

Preliminary Note on Arctic Dog Disease and its Relationship to Rabies

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ABOUT 1930 the Division of Animal Pathology commenced to receive reports concerning a condition occurring among dogs and fur-bearing animals in the Northwest Territories. The information in these reports was meagre and gave little assistance in determining the nature of the disease. In 1932 a member of our staff was sent North on the "Nascopie". He visited a number of posts but found no affected animal or material for autopsy examination. Consequently his mission threw no light on the problem. In 1931 Elton (1) described epidemics among sled dogs in the Canadian Arctic and their relation to disease in Arctic foxes. His paper referred principally to the cyclical features rather than pathology.

Considerable speculation has arisen concerning the nature of the disease, some believing that it is the fox encephalitis described by Green, Ziegler, et al (2) which had become endemic among Arctic foxes and transferred to dogs, some that it is caused by an undescribed virus, others that the food supply of the dogs is related to the condition and that either food poisoning or deficiencies are responsible.

At long intervals communications arrived describing new epidemics. Occasionally tissue was forwarded but since this was invariably preserved in alcohol or another fixative and usually failed to arrive at the Institute within the year, precise examination was impossible.

Four years ago a plan was drawn up for the study of the disease whenever it should break out at an accessible Post. This year the condition was reported at Baker Lake, which is situated approximately 400 miles north of Fort Churchill and can be reached by aeroplane. The author, equipped with supplies for collecting samples, visited this Post, obtained pertinent information, held autopsies and returned with tissues for experimental study. Unfortunately the disease had subsided but the carcasses of three dogs and one fox were available. They were frozen solidly and in a good state of preservation.

Field information.—The Officer in charge of the Hudson Bay Post** and Commanding Officer of the Royal Canadian Mounted Police*** were most helpful. Their observations were kindly given in detail; also they acted as Eskimo interpreters.

It is believed that in addition to dogs, foxes, wolves and possibly lemming are susceptible. The disease is said to occur in cycles of from 7 to 12 years commencing in late autumn or early winter with a tendency to

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Dog inoculated with fox brain material. Picture taken on third day of symptoms shows complete paralysis of lower jaw.

subside in the summer. The cycles coincide with an increase in the population of foxes and lemming. Between cycles losses are negligible. The evidence tends to suggest that the enzootic among dogs is confined to small isolated outbreaks at a Post. This, of course, may be due to natural isolation. The number of dogs in one settlement is not large—perhaps 20 to 50—which is augmented occasionally by dogs of visiting trappers. During an enzootic, sick or dead foxes are found scattered over the country. This is also said to be true of lemming. Dead wolves are occasionally found but information concerning these animals is rather indefinite.

Carcasses are not destroyed. Wood for fire is unavailable and the ground cannot be opened. Therefore, they are left to be eaten by carnivorous animals.

Epidemiology.—Having regard to the surrounding circumstances it is difficult to arrive at an opinion regarding all the factors involved in an outbreak. Some points are reasonably certain. The history strongly suggests that the reservoir of infection is in foxes and other wild animals and that the epidemic in dogs is started from this source. There appears to be general agreement that so-called “crazy” foxes enter a settlement and attack dogs. These dogs become ill and in turn infect other dogs. Infection results from a bite—not contact. It is believed that a dog which has been bitten by either a “crazy” fox or an affected dog will die eventually. In fact in recent years an animal which has been known to be bitten by a diseased one is shot. Eskimos are occasionally bitten by affected dogs. They are well protected by leather clothing however and the skin is rarely penetrated.

In the Baker Lake district a severe outbreak took place in 1934. Many dogs and foxes died. Another outbreak occurred in 1946-47. It was less severe and only a few local dogs succumbed. Both of these outbreaks followed the typical pattern described, that is “crazy” foxes first came into the settlement and attacked dogs. The last outbreak was perhaps less severe because of the system now adopted of tying up dogs when they are not at work. This prevents intermingling and reduces contact with wild animals at night.

In 1934 the fox population was large, while in 1946 the lemming population was dense.

Symptoms.—The symptoms described suggest a lesion of the central nervous system. The initial symptom is inappetence, followed by accelerated breathing and panting. Although temperatures have not been taken, it is believed fever is present as the animal's body will melt snow. Tremors and spasms develop and the dog assumes a frightened expression. Later it becomes vicious and will attack a person or a dog. Many animals bite their tails and it is not unusual to find the tails bitten off. Frothing at the mouth and bleeding from the nose is occasionally exhibited. Some dogs become paralyzed in the hind quarters and walk with great difficulty. The majority go into coma before dying although a few succumb to convulsions. The average duration from the onset of the disease is said to be four days. A few animals may linger for a week. It is believed that the incubation period is short and that symptoms appear on or before the fourth day following exposure. This is doubtful since animals may be exposed simultaneously to a common source of infection and the periods of incubation vary, thus giving the appearance of a short incubation period in the last to come down because of their exposure to their affected team-mates.



Dog inoculated with fox brain material. Picture taken on third day of symptoms shows complete paralysis of lower jaw.

Nothing is known of the early symptoms in wild animals. Foxes colloquially termed 'crazy' boldly walk into a settlement, even into a dwelling. They will fight tethered dogs and appear unafraid of man. A disease of lemming which takes the form of extreme weakness, inability to move and coma is thought to be related.

Autopsy

White fox.—This animal had been found dead five miles from Baker Lake. The only gross lesions were a limited congestion of the apical lobes of the lungs, congestion of the meninges and flattening of the convolutions of the brain.

Dog (1).—The carcass was that of a Husky dog which had been found dead in the morning but had shown no previous illness. Necropsy examination revealed an inflammation of the stomach and of two-thirds of the intestines.

Dog (2).—This was a Husky dog that had developed symptoms of the disease while on the trail. In the words of the Native, it had become 'crazy'. On the second day of illness it was shot. The only lesion found was that the end of the tail had been bitten off.

Dog (3).—This was a Husky dog. It developed nervous symptoms, showed viciousness and convulsions. It died on the fourth day of illness. No gross pathological changes could be found.

Microscopic examination

Numerous impressions were made from appropriate brain material of each animal. These were stained by William's modification of Van Gieson's method. In the hippocampus of the fox there was present inclusions with characteristics indistinguishable from Negri bodies. No inclusions were found in dogs 1 and 2. In dog 3, however, indefinite inclusions were found in the hippocampus which were not entirely characteristic of Negri bodies.

It was thought advisable to concentrate on the two animals in which inclusions were found leaving until later a closer examination of dogs 1 and 2. Because of this, there follows a description only of the work carried out on the fox and dog 3.

Histopathology

Paraffin sections were prepared from formol-saline fixed tissues collected at Baker Lake and from animals inoculated at the laboratory. These were stained with Harris' haematoxylin and LeMesurier's Triple Eosin. The tissues were subject to low temperature for several weeks and this may have caused some of the changes noted.

Fox: brain.—The lesion was that of inflammation and degeneration. These were characterized by neuronal degeneration, marked chromatolysis, slight oedema and a moderate infiltration of lymphocytes. Perivascular cuffing was not a feature. Negri bodies were not found in sections.

Lung.—A severe and extensive congestion and oedema.

Kidney.—Apart from a diffused karyolysis of the nuclei of the medullary portions of the collecting tubules, was normal.

Liver.—Fragmentation of the cords and focal degeneration.

Myocardium.—There was a severe fragmentation of the bundles.
Urinary bladder.—The lining epithelium was not present. The muscular and serous coats reacted faintly to eosin.
Spleen.—Marked chromatolysis of the pulp.
Adrenals.—Essentially normal.
Dog (3):—brain.—Oedema and chromatolysis. Inclusion bodies not found in sections.
Lungs.—Congestion and marked effusion of serum into the alveolar spaces. Haemorrhage had occurred in some areas.
Kidneys.—Essentially normal.
Liver.—Severe and extensive degeneration. The cell membranés were indistinct. The sinusoids contained a granular acidophilic material.
Myocardium.—Extensive fragmentation of the bundles.
Urinary bladder.—Most of the lining epithelium was gone. What remained and the muscular and serous coats were normal.
Spleen.—Marked chromatolysis of the pulp.
Stomach.—Normal. The redness noted on autopsy was not explainable from the microscopic study.
Animal Inoculations.—A portion of brain was ground, saline added and inoculated intracranially into several species of animals. Details appear on tables 1 and 2.

TABLE 1

Inoculum - Fox brain
Route - Intracranial

Experimental Animal	No.	No. Died	Days		Negri bodies present
			1st Symptoms	Death	
Dog.....	1	1	20	27	Yes
Hamster.....	1	1	17	18	Indefinite
Rabbit.....	2	2	18-20	19-21	Yes
Mice.....	6	6	10-17	11-18	Inclusions but not typical

TABLE II

Inoculum-Brain Dog 3
Route-Intracerebral

Experimental Animal	No.	No. Died	Days		Negri bodies present
			1st Symptoms	Death	
Hamster.....	2	1	13	14	Yes
Rabbit.....	2	2	17-21	18-23	Yes
Mice.....	6	6	12-16	13-17	Inclusions but not typical

Discussion

The evidence presented indicates that the fox and dog No. 3 were affected with rabies. This infection must at least form a part of so-called Arctic dog disease. Before conclusions can be drawn it will be necessary to conduct examinations of material from Northern Posts taken from ani-

mals dying during epidemics. The histories available, the transference of the disease from one animal to another by a bite taken together with the demonstration of the virus indicates that rabies is not an uncommon infection in the North. The presence of rabies in wild animals makes its elimination almost impossible. In large measure it may be controlled in dogs by vaccination but the reservoirs will continue to exist.

Having regard to freedom from rabies in the settled parts of Canada, one is tempted to surmise the manner in which this infection became seeded down in the North. Likely it occurred many years ago. It may have been brought in by explorers, fur-traders or whalers, even if the length of time occupied by a voyage would seem to cover the incubative period of the disease. It would be extremely interesting to search extant references to Northern voyages or to the cruises of fur-trade ships in the hope of finding some reference which might suggest the presence of rabies among dogs on voyages. Another method by which the disease may have been introduced is from Siberia by way of Alaska. At any rate it is likely that rabies has existed long and is widespread among wild animals of the North.

It is proposed to continue this investigation with the purpose in view of determining whether Arctic dog disease is rabies or a composite of rabies and other infections or conditions.

Summary

1. Two of four animals which died in the neighbourhood of Baker Lake were affected with rabies.
2. The epidemiology suggests that wild animals are the reservoirs and that dogs become infected from this source.

Acknowledgment

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References

1. ELTON, CHARLES. (1931) Can. Jour. Res. 5. p. 673-692.
2. GREEN, R. G., ZIEGLER, N. R., GREEN, B. B. AND DEWEY, E. T. (1930). Amer. J. Hyg. 12: 109-129.

Sommaire

L'examen microscopique des tissus d'animaux morts dans la région du lac Baker (situé à environ 400 milles au nord de Fort Churchill) et l'inoculation expérimentale révèlent que certains de ces animaux (un chien et un renard) souffraient de rage. Selon l'auteur, cette infection joue un rôle dans un complexe pathologique fréquemment observé chez les chiens de l'Arctique. L'étude épidémiologique suggère que des animaux sauvages, le renard et le loup entre autres, agissent comme réservoirs du virus de la rage et que le chien s'infecte à partir de ces animaux.