alized Shwartzman phenomenon in the turkey poult were unsuccessful. Large (1,000-15,000 μg) single doses of endotoxin, administered intravenously, failed to produce vascular collapse or other clinical signs in the poult. Attempts to reproduce a syndrome with lesions similar to aortic dissecting aneurysm as it occurs under field conditions, by use of endotoxin alone, or in combination with adrenalin, were unsuccessful. These experiments cast some doubt on the likelihood of Gram-negative organisms or sensitization by them being responsible for the naturally-occurring syndrome of dissecting aneurysm.

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Received May 11, 1962. P.S.E.B.M., 1962, v110.

Human Adenovirus Complement-Fixing Antibodies in New York Family Dogs. (27642)

L. E. CARMICHAEL AND FRANCES D. BARNES (Introduced by James A. Baker)

Veterinary Virus Research Institute, New York State Veterinary College, Cornell University, Ithaca, N. Y.

Reports of human adenovirus complement-fixing (CF) and neutralizing antibodies in farm and laboratory dogs have suggested the possibility that canines may act as healthy carriers(1,2). Serological studies in Sweden, however, failed to show CF antibody in dogs, despite the prevalence of adenovirus infections in the human population(3). In addition to public health considerations attending possible adenovirus infections in dogs, demonstration of a high incidence of adenovirus antibodies in dogs would also probably have implications as regards infectious canine hepatitis (ICH), since prior immunological experience with certain human adenoviruses alters the response of dogs to ICH virus(2).

Dogs have been shown to be susceptible to human adenovirus types, for both CF and neutralizing antibodies develop following a single inoculation. The course of the disease in dogs is entirely without clinical signs and criteria for adjudging infection are therefore serological or based upon virus isolation. Reports of human adenovirus isolation from experimentally infected dogs are conflicting(1, 2). Whereas one group reported persistence of virus in excretions and secretions for periods up to 7 days(1), attempts to isolate virus from inoculated dogs in our laboratory failed when specimens were tested later than 24 hours after exposure to adenovirus types 4 and 7(2). In addition, contact transmission to susceptible littermate dogs did not occur. This suggested that dogs probably do not act as carriers or reservoirs of human adenovirus types, despite the ease with which they may become infected.

In an effort further to assess the role of dogs as asymptomatic carriers of human adenoviruses, serums were selected from sam-

TABLE I. Distribution of Adenovirus CF Antibody in New York Dogs.

C-F titer*	No. of sera in each class
< 4	995
4	14
8	6
16	0
32	3
>32	0

* Titer expressed as reciprocal of dilutions showing complement-fixation with 4 units of adenovirus 4 group antigen. Total negative: 97.8%. Total positive: 2.2%. Considered negative if complement not fixed at 1:4 serum dilution.

ples collected from dogs located primarily in the north and central portions of New York State. These were then tested for adenovirus CF antibody. The results and implications of our findings are reported here.

Materials and methods. Serums. Sera from 1110 dogs were selected from samples submitted by veterinarians to the Diagnostic Laboratory, New York State Veterinary College, for canine distemper and/or canine hepatitis serology. Although sera were randomly chosen from a large serum collection, only family dog samples were tested since the chance of intimate contact between these dogs and their owners was thought to be greater than between humans and dogs maintained in kennel circumstances.

All sera were requested to be submitted free of preservatives, and were kept frozen until tested. Any that showed evidence of hemolysis, bacterial contamination or addition of preservatives, such as phenol, were discarded before testing. In addition, records were kept of each dog's location, breed, sex, age and immune status, especially as regards ICH. Unfortunately, it was not possible for us to collect serum from the owners.

CF tests. Test procedures for adenovirus CF antibody have been described(4). Since canine serum may show anti-complementary properties, especially if not harvested and frozen soon after bleeding, complete serum control titrations were performed simultaneously with the actual test. Serum antibody titers were not included in the final compilations if serum controls showed anti-complementary properties. Hemolytic properties have not been encountered with canine serum.

Results. Adenovirus CF titration results are summarized in Table I. In all 1110 sera were tested. However, 82 of these were discarded following a preliminary screening test at a 1:4 dilution because serum controls showed nonspecific fixation of complement. Of the 1028 sera finally tested, 23 (2.2%) showed positive adenovirus titers that ranged from 1:4 through 1:32.

Although the number of sera showing adenovirus antibody was small when compared with the total number tested, these showed no correlations between the presence of CF antibody and dog's breed, sex, age or ICH immune status, as measured by absence of presence of neutralizing antibody. In regard to the latter, 250 serums that showed no adenovirus antibody were tested for ICH neutralizing antibody and 83% possessed titers greater than 100. The 95% confidence limits for such a sample size are $\pm$ 6%. ICH antibody was found in 80% of the 23 sera with adenovirus antibody.

Discussion. These results would indicate that dogs probably do not act as important reservoirs of human adenoviruses. It should be noted that the CF relationship between ICH virus and human adenovirus types is unilateral, *i.e.*, ICH antiserum reacts in the CF test only with the homologous antigen, while human adenovirus antisera thus far studied fix complement with both viral antigens(2,3). A 2.2% incidence of adenovirus antibody suggests an extremely low infection rate, which is in accord with the observations of Heller and Salenstedt(3), who found virtually no adenovirus CF antibody in sera from 112 Swedish dogs randomly selected. The reports of adenovirus CF and neutralizing antibodies in laboratory and healthy farm dogs(1,2), then, probably represent exceptional circumstances and the asymptomatic infections that occurred were likely tangential, *i.e.*, they did not continue to cycle. Failure to spread was also indicated in the present study, for on 2 occasions positive adenovirus titers were found in one dog of a household while no antibody was found in other dogs in the same household. A similar situation appears to exist with measles vi-

TABLE II. Relationships Between Human, Canine and Bovine Adenoviruses as Shown by Complement-Fixation.

	Antiserum*		
CF antigen	Adeno. 4	ICH	Bovine #10
Adeno. 4	1:64	<2	1:4
ICH	1:32	1:128	1:4
Bovine #10	1:16	1:4	1:32

* Serums against ICH and bovine #10 adenoviruses were prepared in beagles. Adenovirus 4 antiserum was prepared in guinea pigs.

rus, which readily infects dogs but apparently fails to spread(5).

In addition to the public health aspects of the finding of adenovirus antibodies in healthy dogs, it has been hypothesized that the presence of significant adenovirus infections in the canine population might partially account for some of the variation observed in the clinical and serological responses of dogs infected with ICH virus(2). This seemed plausible, since dogs experimentally inoculated with adenovirus types 4 or 7 showed secondary-type antibody responses to adenovirus and ICH virus following challenge with ICH virus. This accelerated antibody production correlated with the duration of ICH viremia and was attended by a slight modification in the severity of illness. Such dogs also retained adenovirus neutralizing and CF titers for periods up to 340 days, presumably as a response to continued antigenic stimulation by ICH virus that persists, primarily, in the kidneys. In view of the present serological data, however, this tempting speculation appears unfounded.

The possibility of canine infections with non-primate adenoviruses cannot be excluded, especially since 8 of the adenovirus positive sera came from rural dogs that probably had contact with farm animals. Cattle have been shown to harbor at least 2 distinct adenovirus types(6,7). One type has been isolated in this laboratory from herds in the Ithaca area which is serologically identical to bovine adenovirus #10 reported by Klein(6). The bovine strains also readily infect dogs, evoke CF and neutralizing antibody and create in dogs a state of secondary antibody response to ICH virus as measured by the CF test. The serological (CF) relationship between bovine #10, human type 4 and canine (ICH) adenovirus strains is shown in Table II. As occurs following infection with the human types, antibody to the bovine adenovirus persists in dogs for long periods if ICH infection occurs after the alien virus infection. If alien adenovirus infections were common in dogs, one would expect a higher antibody incidence than actually found, for ICH is a remarkably common disease despite the widespread use of vaccines. It appears, then, that alien adenovirus infections in dogs are infrequent and are probably of little epidemiological significance.

Summary. A survey of New York dog serums for adenovirus CF antibodies showed an incidence of 2.2%. Such a low incidence suggests that dogs are only incidental hosts for agents that evoke antibodies which fix complement with human adenovirus CF antigens. Infections of dogs by non-primate adenoviruses could not be excluded since these may also evoke antibodies which fix complement with human type adenovirus antigens. A previous suggestion that alien adenovirus infections in dogs might partially account for the varied clinical and serological responses seen when dogs are infected with ICH virus now appears unlikely.

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Received May 29, 1962. P.S.E.B.M., 1962, v110.