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Excretion of Poliomyelitis Virus.*

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During the early stages of human poliomyelitis virus appears in the pharyngeal secretions and in the stools.^{1,2,3,4} The experiments of Melnick⁵ suggest that this phenomenon is excretory, since it occurs in the stools after parenteral inoculation, but little is known of the mechanism or pathways of excretion. The present study is part of an exploration into the mode of virus excretion.

Following an hypothesis proposed in another paper⁶ and using monkeys, we have applied 20% virus (our *Cam* strain, 2nd-7th passages) for 10 minutes to the central end of the divided infraorbital branch of the right trigeminal nerve in the cheek ("nerve dip"), sedulously avoiding virus contamination of the skin and mucous membranes. Preliminary tests with rhesus (*M. mulatta*) showed that on the third day heavy lesions were usually present in the homolateral but not the contralateral semilunar (Gasserian) ganglion, while no more than minimal lesions were found, and then only occasionally, in the central components of the trigeminal system in the pons and medulla. At the same period, virus was detected in the homolateral but not in the contralateral ganglion. Virus was also found in pooled nasopharyngeal washings collected from the 2nd to the 5th day, inclusive.

With these preliminary data at hand, 4 cynomolgus monkeys (*M. irus*) of Philippine origin were similarly treated and materials collected and pooled serially on the second, third and fourth days after exposure, the animals being sacrificed on the fourth day. Nasopharyngeal washings were obtained by washing 0.85% NaCl solution through one nostril with a catheter and collecting the returning fluid from the other. This material as well as the stools and intestinal contents was concentrated by the technique described by one of us (R.J.S.)⁷ and subinoculated intrathalamically into rhesus monkeys. The results are shown in Table I.

Discussion. In a previous paper⁶ we have suggested on anatomical grounds the hypothesis that when poliomyelitis virus, which is known to be axonally conducted, has penetrated a body surface, entered the telodendria of a peripheral afferent neuron and ascended to the corresponding peripheral ganglia where it can multiply and infect adjoining neurons, it would then be in a position to spread not only centripetally to the CNS but also centrifugally back to the surfaces supplied by the same nerve system. This possibility arises because the peripheral neurons of most afferent nerves have T-shaped axons, one branch of which ascends to the CNS and the other is directed to the periphery. In the case of the trigeminal nerve, which was investigated in the present experiments, virus would thus be brought back by centrifugal spread to the terminal arborizations in the nasopharyngeal mucosa, which are stated to end free on the surface,⁸ whence it might be

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¹ Taylor, E., and Amoss, H. L., *J. Exp. Med.*, 1917, **26**, 745.

² Paul, J. R., Salinger, R., and Trask, J. D., *J. A. M. A.*, 1932, **98**, 2262.

³ Howe, H. A., Bodian, D., and Wenner, H. A., *Bull. Johns Hopkins Hosp.*, 1945, **76**, 19.

⁴ Horstmann, D. M., Melnick, J. L., and Wenner, H. A., *J. Clin. Invest.*, 1946, **25**, 270.

⁵ Melnick, J. L., *J. Immunol.*, 1946, **53**, 277.

⁶ Faber, H. K., and Silverberg, R. J., *J. Exp. Med.*, 1946, **83**, 329.

⁷ Silverberg, R. J., *Science*, 1945, **102**, 380.

⁸ Schaeffer, J. P., *The Nose, Paranasal Sinuses, Nasolacrimal Passageways, and Olfactory Organ in Man*, P. Blakiston's Sons and Co., Philadelphia, 1920, p. 285.

TABLE I.
Distribution of Poliomyelitis Virus After Right Infraorbital Nerve Dip. Four Cynomolgus Monkeys. Cam Strain of Virus.

Days after inoculation	Nasopharyngeal washings	Stools	Semilunar ganglia		Washed pharyngeal wall
			Right	Left	
2	0	0	—	—	—
3	+*	0	—	—	—
4	+	+	+	0	0

* Non-paralytic case: cord histologically positive.

— Not tested.

+ Clinically positive: cord sections positive.

0 Cord sections negative; symptoms absent or very questionable.

excreted and detected in the overlying mucus.

Our experiments tentatively confirm the hypothesis in the following respects: (1) ascent by centripetal spread to the Gasserian ganglion; (2) limitation of infection to the nerve system in question during the first 3 days; (3) excretion of virus in the appropriate area on the third day. Avoidance of primary exposure of the mucosa to virus rules out implantation of virus on the mucosal surface. Excretion by the lymphatics is highly improbable, since lymph flow is away from rather than toward the surface.⁹

The very early appearance of virus on the nasopharyngeal mucosae is noteworthy and interesting in reference to similar findings in the human disease,¹⁻³ as is the fact that it

⁹ Yoffey, J. M., and Drinker, C. K., *J. Exp. Med.*, 1938, **68**, 629.

appeared a day later in the stools than in the nasopharyngeal washings, which might be explained on the basis of swallowing.

This work is to be repeated and expanded.

Summary. Poliomyelitis virus when applied to the central end of a divided branch of the trigeminal nerve in the cheek travels centripetally to the corresponding semilunar ganglion within three days. Centrifugal spread to the nasopharyngeal surfaces, which are supplied by the trigeminal nerve, was demonstrated by detection of virus in the nasopharyngeal washings on the third and fourth days. Virus was also found in the stools on the fourth but not on the third day, suggesting that it had been swallowed. It is suspected that excretion, like invasion, of poliomyelitis virus occurs through axonal channels.

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Prolonged Survival of Adrenalectomized-Nephrectomized Rats on a Low Potassium Diet.*

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Adrenalectomized animals are extraordinarily sensitive to all types of stress, including

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the metabolic derangements following nephrectomy. During the course of investigations on the relation of the adrenal cortex to urea synthesis, considerable difficulty was met in maintaining life in adrenalectomized-nephrectomized animals long enough for satisfactory study. The limited survival was not influenced by the use of liberal amounts