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Susceptibility of the Bear to Fox Encephalitis.

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Fox encephalitis[1] is a common disease of the North American silver fox and has been identified on fox ranches throughout the United States. Red foxes, dogs, and coyotes[2] are also highly susceptible. Although not generally recognized clinically, fox encephalitis frequently appears to occur as a natural disease in dogs.[3] The gray fox,[4] which is related to the South American foxes and dogs, and the raccoon[5] are only slightly susceptible to experimental infection.

Inoculation of the anterior chamber of the eye affords a direct and easy method of identifying the fox encephalitis virus and of establishing susceptibility to infection.[6] In foxes and dogs such inoculation results in an acute systemic infection and encephalitis with a high mortality. In the inoculated eye the virus damages the single layer of endothelial cells which line the posterior surface of the cornea, resulting in a grayish corneal opacity. The characteristic intranuclear inclusions produced by the virus can be seen in these endothelial cells. Only the injected eye will show the opacity. Injection of the virus into the anterior chambers of the eyes of the less susceptible raccoon and gray fox produces regularly the corneal opacity, but these animals otherwise generally remain well. The cat appears immune to the general infection, but with young kittens[7] intra-ocular injection either is negative or results in incomplete opacity. The eye inoculation has been found negative in rabbits.[7]

We have now been able to show that the zoologic range covered by the virus of fox encephalitis also includes the black bear, *Euarctos americanus*. Three specimens of this animal received at our laboratories have been tested for susceptibility to the virus.

Fox encephalitis virus, preserved as 20% homogenized fox brain in 50% neutral glycerin, was prepared in serial, ten-fold dilutions in Ringer's solution. To determine the minimal infective dose that would produce corneal opacity in foxes, 0.1 cc of each dilution was injected into the anterior chambers of the eyes of red fox pups. Since we desired only to approximate the titer of the virus, only one eye was inoculated per dilution, and the dilutions were carried out to 10^{-9}. The virus proved active at a dilution of 10^{-6}.

A young, wild black bear was received in the laboratory in rather poor condition. It was underweight, extremely irritable, and did not eat well. This animal was anesthetized with ether and was injected intra-ocularly with 0.1 cc of a 10^{-2} dilution of virus in the right eye and 0.1 cc of a 10^{-4} dilution in the left eye. Within 3 days the bear developed a complete opacity in its right eye and a partial opacity in its left eye. On the 4th day after inoculation the animal was found dead, without previous symptoms or autopsy findings of fox encephalitis. However, a smear of the endothelial cells of the posterior surface of the cornea revealed the characteristic fox encephalitis inclusion bodies. Aqueous humor removed from the eyes was cultured on blood agar and was found free of bacteria.

The intra-ocular test was repeated on a second young black bear. This animal although somewhat underweight otherwise appeared normal. The virus, diluted with saline, was inoculated into the anterior chambers of the left and right eyes, with 0.2 cc of 10^{-3} and 10^{-4} dilutions respectively as the

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3 Green, R. G., and Shillinger, J. E., *Am. J. Hyg.*, 1934, **19**, 362.

4 Green, R. G., unpublished data.

5 Green, R. G., Evans, C. A., and Yanamura, H. Y., PROC. SOC. EXP. BIOL. AND MED., 1943, **53**, 186.

6 Evans, C. A., Yanamura, H. Y., and Green, R. G., PROC. SOC. EXP. BIOL. AND MED., 1943, **53**, 183.

7 Evans, C. A., and Green, R. G., *Staff Meeting Bulletin, Hospitals of the University of Minnesota*, 1945, **16**, 142.

inoculum. This animal showed no sign of susceptibility to the virus until the 10th day after inoculation, when partial corneal opacity of the left eye appeared, becoming complete 2 days later. No further observations were possible since it became necessary at that time to kill the bear. However, the animal did exhibit intranuclear inclusions of fox encephalitis virus in the corneal endothelium. The aqueous humor was bacteriologically sterile.

A third black bear, which was half grown, was inoculated intramuscularly with 5 cc of 20% virus but did not develop observable symptoms.

Conclusions. The intra-ocular inoculation of two bears and the intramuscular injection of a third with fox encephalitis virus indicate that the black bear *(Euarctos americanus)* is only slightly susceptible to this virus infection. Since the bear, like the raccoon, is an offshoot of the canines, the pathogenic properties of fox encephalitis virus derived from foxes seem sharply confined to the canine family.

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Two Related Salmonella Types: *S. luciana* and *S. marseille.**

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A. *Salmonella luciana* was isolated by Mrs. Mildred Galton from the feces of a normal food handler. The organism fermented glucose, xylose, arabinose, rhamnose, maltose, cellobiose, trehalose, mannitol, sorbitol, and dulcitol with production of acid and gas. Lactose, sucrose, inositol, and salicin were not fermented. The culture utilized *d, l,* and *i*-tartrate, mucate, and citrate. Hydrogen sulfide was produced but indol was not formed nor was gelatin liquefied.

The organism was agglutinated to the titre of, and absorbed all agglutinins from *S. aberdeen* O serum. Its somatic antigens are XI.

S. luciana was diphasic and the H antigens of phase I were identical with the H antigens of *S. paratyphi A* (a). The antigens of phase 2 were identical with phase 2 of *S. glostrup* (e,n,z_{15} . . .). The antigenic formula of *S. luciana* is XI:a-e,n,z_{15} . . .

B. *Salmonella marseille* was isolated from the stools of a person affected with gastro-enteritis, by Captain W. B. Sutton of the 4th Medical Laboratory, U. S. Army. Its biochemical properties differed from those of *S. luciana* only in that it produced acid from raffinose after 9 days incubation and it did not utilize *i*-tartrate.

The somatic antigens of *S. marseille* were identical with those of *S. aberdeen* (XI). The culture was diphasic and phase 1 resembled that of *S. paratyphi* A (a) although when used to absorb *S. paratyphi A* serum a slight residue of agglutinins remained for *S. paratyphi A, S. luciana,* and *S. loma-linda.*

Phase 2 of *S. marseille* was agglutinated by serums for all the nonspecific phases of the Kauffmann-White classification. When tested with serums for single factors 2, 3, 5, 6, 7, 10, and 11 it was agglutinated only by serums for factors 3 and 5. In absorption tests phase 2 of *S. marseille* removed all agglutinins from serum derived from phase 2 of *S. thompson* (1,5 . . .). The diagnostic formula of *S. marseille* is XI:a-1,5 . . .

Summary. Two new Salmonella types were described. *S. luciana* (XI:a-e,n,z_{15} . . .) was recovered from the feces of a normal food handler while *S. marseille* (XI:a-1,5 . . .) was isolated from the stools of a patient affected with gastro-enteritis.

* The investigation reported in this paper is in connection with a project of the Kentucky Agricultural Experiment Station and is published by permission of the Director. It was supported in part by a research grant from the U. S. Public Health Service.