Ammonia was obtained either by treating aniline with nitrous acid, or by the action of nitrate of potash on the chloride, or by leading the binoxide of nitrogen into a solution of the nitrate; the latter was the way generally employed. After about twelve hours' action of NO_2 on a solution of the nitrate in a water-bath, the solution was filtered from the nitrophenassic acid, and distilled with potash, the distillate treated with ether to dissolve out the aniline, redistilled in hydrochloric acid, evaporated, and the ammonia determined as platinum salt. These results have led me to try the action of nitrous acid on other organic bases, and I have already obtained from ethylaniline a base which to all appearance is ethylamin. The chloride gives off, when heated with potash, an alkaline inflammable gas, and the platinum salt resembles that of ethylamin; but the platinum determination made with it does not agree very well with that salt. I am now repeating the reaction on a larger scale, so that I shall shortly be able to see whether it is really ethylamin or not.

The foregoing experiments were carried out in the Royal College of Chemistry under the direction of Professor Hofmann.

III. "On the Existence of Amorphous Starch in a new Tuberaceous Fungus." By Frederick Currey, Esq., M.A. Communicated by Joseph Dalton Hooker, M.D., F.R.S. Received December 17, 1857.

Amorphous starch (including under that term all starch not in the form of the ordinary starch-granule) is rare in the vegetable world. Until the present year Schleiden was the only botanist by whom it had been noticed, and his observations have been doubted by Sanio, Caspary, and Schenk. He (Schleiden) states (Grundzüge, i. 181) that he has seen amorphous starch in the form of a thin pasty layer in the cells of the albumen of *Cardamomum minus*, in *Sarsaparilla*, and in the rhizome of *Carex arenaria*. Sanio* has just published the result of some experiments made by him upon the cells of the epidermis of *Gagea lutea*. Upon applying a solution of iodine to these cells, he observed a fine flocculent blue precipitate in their interior. The blue colour was confined to the fluid contents of the

* Bot. Zeitung, 19th June, 1857.

cells, the primordial utricle and the nucleus becoming yellow under the iodine.

Another observer, Dr. Schenk*, has lately noticed the occurrence of starch in a state of solution in the epidermal cells of the stem, leaves, and other parts of *Ornithogalum nutans* and *Ornithogalum lanceolatum*. These cells were found to contain (besides nuclei) a thick homogeneous fluid. Tincture of iodine coloured the fluid first wine-red, then violet, and finally indigo-blue; and the fluid at the same time lost its homogeneous nature, and became finely granular and flocculent.

The above mentioned are all cases of phænogamic plants. The Fungi have hitherto been considered wholly devoid of starch, unless, perhaps, the case mentioned by Schacht† may be an exception. He states that he observed the mycelium of a small mould-fungus become clear blue under the action of iodine. He could not, however, ascertain whether the colour was in the membrane or in the contents, and if the former, it is as likely that the colour (being clear blue) arose from the presence of cellulose in a young condition, as from starch‡.

Mohl, in his treatise on the vegetable cell, speaks of starch as probably existing in all plants *except the Fungi*. A special interest, therefore, attaches to any plant of the latter tribe, in which starch can be shown to exist, and such a plant has lately come under my observation. The fungus in question, which is interesting not only

* Bot. Zeitung, July 17th, 1857. † Die Pflanzenzelle, p. 39.

‡ In the 'Annales des Sciences Naturelles,' 4th Series, vol. iii. p. 148, Nylander mentions a blue colour being produced by iodine in the summits of the asci of certain *Sphæriæ*, which he attributes to the presence of lichenin. Gerhardt, however, in his 'Lehrbuch der Organischen Chemie,' states that a pure solution of lichenin is coloured yellowish by iodine.

It is not easy to understand why the writers who speak of amorphous starch, take no notice of the lichens. Irrespective of the fact that the membrane of the asci of lichens is coloured blue by iodine, it is well known that the asci and paraphyses are often surrounded by a viscid substance which is coloured by iodine in the same manner as starch, and which cannot well be anything else than starch in an amorphous state. Schacht, indeed, calls the viscid substance "aufgequollene Stärke;" but this expression would be more applicable to the condition of starch when subjected to the action of hot water or sulphuric acid, and seems hardly consistent with his previous definition of the substance as a shapeless, paste-like mass. (See Die Pflanzenzelle, pp. 148, 149.)

for its chemical composition, but as constituting a new genus in the family of the Tuberacei, occurred in the spring of the present year, growing gregariously upon fragments of wood on the sands by the sea-shore at Sketty, near Swansea. To the naked eye each individual specimen presents the appearance of a small, round, somewhat flattened body, of a dull yellow colour, and with an unevenness of surface caused by numberless convolutions of the coat of the fungus, which require the aid of a lens in order to be clearly seen. The diameter of the largest specimen does not much exceed the 1-8th of an inch. Externally there is a strong resemblance to small specimens of *Dacrymyces deliquescens*, or perhaps a nearer still to the truffle described by Tulasne, in the "Fungi hypogæi," under the name of *Hydnobolites cerebriformis*. This resemblance, however, is only superficial, as will be seen by the following description of the plant when examined microscopically. The coat of the fungus consists of a convoluted membrane of considerable thickness, formed of several layers of cells, the outer of which are large and rounded, the inner long and flat. In most of the specimens the contents of the coat consist mainly of an innumerable multitude of naked spores; but in almost all, a careful examination will detect, here and there, isolated sacs or asci containing sporidia; and a few of the plants which were in a younger state than the rest exhibited asci in abundance, showing satisfactorily that the fungus must be classed with the Ascomycetes,—not with the Gasteromycetes.

There is no doubt that the asci are absorbed at an early period, and the sporidia then form a dense mass.

It is exceedingly difficult, from the crowded state of the contents, to trace out the manner in which the asci originate; but I have satisfied myself that they spring at intervals from threads proceeding from the inner surface of the thick external membrane. Fig. 4 represents one of these threads with the asci springing from it, magnified 315 diameters. The asci themselves are broadly clavate, with a very short stem, and are frequently, if not usually, drawn out at the apex into a sort of point, as shown in figs. 2, 3 and 4.

The sporidia are extremely curious. They are globular and colourless, and furnished with long delicate sharp rays projecting from the surface in every direction. Each sporidium is furnished with an internal nucleus, or probably oil-drop (sometimes broken up into

several), which varies somewhat in size, and is sometimes in the centre of the globe, sometimes placed eccentrically. Their form will be seen by reference to fig. 5.

The average diameter of the sporidia is about $\frac{1}{2000}$th of an inch. Upon placing a thin section of one of the plants in water under the microscope, and adding a drop of solution of iodine, the sporidia in the course of a few seconds assume a more or less dark purple colour, precisely similar to that produced in starch by the same reagent; and not only are the sporidia themselves thus affected, but the fluid surrounding them is tinged of an intense purple colour for some distance round the mass of sporidia. This latter colouring is doubtless produced by the effect of the iodine upon a viscid matter which surrounds the sporidia, and which may either originate in the disintegration of the asci, or may be an independent secretion. There can be little doubt, I think, that this viscid matter is starch in a state of solution. It might be taken for dextrine, but that it differs from that substance in assuming a purple colour under iodine.

The sporidia, although coloured by iodine in the same manner as starch-granules*, do not exhibit any cross when viewed by polarized light. The small size of the Fungi precludes the possibility of procuring a sufficient quantity of the viscid matter to test its effect upon the plane of polarization.

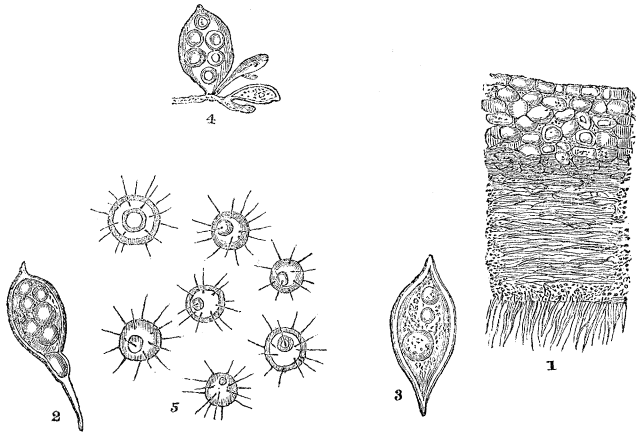
I find the sporidia unaffected by boiling water or even by long soaking in sulphuric acid, in which respect they differ from starch-granules. The purple colour, however (as is the case with starch), disappears under the action of heat or of alcohol.

I have named the plant *Amylocarpus encephaloides*, for reasons sufficiently obvious from the above description. Its systematic position is certainly with the Tuberacei, but it has no near allies. The only plant resembling it in structure is *Endogone*, but it is doubtful whether the vesicles of *Endogone* be spores or asci. If the latter, the affinity with *Endogone* would be close.

In conclusion I may mention, that in a very late number of the 'Annales des Sciences Naturelles' (4 série, vol. vi. p. 318), which has reached me since my first observations on the above fungus, M. Tulasne remarks, that in several species of *Erysiphe* the tips of

* The blue colour does not extend to the nucleus of the sporidia, which is yellow under the iodine.

the radicular appendages are tinged blue by solution of iodine, and that he has observed the same effect produced upon the matter contained in the summits of the asci, and upon the mucous envelope of the sporidia of several species of *Sphæria*. It would seem, therefore, that the absence of starch can no longer be considered as characteristic of the Fungi, and that the existence of that substance in an amorphous state may be considered as satisfactorily proved.



DESCRIPTION OF THE FIGURES.

Fig. 1. Vertical section of the coat of the Fungus, showing the successive layers of cells, the innermost of which give off threads into the interior of the plant, × 315 diameters.

Figs. 2 and 3. Asci with sporidia, × 415. In fig. 3 the sporidia are only partially matured.

Fig. 4. The extremity of a thread showing the mode of origin of the asci, × 315.

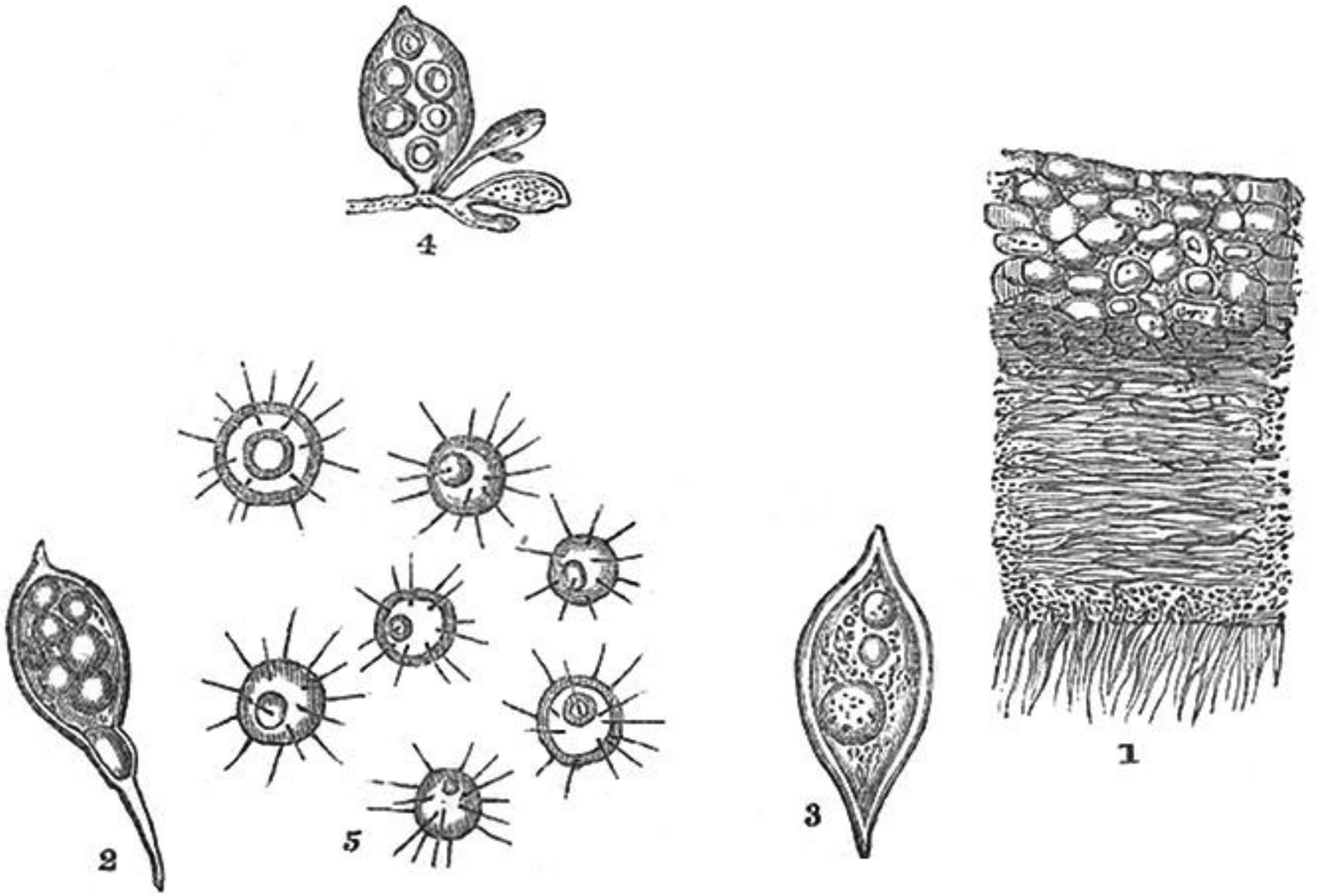
Fig. 5. Free sporidia, × 415.

IV. "On the Singular Solutions of Differential Equations." By the Rev. Robert Carmichael, Fellow of Trinity College, Dublin. Communicated by Arthur Cayley, Esq. Received December 28, 1857.

(Abstract.)

The objects contemplated in this paper are the following:—

1. The reduction to a symmetrical form of the well-known theorem by Clairaut for the integration of differential equations in a



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