infection, but fails to protect in a dilution of 1:160 30 minutes beforehand or in a dilution of 2:5 10 hours after infection.

This protection test is being used in the comparison of certain of the polyvalent sera now on the market. All of those tested show good protection (namely against 100,000 m.l.d.) when given in a dilution of 2:5 one-half to one hour before infection. On titrating them, they have been compared with the monotypical Type I antimeningococcal serum prepared in this laboratory. Table I shows such a comparative test. It will be noticed that the normal human serum does not protect. The polyvalent serum gives as good or slightly better protection than does the homologous serum. Both antimeningococcal sera protect when diluted 1:160 (against 1,000 m.l.d.) and when given in a dilution of 2:5 10 hours after infection (against more than 100 m.l.d.).

Thus, the use of Miller's technique has allowed one to titrate the virulence of freshly isolated meningococcus strains and to develop a protection test for titrating antimeningococcal serum. The results in both instances are consistent only when pure breeds of susceptible mice are used. In our hands the use of unselected stock mice has led to results which, on account of their inconsistency, are highly unsatisfactory.

8018 P

Rate of Lymph Flow in Edematous Skin of Cardiac and Renal Disease.

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In normal skin an intradermal injection of deeply colored vital dye renders the lymphatics visible.[1] In a few minutes some of the dye drains away into the deeper channels appearing like colored streamers when seen through the skin. Scores of tests on normal volunteers have shown these colored streamers to be long or short under conditions known to increase or decrease lymph flow respectively. The method, to be described elsewhere, has been used to compare the rate of lymph flow in the edematous skin of cardiac and nephritic patients.

In more than 60 experiments upon 14 individuals with cardiac

[1] Hudack, S. S., and McMaster, P. D., *J. Exp. Med.*, 1933, **57**, 751.

disease and edema of the lower limbs, we have found the lymphatic capillaries widely dilated and dye entered them more readily than in normal skin. The intercommunication between the channels was extremely rich and the injection of the superficial network very complete, showing that they were fully open. Dye was carried farther in the channels to color a wider area and escaped from them more rapidly than in normal skin.

In instances of long standing cardiac edema, isolated colored "islands", skin regions in which the superficial lymphatics contained dye, appeared during the course of the intradermal injection several centimeters away from where the needle had entered and separated from the immediate area of staining by skin of normal hue. These are never seen under normal circumstances. It is plain that some of the injected pigment entered the deeper plexus, passed along this unseen and emerged again at some distance in the superficial plexus. The "islands" appeared below the site of injection as well as elsewhere around it. A valvular incompetence of the deeper lymphatics, due to widening of them, will explain the retrograde flow.

We have never observed a formation of colored streamers in cases of cardiac edema, despite the dilatation of the lymphatic channels—in other words there is none of the evidence of lymph flow seen in the normal limb. Yet the fact that the lymphatics are patent can readily be demonstrated. When a region stained as result of an intradermal injection of dye is massaged, colored streamers promptly appear. If this is done in the case of a patient with outspoken, long standing edema and the skin is stroked from the injection site toward the periphery, a retrograde passage of dye takes place along the superficial lymphatics, sometimes as far as 10-12 cm. The phenomenon is never seen in normal man nor does it occur again in the patient a few days after the edema has been reduced by therapeutic measures. It is indicative of a valvular incompetence of the lymphatics such as will explain the "islands" of dye. In the edematous legs of patients with cardiac disease there is evidently a stagnation of lymph, a true breakdown of lymph transport with failure of the valves to function properly.

In contrast to these findings there exists a greatly increased lymph flow in nephritic edema that is attended by a lowering of the plasma protein concentration. More than 70 experiments upon 16 individuals showed wider lymphatic capillaries than normal but narrower than in advanced cardiac edema. Other local changes are far less pronounced than in cardiac edema and the "islands" of dye

observed in the latter condition, and the other signs of incompetence of the valves have not been encountered.

Practically at once in many cases of nephritic edema, dye streamers become visible extending from the injected region. In every instance they have appeared far sooner, and lengthened much more rapidly than in any normal instance. Within 3 or 4 minutes they have the appearance assumed after 20 minutes to half an hour in the normal human being. Lymph flow is obviously far more rapid than usual. Its rate as judged by streamer formation, varies with the changes in the patient's condition. Streamer formation was least when edema was increasing, but still much more than normal. It was still greater in the stationary periods and greatest by far in periods of diuresis. At these times one or 2 colored streamers developed that extended from the ankle to Poupart's ligament within 15 minutes after an ankle injection of only 0.02 cc. of dye solution in a leg lying horizontally or even extended against gravity to the knee in a leg hanging vertically. Such findings have never been observed in normal individuals.

Lymph flow is excessive in the edematous skin of the nephritic patient. In cardiac edema on the other hand there is a virtual stagnation of the lymph.

8019 P

Relation of Entoptic Stray Light to Flicker and the Perception of Movement.*

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Under certain conditions, flicker is seen in the visual field surrounding the test-object, presented against a dark background, when this object subtends only a small visual angle. Unlike flicker in the test-object itself, field flicker has received little or no study. It appears when the test-object is very bright, or large, or when the flicker of the test-object is much below its critical fusion frequency. The question arises whether the phenomenon is due either to some sort of neural interaction, or to entoptic stray light. Recently considerable evidence has been adduced to make it entirely

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