organism, it is curious that no appreciable lysis could be detected in the broth cultures during the course of these serial passages. At the end of the 25th serial passage the picture was essentially the same as during the earlier passages.

With the exception of one tumor presenting surface ulcerations, from which a mixed bacterial flora was cultivated, cultures made from the freshly harvested tumor pulp failed to reveal the presence of bacteria in the tumor tissue. It would for this reason be difficult to explain the presence of the bacteriophage in these tumors were it not for the fact that a similar bacteriophage may also be isolated from the intestinal contents of such mice. It is entirely conceivable that it may find its way from there to various tissues of the body.

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Reciprocal Innervation of Antagonistic Eye Muscles.*

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Reciprocal innervation of antagonistic eye muscles has been more or less generally accepted since the time of the experiments of Sherrington.[1] Recently, however, some controversy has arisen, due chiefly to the experiments of Tilney and Pike[2] and of Lorente de Nó.[3] These investigators have concluded that the law of reciprocal innervation is not valid in the case of antagonistic eye muscles. It therefore seemed to us desirable to further investigate this problem. The animals we used in our experiments were dogfish *(Mustelus californicus* and *Triakis semifasciatis).* In order to demonstrate the phenomenon of reciprocal innervation we have employed a slightly different method from any used heretofore. Instead of stimulating the cerebral hemisphere or rotating an animal around one of its principal body axes to evoke eye movements, we employed the method used by Maxwell.[4] Briefly, this method consists in exposing a semicircular canal and subsequently applying a mechanical stimulus to its ampulla.

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† The experiments were conducted at the Scripps Institution of Oceanography of the University of California, La Jolla.

Labyrinthine excitation invariably results in conjugate movement of the eyes, the direction of which depends upon the particular structure which is stimulated. When a stimulus is applied to the ampulla of the right horizontal canal, the eyes turn to the left in the horizontal plane. Stimulation of the left horizontal ampulla causes both eyes to turn to the right. The most important muscles concerned in the production of ocular rotation in the horizontal plane are the *rectus internus* and *rectus externus*. In order to test the reciprocal action, these muscles were detached from the bulb of the right eye and were connected by means of threads to recording levers (modification of the Bartels[5] method used by Maxwell and Huddleston[6]). Graphic records were made of the responses of these muscles to alternate stimulation of the right and left horizontal ampullae.

When a stimulus is applied to the ampulla of the right horizontal canal, the *rectus internus* of the right eye strongly contracts and the *rectus externus* relaxes. Stimulation of the left horizontal ampulla causes the *rectus externus* to contract and the *rectus internus* to relax. The extent of relaxation of the antagonistic muscle, however, is never found to be proportional to the contraction of the protagonist, and indeed may be entirely absent in many cases. When an antagonist fails to relax under these conditions, does it mean that reciprocal innervation of these muscles is absent, or is it that the conditions are not optimal for the appearance of the phenomenon?

When an extrinsic eye muscle is caused to contract by labyrinthine stimulation it slowly relaxes, requiring 4 or 5 seconds at times for it to return to its original position. This means of course, that the muscle, during the period of relaxation, is in a state of gradually diminishing tonic contraction. Thus if the *rectus externus* is caused to contract by stimulating the left horizontal ampulla, it will slowly relax when the stimulus is removed from the ampulla. If now, a stimulus is applied to the right horizontal ampulla during the period of relaxation, the muscle relaxes rapidly, and simultaneously with the contraction of the *rectus internus*. When either of these 2 muscles is caused to enter into a state of tonic contraction by stimulating the appropriate ampulla, it invariably relaxes almost instantaneously when the opposite horizontal ampulla is stimulated; the onset of relaxation of the antagonist coincides almost exactly with the beginning of contraction of the protagonist. We, therefore, interpret these results as proof of reciprocal inneraction of the *rectus externus* and *rectus internus*. At a future date we are planning to test the

reciprocal relation of the 2 remaining pairs of antagonistic eye muscles.

[1] Sherrington, C. S., *Proc. Roy. Soc.*, 1893, liii, 407.

[2] Tilney, F., and Pike, F. H., *Arch. Neurol. and Psychiat.*, 1925, xiii, 289.

[3] Lorente de Nó, R., *Trav. Lab. recherches biol. univ. Madrid*, 1925, xxiii, 259.

[4] Maxwell, S. S., "Labyrinth and Equilibrium," Monographs on experimental biology, J. B. Lippincott Company, Philadelphia and London. 1923.

[5] Bartels, M., *Arch. Ophthal.*, 1911, lxxciii, 129.

[6] Maxwell, S. S., and Huddleston, O. L., *J. Gen. Physiol.*, 1926, viii, 441.

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Effect of Insulin on Protein Metabolism.

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The effect of insulin upon the protein metabolism of the rat was investigated by analyzing the entire carcass for urea and amino acid nitrogen within 1 to 4 hours after the commencement of the experiment.

Each estimation consisted of the sum of the substance in question within the animal and that amount which had been excreted within the experimental period. The values obtained were compared with those from control animals which received injections of 1% sodium chloride. Marked increases in the rate of urea formation were observed. The amino nitrogen content of the whole animal decreased. The average decrease observed was approximately equal to the average increase in urea nitrogen. These results were found to be independent of the nature of the diet—high or low protein, upon which the animals had been maintained for the preceding 3 days.

It is possible that the increased protein catabolism, here observed, is secondary to the accompanying hypoglycemia, and is due to a compensatory increase in the rate of glucogenesis from amino acids.