IMPRS CHEMICAL COMMUNICATION IN ECOLOGICAL SYSTEMS

Project 4

Host effectors in symbiosis maintenance

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Background:
Nutritional symbioses are widespread in insects, allowing them to exploit otherwise inaccessible ecological niches. To balance costs and contributions of their symbionts, hosts exert spatially and temporally concerted control over the symbionts' metabolism, but the molecular details of host effectors remain poorly understood. Comparative approaches across convergently evolved association of different beetles with cuticle supplementing bacterial symbionts revealed a number of conserved as well as alternate effector candidates.

Project description:
The aim of this project is to elucidate mechanisms of host-symbiont interactions using a range of techniques across multiple beetle families and associated symbionts. These include the localization of effector proteins on an (ultra-)structural level, manipulation of their gene expression and quantifying symbiosis-relevant traits. The project will be integrated in the larger group of scientists working on the metabolic interplay and molecular control, as well as eco-evolutionary context of cuticle-supplementing symbioses in beetles. The focus of the project is expected to be co-developed by the successful applicant, and the applied methods will include advanced molecular manipulation via RNAi, microscopic techniques, *in vitro* cultivation of symbiotic organs, chemical analytics and phenotypic description of the symbiosis.

Candidate profile:

- a deep interest in the molecular biology and evolutionary ecology of insect-microbe interactions
- a strong background in insect or molecular biology, insect physiology, microscopy or insect cell culture
- a steady hand and patience for handling minute structures
- critical scientific thinking skills

- curiosity, creativity, and ambition
- excellent time management and organizational skills
- the ability and willingness to interact with other scientists in the group
- very good communication skills
- proficiency in written and spoken English

Reading:

Anbutsu, H. et al. Small genome symbiont underlies cuticle hardness in beetles. *Proc. Natl. Acad. Sci*. 114, E8382–E8391 (2017).

Bublitz, D. C., et al. Peptidoglycan Production by an Insect-Bacterial Mosaic. *Cell* 179, 703-712 (2019).

Engl, T. et al. Ancient symbiosis confers desiccation resistance to stored grain pest beetles. *Mol. Ecol*. 27, 2095–2108 (2018).

Feng, H. et al. Trading amino acids at the aphid–Buchnera symbiotic interface. Proc. Nat. Acad. Sci. USA, 116, 16003-16011 (2019)

Kiefer, J. et al. Inhibition of a nutritional endosymbiont by glyphosate abolishes mutualistic benefit on cuticle synthesis in *Oryzaephilus surinamensis*. *Commun. Biol*. 4, 554 (2021)

Kiefer, J. et al. Cuticle supplementation and nitrogen recycling by a dual bacterial symbiosis in a family of xylophagous beetles. The ISME J., 17, 1029-1039 (2023)

Whittle, M., et al. Insect-host control of obligate, intracellular symbiont density. *Proc. Roy. Soc. B* 288, 1963 (2021)