15987

Susceptibility of the English Sparrow (*Passer domesticus*) to Infection with Psittacosis Virus of Pigeon Origin.

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The demonstration of ubiquitous infection among feral pigeons with psittacosis or psittacosis-like viruses[1,2,3] emphasizes the possibility of infection in the common English or house sparrow *(Passer domesticus)* because of its habit of feeding in association with pigeons. Various other members of the order Passeriformes have been shown to be naturally infected with psittacosis virus.[4]

Attention also was directed toward this possibility by an illness diagnosed serologically in this laboratory as psittacosis which was encountered in a woman physician who had handled a sick English sparrow. The onset of illness was on December 2, 1945 just 2 weeks after the patient had killed a sick and emaciated English sparrow which had frequented a bird feeding tray at her home. The patient also had scraped and cleaned the tray of droppings. A few pigeons belonging to a neighboring loft were noticed nearby occasionally. The illness was not severe and consisted of fever lasting for 6 days, (the highest temperature was 102.5°F) chills, severe sweats, and a dry cough. Abnormal physical findings were limited to the presence of rales over the lung bases. A roentgenogram of the chest taken 15 days after onset revealed an area of increased density at the left base and an increase in width of the hilar shadow. The specific diagnosis was not considered during the acute illness so that material for virus isolation studies was not available. Serum taken 29 days after onset fixed complement in the presence of both psittacosis antigen and commercial *Lymphogranuloma venereum* antigen (Lygranum) in a dilution of 1:32. Serum taken 10 weeks after onset also fixed complement in the presence of psittacosis antigen but not in the presence of Q fever antigen. Samples of serum which had been collected for another purpose 3 and 5 months prior to the onset did not fix complement. While it was not possible to state definitely that the source of virus was the English sparrow, the question was considered worthy of further study.

Efforts to investigate the susceptibility of the English sparrow to psittacosis virus were undertaken in two ways. The first was to seek evidence of natural infection by attempts to recover the virus from birds captured in the vicinity of Washington, D. C. and by testing their serum for the presence of complement fixing antibodies. The second was to test directly the susceptibility of this species by the inoculation of captured birds with a known strain of virus.

Sparrows were captured in a wire funnel trap in 4 different locations in the Washington, D. C. area during 1946 and 1947. The spleen, liver, and a kidney of each bird to be tested for the presence of virus were ground together in a mortar, and a 10% suspension in 0.85%, NaCl solution prepared. This was inoculated intraperitoneally into stock white mice (NIH strain). A week or ten days later the mice were autopsied and a normal saline suspension of the spleen inoculated intracranially into a second lot of mice. A third transfer was routinely made intracranially.

Approximately half of the birds were first bled from the heart by passing a 22-gauge needle through the suprasternal notch in the midline and parallel to the vertebral column. Complement fixation tests of the serum were performed according to the technique devised

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1 Zichis, J., Shaughnessy, H. J., and Lembke, C., *J. Bact.*, 1946, **51**, 616.

2 Labzoffsky, N. A., *Canad. J. Pub. Health*, 1947, **38**, 86.

3 Davis, D. J., and Ewing, C. L., *Pub. Health Rep.*, 1947, **62**, 1484.

4 Meyer, K. F., *Medicine*, 1942, **21**, 175.

TABLE I.
Results of Inoculation by Different Routes of the English Sparrow with Psittacosis Virus of Pigeon Origin.

No. of bird	Route of inoculation	Result in days after inoculation	Complement fixation titer of bird serum	Recovery of virus from bird organs by intracranial mouse inoculation		
				Brain	Spleen and liver combined	Kidney
965-1	intracranial	dead 3 days	—	+	0	0
965-2	"	" 3 "	—	+	+	0
965-3	"	" 9 "	—	+	+	+
965-4	"	" 15 "	—	+	+	—
990-1	intraperitoneal	" 7 "	—	—	+	+
990-2	"	" 15 "	—	+	+	+
1047-3	oral-gastric	sacrificed 14 days	1/64	—	+	0
1047-4	" "	" 14 "	0	—	0	0
1057-1	" "	dead 10 days	—	—	0	0
1057-2	" "	sacrificed 14 days	0	—	+	+
1057-3	" "	" 14 "	1/256	—	0	0
1106-2	" "	" 14 "	0	—	0	0
1118-5	" "	" 14 "	0	—	0	0
1118-6	" "	" 14 "	0	—	0	0
1119-2	" "	dead 9 days	—	—	0	0
1119-3	" "	" 11 "	—	—	+	+
1119-4	" "	" 11 "	—	—	+	+
1119-5	" "	sacrificed 11 days	0	—	+	+
1144-1	" "	dead 8 days	—	—	+	+
1144-2	" "	sacrificed 14 days	0	—	+	+
1144-3	" "	" 14 "	0	—	0	0

+ Virus recovered.
0 Virus not recovered.
— Not attempted.

by Bengtson[5] for rickettsial diseases. The antigen was prepared from psittacosis virus recovered from a parrot, grown in allantoic fluid of the developing chick embryo and killed with formalin or phenol.

Psittacosis or psittacosis-like virus was not isolated from any of the 103 sparrows examined. In two instances an unidentified bacillus apparently originating in the birds caused the death of the mice. No complement fixing psittacosis antibodies were detected in the 59 samples of serum tested.

Experimental Injection. In order to investigate the susceptibility of this species to infection with psittacosis virus sparrows were inoculated by 3 different routes with virus recently isolated from a feral pigeon. A total of 37 birds were inoculated, 4 intracranially under ether anaesthesia, 2 intraperitoneally, and 31 by dropping the inoculum into the throat or by passing a blunt needle down the esophagus of the anaesthetized bird. Due to trauma and the difficulty of keeping wild birds, 16 of the 31 inoculated by the latter method died within a few days and are not included in Table I.

The experimental birds were captured in the wild state, but the chance of natural infection was probably less than 1 in 100 since no virus had been found in 103 birds trapped at the same times and places. The virus inoculum was a saline suspension of mouse brain, yolk sac or allantoic fluid of the developing chick embryo infected with the same strain (No. 26) of pigeon virus.

White mice inoculated intracranially with each inoculum as a control died, and impression smears of the brain stained by Machiavello's stain showed typical clusters of elementary bodies in each instance.

Table I shows the results of inoculation of virus into the 21 birds which survived the trauma of capture and inoculation. Birds surviving until the 14th or 15th day after inoculation were bled and the serum tested for complement fixing antibodies. The sacrificed birds and those which died were autopsied, and tested for the presence of

[5] Bengtson, Ida A., *Pub. Health Rep.*, 1944, **59**, 402.

virus by inoculating mice intracranially with an approximate 10% suspension of the organs in 0.85%, NaCl solution. The presence of the characteristic clusters of elementary bodies in impression smears of the brain of mice dying 3 to 7 days after inoculation with the suspected material was taken as evidence of the presence of virus in the organ tested.

Birds inoculated intracranially died 3 to 15 days later and showed no gross abnormalities. Virus was present in the kidney and combined liver and spleen as well as in the brain.

In birds inoculated intraperitoneally the spleen was enlarged and soft, and the liver showed gross areas of focal necrosis, while the remaining organs appeared normal. Virus was recovered from the brain, kidney, and combined liver and spleen.

The oral-gastric route of infection was selected as approximating a natural mode of bird to bird transmission of virus. It was recovered from the organs of 7 of the 15 birds inoculated by this route which survived the first 7 days, and was present in the kidneys of 6 of these. Serum from 2 birds killed on the 14th day, from only one of which virus was recovered, fixed complement in the presence of psittacosis antigen, but serum from 2 others from which virus was recovered did not fix complement. Six other samples from uninfected birds were negative. The failure to demonstrate antibodies in birds from which virus is recovered may be due to a delay in antibody production as has been observed in pigeons.[6]

Summary. A serologically diagnosed case of psittacosis following exposure to a sick English sparrow and its droppings suggested an investigation of this species of bird as a carrier of psittacosis virus. 103 sparrows were examined for presence of active virus and serum from 59 of them were tested for complement fixing antibodies, but no evidence of natural infection was obtained. Four birds inoculated intracranially, 2 inoculated intraperitoneally and 7 of 15 inoculated by the oral-gastric route with psittacosis virus of pigeon origin became infected and virus was recovered from their organs.

[6] Meyer, K. F., Eddie, B., and Yanamura, H. Y., PROC. SOC. EXP. BIOL. AND MED., 1942, **49**, 609.

15988

Tyrosine Tolerance Test in Pregnancy and the Puerperium.*

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We have shown previously that in normal pregnancy there is a marked increase in the excretion of both ingested and intravenously administered histidine, and that this is associated with a reduction of renal tubular reabsorption as well as with a delayed gastrointestinal absorption of this particular amino acid.[1,2] There is no apparent change, however, in the rate at which histidine disappears from the blood stream. The strange rejection of this important amino acid by both the renal and gastrointestinal epithelium during normal pregnancy is unexplained; we wished, therefore, to compare this finding with the metabolism and excretion of another amino acid, tyrosine, by the maternal organism. It would be desirable to know, furthermore, whether a tyrosine tolerance test might be of use as a measure of liver function in the toxemias of late pregnancy.

Following the oral ingestion of as much as

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[1] Page, E. W., *West. J. Surg.*, 1943, **51**, 482.

[2] Page, E. W., *Am. J. Obstet. and Gynec.*, 1946, **51**, 553.