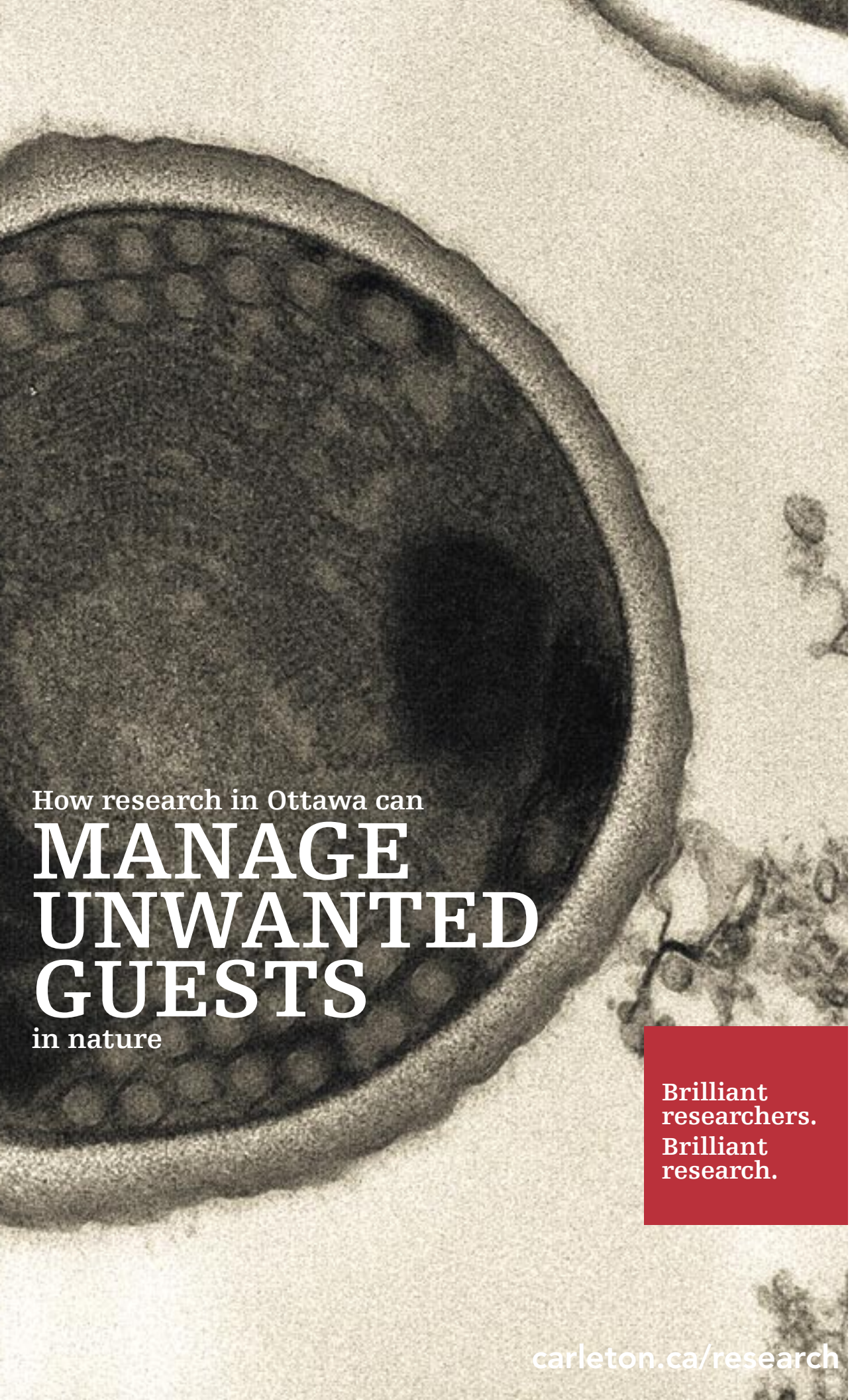

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How research in Ottawa can

MANAGE UNWANTED GUESTS

in nature

Brilliant researchers. Brilliant research.

Mark R. Forbes, PhD
Carleton University's Canada Research Chair in Ecological Parasitology/ Wildlife Conservation

carleton.ca/research

Brilliant researchers.
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Research snapshot

Purpose
To study the intricate relationships between parasites and their hosts, and the impact parasites have on the environment and the commercially-valuable relationships between species.

Scope
To investigate the relationship between microparasites and the mud shrimps they infect as well as the effect of these disease organisms on one of Canada's most important ecosystems.

Thesis
The health of the mud shrimp affects the health of many other species in the ecosystem, and the destruction caused by parasites can create a domino effect by knocking off species all along the food chain.

Outcome
To inform conservation policies to protect the wildlife reliant on mud shrimp.

Selected publications

- Forbes, M.R., P. Rutherford, and D.L. McRuer. "Does natural history explain variable prevalence of Aeromonas hydrophila in wild-caught frogs of three species?" *Ecoscience*. 2004
- Forbes, M.R., K.E. Muma, and B.P. Smith. "Diffuse coevolution: constraints on a generalist parasite favour use of a dead- end host." *Ecography*. 2002

Grad student projects
Yemisi Dare,
third-year, PhD in biology,
Amphibian development, sexual size dimorphism, and susceptibility to parasitism.
Stacey Robinson,
first-year, master's in biology,
Parasitism and heavy metal accumulation in avian host

Honours
- 2004 Research Achievement Award Recipient, Carleton University
- 2003 Petro-Canada Young Innovator's Award
- 2001 Visiting Researcher, ETH Zürich

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A pox on your house: parasites and their (in)tolerant hosts

The unwanted houseguest—it is a host or hostess's worst nightmare. Even if the unwelcome visitor is not terribly unpleasant, the host always pays in some way and in extreme cases, the relationship can become destructive. Either way, nobody likes a parasite.

Biologist Mark Forbes, the Tier II Canada Research Chair in Ecological Parasitology/Wildlife Conservation at Carleton, investigates how parasitic relationships evolve. He argues that we need to know how parasites affect other species because well over half of all organisms on earth pursue a parasitic lifestyle and can harm individual hosts, host populations, and entire ecosystems.

"Disease organisms pose a threat because parasites can be ecosystem engineers," he states. "If we understand how they find and infect their hosts, why some organisms get really nasty, and how hosts fight back, we can learn more about ecological problems such as why infectious organisms appear and re-appear and, what we can do to protect species and environments that are at risk."

ECOLOGICAL IMBALANCE

All ecosystems are made up of living organisms and non-organic matter. In a healthy system, there is not too much of one element or too little of another. When there is imbalance, however, things can go wrong. In the case of the great Irish potato famine of 1845, an airborne parasite infected millions of potatoes—Ireland's staple crop—turning them to black, inedible lumps. For the more than three million Irish peasants who survived on a diet solely made up of potatoes, the loss was devastating. The crop failures led to a severe food shortage and over a million people starved to death. Many of those who did not die left Ireland for British colonies such as Canada.

Forbes investigates parasites in animals rather than plants, but he says that the principle is the same. "Parasites exist in all healthy systems but when they become virulent and the host species are strongly affected, an ecosystem could be in serious trouble."

ORGANISMS BECOME DEADLY

The mud shrimp *Corophium volutator* is one of the species he studies. Just as the potato was essential to the Irish economy of the mid 1800s, this little crustacean is vital to the ecology and fishing industry of the Bay of Fundy. Each year, billions of shrimp dig into the Fundy intertidal mudflats and the shrimp are the main prey for many species including local groundfish.

The *Corophium* population has shrunk significantly from time to time at some mudflat sites and Forbes recently looked at the relationship between *Corophium* and a newly-discovered single-celled parasite to see if this organism is a contributing factor. What he suspects is that the behaviour of this microorganism leads to possible population control: they "feminize" the males (i.e., change them into females).

To affect the sex change, it appears that the parasite lodges itself in the mother shrimp's ovaries. The organism is passed along with her eggs and those eggs destined to become a male shrimp may become female if parasitized. Their ovaries then carry the parasite's offspring and so the cycle continues. If males become too rare, the shrimp population can fall, sending a ripple through the whole system: fewer shrimp means fewer fish, and ultimately fewer dollars flowing into the local economy.

The jury is out on whether this "feminization" of male shrimps actually occurs but Forbes says it is a good example of how one tiny organism might affect an entire ecosystem. "The parasitized shrimp are not diseased but what we learn from parasitic relations might teach us more about how some disease organisms, such as HIV or avian flu, are, or become, deadly."

"Disease organisms pose a threat because parasites can be ecosystem engineers."

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