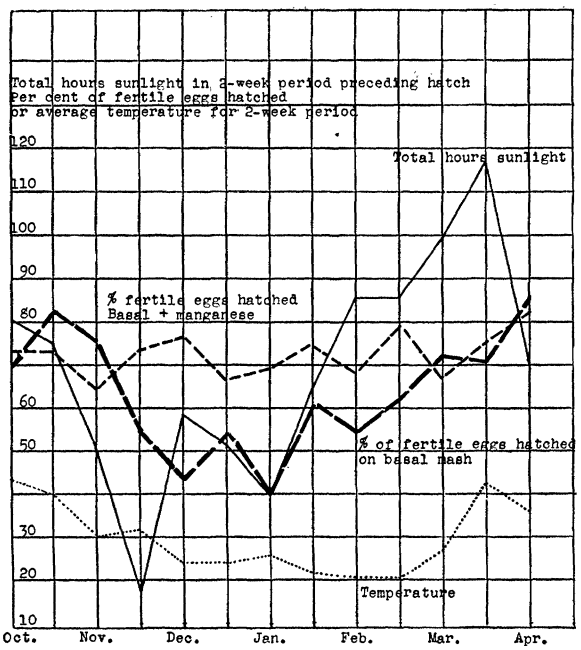

FIG. 1. The effect of manganese, sunlight, and temperature on hatchability of hen's eggs.

sunlight. The correlation was found between the total hours of sunlight during the 2-weeks period preceding the time the eggs were laid and the hatchability of the eggs. The period of diminishing per cent. of hatchability followed shortly after the period during which the total hours of sunlight diminished. Likewise the improvement in hatchability followed the increase in sunlight. There was no correlation between the fall or rise in the mean temperature and the per cent. of hatchability. Byerly, Titus, Ellis and Nestler[1] also have reported that hatchability of eggs from hens on a high soy-bean oil meal ration was markedly improved when the hens had direct access to sunlight. Since there was no fall in the hatchability of eggs from groups receiving added manganese, there must have been a borderline deficiency in the manganese content of the ration. During the spring, when there was adequate sunlight, this deficiency was eliminated, as was shown by the nearly equal hatchability of the two groups. That the vitamin D of cod liver oil was not a factor in the effect of sunlight has been shown by a number of experiments.

What explanation can be given for this apparent sparing action of sunlight on a hen's requirement for manganese can not be stated at present.

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[1] T. C. Byerly, H. W. Titus, N. R. Ellis and R. B. Nestler, *Jour. Poultry Sci.*, 16: 323, 1937.

THE ELECTROPHORETIC ANALYSIS OF ANTIPNEUMOCOCCUS HORSE SERA

RECENT work has indicated that the antibody activity of antipneumococcus horse serum is associated with proteins which differ from the principal globulins of normal horse serum in both molecular weight[1] and electrical mobility.[2] These antibodies are heavier than the principal globulins and electrophoretic observations have indicated that they move with a velocity intermediate between those of the β and γ components of normal sera.[2]

We have made electrophoretic[3] measurements upon a number of antipneumococcus horse sera and of antibody concentrates from them. Our results differ from the foregoing in showing that the antibody activity in all our preparations has the same electrical mobility as the ordinary γ-globulin. This is illustrated in Fig. 1, which reproduces the Longsworth[4] mobility-concentration patterns of an antipneumococcus horse serum before and after absorption of the serum with specific polysaccharides. This photograph was made with a bivalent Types I and II antiserum; similar results have been obtained with a bivalent serum against Types IV and VIII pneumococci. The measured mo-

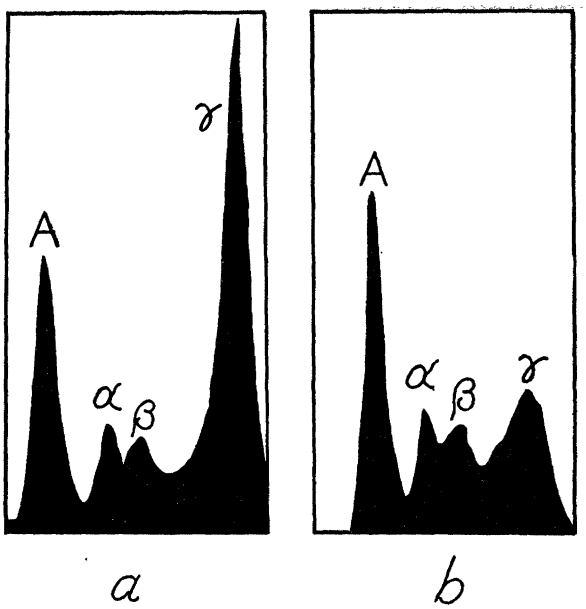

FIG. 1. Longsworth patterns of (a) unabsorbed and (b) absorbed antipneumococcus horse serum No. 6639. The albumin peak is designated by A, the globulin peaks by α, β, γ. The decrease in area of the γ-peak on absorption is evident.

[1] J. Biscoe, F. Hercik and R. W. G. Wyckoff, SCIENCE, 83: 602, 1936; M. Heidelberger and K. O. Pedersen, *Jour. Exp. Med.*, 65: 393, 1937.

[2] A. Tiselius and E. A. Kabat, SCIENCE, 87: 416, 1938; *Jour. Exp. Med.*, 69: 119, 1939.

[3] A. Tiselius, *Trans. Faraday Soc.*, 33: 524, 1937.

[4] L. G. Longsworth, *Jour. Am. Chem. Soc.*, 61: 529, 1939.

bilities of the various components in these sera are listed in Table 1; except for the absence in our photographs of the extra component with -2.1×10^{-5} cm^2 sec^{-1} volts^{-1} which had been identified as antibody, our measurements agree well with earlier ones.[2]

We have measured the areas under the globulin portion of the Longsworth photographs of sera before and after absorption with specific polysaccharides. This loss of area, limited to the γ-component, has paralleled the antibody content as determined by direct chemical[5] analysis (the last column of Table 1).

TABLE 1

Serum	Type	Mobility					Decrease in globulin area on absorption	Antibody per cent. of total globulin
		A	α	β	Antibody	γ		
		$-\mu \times 10^5$ cm^2 sec^{-1} volt^{-1}						
							%	%
6639	I and II	5.3	4.0	3.0	—	1.0	37	32
8617	IV and VIII	5.1	3.7	3.0	—	0.8	32	33
Tiselius and Kabat	.....	5.5	3.7	3.0	2.1	0.9		

We are not yet able to explain in satisfactory fashion the differences between our results and those of Tiselius and Kabat. Both sets of experiments were made at the same pH (7.7) and with similar buffers (0.15M NaCl, 0.02M total phosphates). All our accurate electrophoretic measurements have been made on sera diluted 1:4, but a few photographs of undiluted sera and of sera diluted 1:2 have given the same results. Though there is as yet only fragmentary evidence[6] to support the hypothesis, it is possible that the antibodies in a horse become smaller under prolonged immunization. The sera available for the present experiments were all from horses which had been producing antibodies for many years, and their antibodies may be different from those in the sera examined by Tiselius and Kabat.

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THE PHYSIOLOGICAL CHANGES PRODUCED IN YEAST BY ULTRA-VIOLET LIGHT AND BY HEAT

As part of an extensive investigation in these laboratories[1] of the effects of salts and lethal agents on biological systems an occasion has recently been found to make a comparative study of the effects of ultra-violet light and of heat. A single cell isolation of a strain of *Saccharomyces cerevisiae* was used as the test organism. Of the physiological functions studied, the ability of the cells to divide, thus forming colonies on agar, was found to be the most sensitive to both agents. The aerobic respiration of the cells was quite sensitive to heat, but proved to be relatively unaffected by ultra-violet light, that is, λ2650. Likewise, the resistance to staining with methylene blue is decreased by heat, but within comparable time limits is relatively unaffected by λ2650.

One of the more striking observations is that irradiation with λ2650 followed by heat treatment is two to five times as lethal as the treatment of the organisms in the reverse order. This is manifest in both the ability of the cells to form colonies and the resistance of the cells to staining.[2] Both functions are thus sensitized to heat by this wave-length. On the other hand, the rate of respiration is not sensitized, but is reduced by the same amount whether radiation is followed by heat treatment or *vice versa*.

The details of these experiments and the significance of the results in a general understanding of the nature of the lethal action of heat and ultra-violet light will be published shortly. In addition, the results give certain indications as to the mechanisms of the physiological processes studied and establish that certain of them are relatively independent of each other, *e.g.*, the ability of the cells to form colonies and their rate of respiration.

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[5] M. Heidelberger and F. E. Kendall, *Jour. Exp. Med.*, 61: 559, 1935.

[6] See for instance, E. A. Kabat, *Jour. Exp. Med.*, 69: 103, 1939.

[1] B. M. Duggar and A. Hollaender, *Jour. Bacteriol.*, 37: 219–239, 241–256, 1934; A. Hollaender and B. M. Duggar, *Proc. Nat. Acad. Sci.*, 22: 19–24, 1936; A. Hollaender and W. D. Claus, *Jour. Gen. Physiol.*, 19: 753–765, 1936; A. Hollaender and B. M. Duggar, *Jour. Bacteriol.*, 36: 17–37, 1938.

[2] W. T. Bovie and G. A. Daland (*Amer. Jour. Physiol.*, 66: 55–66, 1923) have reported a similar sensitization of *Paramecium caudatum* to the lethal action of heat by irradiation with the short ultra-violet rays transmitted by fluorite ($\lambda < 2000$Å). The relation between our work and that of various investigators on the (small) temperature coefficient of the lethal action of ultra-violet light is probably rather remote.

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