Measurements were made both by means of a capillary viscosimeter of Ostwald and in the torsion viscosimeter of du Noüy. It was found that in general the viscosity of the mixture of bacteria with a corresponding bacteriophage increases steadily up to the time when visible lysis sets in, at which time the viscosity begins to diminish until it gradually reaches the original level.

In general, the greater the relative concentration of phage, the sooner the maximum viscosity is attained. The greater the number of bacteria (within the limits compatible with the concentration of phage present) the greater is the percentage of change in viscosity. At its maximum, the increase in viscosity of the mixture has varied in the experiments thus far performed, between 14 and 50 per cent, depending on the relative concentration of bacteria and bacteriophage. When calculated according to the formula of Kunitz[1], these results indicate an average increase of the volume occupied by bacteria of from 6 to 12 times. If, in place of living, susceptible bacteria, one employs a culture of homologous, resistant variant, or heterologous bacteria, or homologous, susceptible bacteria killed by heat, the viscosity remains unchanged. The heated bacteriophage which is devoid of its lytic power does not induce swelling of bacteria, and the viscosity of the original mixture remains unchanged.

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The production of antirachitic properties in human milk resulting from irradiation of the mother.

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Since it has been established that exposure to sunlight or to ultra-violet rays from artificial sources is able to protect animals or infants from rickets, the question arises whether this protective quality can be transmitted through the milk by the mother

[1] Kunitz, M., *J. Gen. Phys.*, May, 1926, Vol. ix, No. 6.

to the young. As the result of some experiments on cows, Luce[1] concluded that "the anti-rachitic value depends on the diet of the cow and possibly also on the degree of illumination to which she is exposed." More recently Steenbock, Hart and their associates[2] showed that the irradiation of a goat led to a decided increase in the antirachitic potency of their milk.

This is a question of importance in relation to the etiology of infantile rickets, for although this disorder occurs less frequently among nursing than among bottle-fed infants, nevertheless it has been found in from 1/3 to 1/2 of the breast-fed infants in the temperate zone. In the following experiments, undertaken to elucidate this question, rickets was primarily induced in a series of rats by means of the Sherman-Pappenheimer low phosphorus diet. After radiographs had shown that rickets was present, a ration of 25 cc. of human milk was substituted for the rickets-productive dietary. When the milk had been fed in this amount for a period of 9 days the animals were again radiographed, their blood analyzed for inorganic phosphorus, and the bones examined microscopically. It was thus found that this quota of milk failed to induce healing as evidenced by the radiologic as well as the microscopic picture. The inorganic phosphorus in the blood was very low—1.98 mg. per cent.

The woman was then irradiated every other day by means of a mercury-vapor lamp. The irradiation period at the outset was 4 minutes, and was gradually prolonged; the distance was 30 inches. After 5 treatments the distance was increased to 60 inches, and a constant exposure of 56 minutes established, which rendered the intensity approximately the same as during the initial period. After irradiation had been carried out in this manner for 1 month, the milk was fed to the rats daily in 25 cc. per capita amounts. As in the first part of the experiment, the animals had been previously rendered antirachitic by the low phosphorus ration.

A striking difference was noted between the results obtained from feeding milk which had been collected previous to or subsequent to irradiation of the mother. Whereas healing had not been brought about by means of the first milk, quite the reverse

[1] Luce, E. C., *Biochem. J.*, 1924, xviii, 716.

[2] Steenbock, H., Hart, E. B., Hoppert, C. A., and Black, A., *J. Biol. Chem.*, 1925, lxvi, 441.

was the case with the second milk, which in every instance produced marked calcification of the epiphyses. In several animals of the latter group the bones appeared almost normal. The inorganic phosphorus content of the pooled blood of these animals was 5.61 mg. per cent. It is evident that antirachitic properties had been transmitted to the milk in high degree as the result of the irradiation.

It seems that an experiment of this kind has a definite application to pediatrics. It clearly indicates the value of ultra-violet irradiation of the mother during lactation as a preventive of rickets in the baby. Probably during the winter months, when the infant is most in need of protection from rickets, the intensity of sunlight is insufficient to produce this property in the milk.

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Photopharmacology. V: Influence of sun's rays on growth of yeast in sodium benzoate.

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Growth of yeast cells in sugar solutions, in light and darkness was studied by measurements of CO_2 evolved. Uniform suspensions of Fleishman's baking yeast were made in solutions of glucose or more often of sucrose, and the growth in sunlight and in the dark at the same temperatures was studied in two sets of fermentation tubes. Ordinarily suspensions of 0.5 or 1 per cent by weight of yeast in a 5 per cent or 10 per cent solution of sugar was employed. It was found that fermentation took place more rapidly in the dark than in the light, at the same temperature. The effect of sodium benzoate on the growth of yeast and fermentation was studied by adding the drug in concentrations of 1:1500 to 1:500. It was found that sodium benzoate in concentration of 1:1000 produced practically no inhibition in the growth as compared with normal yeast suspensions when kept in dark, and that even concentration of 1:500 of ben-