

Ph.D. Student position in the diversity and evolution of insect symbioses at the Institute of Environmental Sciences at Jagiellonian University in Kraków, Poland

The Symbiosis Evolution Research Group (www.symbio.eko.uj.edu.pl) at the Institute of Environmental Sciences of Jagiellonian University (www.eko.uj.edu.pl) in Kraków, Poland **is seeking a motivated Ph.D. Student** to join the project focused on the evolutionary dynamics of heritable nutritional symbionts of hemipteran insects.

Specifically, we aim to systematically describe the evolution of microbial symbioses of hemipteran insects from the suborder Auchenorrhyncha. For about 300 million years, these insects, including cicadas, spittlebugs, leafhoppers, treehoppers, and planthoppers, have specialized on nutrient-poor diet of plant sap thanks to nutritional contributions of specialized microbial symbionts that living in their tissues. These symbionts have been strictly heritable, transmitting from mothers to offspring for a long time, often for hundreds millions of years. But in many host clades, some of them were replaced or complemented by other microorganisms. We are describing the incidence and nature of these symbiont replacements, the origins of the replacing microbes, their genomic evolutionary patterns, their current biological roles, and the effects of the replacements on the ecology and evolution of the insects.

The Ph.D. Student will focus on bioinformatic reconstruction of the symbiont co-diversification and replacement patterns, and on phylogenomic analyses of the host and symbiont relationships. Depending on skills and interests, they will have an opportunity to participate in international fieldwork, work with collected insects, conduct laboratory experiments, conduct molecular work (automated DNA extraction, next-generation sequencing library preparation), comparative genomics, and advanced microscopy. The system provides great potential for a dedicated student to explore their own ideas and evolutionary questions related to insect symbioses, and acquire cutting-edge research skills. The Student will be encouraged to work closely with project collaborators, including Gordon Bennett (University of California - Merced), Insect Biome Atlas consortium members in Sweden and Madagascar, and Anna Michalik (Jagiellonian University).

The Ph.D. Student will join a dynamic, international, multi-lingual group established recently at one of the top research institutes in the fields of Ecology and Evolution in Central Europe, in a medieval city known as the cultural capital of Poland, with good access to outdoor recreation opportunities and well-connected to the rest of Europe. They will be encouraged to spend time in the laboratories of international collaborators. **For more information about the project and Group, visit www.symbio.eko.uj.edu.pl.**

The successful candidate will have an M.Sc. or similar degree in a relevant field by September 2020. They will have demonstrated interest in Evolution, Entomology, Microbiology, and/or Genomics; experience with, or a keen interest in learning, Bioinformatics and Computational Biology; and strong English language, communication, and organizational skills. Previous research experience in insect ecology, evolution, and especially symbioses, hemipteran taxonomy, molecular biology, microbiomes, phylogenomics and/or comparative genomics are an advantage.

The student will be supported by a 48-month tax-free doctoral scholarship (approx. 2500 PLN per month), and/or a 45-month research stipend from the National Science Centre Sonata Bis research grant, starting at 3000 PLN per month, which will be awarded in a separate competition.

The official start date of the Ph.D. Program is October 1st, 2020.

The candidates should send the following documents by email to Dr. Piotr Łukasik (p.lukasik@uj.edu.pl):

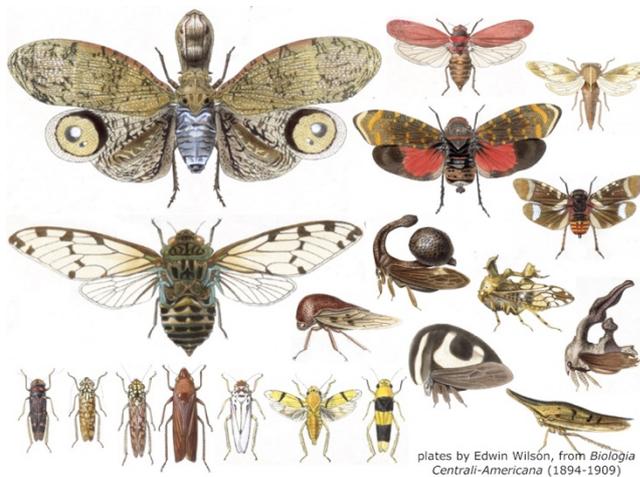
- 1) A Cover Letter in English, explaining how the applicant's background and research interests make them a suitable candidate for the position.
- 2) A Curriculum Vitae including information on relevant academic achievements, publications, awards, relevant experience, and training. This document should also include the names, affiliations and email addresses of two people with first-hand knowledge of the applicant's skills and past research experience, who have agreed to provide confidential references.

Candidates selected based on these documents will be interviewed via Skype. **The evaluation of applications begins on 1st July 2020.**

Application to the Ph.D. Program at the Institute of Environmental Sciences. One or more of the interviewed candidates will be invited to apply for a place in one of the Ph.D. Programs at the Faculty of Biology at Jagiellonian University, preferably the English-language Ph.D. Program in Biology: <https://wb.uj.edu.pl/studia/phd-biology>, or the standard Ph.D. Program in Polish: <https://wb.uj.edu.pl/studia/studia-3-stopnia-biologia>. In 2020, online application for both programs close on 7th September, oral interviews (in person or via Skype) take place between 9th and 14th September, and the results are announced on 16th September.

Application for additional grant-funded scholarship. After being accepted to the one of the PhD Programs of the Faculty of Biology at Jagiellonian University, the Student will be invited to participate in the competition for the grant-funded position in the Polish National Science Center Sonata Bis 18 project “The evolutionary dynamics of the symbioses of Auchenorrhyncha”

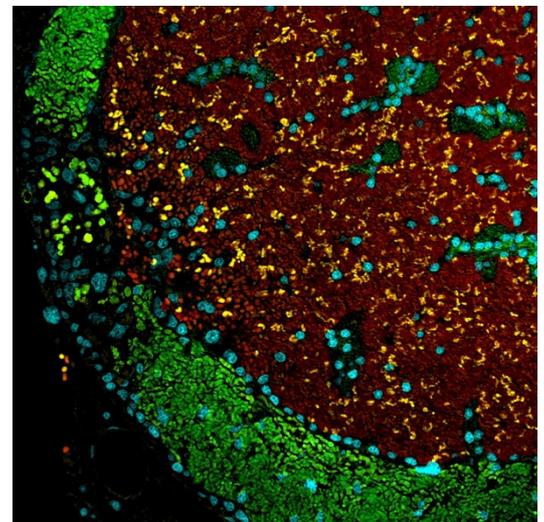
For further information about the project or the procedure and the and informal inquiries, please contact Dr. Piotr Łukasik. (p.lukasik@uj.edu.pl). The review of applications starts on 1st July 2020.



plates by Edwin Wilson, from *Biologia Centrali-Americana* (1894-1909)

Central American Auchenorrhyncha, pictured here, demonstrate some of the morphological and functional diversity of this important insect clade. Our team uses high-throughput sequencing and other approaches to understand the diversity, biology, and evolution of heritable nutrient-providing microbial symbionts associated with different clades of Auchenorrhyncha.

Heritable endosymbionts of Auchenorrhyncha live in special insect tissue known as bacteriome. In this fluorescent microphotograph, different types of ancient bacterial symbionts of a Chilean cicada have been shown in **green**, **red** and **yellow**. Some of these bacteria have genomes smaller than any other known cellular organism, and can only live in extremely close associations with other symbionts within the insect tissues. In other cicadas and many other Auchenorrhyncha, these symbionts have been replaced by fungal pathogens that subsequently evolved into heritable mutualists... **Help us figure out how this is happening, why, and what are the ecological and evolutionary consequences!**



References:

- McCutcheon J.P., Boyd B.M., Dale C (2019): The life of an insect endosymbiont from the cradle to the grave. *Current Biology* 29(11): R485-R495. <https://www.sciencedirect.com/science/article/abs/pii/S0960982219303306>
- Bennett G.M., Moran, N.A. (2015): Heritable symbiosis: The advantages and perils of an evolutionary rabbit hole. *PNAS* 112(33):10169-10176. <https://www.pnas.org/content/112/33/10169>
- Łukasik P., Nazario K., Van Leuven J.T., et al. (2018): Multiple origins of interdependent endosymbiotic complexes in a genus of cicadas. *PNAS* 115(2):E226-E235. <https://www.pnas.org/content/115/2/E226>