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Distemper in the silver fox (*Culpes vulpes*).

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An epidemic of very large proportions has occurred on a number of fox ranches in Minnesota. The specific disease under consideration had been diagnosed as "fox distemper" because of its similarity, from the clinical aspect, to the disease in dogs which is known as "canine distemper." The varied features of canine distemper, which is described as appearing in several forms—the upper respiratory, the central nervous system, and the intestinal types—were all present in the foxes afflicted with this disease on each individual ranch. Most foxes exhibited a very marked infection of the conjunctiva and nasal cavity, from which issued a purulent discharge. A large number of foxes exhibited nervous symptoms before death, ranging from muscular twitching to violent convulsions. A diarrhea appeared to be always present.

Many foxes were not recognized as being sick but were found dead in their pens, although visited daily. Autopsies on a hundred foxes showed a great preponderance of pneumonia, usually extensive. The liver was usually congested; the spleen congested and enlarged. The intestinal mucosa was usually inflamed in the lower portion. Ulcerations were present in the intestine in some cases.

Bacteriological studies of foxes dying on the ranches yielded a great variety of organisms. Streptococci and various diplococci predominated in the pneumonias. *Bacillus bronchosepticus* could be isolated from the nasal secretions. Blood cultures yielded a great variety of organisms. Usually a mixed culture was ob-

tained. Because of the large numbers of organisms encountered, it was believed that these were secondary invaders, and that much of the pathology observed was due to these secondary invaders. It was noted that some few foxes dying on the ranch did not exhibit pneumonia. Some did not exhibit a very marked discharge from the eyes and nose. It was therefore believed that these two pictures did not form a part of the primary infection.

Experiments in transmission of the disease to well foxes were undertaken in order to get rid of the secondary invaders. Those parts of a diseased animal were chosen for this work in which the smallest variety of organisms was found. The disease was successfully transmitted to well foxes by the direct injection of blood, and by injection of emulsified brain and spinal cord.

The diseased foxes used for transmission represented all types of the disease, some with pneumonia and nasal discharge, and some without these findings. In all cases a type of the disease was readily produced in which there was no marked purulent discharge from the eyes and nose, and in which no pneumonia occurred. In the animals dying of the experimental infection the liver was congested and enlarged, and ulcerating lesions of varying grades were present in the intestine.

The disease was successfully transmitted through several series of animals. From the third member of these series a pure culture of a gram negative bacillus belonging to the genus *Salmonella* was isolated. The material containing this organism in pure culture was injected into the fourth member of the series, and the organism again regained in pure culture. The organism was also regained in pure culture in the injected material in the fifth and sixth members of the series, and recovered in pure cultures in both cases.

The organism was isolated in pure culture and was injected into four foxes. The foxes were injected in pairs on the same day, and the respective pairs died on the same day, about eighteen days later. The organism was recovered in pure cultures from various tissues of these four animals.

In the disease produced by the pure culture, symptoms and pathological findings were found which corresponded exactly to those cases occurring on the ranch which did not show signs of secondary invaders. It is therefore established that this organism of the genus *Salmonella* was the cause of the primary disease epi-

demic upon these ranches, and the large variety of pathology encountered was due to the presence of secondary invaders.

When the organism is injected in pure culture intraperitoneally, there are no immediate symptoms. After three or four days the animal begins to drip at the nose as if it had a very acute cold. This excessive secretion lessens after a few days, and the nose becomes dry. The eyes are watery, and after two weeks begin to sink or recede into the head. The animal shows the first marked signs of being ill from sixteen to twenty days after injection, and dies very shortly after the appearance of symptoms. Very marked convulsions may occur before death following injection of the pure culture. The organism can be isolated from every organ and from the meninges. Pneumonia does not occur. The trachea may be inflamed. The liver is enlarged and congested, as is also the spleen. Lesions are found in the gastrointestinal tract which vary from an intense inflammation to definite ulceration and, in some cases, to definite perforating ulcers which may be multiple. The stomach and bladder may also be inflamed. Intense hemorrhages from these ulcerations sometimes occur.

The organism isolated apparently represents a new species of the genus *Salmonella* when classified according to the definitions of the Society of American Bacteriologists. Its identifying characteristics have as yet not been completely worked out.

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