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# RESEARCH DIRECTIONS

## Outcomes of co-evolutionary addiction

**Dr Markus Riegler, of the Hawkesbury Institute for the Environment, is leading a research team to investigate what happens when insects and bacteria get together for their mutual benefit. This research is supported by funds from the Hermon Slade Foundation.**

'Insect science is undergoing an exciting paradigm shift with the discovery that most insects harbour microbial symbionts that drive many aspects of insect biology,' says Dr Riegler. 'Microbes of insects can define insect diets, protect insects from parasites and cause insects to diversify. As a result, they contribute greatly to the ecological and economic significance of insects.'

There are two types of these insect microbe relationships. : "Obligate mutualists", when insects rely on bacteria for development and reproduction; and "facultative symbionts", which may benefit insect hosts under certain environmental conditions. Plant-sap feeding insects such as aphids harbour bacteria which synthesise essential amino acids the insects can't get from plant sap. Such an interaction could lead to a co-evolutionary "addiction" that could change the bacteria's genome over time. Many sap-feeding insects also contain microbes that can affect the biology of the host plant.
This project will explore the microbial symbionts of psyllids, a group of plant-sap feeding insects. Many Australian psyllids feed on eucalypts; some are known as lerp insects and some cause serious defoliation and eucalypt dieback (as recently seen in parts of Western Sydney). All psyllids harbour *Candidatus Carsonella ruddii*, a proteobacterium and they have co-evolved, but the nutritional role of Carsonella in psyllids is untested. Carsonella has one of the smallest known bacterial genomes, characterised by gene loss and a lack of key genes for bacterial function. At the same time psyllids can harbour other bacteria, such as Liberibacter which is of global concern for citrus and potato farmers.

*Photo taken by M. Riegler*

The research team will test the hypotheses that Carsonella has experienced genetic meltdown resulting in psyllids as "unfaithful" partners, that then repeatedly replace Carsonella with other secondary symbionts and become more receptive to bacteria that are harmful to plants.

**Project Title:** Shopping for tenants: does co-evolutionary addiction and symbiont meltdown leave jumping plant lice in need of new microbial partners?
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