

the action of steam, and letting it cool again. In that way the cells by which fermentation is induced are destroyed. The special agent in the production of alcohol, the genus *saccharomyces*, has no advantage over vegetable or animal cells in that respect except in causing the fermentation in a more marked degree. If the grape itself were cut from the vine and put into a sealed jar, and the greatest possible care taken to prevent injury to the skin, so that no extraneous ferment might make its way into the juice, still alcohol in considerable quantities would be formed by the action of the fruit cells themselves. This has been abundantly proved by Schutzenburger, the greatest modern authority on fermentation. He took a large number of fruits—pears, apples, apricots, peaches—and isolated them from the parent stem, taking all the necessary precautions to prevent fermentation, and he found that alcohol was produced by the cells of the fruits themselves in as large quantities as from one-half to one per cent. In the case of some three or four large Jersey pears, I think he was able to get as much as half an ounce of alcohol. So that alcohol is simply a half-way stage, so to speak, between the conversion of starch into sugar on the one hand, and the conversion of sugar into carbon dioxide and water on the other, the final stage of fermentation.

12455a. It has been said that athletes preparing for contests of any kind, abstain from the use of alcohol. Have you any knowledge as to that?—That has not been the practice in general. If we take the dietary of the Oxford and Cambridge crews, probably the most scientific dietary in the world, we find that a pint of beer is included in it. The only notorious case of any great feat having been accomplished on water was one of Weston's feats of walking; I think it was one hundred miles in a hundred hours. But he surpassed himself in a subsequent effort, in which he used I think, four or five ounces of champagne during the day; and his feat has been surpassed by another Englishman, who accomplished a much greater distance on beer. There is no absolute rule to guide athletes. The only rule to which we can refer is that of the dietaries of the Oxford and Cambridge crews.

12456a. Given a drink, say beer, containing we will say six per cent of alcohol, and another drink containing three per cent, can you tell us whether it would require double the quantity of the latter to have the same effect as the former?—No, it is very hard to say that, because the effect varies with different constitutions, and alcohol exerts different effects in different liquids. You cannot say that ten or twelve per cent of alcohol in wine exerts the same or anything like the same effect as four or five per cent in beer. In fact, I may say that some years ago, even when I was a student, I came to the conclusion that alcohol as alcohol does not exist in fermented liquors, it is so combined chemically with the different ethers and salts and other constituents of these liquors. This is now being taken up by some of the leading chemical thinkers of the present day on what is called the theory of solution. For instance, when we put salt in water, a chemist of the present day would hesitate to say that it existed as salt in water, as there is to a greater or less extent a chemical combination of the elements of water with the salt, and a partial decomposition takes place. In the same way I claim that in fermented liquors alcohol as such does not exist, and therefore the physiological effects of different drinks vary exceedingly, and the amount of alcohol that may be extracted as such is no guide to the physiological action of any unfermented liquor.

12457a. Have you studied the question of heredity in connection with the alcohol habit?—I have to some extent, as far as a young man of my age could, and also of course, in all the works I could obtain on the subject.

12458a. What has been the result of your investigation or study?—I think heredity plays a very small part in the question of drunkenness. Children who inherit weak natures from parents who have never touched alcohol are very much more likely to take to liquor than strong healthy children of parents who in the matter of liquor have not been so abstemious.

12459a. Have you studied the question at all in connection with the statistics of insanity? If so, with what result?—So far as the statistics of insanity are concerned, I think they are simply silent. Until comparatively recent years it was almost impossible to get even ordinary statistics on the subject. Tuke, a great authority, in his work on "Liquor and Insanity," points out that there is little or nothing in the theory of heredity, and as I said before, that the men who have inherited weak natures are as likely

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