except possibly in a very slight degreee. They also indicate diminution of muscle tonus; however, in the absence of tonus curves based on measurements carried out before the operation, the exact diminution of tonus referable to sympathectomy, in these cases, cannot be ascertained.

The possible rôle of increased circulation through the limb, following sympathectomy, in the diminution of muscle tonus, will be considered in another paper. The data available at present do not warrant the conclusion that circulatory changes referable to sympathectomy play more than a minor rôle in the measurable changes in muscle tonus following this operation.

The results of the tonus measurements on the quadriceps femoris in man here reported in general corroborate the results of our studies[2] involving tonus measurements on extensor muscles of the extremities, before and after sympathectomy, in experimental animals.

[1] Spiegel, E. A., *Z. ges. neurol. u. Psych.*, 1923, lxxxi, 246.

[2] Kuntz, A., and Kerper, A. H., *Am. J. Physiol.*, 1925, lxxvi, 121. PROC. SOC. EXP. BIOL. AND MED., 1925, xxiii, 77; 1926, xxiii, 367; 1926, xxiv, 103.

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Studies on the Enzyme-Action of Yeast.

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If a suspension of yeast is brought together with a solution of glucose in adequately chosen proportions, then some protein admixed, and precipitated by a suitable protein precipitant, the glucose is carried down with the protein and yeast, and no trace of glucose can be recovered in the filtrate.

If, for example, 50 cc. of a 0.2 to 0.4 per cent solution of glucose and 10 g. of yeast, suspended in 50 cc. of diluted egg white or neutral casein solution, are poured together and mixed, subsequent precipitation by tungstic acid will remove all the glucose from solution. And this reaction takes place, even though fermentation be prevented by chilling both the yeast and the glucose to 0° C. before they are united, and kept at that temperature throughout the entire operation. Evidently *an adsorption-like combination takes place between yeast and glucose as soon as they come into contact.*

If the yeast is separated from a yeast-glucose solution by centrifugation or filtration, the glucose is recovered in the solution. On

dialysis the glucose passes through the membrane. These observations indicate that the union between yeast and glucose is so labile that it cannot withstand the disrupting forces involved in these operations, and even might cast doubt on the conception of a union between yeast and glucose.

But on our further inquiry into the nature of the initial yeast-glucose combination, it was found that factors which damage enzyme action invariably also destroy or prevent the formation of this combination. Thus, in the presence of phenol, sodium fluoride, salycylic acid, etc., which prevent fermentation, the glucose is not removed from solution with the yeast-protein precipitate. Heating of the yeast-glucose mixture, too, prevents the precipitation of glucose. The result is the same if mercury solutions are used for the precipitation of the proteins in the mixture; namely, the glucose is recovered in the filtrate, whereas precipitation by tungstic acid—all other conditions being identical—removes the glucose from solution.

Further experiments have shown that the adsorption by yeast is specific and selective, in that it affects exclusively substances which are fermentable. Lactose, arabinose, etc., for instance, are not adsorbed, and can be quantitatively recovered under circumstances which lead to complete removal of glucose, sucrose, mannose. This specific selectivity of the adsorption phenomenon, plus the fact that substances which inactivate enzymes prevent it, indicate that it is a reaction between enzyme and substrate, in fact, the first phase of enzyme action.

The extreme rapidity of the reaction allows the inference that some of the enzymes of the yeast are situated in some definitely organized system around the surface of the cells; this may furnish the explanation for the great difference between the fermentation process by living yeast and cell-free fermentation, and further studies will be made on this question.

Using for protein precipitation in yeast-glucose mixtures tungstic acid and mercury, under otherwise identical conditions, enables us to follow up simultaneously both processes: the loose combination as well as changes which result in transforming sugar into non-reducing products. Results of these studies will be presented in a subsequent paper.

The simplicity and rapidity of the selective removal of glucose from solutions, as outlined in the foregoing, has served in our hands as the basis of a method for the quantitative determination of the "true sugar" in blood, urine, etc., and for the separation of fermentable sugars from non-fermentable ones. The method will be described elsewhere.