

# David and Goliath

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**Grades:** 10-12

**Subject:** science, biology

**Skills:** reading, comprehension, research

**Duration:** 60-90 minutes

**Vocabulary:** ataxia, abomasum, rumen, peritoneal cavity, nematode, gastropod, histology, parasitology, parasite, ectoparasite, endoparasite, disease.

## Objectives:

Students will be able to: 1) describe and outline the life cycle of the brainworm in White-tailed Deer.  
2) describe the transfer of brainworm between deer and Moose

## Method:

Students read a first-hand account of the research into brainworm in White-tailed Deer and the discovery of the cause of “moose sickness”.

## Background:

Three basic elements needed for survival by all animals in Algonquin Provincial Park are food, water, and shelter. Finding all three can be a challenge in and of itself, but animals also have to deal with other factors that affect their chances for survival. Disease and parasites are something every animal in Algonquin Park has to contend with day-to-day. All animals in Algonquin have at least one parasite either on (ectoparasite) or in them (endoparasite), and sometimes several. For the most part an animal is not killed by its parasites, as it would not be beneficial for the parasite. Sometimes, however, the host is killed by the parasite either directly or indirectly.

This can occur in several ways:

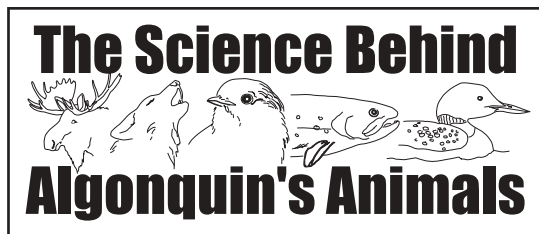
- Firstly, when a parasite uses a host as a food source for developing young, as occurs with certain parasitic wasps. Finding a caterpillar, the wasp lays its eggs in the living



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host and suppresses its immune system. As the larvae develop they feed on the caterpillar until they pupate and cause the eventual death of their host.

- Secondly, when the parasite causes discomfort to its host which results in the host harming itself in order to alleviate the discomfort. This occurs with Moose that suffer from Winter Tick infestation. While the removal of blood by the ticks does not seriously harm the Moose the discomfort of the itching by the tens of thousands of ticks causes the Moose to rub against trees to alleviate the itching. During these scratching bouts the Moose often rubs off large patches of hair, leaving exposed skin. This usually happens in late winter or early spring when cold, wet weather can occur. When a Moose has too much skin exposed it may die from exposure if the weather is not favourable. The winter of 1999 was a bad time for Winter Tick infestation and the Moose population in Algonquin suffered a major die-off.
- Lastly, when a parasite of a well-adapted host infects a susceptible but unsuitable host and kills that host. This occurs with a parasite found in White-tailed Deer and Moose. Moose and deer are members of the same family (Cervidae) and share similar characteristics, habitat, and food needs. One attribute they do not share is the tolerance for certain parasites. Deer carry a parasite that, while not harmful to the deer itself, is fatal to Moose.

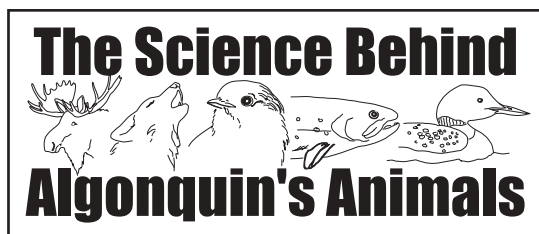
Since Algonquin's establishment in 1893 it has been noted that the Moose and deer populations have greatly fluctuated opposite to one another. In 1993 the population of Moose in Algonquin was estimated at a high of 4600 animals, but for many years the population was meagre, while the deer population flourished. During this time Algonquin Park staff and researchers had known Moose to suffer from a strange sickness known as "moose sickness". This was an ailment that caused blindness, lack of coordination and paralysis. The cause of the disease was unknown for many years until research done in Algonquin Park at the Wildlife Research Station, by Dr. Roy C. Anderson, revealed the source of the disease. Living in the spinal column and brain of White-tailed Deer was a small nematode worm. What researchers found is that the brainworm lives out its life in the brain and spinal column of the deer without harming it. It reproduces and the young are subsequently



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passed out of the deer through the feces. At this point a snail may come along and feed on the deer droppings. While crawling over the droppings the worm may enter the snail through its foot, which then starts the next stage of its life cycle. Moose consume a lot of browse in a day and during the course of browsing may accidentally eat an infected snail. Once inside the Moose the brainworm then burrows into the Moose's spinal column and brain, eventually killing the Moose.

Although Moose and deer are related, Moose are relatively new to North America, only having arrived about 10,000 years ago from Asia. As a result, they die probably because they have not evolved a viable defense to the brainworm parasite unlike White-tailed Deer.

It is easy to see then why over the years Moose have disappeared or remained low in numbers when deer numbers were high. More deer meant more infected snails, which meant more sick Moose.

### Materials

✓	Items Required	Quantity
	deer brainworm diagram (labelled)	one
	deer brainworm diagram (unlabelled)	one per student
	brainworm article, <i>The elucidation of the biology of the meningeal worm</i>	one per student
	<i>Common Parasites of Algonquin Provincial Park</i>	one

### Procedure:

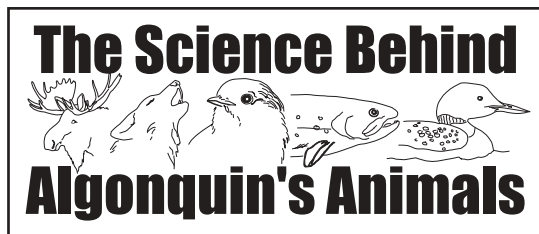
- 1) Write the word 'parasitology' on the board or overhead and ask the students if they know what it is. Explain that apart from research on wildlife in Algonquin Provincial Park there is also research done on the diseases and parasites of wildlife.
- 2) Write the word 'parasite' on the board or overhead and have the class collaborate to come up with a working definition of the word. Repeat the process with the word 'disease'.
- 3) When disease and parasite definitions have been established have the students brainstorm the different types of diseases and parasites animals in Algonquin Park would encounter. This list



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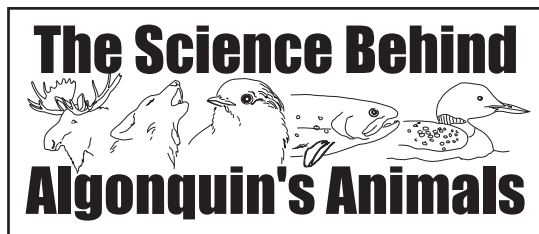
should be small as most students will not be familiar with most wildlife diseases and parasites. Once the students have exhausted all possibilities you may add to the list from the list provided.

- 4) From the list choose one ectoparasite and one endoparasite (winter tick and brainworm would be a good example) and ask the students what is different about the two parasites (one lives outside the host the other inside). Present the terms endoparasite and ectoparasite.
- 5) Using the definition of parasite that the class has provided, initiate a discussion on the purpose and functionality of parasites. Within the discussion the point should be raised that most parasites do not harm their hosts as it would not be beneficial to the parasite. When this point is made it should be explained that some parasites will eventually kill their host and some actually kill their host if the host is not suitable.
- 6) Explain that White-tailed Deer carry a parasite that while not harmful to the deer, is deadly to Moose. For years researchers in Algonquin Park knew that Moose suffered from an ailment known as “moose sickness” but it was not until research on the White-tailed Deer parasite that the cause of this sickness was discovered.
- 7) Hand out the article, *The elucidation of the biology of the meningeal worm*, written by Roy C. Andersen on his research and discovery of the cause of “moose sickness”.
- 8) Hand out the deer brainworm diagram.
- 9) Have students make notes on the life cycle of the parasite in White-tailed Deer and in Moose and have them label the deer brainworm diagram and draw in the life cycle of the parasite.

### Variations:

Have students create a labeled diagram showing the transfer of brainworm from White-tailed Deer to Moose.





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**Extensions:**

- 1) Have students find out what other members of the deer family are affected by brainworm.
- 2) Have students research and write a report on one type of other parasite or disease that affects animals in Algonquin Park (some of the parasites and diseases from the brainstorming list may be applicable to Algonquin Park. Use the following list to supplement the brainstorming list):
  - leeches (different species feed on different animals)
  - parasitic wasps, flies and beetles (*Insects of Algonquin Provincial Park* offers a good introduction to these parasites and parasitoids)
  - mange
  - rabies
  - parvo virus
  - salmonella
  - Winter Tick
  - West Nile Virus
  - brood parasites

**Evaluation:**

Ask students to:

- 1) Label the White-tailed Deer diagram and complete the life cycle of the brainworm on the diagram (see labelled teacher's diagram).
- 2) Define endoparasite, ectoparasite, and brood parasite and give an example of each.



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