ORIGINAL COMMUNICATIONS.

NOTES ON THE VINEGAR-PLANT.

By SPENCER THOMSON, M.D.

WITHIN the last two or three years, there have appeared from time to time, in various journals, medical and general, notices of what is called the "vinegar-plant", a peculiar fungoid development, now extensively used in many parts of the country for the domestic manufacture of vinegar. Seeing this mode of making vinegar in frequent operation in a cottage I had occasion to visit professionally, I was induced to make a few experiments and observations, with a view to ascertain the nature of the vegetable growth, and, if possible, its mode of action; the interest being the greater, as apparently from the queries respecting it, the vinegar-plant is an unknown object of curiosity to some of our scientific men.

The plant itself, when well developed, resembles nothing so much as a thick unbrowned pancake; its consistence is very tough and leathery, and its form and diameter are dependent on those of the vessel in which it grows. When young, the growth is thin and gelatinous looking.

The ordinary mode of making vinegar by means of the vinegar-plant is very simple. It is thus described:* "Put the plant—a young one—in an earthen jar, add to it half a pound of the coarsest moist sugar, and half a pound of treacle, with five pints of milk-warm water; cover it lightly over, so as to keep out the dust, but not the air; and then put it in a moderately warm situation; there let it remain seven weeks, not disturbing it more than you can help. At the end of that time, pour off what is now the clear vinegar, and keep it in well corked bottles for use. Again, add to the plant the same quantity of water, sugar, and treacle, as before. At the end of the second seven weeks, the plant will have become like two thick pancakes, and the two parts may be easily divided, care being taken not to tear either the old or the new plant. If the plant is exposed to the cold, or kept too long out of the liquid, it will die."

By the domestic makers of vinegar by means of the plant, it is insisted upon as a necessity that a plant should be present in the saccharine solution: this, of course, is an error; but, on the other hand, it is equally erroneous to assert that the plant is simply an adventitious growth, which is developed during the formation of the vinegar, but which has nothing to do with the process. In my first experiment, I placed in a dark situation, of 75° average temperature, three glass vessels of saccharine solution, made with treacle and sugar, in the proportions above named. To one vessel I added a young vinegar-plant, which immediately sank to the bottom; to another, a small quantity of yeast; the third was left without any addition. In the course of two or three days, as might be expected, in the solution containing yeast, active alcoholic fermentation was going on; in a few days more, this had subsided, giving place to acetification, which, by the sixteenth day, was complete, the solution being converted into strong vinegar. At the end of a week, the solution containing the vinegar-plant smelled like sour milk; the plant added to it still remained at the bottom of the vessel, but a new plant had formed on the surface of the liquid. In the simple solution, no apparent change was to be detected. At the end of three weeks, the report is: "Solution with yeast converted into strong vinegar, and bearing on its surface a gelatinous looking growth, resembling the vinegar-plant, but more brittle, and less leathery. Solution containing vinegar-plant acid, but not strongly so, bearing a fresh well formed plant on its surface. Simple solution scarcely acid, also bearing a gelatinous plant."

This report was on April 22nd; the same day, five glass vessels of the sugar and treacle solution were taken. Into No. 1 was put the fresh vinegar-plant, formed from the plant used in the first experiment; into No. 2 was put the plant formed on the surface of the acetified yeast solution; into No. 3 was put the plant formed on the surface of the simple solution, all these being obtained from the first experiment; into No. 4 was put a small portion of yeast; No. 5 was left a simple solution. To the above were added two vessels containing each a solution of pure white sugar, in the proportion of two ounces to the pint; one was left simple; to the other a vinegar-plant was added. The seven vessels were placed in a dark situation, of average temperature, from 55° to 65° F. At the end of three months, all the solutions of coarse sugar and treacle were very acid, but that to which the yeast had been added was most strongly so: all five bore on their surfaces well formed plants, and in the first three, to which plants—from yeast, vinegar-plant, and simple solution of first experiment—had been added, the old plants lay unchanged at the bottom of the vessel. The simple solution of white sugar was apparently unchanged; that to which the vinegar-plant had been added was very distinctly acid, but weak compared with the brown solutions; and on its surface it bore a very fine transparent plant, loose in structure, and very different from the compact leathery mass growing in the coarse solutions. When lifted out of the solution, this plant resembled nothing so much as the vitreous humour of the eye, both in appearance and texture. In this solution, as in the others, the old plant, which had been added in the first instance, lay at the bottom of the fluid unaltered.

The question arises, What is the vinegar-plant? If a portion of it be placed under a high magnifying power, 600 diameters, it will be found to consist of spores and minute cells, in various stages of development, lying among interlacing and branched filaments; in short, the spores, cells, and filaments are precisely similar to those seen in the vegetative and mycelium stages of a common mucar, or of the penicilium glaucum, only they are more minute. The vinegar-plant, therefore, is simply an expanded thallus, formed by an aggregation of spores and cells entangled in the filaments developed by the budding forth of the latter; the whole apparently being connected by mucilaginous matter. The form and structure—if it can be so called—of the thallus is apparently determined by the nature of the medium in which it is developed.

Of course there could be no doubt beforehand of the conversion of the coarse saccharine solutions into vinegar, without the addition of yeast, of vinegar-plant, or of any other ferment; their own azotized components in their unpurified condition being sufficient for the purpose, especially under the higher temperature of the first experiment; but the question arises, how far the presence and growth of the vinegar thallus influence or assist the elementary changes by which the saccharine is converted into the acid. As mentioned at the commencement of this paper, it has been asserted that the presence and growth of the vinegar-plant is simply adventitious, and that it exerts no influence in the acetifying process. The error of this supposition is proved by the experiment with the solutions of refined sugar; for, whereas the simple solution remained unchanged at the end of three months, that to which the vinegar thallus had been added was distinctly acetified, this being in my opinion sufficient to prove that the fungoid development or thallus known as the vinegar-plant, is the distinct acetic ferment, capable of determining the acetic fermentation in saccharine solutions, by a power in strict analogy with that by which the torula cerevisiæ or yeast ferment excites the alcoholic fermentation. Like the torula cerevisiæ, the vinegar-plant appears to be capable of development, *de novo*, in saccharine fluids containing azotized matter, provided external circumstances are favourable. It would also appear, that although, like the yeast-plant, its presence may not be absolutely necessary for the excitement and perfecting of its peculiar fermentation it does exert a certain amount of catalytic action upon the components of the saccharine solution, thereby determining and aiding their conversion into acetic acid. I am inclined to think,

* Lancet, 1853, vol. ii, p. 203.

moreover, that the presence of the vinegar-plant will give rise to the formation of acetic acid in a saccharine solution, at a lower temperature than that at which the change could take place, were the acetic ferment absent.

There is, however, one remarkable difference between the mode of action of the alcoholic and acetic ferments. As the process of alcoholic fermentation consists of interchange of elements within, and of escape of carbonic acid from the fluid undergoing the change, the yeast torula seems to be in active vegetation as truly throughout the whole fluid, even at the bottom; its greater collection at the surface being simply due to its being carried upwards by the escaping gas. The vinegar-plant, thallus, or ferment, on the other hand, is active only on the surface of the fluid. Old plants once submerged—at least in the saccharine solutions used in the making of vinegar which had a sp. gr. 1·040—do not rise again, but continue without change or increase at the bottom of the fluid, whilst a new plant forms on the surface. How far that surface growth of the plant may be connected with the absorption of the oxygen necessary for the acetifying process, it is, at present at least, impossible to say.

It may be asked, how comes the vinegar thallus in a solution to which no spore or spawn from another plant had been added? It is, I believe, a fungoid development, the form of which is determined by the nature of the medium in which it vegetates; but when it is developed, I believe it is capable of assisting in, and predisposing to those elementary changes and interchanges which take place in the acetous fermentation, and perhaps of aiding the absorption of oxygen necessary for the process. With such a view, the originating spores may have been those of the sugar fungus, or of some of the common moulds. Indeed, if vinegar with a growing vinegar-plant on its surface be exposed to the atmosphere for a considerable length of time, the vinegar thallus passes into a crop of mould. Dr. Carpenter* observes, "of all the protophytes it may be remarked, that the conditions under which they are developed, produce a considerable modification in their mode of growth, and may even effect such a change as to obscure their characteristic 'nisus'". The history of the vinegar-plant appears to corroborate this idea. Throughout this paper, the vinegar thallus has been spoken of as a fungus; and if it be characteristic of the fungi that they are most readily and perfectly developed in situations where azotized matter in a state of decay or change furnishes them with a free supply of carbonic acid and ammonia, then must the vinegar plant belong to them, for we have seen that in the solution of refined sugar from which azotized ammonia-yielding elements had been removed by purification, little, if any, development took place, and the acetification was weak. This latter fact, moreover, proves that the catalytic action is dependent upon the growth of the thallus; for were it not so, were it simply occasioned by the presence of a thallus, there is no reason why the acetification of the pure sugar solution should not have advanced equally with that in the unpurified solutions, each having a similar old plant introduced into them. Again, the vinegar thallus developed on the surface of the saccharine fluid must, necessarily, have continued fresh supplies of whatever element is most essential to its development from the free communication between the particles of the fluid, and as long as the fluid can furnish the element or elements, it continues to flourish; if, however, as stated above, the growth of the thallus be permitted to continue upon a portion of vinegar exposed to the atmosphere for a considerable time, probably from exhaustion of the element required, the vinegar plant degenerates into simple mucar. Similarly, mucar or mould forms on the surface of a solid mass of cheese or of sugar preserve. There can be no interchange of particles as in the fluid, consequently the outer layers of the supporting medium can only furnish the food for growth. Is it that the vinegar thallus requires a more ample supply of some particular element of saccharine and at the same time azote-yielding fluids or substances, for its development than is requisite to support the growth of the moulds?

The observations in the foregoing paper I offer rather as suggestive than otherwise. The subject is one which does not appear to have undergone any special investigation, and my chief object is to direct to it the attention of those who have more leisure than myself to devote to such inquiries.

Haunton, Burton-on-Trent, August 25th, 1853.

* Principles of Physiology, p. 197.

CLINICAL ILLUSTRATIONS OF SOME DISEASES OF THE ŒSOPHAGUS.

By C. E. REEVES, B.A., M.D.

[*Continued from page* 704.]

SPASMODIC STRICTURE.

STRICTURE FROM AFFECTION OF THE STOMACH. CASE I. Mr. Abernethy relates the following case.* A lady had for many years suffered from what her medical attendant supposed to be organic stricture of the œsophagus. She was now reduced to such a state, that food could be taken only in very small quantities at a time, large quantities of liquid being necessary to enable it to descend into the stomach. He was requested to pass a bougie, but he declined to do so, as the disordered stomach, furred tongue, and tender epigastrium, led him to suppose that it was only sympathetic. Attention to the stomach and bowels soon gave relief to the difficulty in swallowing, and she ultimately got quite well.

CASE II. A young man,† of florid complexion and full habit of body, after walking a considerable distance on a very hot day, was suddenly taken with severe pain at the orifice of the stomach, with great difficulty in breathing, and inability to swallow. He was cured by copious extraction of blood. In the following winter, a slight return, which yielded to purgatives. In the following spring, he was suddenly awakened early one morning with the pain and other symptoms. Bleeding gave him great relief, but only for a short time. He was again bled, by which he was permanently relieved.

CASE III. A female, aged 69,‡ had suffered frequently from pains in the throat, descending at times down to the stomach, with great difficulty in swallowing. A bougie met with some slight obstruction at the lower part of the pharynx, but gave great relief to the obstruction. Five days afterwards, a pain seized her at the epigastrium, and obstruction for the first time manifested itself at the entrance into the stomach. She sank soon after. The stomach was thickened throughout, except for one or two inches near the pylorus, and would not contain more than six ounces of fluid.

CASE IV. A man, aged 45, was, says Monro,§ under the care of my father, Dr. Keith, Mr. Wardrop, and Mr. G. Bell; he had been suffering from dyspepsia and pain in the stomach for two years, and for the last three months from occasional attacks of spasmodic stricture. In October 1810, the stricture became more troublesome, particularly at breakfast. On October 17, a bougie was passed, an obstruction being felt quite distinctly; but it was not relieved until the 9th of November. A cold reproduced the dysphagia, which yielded in the course of a few days to the introduction of the probang. He sank the following May, with all the symptoms of malignant disease of the stomach. The œsophagus was found quite healthy, the stomach distended with dark coloured fluid, and adhering to the liver, a fungous ulcer existing at this point.

STRICTURE FROM AFFECTIONS OF THE LIVER. Portal (*Maladies du Foie*) mentions a case of hepatitis, attended by another physician and himself, where stricture of the œsophagus existed.

Frank met with it in a case of inflammation of the superior surface of the liver. He also mentions a case which

* Abernethy's Surgical Works, vol. i.
† Dr. Innes, Medical Communications.
‡ Howship, Practical Observation on Indigestion.
§ Monro, Morbid Anatomy of the Stomach and Gullet.