Experiments (1) on the dissemination of vaccinia virus along the cervical lymphatic pathway, following intranasal instillation, directed attention to the possibility that a similar mode of spread might hold good for the virus of poliomyelitis. In recent years the view has been gaining ground that this virus extends along nerve fibers, involving first the terminations of the olfactory nerve in the upper part of the nose, and then spreading to the olfactory bulb and throughout the central nervous system (2, 3).

The lesions in poliomyelitis, however, are not confined exclusively to the nervous system. Burrows (4), investigating the pathology of the disease in 50 fatal cases, concluded that the nervous involvement was only a rare complication in a widespread infectious disease, and that the name "infantile paralysis" was misleading, since it described what was only an occasional complication. He therefore suggested that the name "acute lymphatic hyperplasia" would accord better with the pathological findings. The literature contains numerous observations which fit in with this idea. Leiner and von Wiesner (5) reported the finding of virus in the cervical and mesenteric nodes of monkeys after intracerebral injection. Kling, Levaditi, and Lépine (6) found virus in the mesenteric nodes of monkeys which had been infected via the gastro-intestinal tract. Kling, Olin, and Gard (7) found virus in cervical or mesenteric lymph nodes in five out of thirty-seven human cases which came to autopsy, and in two cases out of thirteen, one in an inguinal and one in a mesenteric node, in monkeys which had developed paralysis after intracerebral inoculation of virus. It is of interest to recall the earlier experiments of Flexner and Lewis (8) in which virus was found in the regional lymph nodes, axillary and inguinal, after subcutaneous injection. Flexner and Lewis (9) also found virus in a human mesenteric node, though more recently Flexner (3) has expressed the view that this result may have been due to faulty technique. Virus has also been found in the tonsils of subjects coming to autopsy (10, 11), while Sabin (12) has shown that the disease can be produced by injection of virus into the tonsillopharyngeal region.

The primary object of the present experiments was to determine whether virus could ever be detected in cervical or thoracic duct lymph. In addition, we have endeavored to produce the disease by the injection of virus into lymph nodes, and by rubbing into the taste buds.

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Material and Methods

The experimental animal has been the rhesus monkey (Macaca mulatta), and the virus the Toomey "T" strain. The presence of virus in lymph was tested for by intracerebral injection into normal monkeys. In the case of thoracic duct lymph, the lymph was centrifuged, and sediment and supernatant fluid tested separately.

RESULTS

1. Virus Is Not Present in Cervical Lymph Immediately after Nasal Instillation.—In two monkeys, the cervical lymph ducts were cannulated, and 1.5 cc. of freshly made virus suspension dropped into each nostril, after which lymph was collected for 4½ and for 5 hours, respectively. The test monkeys injected with this lymph did not develop paralysis. The results thus agree with previous experiments with vaccinia virus in rabbits (1).

2. Virus Is Not Present in Cervical Lymph When Paralysis Has Developed.—Paralysis was produced in six monkeys, in two by intracerebral inoculation of virus and in four by nasal instillation. In the latter, the animals were anesthetized, placed in the Trendelenburg position, and 1.0 cc. of virus suspension dropped into each nostril; the animals recovered after a few hours. When paralysis developed, the animals were again anesthetized, and the cervical lymph ducts cannulated. None of the test monkeys injected with lymph thus obtained developed paralysis.

3. Virus Is Not Present in Cervical Lymph after Infection Has Taken Place but before the Onset of Paralysis.—Two monkeys were infected by nasal instillation of virus. At intervals of 1 and 4 days afterwards, respectively, the cervical ducts were cannulated aseptically, sufficient lymph obtained, and the animals then allowed to recover. In the first case paralysis developed 7 days after operation, in the second case 2 days after, thus showing that the animals were infected at the time of operation. The test monkeys injected intracerebrally with the lymph thus obtained remained perfectly normal.

4. Virus Is Not Present in the Thoracic Duct Lymph of Paralyzed Animals.—In rabbit experiments (1) vaccinia virus was found almost constantly in thoracic duct lymph after nasal instillation. It was therefore decided to test for the presence of poliomyelitis virus in the thoracic duct lymph of paralyzed animals. Three monkeys were infected, two intracerebrally and one intranasally. When paralyzed, the left clavicle was removed and the thoracic duct cannulated. By analogy with vaccinia experiments (1) in which the lymphocytes were found to act as virus carriers, it was thought that by centrifuging the lymph and injecting a large number of lymphocytes, one might be able to concentrate any virus
present. The test animals therefore fall into two groups. In the first group, three animals were inoculated intracerebrally with 1.0 cc. of lymph containing, respectively, 99,000, 285,000, and 446,000 lymphocytes per cubic millimeter. In no case did paralysis develop. In the second group, three monkeys were injected intracerebrally with 1.0 cc. of supernatant fluid free of cells; and here also there was no paralysis.

5. **Infection Is Not Produced by Injecting Virus into Lymph Nodes.**—Leiner and von Wiesner (13) described, in one experiment, the development of paralysis after injecting virus into a lymph node. The result seemed worth confirming, and in six monkeys virus was injected into two or more inguinal lymph nodes. All the injected monkeys remained perfectly normal.

6. **Infection Is Not Produced by Rubbing Virus into Taste Buds.**—If it be true that virus obtains access to the central nervous system through the free terminals of the olfactory nerves, it is reasonable to suppose that infection should be possible via the taste buds, where there are also free nerve terminals. Two monkeys were anesthetized, and virus rubbed into the taste buds (circumvallate papillae) several times during a period of 2 hours. In one of these experiments, pledgets of cotton wool soaked in virus were placed over the taste buds in between the periods of rubbing so as to ensure the most thorough contact of virus with nerve endings. No paralysis developed.

**DISCUSSION**

In twenty-one experiments, conducted with one strain of virus, the results have been so consistently negative that one must conclude that the strain of virus employed does not spread by way of the lymphatic vessels and nodes, or else that it is present in concentrations below the minimal infective dose.

We are indebted to Dr. Eugene R. Sullivan for his assistance in our earlier experiments.

**CONCLUSION**

In *rhesus* monkeys the Toomey "T" strain of poliomyelitis virus could not be detected in cervical or thoracic duct lymph after intranasal or intracerebral inoculation.

**BIBLIOGRAPHY**