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Relationship of the Virus of Cat Pneumonia (Baker) to the Psittacosis-Lymphogranuloma Group of Agents.*

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An infectious respiratory disease of domestic cats has been shown by Baker[1] to be associated with the presence of a virus which is characterized by the formation of elementary bodies. This agent was recovered from suspensions of infected cat lung by the intranasal inoculation of mice. Following inoculation of previously uninfected kittens it produced an acute respiratory disease with pneumonia. The virus was highly pathogenic for mice and could be passed readily in this species by intranasal inoculation. It was easily cultivated in the yolk sac of developing chick embryos. Impression films of infected lung tissue or of yolk sac membranes revealed numerous elementary bodies when either the Giemsa or the Macchiavello stain was used. Immunological studies with this virus have not as yet been reported.

Early in the course of work on the Baker virus it became apparent that this agent possesses certain characteristics similar to those of the virus of mouse pneumonia reported by Nigg.[2] The latter also is an elementary-body virus which is known to be antigenically related to the psittacosis-lymphogranuloma group.[3] The Baker agent, like the Nigg virus, was found to be exclusively pneumotropic in its pathogenicity for mice, producing no evidence of disease when inoculated intracerebrally or intraperitoneally. The intranasal inoculation of low dilutions of either virus into mice usually resulted in extensive pneumonia and death within 48 hours. Higher dilutions, on the other hand, caused the development of small areas of pale grey consolidation which slowly increased in extent and sometimes persisted for as long as 2 months after inoculation. The pathological lesions in the lungs of mice inoculated with these 2 agents were indistinguishable microscopically. Because of these general similarities, a study was made of the possible antigenic relationship of the Baker virus to the Nigg virus and to the virus of psittacosis. In this paper, evidence is presented which indicates that the Baker virus, like the Nigg virus, should be regarded as a member of the psittacosis-lymphogranuloma group. A comprehensive comparison of the biological properties of the Baker and Nigg viruses will be the subject of a subsequent report.

Viruses. A strain of the cat pneumonia virus in yolk sac material was obtained through the courtesy of Dr. James A. Baker. The virus was maintained by passage in the yolk sacs of developing chick embryos and by passage in the lungs of mice. In order to avoid the possibility of contamination of the agent with a latent mouse virus, egg passage material was used exclusively for the immunization of animals and for the preparation of antigens for complement-fixation tests.

Through the courtesy of Dr. Geoffrey Rake, the Nigg mouse pneumonia virus was obtained in the form of infected mouse lung tissue. Three serial passages in Swiss mice were carried out in this laboratory, following which the virus was maintained by passage in eggs. A strain of psittacosis virus, which was isolated from an infected pigeon in this laboratory during 1942,[4] was used.

Complement-Fixing Antigens. Baker and Nigg virus antigens were prepared from infected yolk sacs by a method similar to that

* The Bureau of Medicine and Surgery of the United States Navy does not necessarily undertake to endorse views or opinions which are expressed in this paper.

1 Baker, James A., *Science*, 1942, **96**, 475.

2 Nigg, C., *Science*, 1942, **95**, 49.

3 Eaton, M. D., and Corey, M., PROC. SOC. EXP. BIOL. AND MED., 1942, **51**, 165.

4 Smadel, J. E., Wall, M. J., and Gregg, A., *J. Exp. Med.*, 1943, **78**, 189.

described by McKee, Rake and Shaffer[5] for *Lymphogranuloma venereum* virus. Psittacosis virus antigen was prepared from chick embryo tissue culture infected with a parakeet-derived strain of psittacosis virus. The method used for the preparation of this antigen has been described by Smadel.[6] Control antigens were prepared from normal yolk sacs and from uninfected tissue culture material by methods identical with those used for the virus antigens.

Sera. Immune sera against the Baker and Nigg viruses were obtained from Syrian hamsters or from mice which had been inoculated intranasally with infected egg material. Antiserum against the pigeon strain of psittacosis virus was obtained from mice which had received intraperitoneal injections of a suspension of infected mouse brain. Convalescent serum from 2 patients who had recovered from psittacosis were included in complement fixation tests against the various antigens.

Complement-fixation Technic. The complement-fixation technic employed was identical in all details with that previously described.[7] Sera were tested in two-fold dilutions, from 1-4 to 1-256. The endpoint in each test was taken as the highest dilution of serum in which little or no hemolysis occurred. The titers were recorded in terms of the initial dilution of serum. Appropriate hemolytic and anticomplementary controls were included in each test. All reagents were tested for anticomplementary activity in twice the highest concentration used in a test. Comparisons of the activity of antisera and antigens were made simultaneously in the same experiment. Normal human and animal sera, as well as uninfected yolk sac and tissue-culture antigens, were included as controls in each test.

Results. Complement-fixation tests were carried out with Baker, Nigg, and psittacosis viruses in the presence of antisera against each of these agents. The results of these tests are presented in Table I. It will be seen that the antisera against the Baker virus fixed complement in high dilution in the presence of both the psittacosis and Nigg virus antigens. The titers observed against these heterologous antigens were not significantly lower than the titer against the Baker virus antigen itself. Similarly, the antisera against psittacosis and Nigg viruses produced fixation of complement with the Baker virus antigen. It is noteworthy that both convalescent sera from patients with psittacosis also fixed complement at similar dilutions with all 3 virus antigens. No significant antigenic differences between the 3 viruses were revealed by these tests when either hamster or human serum was employed. However, in the case of immune mouse serum it is of interest to note that the titer against the homologous virus was usually considerably higher than was the titer against either of the heterologous viruses.

The results of these tests indicate that the virus of cat pneumonia (Baker) is antigenically related to psittacosis virus and to

[5] McKee, C. M., Rake, G., and Shaffer, M. F., PROC. SOC. EXP. BIOL. AND MED., 1940, **44**, 410.

[6] Smadel, J. E., *J. Clin. Invest.*, 1943, **22**, 57.

[7] Thomas, L., Curnen, E. C., Mirick, G. S., Ziegler, J. E., Jr., and Horsfall, F. L., Jr., PROC. SOC. EXP. BIOL. AND MED., 1943, **52**, 121.

TABLE I.
Results of Complement-Fixation Tests with Baker, Nigg, and Psittacosis Viruses and Antiserum Against Each of These Agents.

Antiserum		Complement-fixation titer against indicated antigen				
Species	Immune against	Baker virus	Nigg virus	Psittacosis virus	Yolk sac control	Tissue culture control
Hamster	Baker virus	1-256	1-256	1-128	0	0
"	Nigg "	1-64	1-128	—	0	0
Mouse	" "	1-16	1-64	1-8	0	0
"	Psittacosis virus	1-32	1-16	1 64	0	0
Human (L)	" "	1-128	1-256	1-256	0	0
" (A)	" "	1-64	1-64	1-64	0	0
Hamster	Normal	0	0	0	0	0
Mouse	"	0	0	0	0	0
Human	"	0	0	0	0	0

the Nigg virus of mouse pneumonia. Minor antigenic differences between these 3 elementary body viruses may, however, exist.

Discussion. It seems apparent that another potential host, the cat, must be added to the wide variety of species from which viruses of the psittacosis-lymphogranuloma group have been recovered. Certain members of this group of elementary-body viruses have been tentatively separated from each other on the basis of minor antigenic differences,[3] differences in host range,[8] or differences in the route of inoculation by which they are pathogenic.[9] In mice the Baker virus is limited in its pathogenicity to the respiratory tract and in this respect it differs from the viruses of parrot or pigeon psittacosis, meningopneumonitis, and lymphogranuloma venereum, but resembles the Nigg virus of mouse pneumonia. The similarity between these two viruses is of considerable interest in view of the possibility that the disease in cats may have originated as the result of feeding upon infected mice. The recent observation by Karr[10] that normal mice could become infected following the ingestion of infected mouse tissue, may support this view.

Conclusion. The virus of cat pneumonia described by Baker is antigenically related to psittacosis virus and to the Nigg virus of mouse pneumonia. It should, therefore, be included in the psittacosis-lymphogranuloma group.

8 Eaton, M. D., Beck, M. D., and Pearson, H. E., *J. Exp. Med.*, 1941, **73**, 641.

9 Pinkerton, H., and Moragues, V., *J. Exp. Med.*, 1942, **75**, 575.

10 Karr, H. V., *J. Inf. Dis.*, 1943, **72**, 108.

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Formation of Invisible, Non-perceptible Films on Hands by Cationic Soaps.*

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Many of the synthetic detergents of the cationic type are excellent germicides.[1] They also clean skin very effectively when employed in aqueous solutions at about one per cent concentration. While studying the effectiveness of the detergents in this concentration range for rapid degermation‡ of hands, we encountered several unexpected phenomena which are described in this report.

The extent of degermation was evaluated by a modification of the technic devised by Price.[2] Each hand is brushed systematically for 15 seconds over the nails, 15 seconds over the back of the hand, and similarly over the palmar surface. During this procedure the brush and hands are dipped frequently into 2 liters of water in a basin. Soap is added to the collecting basin to neutralize the cationic detergent and prevent bacteriostasis. One cc of this solution is poured with beef-infusion dextrose agar medium into a petri dish. The number of bacterial colonies on the plates is counted after incubation for 2 days, and the number of organisms removed from the hands is calculated. By this technic usually 1 to 10 million organisms are removed from both

* The work described in this paper was done under a contract, recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and the University of Chicago.

† On leave from University of Chicago for active duty in U. S. Public Health Service, Washington, D.C.

1 Baker, Z., Harrison, R. W., and Miller, B. F., *J. Exp. Med.*, 1941, **74**, 611.

‡ "Degermation" includes both the killing and the mechanical removal of bacterial flora.

2 Price, P. B., *J. Infect. Dis.*, 1938, **63**, 301.