second year production of the mother and the first year record of the daughter is $r = 0.196 \pm .032$. While numerically small, these values are both positive and may reasonably be considered statistically significant.

The fact that there seems to be a significant correlation between the annual record of mothers and daughters at once raises the question as to whether the correlation is higher for the period of winter production, with respect to which the birds have heretofore been assumed to be differentiated in genetic constitution, than for the other "cycles."

We are now able to present the thirty-two coefficients measuring the relationship between the four individual "cycles" of the mother's first year and the daughter's first year, table 1, and between the mother's second year and the daughter's first year, table 2.

These coefficients are small throughout, and individually would not be considered significant in comparison with their probable errors. They are, however, preponderantly positive in sign and thus lend support to the conclusion that there is a sensible correlation between the records of mothers and daughters in the type of birds exhibited in contest flocks.

The most interesting feature of this series of results is the fact that the highest correlation is not that between the winter "cycle" of the mother and the winter "cycle" of the daughter, but between the autumn "cycle" of the mother and the autumn "cycle" of the daughter. Thus for the winter "cycle" of the mother's first year and that of the daughter's first year the correlation is $+ .139$ as compared with $+ .199$ for the autumn "cycles." The relationship between the winter "cycles" of the mother's second and the daughter's first year is measured by a coefficient of $r = + .058$ as compared with $r = + .221$ for the autumn "cycles."

This result for inheritance substantiates the conclusions drawn from our earlier studies of inter-annual correlation for the first and second laying year of the same individual.

J. Arthur Harris
Harry R. Lewis
Station for Experimental Evolution
and New Jersey Agricultural Experiment Station

THE UTILIZATION OF ATMOSPHERIC NITROGEN BY SACCHAROMYCES CEREVISIAE

A note on some of the results obtained in this laboratory in the course of studies on the nutrition of yeast may be of interest especially in view of the recent communication to this journal by Lipman and Taylor.[1] These authors claim to have proved the utilization of atmospheric nitrogen by the wheat plant. We have been working for a considerable time in this laboratory on the development of the simplest possible medium that will support the continued growth of yeast, and some of the data have a direct bearing on the utilization of atmospheric nitrogen by the organism.

Zikes[2] and DeKruijff[3] claimed that certain Torula can fix nitrogen. Kossowicz[4] stated that certain yeasts could fix nitrogen but later[5] reversed his opinion. Linder and Newman[6] could observe no nitrogen fixation by yeast. Mulvania[7] concludes that some yeasts can use atmospheric nitrogen. His data are qualitative in nature and he made no attempt to dilute out by subculture any nitrogenous compounds originally present in the yeast.

The yeast used in our work was plated out from a Fleischmann yeast cake and is known as *Saccharomyces Cerevisiæ* Race F. The cultures used in the experiments hereinafter described had been subcultured for three years at 30° C. in Medium E developed by Fulmer, Nelson and Sherwood.[8] The medium contained the following per 100 cc.: 10 grams of cane sugar, 0.188 grams of ammonium chloride, 0.100 grams of dipotassium phosphate, 0.100 grams of calcium chloride. The yeast had then been subcultured for six months in Medium C (2) which contained per 100 cc. the following: 10 grams of cane sugar, 0.188 grams of ammonium chloride, 0.100 grams of dipotassium phosphate. Yeast so grown furnished an

---

[1] Science, lvi, 605 (1922).

[2] *Sitzungsber, K. Akad. Wiss (Vienna) Math. Naturw. K.*, 118, 1091, (1909).

[3] *Ann. Jard. Bot. Butten. Zorg. Sup.*, 3, Pt. 1, 93, (1910).

[4] *Z. Garungsphysiol.*, 1, 253, 5, 26.

[5] *Biochem. Zeit.*, 64, 82.

[6] *Wehnschr. Proc.*, 30, No. 47, 589, (1913).

[7] *Bulletin* 122, Ag. Exp. Station, Univ. of Tennessee.
Chem. Abt., Vol. 15, 2291, (1921).

[8] *Journ. Amer. Chem. Soc.*, xliii, 191, (1921).

ash free from calcium or magnesium. While the growth in Medium C was not as rapid as in Medium E the yeast continued vigorous and normal in appearance. The yeast undergoes no deterioration even after two years of growth in this medium.

The yeast so obtained was inoculated into a series of flasks containing per 100 cc. of medium: 10 grams of cane sugar and varying amounts of dipotassium phosphate. In all experiments the temperature maintained was 30° C. There was a distinct optimum at a concentration of 0.45 grams of dipotassium phosphate per 100 cc. This optimum maintained during subculture. The above concentration then was adopted as standard. Conductivity water was used as the solvent. The medium was sterilized under pressure. While still hot, rubber stoppers were inserted, carrying two glass tubes through one of which air was bubbled through the medium, the other tube serving as outlet. The medium was cooled while being aerated with air from which all ammonia and nitrogen oxides had been removed by passing the air through acid and through alkaline potassium permanganate. A sterile medium which had been aerated under the same conditions as the growing culture showed considerably less than one part of ammonia or of nitrites or of nitrates per million parts of medium. The yeast grows nearly as well in this ammonia free medium as it does in Medium C. The cells are normal in appearance and appear to be in an excellent state of nutrition.

These results bring out two points of interest:

(1) The fact that yeast will grow continuously in a medium composed of sugar and one salt. (Pyrex flasks were used which had undergone several hundred sterilizations. We have not as yet made any correction for materials dissolved from the glass.)

(2) *Saccharomyces Cerevisiæ* will grow in an apparently good state of nutrition using atmospheric nitrogen as the sole source of that element.

It may be that the benefits accruing from the aeration of yeast cultures is as much due to the addition of nitrogen as of oxygen.

Ellis I. Fulmer

Iowa State College,
January 26, 1923

THE AMERICAN CHEMICAL SOCIETY

(Continued)

PHYSICAL AND ORGANIC CHEMISTRY

SECTION II. COLLOIDS

Standardization in the grading of glue: Robert Herman Bogue. So-called standard tests are being developed by the National Association of Glue and Gelatin Manufacturers (*cf.* Alexander, "Glue and gelatin," p. 225). This is to be commended, but the results will necessarily be prejudiced so long as manufacturers only are represented on their committees. A joint committee of manufacturers, consumers and independent experts is obviously necessary for actual and profound progress. Of particular significance is the *arbitrariness* of most or all of the specifications "agreed upon" by the association. Thus, concentration, temperature and procedure are defined by a compromise between extremes in "present practice" instead of by the only sound method—the determination by systematic investigation of the conditions which most accurately evaluate in terms of a fundamental property. Additional data on the use of the MacMichael viscosimeter in the determination of a fundamental property of glues and the conversion of these data to absolute units are given. The use of a pipette type of viscosimeter is discussed and some data bearing on its application and calibration in absolute units are presented.

The action of salts on hydrous cupric oxide: Harry B. Weiser. Hydrous cupric oxide adsorbs ions strongly. If shaken with solutions of neutral salts, like NaCl or Na_2SO_4, hydrolysis takes place and the solution becomes distinctly alkaline, owing to stronger adsorption of acid than of base. On account of this strong adsorption, the presence of certain salts may accelerate the spontaneous loss of adsorbed water. The hydrous oxide may be heated to 100° without darkening in the presence of very small amounts of salts, such as $MnSO_4$, $CoSO_4$, $Al_2(SO_4)_3$, $Cr_2(SO_4)_3$, $ZnCl_2$ and $CuCl_2$. It has been demonstrated that the absence of darkening is not due to stabilization by adsorption of the hydrous metallic oxides as suggested by Bancroft and reaffirmed by Blucher and Farnau; nor to the formation of basic salts as suggested by Spring and Lucion. The explanation is to be found in the change in physical character from the highly gelatinous to the granular form of the oxide. Only those salts which hydrolyze appreciably giving H-ion are effective in low concentrations, since the slight solvent action of the H-ion destroys the gelatinous structure, and the denser granular modification which forms