

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 Karr¹⁰ 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.

14354

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

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† 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.

have obtained the same results, but have found that an additional dip for a few minutes in one percent Phemerol or Zephiran protects the hands under surgical gloves during operations lasting several hours. That is, a 90-second scrub in water at the end of the operation fails to release organisms from the hand previously protected by the detergent film, whereas numerous organisms are removed from the control untreated hand. It has been found, also, that there is no significant multiplication of organisms under the detergent film during the course of prolonged surgical operations.

The film resists ordinary mechanical trauma, as well as brief dips in water or blood, and also exposure to animal tissues, but it is disintegrated by continuous exposure to running tap water for 15 to 30 seconds. Continuous dips in water or physiological saline also disintegrate it. Chemical substances like soap and strong alcohol break the film.

Further evidence for the presence of a film of cationic detergent on the skin may be obtained by dipping one hand in a one per cent solution of the detergent, and the other hand in water, and drying both. If both hands are then dipped in a saturated solution of an anionic dyestuff such as Guinea Green B or Rosindulin 2B for a few seconds and then rinsed in water, it will be found that only the hand which had been dipped in the detergent will be stained by the dyestuff. The influence of wetting action *per se* has been eliminated; it was found that thoroughly cleansed hands which can be wetted by the dyes are not stained by them unless a cationic detergent has been applied previously.

We have done some experiments on individuals performing abdominal operations on animals. The operators worked without gloves, and had one hand covered with the detergent film, whereas the other served as the untreated control. In almost every instance, despite the fact that the operators' hands became quite bloody in the course of several hours manipulation, there was a striking reduction in the number of organisms obtained from the treated hand upon a 90-

second brush-up in water as compared with the control hand. However, it should be mentioned that in those instances when the operators were forced to dip their hands frequently in saline solutions, or to use many wet sponges, the detergent film showed signs of considerable disintegration.

Most of the cationic detergent germicides have been applied heretofore to human skin in concentrations of 0.1 per cent. We have not observed any signs of local or systemic effects from the use of one per cent solutions of Phemerol or Zephiran in single experiments on over 100 individuals. We have also studied the effects of one per cent Phemerol solution when applied frequently to the hands and have found that it can be tolerated without local or systemic toxicity when applied as a brush-up or rinse for 5 to 15 minutes each day over a period of six weeks.[†]

There are hundreds of cationic detergents which have been synthesized, and many of these are available commercially. One of the reasons we wish to present this paper is to encourage others to search for suitable detergents of low toxicity, and also for a detergent which will deposit a film with greater resistance to solution in water.

It is believed that these results point the way for improved methods of hand hygiene, *e.g.*, for surgeons, medical personnel dealing with contagious cases, food-handlers, etc. In instances when surgical gloves are not available, it might be feasible to perform a reasonably sterile operation by protecting the hands with frequent dips in a solution of one percent cationic soap.

Summary. Certain cationic soaps deposit an invisible, non-perceptible film on the hands. This film retains bacteria underneath it, and is very resistant to mechanical trauma. The inner surface of the film has a low bactericidal power, whereas the outer surface exerts a strong germicidal action.

[†]Ten medical students participated in this study. Nine of them tolerated the use of the solution perfectly well; one developed a small area of hyperkeratosis which may have been partly due to mechanical trauma.