fluids, however, the influence of oxygen seems decidedly more potent as a co-initiator of fermentation than that diminution of pressure which is brought about by hermetically sealing the vessel before the fluid within has ceased to boil. Urine will be found to be an example of this latter class of fluids.

The physical influence which has been employed in unusual intensity in the present researches is heat.

Previous experiments have never designedly had recourse to a generating or developing temperature above 100 deg. F. (38 deg. C.) The heat employed has frequently been below 77 deg. F. (25 deg. C.), though a temperature between this and 95 deg. F. (35 deg. C.), has been regarded both by chemists and biologists as most favourable to the occurrence and progress of fermentative changes generally.

Early in the month of August 1875, the author ascertained the fact that some boiled fluids which remained barren when kept at a temperature of 77 deg. to 86 deg. F. (25 deg. to 30 deg. C.) would rapidly become turbid and swarm with organisms if maintained at a temperature of 115 F. 46 C.). More recently he has discovered the surprising fact that a generating temperature as high as 122 deg. F. (50 deg. C.) may be had recourse to with advantage in dealing with some fermentable solutions. Fluids which would otherwise have remained barren and free from all signs of fermentation, have, under the influence of this high temperature, rapidly become turbid and corrupt. This discovery is regarded as of great importance in reference to the questions now under discussion, and it is one which was quite unexpected. The author had previously shared in the generally received opinion that temperatures above 100 deg. F. (38 deg. C.) were likely to impede rather than promote fermentation.

In maintaining the experimental fluids at the high temperature above-named, the vessels containing them were placed in the hot-air chamber of an incubator such as physiologists employ, to which one of the very ingenious gas regulators of Mr. F. J. Page had been fitted (see *Journal of the Chemical Society*, January 1876). In this way the fluids may be kept at a known and practically constant temperature for an indefinite time.

Liquor Potassæ as a Promoter of Fermentation in Boiled Urine.—In the autumn of 1875, the author instituted some experiments to ascertain whether the fermentability of boiled urine, like that of many other fluids, could be increased by previously mixing with it a quantity of liquor potassæ sufficient for its neutralisation.

The experiments answered this question in the affirmative. It was found that urine to which the above-named amount of liquor potassæ had been added, would constantly ferment and swarm with organisms within a few days after it had been boiled; though some of the same stock of urine in the acid state (that is, without the addition of any alkali) would, when similarly treated in other respects, remain barren. The fact of the production of an increased fermentability in boiled urine by previous neutralisation was thus established.

Further experiments were then instituted to throw light upon the cause of such increased fermentability. It was desirable to ascertain whether (1) it was due to survival of germs in the boiled neutralised fluid or (2) to the chemical influence of potash in initiating or helping to initiate the molecular changes leading to fermentation in a fluid devoid of germs and other living matter.

The mode of testing the relative validity of these rival interpretations seemed easy. It was only necessary to ascertain what the effect would be of adding boiled liquor potassæ, in proper quantity, after the acid urine had been rendered barren by boiling it, instead of adding it previous to the process of ebullition. If fermentation occurred in the fluid thus neutralised, without extraneous contamination, the first interpretation would obviously be negatived.

This crucial experiment was at first tried with flasks plugged with cotton wool, the plug in each of them being penetrated by a closed glass tube containing the measured amount of liquid potassæ. The tubes having been drawn out to a capillary portion at the lower end, and bent at an obtuse angle, they could be easily broken by slight downward pressure against the bottom of the flask whenever it was desired to mix the liquor potassæ with the boiled urine. This apparatus was very similar to that first made use of by Dr. William Roberts in some experiments with hay-infusion (*Phil. Trans.*, vol. cxiv, p. 474), in which he obtained opposite results from those now about to be recorded with urine. The latter fluid is, however, for several reasons, more suitable than hay-infusion for trying such experiments.

Several trials made with urine in this apparatus showed that its fermentability was just as much increased by adding boiled liquor potassæ after the urine had been boiled in the acid state, as by adding the alkali previous to the process of ebullition. Such a result was therefore quite opposed to the first interpretation as to the cause of the increased fermentability of neutralised urine.

The definite overthrow or establishment of this interpretation was so important that it seemed desirable to try such experiments again by some more rigid and certain method. The author, therefore, devised a new mode of experimentation in which sealed retorts replaced the flasks plugged with cotton-wool, and in which the contents of the enclosed liquor potassæ tubes could be more effectually heated.

It was first of all ascertained that accurately neutralised urine boiled in a retort and sealed whilst boiling, would ferment in a day or two if kept at a temperature of 122 deg. F.*

This fact having been established, other retorts were charged with a measured amount of urine, and also with a small glass tube containing liquor potassæ in quantity almost sufficient to neutralise the urine employed.† The glass tubes containing the liquor potassæ had been drawn out at one end, sealed, and then immersed in boiling water for different periods, before introducing them into the retorts. After each retort had been charged with urine and a liquor potassæ tube, its neck was drawn out to a capillary point, the urine was boiled, and the retort was hermetically sealed before ebullition had ceased. Thus closed, the vessel was at once immersed with its neck downwards in a can of boiling water for from four to fifteen minutes, so as to expose it and its contents for an additional period to a temperature of 212 deg. F. (100 deg. C.)

The urine was thus boiled in its unaltered acid state and sterilised. After the retorts had cooled the liquor potassæ was liberated from its tube in all but one of the batch, which was kept as a control experiment. The liberation was easily effected. It was only necessary to give the retort a sudden shake so as to drive the capillary neck of the enclosed tube against its side. The tube was thus broken, and immediately (owing to the comparative vacuum within the retort) the liquor potassæ was sucked out and mixed with the fluid which it was destined to neutralise.

The result of these experiments was similar to those executed with the plugged flasks and liquor potassæ tubes. The boiled caustic potash added afterwards within the sealed retorts, caused the previously barren fluids to ferment and swarm with *Bacteria*. The fluid in the control experiment remained pure, though after several days, or longer, it also could be made to ferment by breaking the liquor potassæ tube, and replacing the retort in the warm chamber.

[To be continued.]

NOTE UPON PROFESSOR EICHHORST'S NEW PATHOGNOMONIC SYMPTOM OF PROGRESSIVE PERNICIOUS ANÆMIA.

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IN the number of the *Centralblatt für die Medicinischen Wissenschaften* for December 24th, Professor Eichhorst of Jena announces that he has discovered a pathognomonic characteristic of progressive pernicious anæmia, by which the disease may be recognised and distinguished from all others, both in the early and the advanced stages. He says, "While some of the red blood-corpuscles are of natural size, and are marked only by their pale colour and imperfect tendency to form *rouleaux*, others are to be seen which at once attract attention by their small size. They are often not a fourth of the size of a fully-formed corpuscle. They are, however, more deeply coloured, and, when they roll under the covering glass, it is seen that their biconcave outline is more or less lost. Their diminutive size is such, that many of them look like small red-tinged fat-globules."

These changes he considers as characteristic of the disease in question, as the increase of white-corpuscles is of leucocythæmia. Should his observation prove correct, it is manifestly one of great importance. I am anxious to direct attention to it; and, at the same time, to record the fact that, after careful examination of the blood in two well marked and ultimately fatal cases which occurred in my practice, I did not detect the presence of these bodies. Indeed, in one of the cases, the red-corpuscles were larger than natural, the increase of size being such as to attract the attention of at least one other observer besides myself, who studied the condition of the blood.

* Though the boiled urine will ferment in retorts from which the air has been expelled by boiling, it will undergo this change more quickly if it be in the presence of purified or sterilised air. In the experiments now about to be described, however, it was much more convenient to use airless retorts.

† As a slight excess in the amount of liquor potassæ has been proved to have a most restrictive influence when dealing with urine, it was found safer in these experiments not to provide liquor potassæ sufficient for full neutralisation. Many details on this subject are given in the memoir itself.