Formed materials injected into the abdomen at times resulted in the production of cysts or abscesses sometimes located in the scrotum. When these latter were sufficiently large to cause displacement of the testis into the abdomen, the testis was found to be degenerate. Such degeneration, however, was not due to serological influences of the injected materials, but solely to the mechanical displacement of the organ; removed from the scrotal regulatory influences degeneration of the testis follows rapidly. In the abdomen degeneration is brought about through the exposure to higher than normal temperature for the testis and this degeneration should be carefully distinguished from supposed serological influences.

3007

Observations on the growth of yeasts in pure nutrient solutions.

F. W. TANNER and LOUISE MILLHOUSE.

[*From the Department of Bacteriology, University of Illinois, Urbana, Ill.*]

The multiplication of yeasts in pure nutrient solutions has already received much study; as a result there are many discrepancies in conclusions which have been reached. This brief report deals with two phases of the question: 1, the effect of concentration of an accessory containing substance, and 2, the effect of aeration on the multiplication of yeasts in pure nutrient solutions.

In both of these studies, Fulmer and Nelson's Medium E[1] was used. To study the first part of the problem Fred, Peterson and Davenport's yeast water medium[2] was added to medium E in different dilutions, as follows: 1, 100 cc. medium E + 10 cc. sterile water; 2, 100 cc. medium E + 10 cc. yeast water medium; 3, 100 cc. medium E + 10 cc. of a 1-10,000 dilution of yeast medium, and 5, 100 cc. of a medium E + 10 cc. of a

[1] Fulmer, E. I., and Nelson, V. E., *J. Inf. Disc.*, 1923, xxxiii, 130.

[2] Fred, E. B., Anderson, W. H., and Davenport, A., *J. Biol. Chem.*, 1920, xlii, 175-189.

1-1,000,000 dilution of yeast medium. These cultures after sterilization and inoculation were incubated under the same conditions. *Saccharomyces anomolous, Torula colliculosae, Willia saturnus, Zygosaccharomyces mandschuricus* and *Pichia farinosus* were used.

The results showed that when the yeast water medium was present in greatest amounts there was an acceleration in multiplication, but when it was added only in minute traces, there was little difference between these flasks and the control. There was no alteration in multiplication accelerating effect by heating the yeast medium for 60 hours at 15 lbs. pressure (121.5° C). It is believed that the acceleration in multiplication observed when large amounts of yeast water were added was due to chemically definite food substances and that one need not place the explanation on the presence of "bios." This position seems reasonable because dilution of the accessory containing substance lessened its effect on multiplication and also by the fact that prolonged heating did not alter the value of the yeast water medium.

The second part of the work was to determine whether aeration had any effect on multiplication of yeasts in pure nutrient solutions. Aeration was found to have a decided effect, the multiplication rate being many times greater in the aerated than that in the unaerated medium. For example, *Pichia farinosus* showed a maximum growth of 126 million cells per cc. in the aerated medium and only 17 million cells in the unaerated medium. These results are in agreement with the conclusions of Slator,[3] who worked with beer wort. The different yeasts showed different maximums. For example, *Saccharomyces anomolous* attained a maximum of 149 million cells per cc. in the aerated medium and 34 million cells in the unaerated culture, while *Torula colliculosae* attained but 50 million cells in the aerated and 4.5 million cells per cc. in the unaerated culture. These differences are no doubt due to different nutritional requirements. Medium E seemed to be a better medium for *Saccharomyces anomolous* than for *Torula colliculosae*. It was also noticed that with all of the yeasts but one there was a period of 4 or 5 days during which the yeast did not multiply rapidly. This bears out Slator's findings for yeast in wort. The reason for the beneficial effects of aeration are problematical. It is believed that removal of CO_2

[3] Slator, A., *J. Chem. Soc.*, Pt. 1, 1921, cxix, 115-131.

is the most tenable explanation, although there may also have been beneficial effects from the agitation which the yeasts were subjected to by aeration. These data indicate that the incubation of cultures of yeasts under certain conditions and in vessels of certain shapes, which allow different amounts of oxygen to enter, may greatly influence the crop.

3008

Effect of sodium benzoate upon certain yeasts.

FRED W. TANNER and LUELLA B. STRAUCH.

[*From the Department of Bacteriology, University of Illinois, Urbana, Ill.*]

The data collected under the conditions of these experiments indicate a marked difference in resistance of pure yeasts to sodium benzoate. On dextrose agar and in dextrose broth even in the presence of 0.40 per cent of sodium benzoate, growth was appreciable. *Torula communis* did not grow after the concentration of the benzoate in the broth had reached 0.15 per cent. One strain of *Sacch. ellipsoideus* was also inhibited at this concentration. Another strain showed a greater resistance; it grew in the presence of even 1 per cent but the growth was slower and less abundant. The fungi used seemed to be able to tolerate the sodium benzoate better when growing on a solid medium containing it than when growing in a liquid medium. This is probably explained by the fact that on the solid medium the organisms may use up the disinfectant during the early stages of growth so that the cells which develop later in the history of the culture do not have to endure such a high concentration as in the beginning. In liquid media such as dextrose broth, the sodium benzoate is in solution and therefore may come into closer contact with the cells. Two of the strains of budding fungi, *Mycoderma vini* and a pure culture from vinegar (No. 18) were able to grow apparently as well in the presence of one per cent of sodium benzoate as in the controls.

In sterilized apple juice the results were more striking. The