of cells. Dutrochet subsequently gave out that globules could be produced in albumen by electricity; and Leibig(†) that they were formed in any albuminous fluid, which had been neutralized by an acid. "Here, ergo sum", are great facts, all we require now is to discover that mere abstraction – that property of matter called life,

to make these grow, and transmit their kind, and form an organism"! Has it never occurred to such speculators that in like manner a Phidias can take a block of marble, and strike therefrom an image of the most perfect human form, a Venus, or an Apollo, and that his expectations of these growing into life would be quite as rational? I have no desire to enter into any definition of what the vital force is. Chemical and physical laws are certainly not sufficient to account for the phenomena of life, as far as we yet know them. Physical forces undoubtedly excite and react upon the vital force, and in like manner the presence of life modifies and controls their action. Hippocrates although his physiology was encumbered with Pythagorean theories recognized a vital principle, which he calls φυσις, not as a self-acting, but controlling power, regulating the actions excited by extraneous causes. And it is much to be regretted that Paracelsus, Descartes, and Stahl, while breaking up the splendid dreams of antiquity, should have thrown aside at the same time so much which we now recognize as true.

* Vestiges of the Natural History of Creation. 1844.

Commenting on the discovery of Dutrochet, a celebrated modern writer observes *:- "If therefore these globules be identical with the cells which are now held to be reproductive, it might be said that the production of albumen by artificial means is the only process wanting. This has not yet been effected, but it is known to be only a chemical process, the mode of which may be any day discovered in the laboratory." - But without further investigation he constructs an hypothesis of generation, nutrition, and growth upon this globular foundation, forgetting the precept of Sir Isaac Newton; "hypotheses vel metaphysicae, vel physicae, vel qualitatum occultarum, seu mechanicae, in philosophia locum non habent!" The end of these globules is instructive, they were truly found to be reproductive globules, but ovules, like those described by Leibig, not to vitality but Degeneration of albumen, they were in fact dead. In the presence of vegetations of a low type, (the Torula albuminis?) such as we find in any decomposing organic solution.

But the triumphant fact brought forward in proof

* Proceedings of the London Electrical Society. 1842.

of Spontaneous Generation is founded on the experiments of Crosse and Weekes. Mr. Crosse while experimenting on crystallization, caused a powerful galvanic current to pass through a solution of Silicate of Potash, when he first observed the little creature which in honour of its discoverer, was named the Acarus Crossii. He next treated in like manner a solution of Nitrate of Copper, and in due time the A. Crossii again came forth. Subsequently Mr. Weekes* of Sandwich repeated the experiments, taking every precaution to prevent the entrance of germs from without. He first tried the Silicate of Potash & observed after a time a quantity of gelatinous matter around the negative pole of the battery. "A part of the process," (remarks the author of the Vestiges,) "of considerable importance, considering that gelatin is one of the proximate principles, or first compounds of which animal bodies are formed". But surely the decomposition of a part of the fluid & precipitation of silica will explain the appearance as well, and there is no very striking analogy between it and gelatin. The result of the experiment was that the insect again came forth. Solutions of a different nature were then tried with like success. Lastly Mr. Weekes passed the galvanic current through a solution of the

† Footprints of the Creator, a work which all should read.

Ferrocyanate of Potass, simply conjecturing, that this substance contained more carbon than any of the former, accordingly in still greater numbers than ever the Acarus Crossii crawled forth. Of course these facts gave rise to considerable discussion. Specimens were sent to the Paris Academy, and the philosophers there were rather staggered that electro-generated insects should contain iron within them. Again it was against all experience that one animal could be formed from such heterogeneous compounds. Suppose a man were to exhibit specimens of bread, said to have been formed by passing galvanic currents through various solutions; say the first was of Nitrate of Silver, and the product bread; and the second of Sulphate of Magnesia, and the product still bread; and Lastly, the experimentor foregoing, there was more carbon in Chalk, were to try that, and with the production of still greater quantities of bread! Extravagant as the idea is there is no doubt he would find numerous disciples to put faith in him, for as Hugh Miller[†] well observes - "There is a species of superstition which inclines men to take on trust whatever assumes the name of science; and which seems to be a reaction on the old superstition, that had faith in witches, but none in Sir Isaac

* See Mr E. Newman in The Zoologist. 1843. Windsor Review. No. CLXV.

Newton, and believed in ghosts but failed to credit the Epicurean Calendar."

The future history of this insect is also instructive. Thousands of the same species were found in all parts of the Kingdom, in dirty outhouses, among the bottles and debris of laboratories, & lurking among old books. After the fact soon transpired that it was no new species at all, but one of the most plentiful of its tribe, a little bristly monster, which for its preëminent ugliness had been named the Acarus horridus!*

How it found its way into the solutions experimented upon I do not attempt to explain. But a reflecting mind looking for a cause for every effect, with pause long before admitting that an insect of high organization could be formed from such diverse materials. We know that Acari exhibit wonderful tenacity of life, bearing extremes of heat & cold, and resisting almost every effort to destroy them. We know moreover that their minute germs are still more hard to kill than the animals themselves, and find entrance into the most unlikely places; so that many a one besides Mr Weekes has been inclined to ascribe their origin to spontaneous generation.

* Ken's Isis -

The Electric force has of late been invested with almost creative powers. "Organism", says Oken*, "is galvanism resisting in a perfectly homogeneous mass". "Air, water, earth, existing as a saline mucus, and galvanism as a vitalizing principle, are the basis of all organized beings". The Arbor Diana argue some is like a tree, and is produced by galvanism why may not real trees be produced by it also? Others have attempted to prove the identity of the galvanic and vital forces, but all such theories have hitherto proved abortive.

It appears to me that acids from galvanism & electricity being formative agents, they are the antagonists of organization, so far from building up they destroy. We see how the one decomposes all chemical mixtures, eliciting the simple from the compound, & disturbing the attractions which bind particles together. We see in the great laboratory of nature how the other blasts instead of forms life, resolving organized substances into their original elements, and dooms them to premature decay. Where on the other hand, save in the dreams of philosophers, have we permanent instances of their vivifying powers, & artistic design?

* A Disquisition on Pestilential Cholera, &c. By C. Cowell M.D. London 1848. 8vo.

Fungi, as is well known are frequently meteoric, "springing up after storms, or in particular states of the atmosphere". But this is no proof that they are generated by electricity, any more than that they fall from the clouds. We know that after a thunder storm fermentid fluids such as ale undergo Eremacausis, and turn acid, milk also partakes of a similar change, and probably many other animal and vegetable products which escape our notice. Now fungi require for their development a matrix of some organic substance in a state of change, and what is incorrectly called the acetous fermentation is especially suited for such development. This is exactly the state of things we find after a thunder storm, what more therefore is wanting, but that some of the innumerable germs pervading the atmosphere, descending with the rain - those "scavengers of nature" ever active and watchful, should seize at once and claim such products as their own? Surely this is a more simple and rational interpretation of the facts of the case, than to call in a new and little known agent, and invest it with powers which belong only to the Creator. - J. Cordell (*) also suggests that the

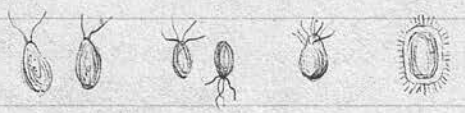
electric force may act under these circumstances by merely fixing the spores mechanically, in the same way that we know certain powders ether to lines traced by a magnet on wood, while from other parts they are at once blown away.

I shall next consider the arguments adduced in favour of the spontaneous origin of infusoria, mould, and the like.

Priestley first observed that the green matter formed in organic solutions, when exposed to light and air, consisted originally of a mass of moving particles which he called animalcules, and that subsequently these were resolved into globules which by elongation & division formed confervæ, or into infusoria. Hence he supposed the moving particles first observed were common to animals and vegetables. Ingenhouz & Sprengel also supported this theory. But we now know that the spores of many cryptogamic plants present the phenomena of motion in a remarkable degree, and that there has been too much tendency at all times to associate the mere fact of motion, with animal life.

Kutzing and Bory de St. Vincent prove that in Oscillatoria Zonata, there are active cells furnished with a red-spot, like

(1) (2). (3) (4).



Spores furnished with ciliary processes, 1. Conferva.
2. Chetophora. 3. Prolifera. 4. Vaucheria.

* Tracts of the Nature of Animals & Vegetables &c: 1799 (Trans.)

† Schwann on fermentation. Muller's Archiv. 1843. p. 453, &c

the so called eye of Ehrenberg's green monads, and these afterwards elongate into undoubted vegetable filaments, still however retaining this red spot, probably the nuclei of the cells.
Many of the confervæ are furnished with ciliary processes which enable them to move through fluids until they find the suitable conditions for growth, these disappear after germination.
The Diatomaceæ and several allied genera are now admitted to belong to the vegetable kingdom, and many varieties figured by Ehrenberg as infusoria, even Volvox and its allies, there is much doubt will be removed to the same division.
It cannot be surprising therefore that the Sporules of plants should give rise to plants.

The question of their origin may be thus stated. Spallanzani(*) proved that no animalcules or vegetations are formed in infusions from which the atmosphere is excluded, as by covering them with oil, or hermetically sealing the vessel.
The experiments of Schwann[†], Helmholtz, and Dr. Marklein, have abundantly proved that under circumstances otherwise favourable for the growth of these beings none appear, when the possibility of the transference of germs or germ is precluded".

* This experiment is given in the Edinburgh New Philosophical Journal. vol xxiii. p. 165.

The supporters of spontaneous generation object to the experiments of Spallanzani, that no animalcules appeared, "merely because the exclusion of air has the effect of preventing that species of decomposition which they regard as necessary for the formation of the Infusoria". Professor Schulze of Berlin(*) set the matter at rest by an ingenious experiment. He filled a glass flask half full of distilled water, in which were various organic substances: this was made air tight by a good cork, through which passed two glass tubes bent at right angles. It was now heated until the water boiled violently, & while the steam was escaping from the two tubes, one was placed in a vessel containing concentrated sulphuric acid, the other in one holding a solution of Potash. The apparatus was then exposed to common light and heat, and the air renewed in ~~the apparatus~~ it several times a day by the experimenter sucking the tube placed in the solution of Potash. From the 28th of May to the end of July, this was continued, and although portions from the edge of the liquid were examined almost daily, not a vestige of any living animal or vegetable substance appeared. And the vessel also exposed to a boiling temperature, & containing the same ingredients but

(†) Todd's Cyclopæd. Anat. & Physiology Art: Generation -

left open, was placed by its side, and in this next day the Professor found Vibriones and Monads, which were succeeded by large Polygastric Infusoria, and Rotifera. I repeated this experiment in the autumn of 1850, and with like results. Surely this proves that something more than changes of composition of the organic molecules in the infusions in whatever way induced, are the sole causes of their formation.

Nor are the other arguments adduced by Dr. Allen Thompson and others more conclusive. That "the nature of the animalcule or vegetable production bears a constant relation to the state of the infusion, so that, in similar circumstances, the same are always produced without this being influenced by the atmosphere" is not wonderful when we remember the tenacity with which certain species associate themselves with certain kinds of soil, although we cannot explain how it is any more than that certain animals and vegetables inhabit different countries and climates.

Again, that we should find "a certain progressive advance in the protective powers of the infusion, for at first the animalcules are only of the smallest kinds of Monads, & afterwards they become larger and more complicated in their structure";

(†) "for Nature", as Aristotle has written, passes continuously from things without life to animals, through things which live yet are not animals: De Part: Animal. l. IV -

(*) Lectures on Comparative Anatomy by Prof. Owen. 1843. p. 27.

is not more wonderful, for we know that while the lowest classes of animals feed upon organic particles which were hastening to decay, they in turn entice and become the prey of the highest classes of their own kind, such as Polygastric animalcules & Rotifera; these of other small animals; which in their turn are devoured by larger animals (fishes!) and thus a pabulum, fit for the nourishment of the highest organized beings, is brought back by a short route from the extremity of the realms of organic matter".(*)

The above remarks apply equally to the subject of vegetable parasites. In all cases where they have yet been found, they have been associated with either a general or local deterioration of the fluids or solids of the animal attacked. And if we allow them to be derived in some instances from the atmosphere, as well as by direct contact or inoculation, we are enabled to explain every case of the kind yet recorded. For hitherto entophytes have only been observed on free surfaces, accessible to the atmosphere, such as on the skin, mucous membranes, and in the breathing apparatus, of the various classes of animals.

* For further information on the subject of the Entozoa. See. Virch's Pathological Anatomy. Owen's Lectures on Comparative Anatomy. And the learned work of J. A. Helm, die Lehre von der Urzeugung. Halle. 1844. Also Redi. De Generatione Insectorum. Amst. 1685.

† - Some scepticism may be natural and pardonable when speaking of organisms $\frac{1}{1000}$th of a line in length, still we think it strange that one who argues so well upon the errors of others, on this very subject, should have made himself liable to a like charge. "At one time," he observes, it was a common belief among scientific men as well as the vulgar that many animals might be produced by spontaneous generation, as for example, the numerous insects or their larvæ infesting putrid substances, various kinds of worms (Annelida), and Molluscous animals, as well as even some fishes and reptiles; but the increased knowledge of the structure and habits of these animals, and in particular the observations of Redi and others, demonstrated the error of this opinion, and shewed it to have arisen merely from the circumstances of their real mode of development not having been observed." Op. cit. Dr. A. Thompson.

The limits of this paper will not allow me to discuss the subject of the Embryon, all allow it presents difficulties, but the arguments advanced to account for the presence of one class, also apply to the other. *

We conclude therefore: —

1st. That as the history of science has advanced, the number of those animals supposed to arise spontaneously has in like ratio diminished, so that those instances recorded by the earlier writers in favour of this view, are now known to be generated by propagation alone. †

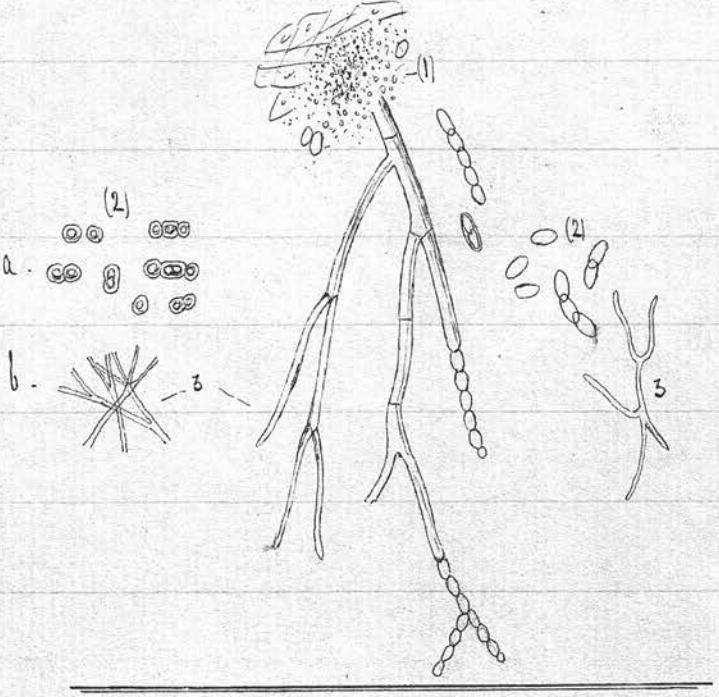
2nd. That in all cases where opportunity has been afforded for tracing, by strict observation, the origin of an organism, it has taken place by propagation; whilst, on the contrary, not a solitary unexceptionable observation of a spontaneous origin exists in the records of natural history. Analogy therefore is completely in our favour.

3rd. That he who argues that any animal or plant arises spontaneously, merely because we have as yet been unable to trace its mode of development, he that can set hypothetical possibility against acknowledged certainty, is not

Fig 1. Molecular deposit, from which Prof. Bennett observed fungi to arise, in a patient suffering from pneumo-thorax.

Fig 2. On the right are sporules belonging to the above; those on the left are the spores of Torula cerevisiæ —

Microscopic appearances.



to be admitted among reasonable beings" - (Johnson).

4th. That we are justified by analogy in stating that Entophytes, like other plants are derived from germs or spores.

5th. That these may be communicated by direct contact, or under peculiar circumstances from germs floating in the atmosphere -

Botanical Relations of the Entophytes.

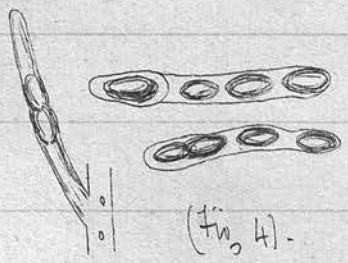
All the Entophytes yet known are cryptogamic plants, belonging to the lowest divisions of Fungi and Algæ.

Those found on man are exceedingly minute, and exhibit under a magnifying power of 300 to 500 diameters, the following elementary forms, variously arranged:—

1st. A molecular blastema, composed of minute granules, forming a soil from which the plants arise. (Fig 1).

2. Round, oval or square cells or vesicles, arranged in twos or threes, or separate, composing the whole plant, with spores, as in Sarcina and Torula. (Sporules). (Fig 2).

3. Fibres of various lengths, with or without divisions or constrictions, or variously branched. (Mallus fibrils). Fig (3).



(Fig. 4).

Thalli of Favus enclosing several sporules.

(*) British & Foreign Med. Review - Oct. 1846.

4. Filaments containing spores. (Sporangium, peristhae, myelium. (Figs 4)

Some writers have denied the vegetable nature of these growths, & believe them merely to be modifications of the ordinary cells of the body. In answer to this we state:—

1st. "No constituent tissue of the human body, normal or abnormal, at all resembles or agrees with the above described forms, considered in all their states of development." (*)

2nd. The fissiparous division of cells, the elongation of these into tubes bearing various branches, often divided by transverse septa, & the simultaneous development of sporangia, distinguish them in like manner from animal cells; and show their analogy, in the former case to the family conio-mycetes, to which belongs the yeasts; and the latter to the hyphæ-mycetes, examples of which are found in various moulds.

3rd. These growths are known to develope themselves under suitable circumstances altogether apart from the tissues of the body. 4th. Parts of spores & sporangia, even when dried and pulverised, have been known to germinate again when placed in suitable menstrua, and this alone would distinguish them from the cells of the human body.

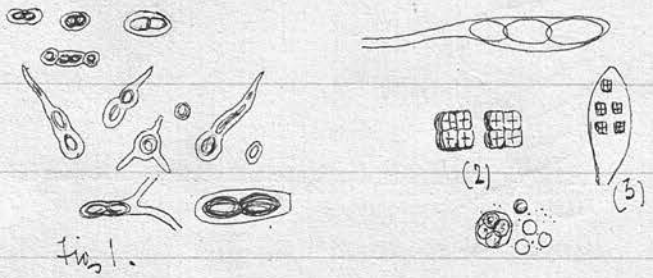


Fig 1.

Diagram illustrating the modes of development in fungi.

Fig 1. Sporules of Favus which Remak introduced into the cut surface of an apple, after three days.

2. Four-fold division of the Saccus Ventriculi.

3. Portion of the frond of one of the algæ, shewing the similarity of division with the last.

The modes of development found in these minute organisms are similar to those in the cryptogamia.

The most common way is by the fissiparous or meismatic division of a cell into two or more parts: or they may increase endogenously, by the setting free of germs formed within a parent cell. Frequently we find a cell put forth one or more buds, which elongate into filaments, & after a time sporules are formed in the extremities of these.

According to Mohl & Henfrey the first process commences by a doubling inward of the inner membrane of a cell, which detaches itself from the outer or proper cell wall, & forms a constriction, which deepens until the original cell cavity is divided into two compartments. Sometimes, as in Saccina, the nucleus of the cell divides into four portions.

This mode of development may be compared to the growth of cells in a flowering plant, which are at first alike but afterwards assume various forms, until the plant is fully evolved; even then it may reproduce new individuals by the process of budding. But there appears to be a limit to this mode of increase. Accordingly we find new vitality infused into

(*) the British Desmideæ. By John Ralfs M.R.S.S. 1848.

(†) Annals of Natural History. Vol. xx. and, British & F: Med: Review. 1848.

the species by the union of two cells, the pollen grain, and the germinal vesicle of the ovule, a new cell is thus formed and the process of growth commences as at first.

In the simplest forms of vegetation the same law seems to hold good, the first cell gives birth to many others like itself, capable of a separate existence, and each performing the functions of stem, root, leaves, in the flowering plant.

But according to the observations of Ralfs (*) and Thwaites, (†) the race would degenerate and run out in time if nothing but fissiparous reproduction existed. Accordingly it has been proved recently that not only in Conjugata, but also in Desmidea, Diatomea, and Palmella, a process analogous to fructification in the higher plants holds good. This takes place also by union of the contents of two cells, the endochrome of one, as in Conjugata passing into the cavity of the other; or sometimes both cells pass into a common receptacle, & form by such union a spherical germ containing spores, which are equivalent to the seeds of plants; or it is believed that fecundation may occur by the partition between two cells in the same filament breaking down, allowing their contents to unite.

(*) Op. Cit.

(†) Balfour B'Army

Speaking of this double mode of reproduction in the Infusoria Professor Owen(*) makes the following observation. "I am apt to think that the fissiparous reproduction has reference principally to increasing the numbers of individuals in the infusoria, or receptacles of decaying organisms, in which they at that time exist; whilst the development of fertile ova has relation to future and different localities or collections of such infusions, into which the ova may be conveyed more easily than the entire animals!" Such also may be nature's meaning with respect to fungi, so that when the medium in which they have grown is dried up or exhausted, their infinitely minute spores may be raised by the wind, & suspended in the air or water, ready by their tenacity of life to vegetate again wherever they find the necessary conditions for their growth. The vibratile filaments attached to some of their spores seem to have a like reference. Some of the fungi increase with amazing rapidity. "Ward noticed Phallus impudicus shoot up three inches in a quarter of an hour, & attain its full size of four inches and a half in an hour and a half." (†) Jamieson states that he has known Boletus gigantea grow in a single night from

the size of a mere point to that of a huge guard. Similar instances may be seen in the rapid multiplication of Torulæ in saccharine solutions, and the blights of wheat, &c, caused by fungi.

Their office is to prevent the accumulation of decaying organized matter upon the surface of the earth, and thus free it from many noxious substances which must otherwise prove detrimental to its inhabitants. But they share with the Infusoria another and still more important task, by fixing upon and fixing during their transit substances which must otherwise disintegrate and return to the inorganic world. Having thus carried them back into the ascending stream of life, and converted the decomposing particles into their own tissues, they in turn become the prey of minute animals, and so on to the highest forms of life. They thus perform by a shorter process the functions of more perfect plants. The one arresting organic substances from death, the other elaborating from the inorganic world new elements prepared for the food of animals.

I shall defer the few remarks I have to make upon the classification of Entophytes until the descriptive portion of this Paper.

Pathological Relations of Entophytes -

The whole class of fungi differ widely in many respects from more perfect plants. The latter derive their nourishment from the atmosphere, & from salts found in the water and soil which they inhabit. The former, as we have seen, require for their development the presence of some organic matter in a state of fermentation, acetification, or putrefaction. As a result of such food they lose many of the more marked characteristics of plants, and seem by their form and color, their secretions and chemical composition, to assimilate more closely to the animal type, for which indeed they are frequently mistaken. This is especially the case with entophytes which seem to form the connecting link between these two great organic kingdoms, and partake somewhat of the characteristics of both. From what we know of their habits therefore we should not expect to find them attacking the fluids or solids of the healthy body, and it will be found by reference to the cases recorded that such is the fact.

The question therefore naturally arises, what is

† Op. Cit. (1842).

* Lectures on Clinical Medicine. Part 2. 1850.

the particular state of the system which renders it liable to their attacks?

Professor Bennett, in his masterly paper on Parasitic growths attacking man and animals, arrives at the following conclusions: "1st. That these vegetations always arise in living animals previously diseased; 2nd. That their presence indicates great depression of the vital powers and impairment of the nutritive functions of the economy; - 3rd. That the peculiar constitution or cachexia favourable to their growth is the tubercular or scrofulous in the mammalia, birds, and fishes, most probably, in reptiles and insects". Subsequently he states that such vegetations in all cases arise from an albuminous exudation allied to tubercle*.

This is undoubtedly true as far as the most important of these growths, such as those occurring in Favus, various scrofulous diseases of the skin, and Mycetoma, &c; and with this author, Erichsen, Burgess, Nelson, Malsten, Bers, and others, I should consider their presence pathognomonic of the scrofulous diathesis - But occasionally we find Entophytes present in bodies otherwise healthy, or any rate

* Gazzetta Musicale. 1843.

unconnected with tubercle, and dependent on local causes. The Sarcina of Goodsir, and cases recorded by Meyer, Wilkinson, Farre, and Hypothesis, are of this description.

That such appearances should not be unfrequent, cannot be surprising, when we consider the following facts. Lebert, in 1845 stated that he had succeeded in precipitating albumen in the form of globules by adding water and acid to serum. MM. Andral and Gavarret(*) repeated his experiments, and found that like globules were formed in any albuminous solution, which had been first neutralised by an acid, such as the white of an egg, various morbid effusions, the serous part of purulent matter, &c. These globules consisted of a number of round or oval vesicles, like those observed in solutions after fermentation. These vesicles first appeared on the surface of the fluid, and soon began to put forth buds, and these lengthened into stems, which gave out branches, which in turn produced smaller ones to an almost indefinite increase. Or several vesicles joined together in groups, which by elongation formed moniliform stems. Like experiments have been since instituted on the milk of various animals, with like results.

It would therefore appear, that it is only necessary to render the albuminous fluids of the body acid, in order to make them a fit soil for parasitic vegetations.

According to this theory we should expect to find them on the surface of foul ulcers, in cases of gangrene where the secretions are intensely acid; in persons affected with phthisis where in like manner a state of acidity prevails throughout the body, and also in typhoid patients.

This also will account for the Muguet occurring so frequently in foundling hospitals, and in those where numbers of infants are reared, where cleanliness is little attended to, and the digestive organs are often out of order, favouring the acid reaction, and where the germs of the parasite are communicated by the nurse from one child to another.

It is well known that vegetations similar to those found in the Muguet are common on the teeth and gums of persons suffering from indigestion. In all cases where the Sarcina has been found the fluids vomited have been in a state of ferment and given the acid reaction.

It has been further proved that the presence of such

(*) Chemie und Mikroskop am Krankenbette. Ein Beitrag zur medizinischen Diagnostik mit besonderer Rücksicht auf das Bedürfnis des praktischen Arztes; bearb. von M. A. Hille. 1845.

growths has had the effect of aggravating and perpetuating such a state in the parts they attack as is favourable for their development.

Diagnostic value of Entophytes. That their presence indicates a scrofulous or cachectic state of the system in many cases, I have already shewn. But a question of great importance now arises. Are parasitic vegetations pathognomonic of certain diseases? Hoffe details certain experiments in which he thinks he has proved the identity of the yeast plant and that generated in albuminous fluids, and by comparing their microscopic appearances and properties, with the vegetations found in favous, Aphthæ, &c, he maintains that these also are identical with the former.(*) If this were true the existence of fungi in various situations would cease to be of diagnostic value except as one among many symptoms of a depraved constitution. But if the spores of these are identical, how is it that in Edinburgh where favus is common, we scarcely ever find an instance of Thrush or Mentagra? Again who could ever mistake the Sarcina for any other vegetation? That some of those

recorded with proof to be identical there can be little question. But the various modes of development in others, their partiality for certain localities, their characteristic appearances even to the naked eye:- the fungi of fevers always appearing within a capsule of epidermic cells; that of thrush on the free surface of mucous membranes, and never extending except in a detached state to the stomach; some attacking the sheath, others the bulb, or interior of hair; others confined to the fluids of the stomach or bladder, all these facts would prove a difference of habit and organisation.

This question can only be satisfactorily determined by those who can compare living specimens. And the observers who seem best entitled to form an opinion upon the subject, as Gruby & Berg, seem to have no doubt as to the distinction of various species.

Classification of Entophytes.

While the most eminent Botanists and Pathologists allow the vegetable nature of these parasites, cases one is agreed as to their true relations. As an instance of this we may take the fungi occurring in fevers. Bryonist

* Erdmann's Journ: f. prakt. Chemie, vol xi. p. 409.

places it among the genus Mycoderma of Persoon; J. Müller thinks it belongs to Oidium, and Link and Klotzsch place it in a new genus which the former calls Achorion. Kützing* who has paid great attention to this order, found it impossible to classify them botanically. There are certainly well marked species which when fully developed may be easily made out, but the early forms of all are so much alike, and indeed the advanced stages of many, that I find it impossible in the present state of our knowledge to separate one from the other. I am therefore compelled to follow the arbitrary classification hitherto adopted, and shall consider:-

1st. The Entophytes found on the human integument and its appendages: 2nd. those found on Mucous membranes; and 3rd. those which are developed in the fluids of the body.

I. Entophytes found on the Skin and its appendages.

a. Of the Achorion Schoenleini. (Oidium Lebert. J. Müller. Mycoderma. Gruby. Trichophyton. Malmsten.) constituting the disease called Porrigo lupinosa and P. favosa. The favous crust consists essentially of an capsule of epidermic cells, lined by a finely granular mass, from which spring cryptogamic plants.

Fig. 1. Transverse section of a favus crust, shewing the capsule lined by molecular matter, from which arise branches and sporules.

Fig. 1.

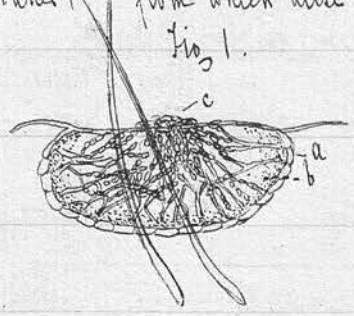


Fig. 2.

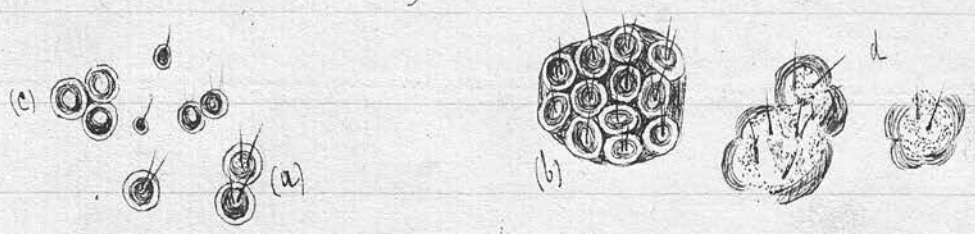


Fig. 2. a. Isolated crusts of favus (P. lupinosa). b. Cluster of same like a honeycomb (P. favosa). c. Crusts not perforated by hairs. d. Advanced stage of favus. (Bennett)

Fig. 3.

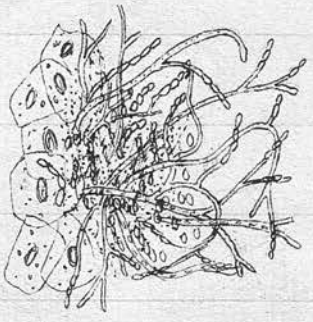


Fig. 4.

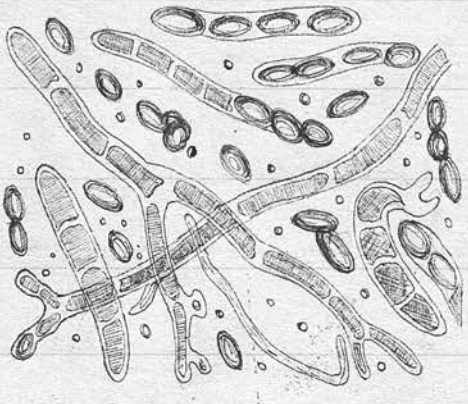


Fig. 3. Branches and Sporules of the Achorion Schoenleini, arising from the molecular albuminous matter situated on the Epithelial scales. 300 Diam.

Fig. 4. Thalli, Sporidia & Sporules, shewing the mode of reproduction. 800 Diam. Bennett.

The plant is thus characterised by Link: Achorion Schoenleini
nobis, Orientale, flavum, coriaceum, cutis humanae praesertim
capitis incolens; thizopodion mollis, pellucidum, floccosum,
floccis tenuissimis, vix articulatis, ramosissimis, anastomoticis*
myelium floccis crassioribus, subramosis, distincte articulatis,
articulis inaequalibus irregularibus in sporidia abeuntibus;
sporidia rotunda, ovalia vel irregularia, in unis vel
pluribus lateribus germinantia.

The capsule of favus is lined by an amorphous mass,
composed of a finely molecular matter, identical in structure,
(according to Bennett), with certain kinds of tubercle. From
this the thalli arise branching Dichotomously, in the extremities
of these are found one or more sporules. The thallus tubes
are from $\frac{1}{400}$ to $\frac{1}{600}$ of a millimetre in diameter, jointed,
sometimes branching at irregular intervals, and containing mol-
ecules, sometimes transparent. The sporules range from $\frac{1}{300}$
to $\frac{1}{1000}$ of a millimetre in diameter, these are most plentiful
in the centre of the capsule, whilst the thallus fibrils and
mycelia are more plentiful at the periphery from which
they arise. That these vegetations are developed from

Sporules is proved by the experiments of Remak. He inoculated an apple with them and placed it in moist sand, and observed their mode of germination. The delicate membrane surrounding the sporules he found to throw out one or more buds, which elongated into filaments, in the extremities of these sporules after a time were observed to form, as in other vegetations of a like nature.

The disease according to Bennett commences with increased redness and vascularity of the skin, which is succeeded by partial dispamation. Pustules sometimes appear, forming scabs but this is not essential to its development. At length sulphur-colored spots are observed with a central depression, these are at first about the size of a lupine seed but spreadily enlarge. The edges of the capsule are at first lower than the sound skin, but afterwards become raised & present concentric lamina, and as it enlarges the centre becomes convex and the enclosed vegetations protrude in the form of whitish mealy sporules, encroaching on its edges. Generally the edges of a number of capsules thus formed approach each other, causing a honey-combed appearance, the whole surrounded by an inflamed border.

"At length the whole cracks or splits up; all regular form is lost; a dense thick crust covers the scalp; an odour, like the urine of cats or mice is evolved; and in chronic cases, vermin deposit their eggs in the interstices, and crawl in large numbers over the surface". At this is accompanied by much irritation and itching of the part which is still further aggravated by the ineffectual attempts of the patient to relieve it.

This disease generally attacks the hairy scalp of children from three to twelve years of age, either those whose parents have died of phthisis, or who have been exposed to hunger, cold, or coped up in close unhealthy rooms. But it is not always connected with the hair for it has been found on the forehead, face, arms, abdomen, legs &c. There has been much dispute as to whether favus be contagious or no? Bateman, Gilbert, Mahon, and many other writers affirming that it is so, whilst others deny this altogether. Gruby, inoculated thirty phanerogamous plants, twenty-four silk worms, six reptiles, four birds, and eight mammalia, but only succeeded in reproducing the disease once, and then in a plant. Bennett inoculated his own person several times, without producing

the characteristic favus crust. This occurred in 1841. Dr. Remak of Berlin, afterwards succeeded in producing the disease on his own person, by fastening portions of favus crusts upon his arms, by means of adhesive plaster. In 1845, Dr Bennett experimented upon one of his pupils with like success. "The subject of this demonstration had light hair, blue eyes, and a very white and delicate skin". That it cannot be transferred more frequently only proves that the plant requires a peculiar soil which it does not find on the healthy skin. Bennett & Erichsen believe the matter exuded from the skin of scrofulous subjects to be necessary for its growth. This view is supported by the fact that those affected have enlarged lymphatics, scrofulous ulcers, and mostly die of phthisis. Thenard's analysis would still further show the analogy between favus matter and tubercle. In 100 parts, he found 90 of coagulated albumen, 17 of gelatine, water, loss, & Phosphate of lime, 5 parts.

For further information consult, Schoenlein in Muller's Archiv: 1839. (who first discovered these vegetations) J. Remak, Medicinische Zeitung (1841-, Bennett Ed: Philos. Trans. V xx - and Lectures of clinical medicine, July 1850. Gruby, Comptes rendus t. xiii. 1841. Cayenne Dictionnaire de Med^ne V. xxix. &c.

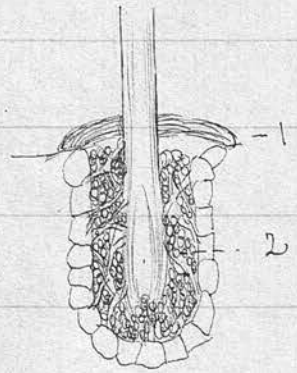


Diagram illustrating the Membrana -

1. Scale surrounding the hair, and loosely connected with the Epidermis -

2. Fibres and spicules of the Achorion Lyrubii situated between the bulb of the hair and its sheath, and firmly attached to both -

6. Achorion Schonleinii (Bennett). This plant was first noticed by Gruby in 1842. He describes it as a species of contagious Mentagra, attacking those parts of the face furnished with hair, especially the chin, upper lip, and cheeks. These parts are at first coated with white or yellowish-grey scales, from 2 to 6 millimetres in the chord, and from 3 to 8 m. in their long diameter. They are slightly raised in the centre, loosely attached to the skin, but adhere firmly to the hairs by which they are perforated. These consist entirely of epidermic scales. But beneath them situated between the sheath and bulb of the hair and completely investing the latter like the finger of a glove, is a layer of matter, which when examined under the microscope, is found to consist of cryptogamic plants and sporules. The sporules are small and round, and give off branches presenting a striated appearance, at angles of from 40° to 80°. These plants originate in the epidermic cells of the hair, and its sheath, to which they are firmly connected. So that the hair cannot be dislodged from its follicle without lacerating the latter. The plants rise from the root of the hair towards the epidermis,

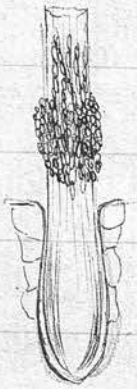


Diagram shewing the part of the hair attacked by the Achorion Audouinii.

But never project beyond it. Vogt thinks this approaches very nearly the vegetation of Favus, but it is distinguished from it by having no distinct capsule, by the sporules being much smaller and round, and by the stems appearing striated.

Gruby, Comptes rendus, 1842. Vogt Pathological Anatomy.

c. Achorion Schoenleinii (Microsporum Gruby).

This vegetation was first discovered by Gruby in 1843. He found in the white matter which covers the skin, on the bald circular spots of Porrigo decalvans (?) cryptogamic plants. These are also found surrounding the hairs as with a sheath, from a distance of two or three millimetres above the bulb.

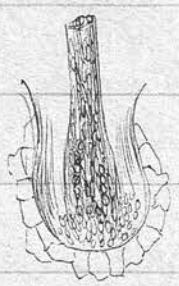
The plants originate in the superficial epidermic scales of the hair, from which they cannot be detached. This cryptogamic covering consists of small interlacing stems, branches, and sporules. The branches (textili.) run in the direction of the hair fibres, are from $\frac{2}{1000}$ to $\frac{3}{1000}$ of a millimetre in diameter, are transparent and contain no molecules. These terminate at the outer surface of the sheath, and are covered with sporules. The sporules are round or oval, transparent, from $\frac{1}{1000}$ to $\frac{5}{1000}$ of a mill. in diameter,

* Lancet, Feb. 10, 1844.

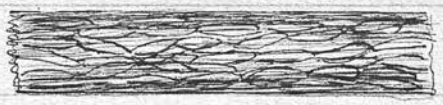
Lyndsay has named this plant in honor of M: Audouin who first discovered the nature of Muscardine, affecting the Bombyx mori.

The disease commences by the hairs becoming opaque about two millimetres from the epidermis, and when examined under the microscope, it appears impose and covered by very minute molecules; subsequently as the vegetation progresses the hair becomes stained and friable, and readily breaks. Like all diseases depending on entophytic growths, this increases with great rapidity. The hairless patches are greyish-white, covered with a mealy powder. The new hairs are attacked as soon as they appear and give way above the vegetation; around their stumps the parasites accumulate in small patches, which have been mistaken for vesicles or pustules, although the epidermis undergoes no inflammatory change.

This affection as pointed out by Horne* is not the true Porrigo decalvens of Willan, because the bare patches in that disease are not covered by any powder or scales, and the hair falls out bringing the bulb with it. Moreover the former disease is contagious, the latter non-contagious. Most probably it is the P. tentulata of Willan. Lyndsay wishes to confer on it the with name Phytosclopekia.



Entophyte of Herpes tonsurans, seated in the roots of the hair.



Fragment of hair magnified 300 diams. & filled with sporules.

5. In 1844, Gruby shewed that the disease of the scalp allied to the last described, and known as the Teigne tondante of Mahon, and Herpes tonsurans of Cazenave, was also caused by an entophyte. M. P. H. Malmsten of Stockholm discovered its nature about the same time.

The cryptogamic plant which causes it differs from the Microsporum Audouini in attacking the roots and interior of the hair, not its epithelial coverings; it appears to me to be very closely allied to the Achorion Gruby.

When examined under the microscope the hair-fragments taken from the diseased surface are found completely filled with spores which are ranged in moniliform rows between their fibres.

The spores are round or oval, transparent, without molecules, and present a diameter of from $\frac{5}{1000}$ to $\frac{8}{1000}$ of a millimetre; about half the size of a blood globule.

"This scab is recognized by the formation of small rough points or rounded spots, more or less extensive, usually on the hairy scalp. These rough points may be compared to those of the substance called chagrin, or the skin of the shark. The hairs which cover these spots are broken at the height of one

* Muhon, Recherches sur la teinte et la Nature des teintes. Paris. 1829.

or two lines above the epidermis, so that from them result real tonsures"*. These patches are of a bluish-white colour, probably depending on the stumps of hair left, and look like the cutis anserina. When rubbed the surface is seen to be covered by a white powder, like flour, among which are fragments of hair and spores. Around these tonsures a number of hairs are observed bent at various angles as if jointed, shewing the progress of the disease.

The spores first attack the root of the hair, are mostly round, seldom branched, but become elongated as they reach its centre into articulating filaments.

Malmsten thinks this plant resembles the Torula olivacea, or the T. abbreviata, of Corda.

This disease seems to have been known to the ancients. Celsus calls it Area, and describes two species, one corresponding with the Alopekia, the other with the Ophiasis of the Greeks.

It is very rare, and it is fortunate that it is so, for in those whom it attacks, mostly strumous children, it spreads rapidly and is very intractable. Minute points are developed on that parts of the scalp, spreading in an eccentric manner,

* "Like the verbum Græcum
Spermagoraiolekitholakanopolides
Words that should only be said on holidays
When one has nothing else to do" –
(But what is a student to do with them who has no holidays?

at length, (in the language of Mahon,) all these circumferences terminate in uniting, in being confounded, and in forming of the whole head a surface entirely bald, and covered by the scurfy points already mentioned." The fungus may also attack the nails.

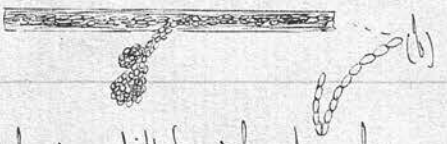
Malmsten found it communicated from mare to child, and from one member to another of the same family several times, and the patients were generally of scrofulous origin. He proposes to designate this disease by the horrific word, "Rhizophytonalopekia"!*

See Muller's Archiv: 1848. Q: Med: Chir: Journal, 1850. also Gruby, Comptes rendus, 1844, t: XVIII. p. 583.

E. Ljinsburg in Muller's Archiv. 1854. p. 34, describes and figures certain fungi which he found in the Phiza pityriasis.

The first change in this disease is inflammatory, the bulb of the hair enlarging and becoming sensitive. Soon the sebaceous follicles are observed to secrete a viscous fluid in much greater quantity than usual.

The entophytes take root between the sheath and bulb of the hair, and soon spread to its centre, which they fill.



(a). Hair in Pleia Polonica, filled with sporules.

b. Enlarged view of an articulating fibre.

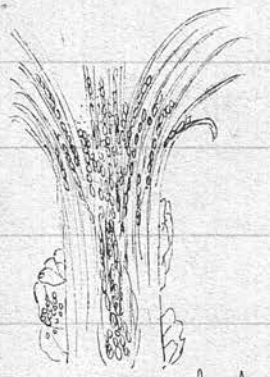


Diagram shewing the manner in which the hair is split up in this Disease, by the Development of Sporules between its fibres.

they are composed of a great number of spores, and a few articulating fibrils, very like those mentioned in the last paragraph, indeed Vogel considers them identical with those of the Tinea tondens. The plant is not affected by either Acetic acid or Liquor Potassæ.

The Parasite appears to cause the following changes;—

1st, Thickening of the roots and sheaths of the hairs; 2nd, the plants growing internally, causes the lower part of the hair to bulge out;— 3rd as the disease advances the spores insinuate themselves between the fibres of the hair, and make them split up, presenting a brush-like appearance, which meeting with the fibrils of the hairs unites them into an entangled mass, composed of the spores, viscid fluid from the follicles, and wavy fibres of the hairs themselves —

Walther Hannover also found certain spores, which they think of a different species, in the viscous fluid secreted by the hair-follicles. These reflect light, and when placed in water exhibited molecular movements; they do not appear to arrange themselves in rows, nor form fibrillæ like the last.

Walther, Archiv für Anat. und physiol: von J. Muller. 1844.

Fig. 1.

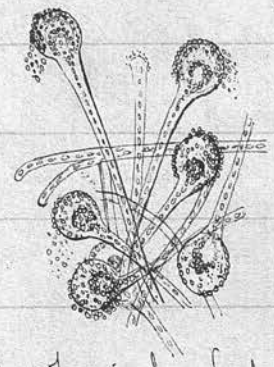


Fig. 2.

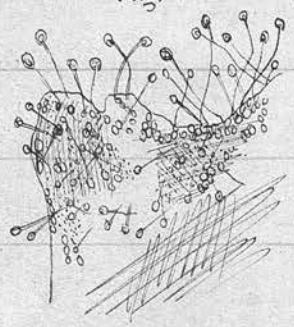


Fig. 1. Fungi found by Mayer in cysts situated on the external auditory process of a girl. Magnified 300 diameters –

Fig. 2. The same under a lower power.

* Many cases of this kind are recorded – See P. S. Horn, De Situ corruptis partibus, corporis humanum viventis – 1739. M. Lebert also records the occurrence of fungi on neglected ulcers – (Physiologie pathologique, Paris (45.)

4. To the class of fungi found on the skin and its appendages, also belongs the case recorded by Prof. Mayer of Bonn, in Müller's Archiv: 1844 - The patient was a young girl, eight years old, and of scrofulous habit. The disease was situated in the external ear, and had been variously treated by several physicians without success. It consisted of a number of small cysts, having an external orifice. To the naked eye they presented a granular, and greenish appearance.

When examined under the microscope the interior of the cysts was found covered with fungi, their stems adhering to their internal surface. These were about $\frac{1}{500}$ of a millimetre in diameter, and terminated in a head of a green color. Its surface was generally covered by a single or double row of spores, which had probably escaped from the sporangium. This observation is interesting, because of the fungi being of a higher order than any yet described, as occurring on man.

5. The fungi found on the surfaces of foul ulcers, gangrenous surfaces &c, are purely accidental, and are so similar to others found on decomposing surfaces, that it is unnecessary to give them particular notice. See, Hemmings, Bericht uber das Königs: Zootom. &c, 1826.*

* This plant wanting a name, I have taken the liberty to associate that of Berg with it.

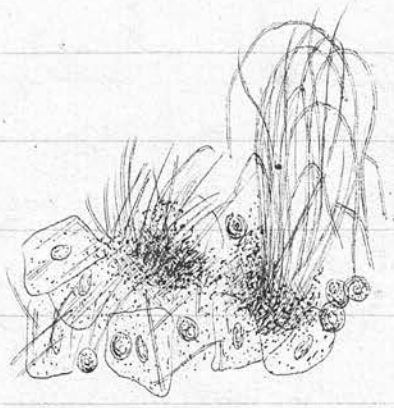
I. Entophytes found on Mucous membranes.

a. Those occurring in the mouth and oesphagus.

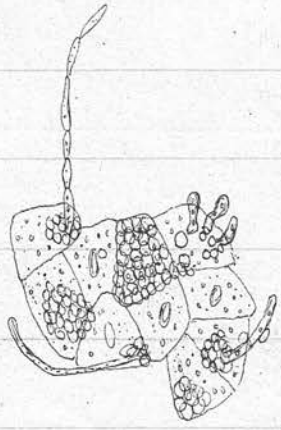
1. Microsporum Berggii. (Achorion). *

Gruby, Vogel, and Berg of Stockholm, discovered about the same period that the aphthae of children were owing to a cryptogamic growth. Dr. Berg gives us the most accurate account of this disease, and I shall follow his description.

"Thrush consists essentially in a deposition of an albuminous molecular matter in the form of points lines &c, on the mucous membrane of the mouth fauces & oesophagus, from which spring a number of spherical or oval cells, with a more or less interwoven web of fibres. These cells are from 1-300 - 1-600''' in diameter, with a well defined edge and transparent except those which possess a nucleus. Many of these large cells presented on their periphery a small budding projection, which frequently elongates into a filament. The cells were either isolated or variously grouped, and the oval ones especially were observed to form into beaded rows, consisting of from 3 to 6 individuals. In the interior of some of these, certain molecular motions were seen by Dr. Höfle. "One can often trace the successive development



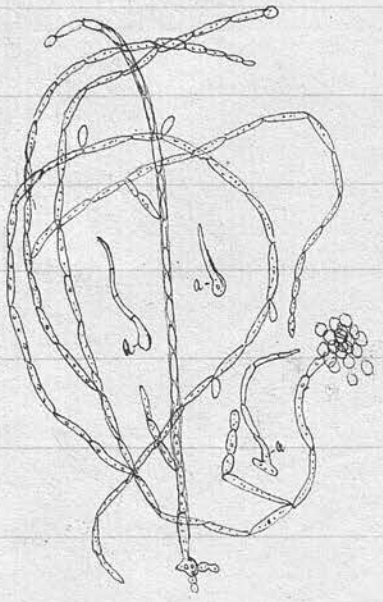
Aphthous crust, filaments rising from molecular stroma
epithelial cells, and a few salivary corpuscles.



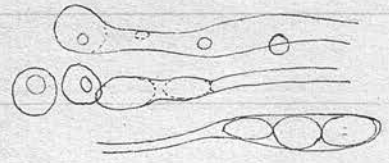
Shewing the mode of development in Microsp. Bergii -

of these cells from a spherical one of the smallest size to an oval cell, and then to a filament". These filaments are of considerable length, especially in favourable situations, and on an average about 1.600th in diameter. These form a confused network and the fibres become more clearly defined when a weak solution of Potash is added, which renders the epithelial cells more clear, and dissolves the albuminous matter, leaving the parasite altogether unaltered. The fibres are either simple cylindrical canals, with or without septa, or exhibites constrictions and partitions, their interior was either transparent, or filled with nuclei more or less numerous, or with minutely granular matter. From the sides of the fibrils and especially their extremities, various sporules spring, which are separated from them by a distinct membrane, and in turn give rise to new ramifications. The sporules take root between the epithelial cells, & are generally except in advanced cases confined to the superficial layer; according to Gruby they originate in the epithelial cells themselves, but he probably mistook the appearance presented by the larger spores while elongating into filaments for these.

The relative proportions of the epithelium, and parasitic growth composing a crust vary according to the age of the disease and



Filaments more highly magnified shewing their jointed character, and the mode in which they give off Sporules. a, Sporules elongating into filaments.



Termination of above tubes more highly magnified.

more or less exposed condition of the aphthous patches. Thus on surfaces exposed to much friction, or on parts where cilia abound we find few or no sporules, hence they do not extend into the salivary ducts, Eustachian tubes, glottis, or in an attached state beyond the cardiac orifice of the stomach while on surfaces much furrowed where several layers of epithelial cells exist as between papillæ and on parts where no cilia are found or in those little subject to friction they abound plentifully. Again we find them much less numerous in children brought up at home and at the breast than in public dispensaries where the mouth is seldom cleansed and they are reared by the hand. The colour of the aphthous patches make these changes evident for whereas in early cases they are of a pearly-white colour, we find them in the latter assuming a yellow or greenish hue which we should expect when cryptogamic growths are abundant. This disease generally attacks debilitated or ill fed children, and it always renders the secretions of the mouth and stomach acid. Dr. Berg found that out of the body the casts produced lactic fermentation in solutions of sugar and albumen, and like changes were produced in solutions of starch, milk &c.

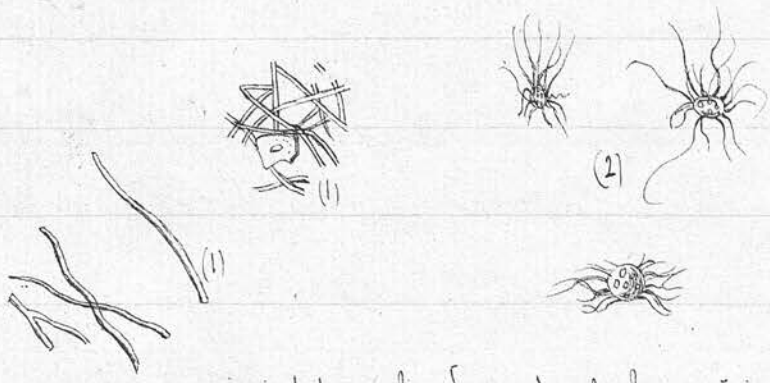
See Berg, Om Torsk hos Barn. Stockholm, 1846. B. & F. Med. Review, 1847. Chemie und Mikroskop am Krankenbette. von Dr. Mark Anel Höfle. 1848. &c.

Vegetations of the kind described last are not uncommon on the teeth and gums of persons subject to indigestion especially those of scrofulous constitution and these perhaps serve to nourish the infusoria which according to Mandl and Chemberg, build up the tartar of the teeth, in the same way that certain certain birds construct of their agglutinated skeletons. What would make this probable is the fact that the tartar is so much more abundant in such persons - M. Robert thinks the tartar is formed by the vegetations.

Langenbeck (1839) and Bennett (1842) have also observed vegetations of a like nature in the black matter which accumulates of the gums and teeth of patients suffering from typhus fever.

Moreover the Microsporum Berzi abounds in the aphthous patches and sores attacking the mouth of patients in the last stages of phthisis, and must greatly aggravate the gastric irritation by rendering the secretions of the mouth and stomach habitually acid. The benefit derived by alkaline drinks in such cases must be evident, as the opposite practice is decidedly injurious.

It appears that also are very commonly developed among the white matter found between the teeth, especially of persons who do not use the brush, they also abound in the hollows



Vegetations found on the Teeth.

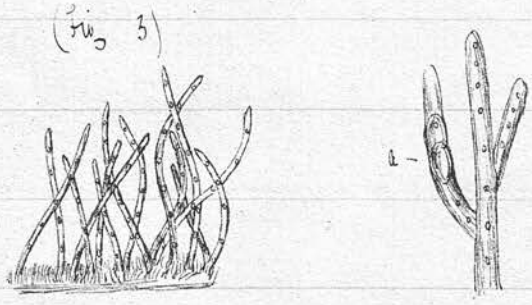
1. Fibres of various length. - 2, Bodies observed by Buchlmann.

§ Microscopical Journal, Vol 2. p. 66.

* Remak (Diagnostische und pathogenische Untersuchungen, Berlin. 1845. P. IX.

† Robin, des Végétaux qui croissent sur l'Homme, &c. 1847. P. 43.

(Fig. 3)



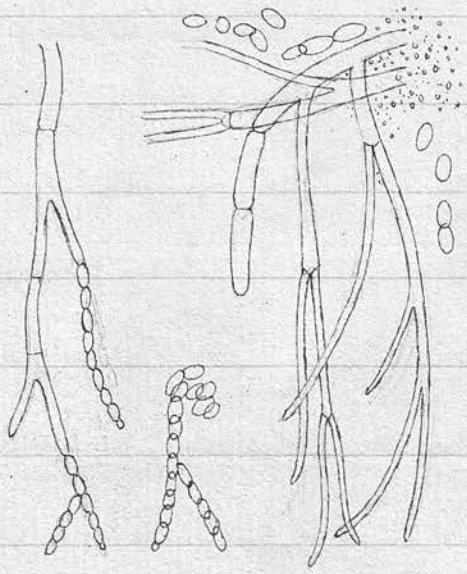
(Fig. 3) Group of the Leptomitus (Rogers), from the Ulcerated mucous membrane of the oesophagus. (4) Filament more highly magnified. a. sporules.

‡ Hannover (Arch. de Müller, 1842).

of various kinds, and are found floating in a detached state among the buccal mucus. They consist mostly of filaments arranged in a wavy manner, of the same diameter throughout and having no partitions. Along with them we discover various animalcules which are much smaller and very active, such as Bacterium termo, Duj; vibrio lineola, Müll: vibrio bacillus, Müll, &c.

Buchelmann[§] also describes beautiful articulating filaments springing from a round or oval granular substance, they are more rare than the other fibres. Remak* & Valentin have observed the same. M.M. Corvisart and Robin† found the fibres above mentioned in immense quantity among the fluids in the stomach of a woman who died of jaundice; and Lebert has discovered them in fecal matter. They appear to be allied to Hygrocrocis. These facts shew that this plant can develope itself in various situations, and is not characteristic of any diseased state.

Hannover‡ mentions certain vegetations occurring in a cursty mass which covered the oesophagus of a man. When examined the part presented spermatozoa, but there were no particular symptoms. He considers they belong to the genus Leptomitus. and has observed the same in typhoid patients.



Vegetable filaments &c, expectorated by a patient with Pneumo-thorax. Penicillium? After Bennett.

*M. Rayer (1842) and Remak (1845) have also confirmed the observations of Prof. Bennett.

6. Entophytes found in the lungs, &c.

Professor Bennett while making microscopic examinations of tubercle and the lining membrane of vomicæ, frequently found fragment of tubes more or less jointed and matted together which he supposed to be of vegetable nature. This supposition was afterwards verified by the case of a man in the last stage of phthisis, and also suffering from pneumo-thorax. On examining the matter expectorated by this man, he found it to consist of long tubes regularly jointed, from $\frac{1}{100}$ to $\frac{2}{100}$ of a mill: in diameter, and variously branching. The edges were well defined and the tubes contained no granules within them. They appeared to arise from an amorphous molecular mass. Interspersed among these tubes were numerous round and oval cells, from $\frac{1}{75}$ to $\frac{1}{100}$ of a m. in diameter, which occasionally appeared to unite forming bead-like rows. They were most plentiful in the viscid matter which adhered to the sides of the spit-box. After death the left lung was found studded with tubercles, and there were various excities, some of which communicated by fistulous openings with the pleura, these were covered by vegetations.

Prof. Bennett thinks they resemble Penicillium glaucum. Op. Cit. *

† Microscopical Journal Vol 2.

* In the disease called fibrous disease, it is very probable that cryptogamic plants will be found.

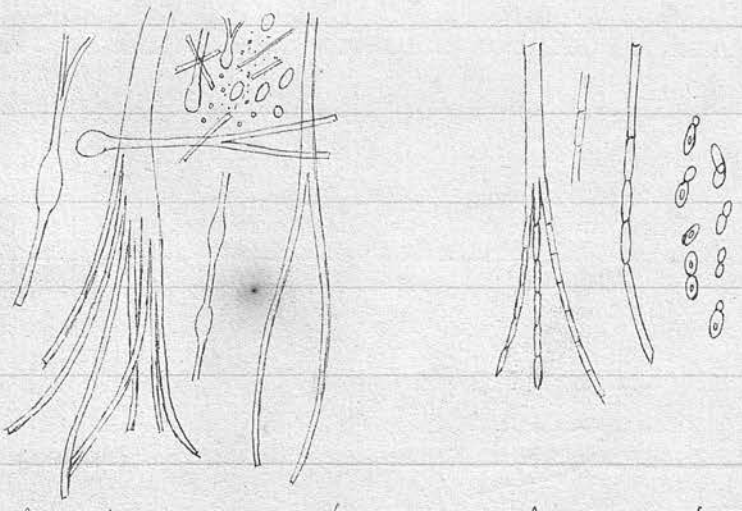
c. Algæ found in the Intestines.

Dr. Arthur Farre[†] describes the case of a middle aged woman who expelled by stool substances having the appearance of shreds of false membrane. Examined under the microscope they were found to consist entirely of an entangled mass of very delicate confervoid filaments. These were of a pale-green colour and exhibited articulations at regular distances, marking their division into cells, as in Oscillatoria and other allied species. The filaments measured $\frac{1}{1000}$ of an inch in diameter, they varied much in length the ends of some were abruptly fractured, others had the appearance of branching dichotomously. This patient had been suffering for some time from slight indisposition, about twelve hours before passing the substances she felt considerable pain and uneasiness in the abdomen. These were the only symptoms. See Microscopic Journal, vol. 2. p. 189. Prof. Bennett has described a similar case in the Monthly Journal of Medical Science. 1848. *

d. Vegetations found in the Vagina.

Mr. Wilkinson in the Lancet (1849), records the case of an old woman, age 77 who discharged from her Vagina purulent matter containing a quantity of delicate filaments like fresh-water algæ.

(Fig. 1) (Fig. 2)



(Fig. 1) Mucus from the Vagina - (2) Same with Acetic acid -

* Synopsis (Edinb. Med. & Surg. Journal, No 157.)

Examined under the microscope it was found to consist of a number of filaments, round and oval cells and granules, and a molecular blastema.

The filaments were of two kinds the one from $\frac{1}{4000}$ to $\frac{1}{8000}$ of an inch in diameter, the other about six times as long. The latter terminated at one end in a truncated manner, and gave off from the other a bunch of from six to seven of the secondary filaments. They were enlarged in certain places probably containing spores.

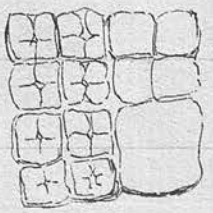
Acetic acid shewed the smaller filaments to consist of elongated cells. The corpuscles were observed of all sizes and in various stages of development from the granule to the filament.

The vagina was healthy, and these corpuscles were developed in the uterus. Wilkinson proposes to name the plant Torula Uteri, but it appears to me to be very much like if not identical with that found by Bennett in the case of pneumo-thorax, and probably both are modified forms of the Penicillium glaucum (Link).

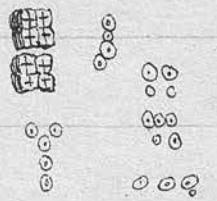
II Entophytes found in the fluids of the Body.

1. Sarcina Ventriculi (Goodsii).

This plant was first discovered by Goodsir* in the fluid ejected from the stomach of a patient nineteen years old and subject to dyspepsia and who every-morning without effort discharged



(Fig. 1).



(Fig. 2).

Fig. 1. The Sarcina Ventriculi. (Goodsir) -

Fig. 2. Cells observed in the fluid along with the Sarcinæ, and from which Busk thinks it is developed, but they seem to me to be more like Torulæ.

a quantity of fluid smelling like fermenting wort. When submitted to the microscope it was found to contain a number of square or oblong bodies, in the perfect form $\frac{1}{800}$ to $\frac{1}{1000}$ of an inch linear along each of their surfaces, and about $\frac{1}{8}$ of this in thickness. They presented exactly the appearance of a wool-pack, hence the name. The edges were well defined, and each individual was divided by cross lines into four secondary squares and each of these in turn was composed of four cells. So that the perfect plant consists of 64 compartments.

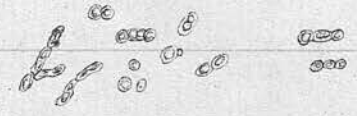
These bodies have since been observed by Busk who considers them not to be vegetable parasites, from their sudden occurrence and disappearance, but this is not stranger than in many other fungi.

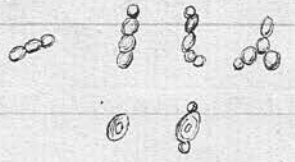
In all cases where they have been found, the fluids of the stomach after standing for some time undergoing a kind of fermentation, and a brownish flocculant matter rose to the top like a yeasty froth. It was found to contain lactic and acetic acids in enormous proportion.

This plant does not appear to produce any particular symptoms except vomiting. Link thinks it is a Sporium, but Goodsir Virchow, Schlossberger and others seem agreed as to its vegetable nature.

Archiv. für Pathol. Anat. und Physiol. p. 264. - Busk in Microscopic Journal, V. 2. p. 321.

* Figures of the Torula will be found at page 62. (Fig. 2 a. b.)





Figures of the Torula cerevisiæ,
after different authors.

2. Torula cerevisiæ. *

This is probably a much more common plant than supposed throughout the intestinal mucous tract.

It consists of round or oval cells, varying in diameter from the $\frac{1}{500}$th to the $\frac{1}{200}$th of a line, and many contain nuclei.

They grow by protrusion of buds, which soon attain the size of their parents, and remain attached to them in rows composed of from three to five individuals. Sometimes we observe a mother cell enlarge, and granules and spherules form within it, it ultimately bursts and liberates them. In more advanced stages they form fibres like many of the vegetations already considered. But the rows of cells are the most frequent and characteristic form.

It only multiplies in fluids susceptible of fermentation.

It has been found in the fluids of the asphagus stomach and intestines. It may be introduced with fermented liquors or arise in a different way, and possesses no particular pathological value. It often occurs also in the urine of diabetic patients, but probably never until it has passed from the bladder, but we occasionally find it independent of diabetes. See Vogel's Pathological Anatomy, Schwann on Fermentation.

Various accidental fungi introduced with the fluids and liquids taken, as well as those developed in the mouth &c, have been found in the fæces, or fluids vomited by patients, but as they possess no pathological value, their enumeration would be as tedious as unprofitable. It might be expected also that in a Paper of this Kind I should not forget the Cholera fungi, which has given rise to so much controversy. But as the various parasites ascribed to it have either proved to be well known species such as the Vibrio's, or more commonly no plants at all, I think it unnecessary to say more on the subject. In conclusion it must be borne in mind that wherever there is a rapid change in the solids or fluids of the body, especially where these undergo fermentation, or where the secretions are altered in some unknown manner as in Cholera, we may expect to find vegetations of a low-order developed among them.

Finis.