

centers must be aided by one or more of the twelve fusion centers. In the interest of binocular single vision, so far as the recti alone are concerned, and in the interest of both binocular single vision and correct orientation, so far as the obliques are concerned.

Dr. Savage exhibited a surface illustrating binocular single vision which he said is the only one that has ever been made. Dr. Manning Brown, a former student of Dr. Savage, had it made for him. By means of this device, the horopter surface, binocular rest and motion can be easily understood. In regard to Dr. Stevenson's rubber ball and knitting needle, Dr. Savage said that of course the eye would tort when rotated on an oblique axis, if it were not for the oblique muscles. The oblique muscles have set for them the task of keeping the horizontal retinal meridian in the movable plane of the horopter circle, whether in monocular or in binocular vision, and faithfully do they accomplish it.

THE TRANSMISSION OF ROCKY MOUNTAIN SPOTTED FEVER BY THE BITE OF THE WOOD-TICK (*DERMACENTOR OCCIDENTALIS*)*

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In THE JOURNAL, July 7, I reported briefly my success in transmitting Rocky Mountain spotted fever to the guinea-pig and monkey. With these results in hand, it at once became apparent that a means had been provided by which to test the theory of transmission by the wood-tick, a theory which was primarily advanced by Wilson and Chowning. It was my first aim to establish, beyond the opportunity of doubt, the susceptibility of the animals mentioned, and it was only after this susceptibility had been determined by inoculation from two different patients that the study of the tick as an intermediate host for the parasite was taken up.

On June 19 a small female tick was placed at the base of the ear of "Bradley" Guinea-pig 1. This guinea-pig had been inoculated intraperitoneally on June 11 with three cubic cm. of defibrinated blood from the patient, Bradley, and died with characteristic symptoms on June 23. After having fed on the infected guinea-pig for two days, the tick was removed, placed in a ventilated pill-box for two days more, and on June 23 was attached to the base of the ear of a female guinea-pig weighing 300 grams. After an incubation period of three and one-half days, the temperature of the animal rose to 104.2, gradually ascended to 106.4, near which point it remained for seven days, when it gradually returned to normal. The bite of the tick in this instance seemed to be very virulent, the whole ear becoming very much swollen, indurated and cyanotic, and a slough almost one-half inch in diameter, which developed in the vicinity of the bite, eventually separated.

The animal exhibited the following course of fever:

June 23, a.m., 102.3; p.m., 102.2.	July 1, a.m., 104.6.
June 24, a.m., 101.0.	July 2, a.m., 105.2.
June 25, a.m., 102.8; p.m., 103.9.	July 3, a.m., 104.7; p.m., 105.
June 26, a.m., 102.4; p.m., 103.6.	July 4, a.m., 104.7; p.m., 103.1.
June 27, a.m., 102.5; p.m., 104.2.	July 5, a.m., 103.8; p.m., 103.9.
June 28, a.m., 106.4; p.m., 105.2.	July 6, a.m., 103.4; p.m., 103.5.
June 29, a.m., 105.6; p.m., 105.8.	July 7, a.m., 102.5.
June 30, a.m., 104.8; p.m., 106.1.	Recovery.

Seven days after inoculation, the external genitalia became swollen and congested, and this condition became more marked until the twelfth day, when it began to subside. At no time were distinct hemorrhages in the genitalia or other parts of the skin to be seen. The course of the disease was exactly similar to that seen in a number of other guinea-pigs which ran a severe course, with eventual recovery. The absence of a hemor-

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rhagic condition in the skin, or of a discoverable roseolar eruption, throws no doubt on the success of the transfusion, since, as shown by other experiments, a perceptible eruption does not appear invariably in spotted fever as it is produced in the guinea-pig experimentally.

It was not possible to attempt the transmission of the disease from this animal to others, because of the lack of guinea-pigs at the time.

As controls I have two experiments in which uninfected ticks fed on normal guinea-pigs without causing a rise in temperature; furthermore, two guinea-pigs, which lived for two weeks in the box occupied by the infected animal showed no abnormal temperature, a fact which argues against the transmission of the infection by mere association with excretions of infected animals.

The result of this experiment brought very forcibly to my mind the probable part which the tick plays in the infection of man and shows the necessity of repetition of the work with a more abundant material. In view of the result which I had obtained I was not surprised to note the recent report of Dr. King¹ of the U. S. Public Health and Marine-Hospital Service, who, starting with material which I had given him, accomplished transmission in the same manner.

Hasty conclusions as to the question of tick transmission in relation to the infection of man are, by all means, to be avoided until such a time as the experiments can be repeated and the life history of the infection worked out more thoroughly. This phase of the subject, in common with others, is being studied by me, the infection still being maintained in animals for these purposes.

It is hoped that some of these questions may be settled satisfactorily before the advent of the disease next year. At all events the knowledge so far gained may well be taken into account in instituting prophylactic measures against the disease.

Clinical Notes

MIXED MALARIA AND TYPHOID FEVER.

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The relatively small number of reported cases of mixed infection resulting from the simultaneous occurrence of the *Plasmodium malariae* and *Bacillus typhosus* in the same patient is sufficient pretext for the relation of the following case, which presents many features of unusual interest and which, furthermore, may prove to those skeptical as to the possibility of a double infection, that the same host may, and sometimes does, entertain two guests whose morphologic appearance and biologic habits so widely differ:

Patient.—On June 2, 1905, I was called to see Mrs. A. C. S., Scotch, aged 35. She complained of frequent micturition, accompanied by vesical tenesmus. The marked irritability of the bladder was most troublesome at night, requiring the patient to leave her bed every few minutes. Heat and opium suppositories afforded some relief by inducing sleep.

Course of Disease.—The next morning a chill caused me to be sent for. I was unable at the time to determine whether its occurrence was due to a cystitis or to some oncoming disease. The patient now complained of headache, pain in small of back, nausea, abdominal tenderness, and extreme nervousness. The temperature at this time was 103 by mouth. As a routine practice in all such cases of doubtful nature, I made an examination of the blood and found that it contained malarial organisms in abundance.

1. Public Health Reports, July 27, 1906.