

SUMMARY OF CURRENT NSERC DISCOVERY GRANT “Invertebrates as housekeepers and bodyguards: exploring the ecology of terrestrial and freshwater cleaning and defensive symbioses.”

In cleaning and defensive symbioses, smaller-bodied species remove debris and/or parasites from larger-bodied host species. The nature of these relationships can vary from helpful to the host (= neutral or even detrimental (= parasitism)). My lab's research program will focus on three widespread but understudied cleaning/defensive mutualisms: feather mites and birds, branchiobdellid worms and crayfish, and *Chaetogaster* worms and snails.

**(1) Does symbiont body size and location on the host influence efficacy of cleaning mutualisms?** Feather

mites include 2600 described species that live on and in the feathers and skin of birds. Those that live on flight feathers have long been suspected to be nonparasitic. Recently we have shown via gut content analysis that the relationship may be mutualistic, with the mites serving as tiny cleaners that eat potentially dangerous microbes on the feathers of their hosts. My lab will examine this relationship at a fine scale to assess how mite distribution among flight feathers affects and is influenced by the distribution of potential food sources among and within feathers. We will also assess how size of mites affects their location on feathers and limits the food items they can eat.

**(2) Can symbionts aid range expansion of their hosts?** Branchiobdellid worms live on the bodies of crayfish and can act as cleaning mutualists or parasites, depending on species and population density. Until recently, branchiobdellids were absent from Alberta, where the single species of native crayfish was historically restricted to the small Beaver River drainage in northeastern Alberta. Since 1991, the crayfish has greatly expanded its range in Alberta. The original Beaver River population still lacks crayfish worms, but in the naturally invaded parts of the new range, the crayfish have brought along their symbiotic worms. Could the presence of worms have aided natural upstream expansion of crayfish into Alberta? We will manipulate worm loads to assess how they affect host fitness, including in newly colonized water bodies.

**(3) What shifts symbioses from good to bad for the host?** The tiny worm *Chaetogaster limnaei* is unusual in being a symbiont of freshwater snails. Typically, worms live on the outer surface of the snail where they consume material stirred up by host movement. There are many reports of *C. limnaei* eating larvae of parasitic flatworms. This may protect their hosts from infection. Other studies suggest that snails suffer when *C. limnaei* is present. We will investigate ecological relationships between *C. limnaei* and their snail hosts to determine whether worms consistently act as defensive mutualists, or if this is dependent on host species, *Chaetogaster* number and genotype, or species of parasitic flatworm.

**Importance:** What we learn will help researchers to understand how cleaning symbionts influence the health and ecological success of birds and freshwater animals.