Open position for the LSM call of applications

Department/Institute: LMU faculty of Biology, Evolutionary Biology

Subject areas/Research fields: Evolutionary Biology, Genetics, Behavior

Keywords: Speciation, *Heliconius*, Mate choice, Behavior, Sensory ecology

Name of supervisor: Prof. Dr. Richard Merrill

Project title: The genetics of sensory and behavioral adaptations in *Heliconius* butterflies

Project description:

We are looking for a PhD student to investigate the genetics of sensory and behavioral adaptations during species divergence in tropical *Heliconius* butterflies. The student will join Prof. Richard Merrill's research group at LMU Munich, and will work closely with our collaborators at Universidad Regional Amazónica Ikiam (Ecuador) and/or Universidad del Rosario (Colombia).

Heliconius butterflies are well known for their diversity of bright warning patterns, which are also used as mating cues (Merrill et al JEB 2015). Closely related taxa often display divergent wing patterns, and because males almost invariably prefer to court females that share their own color pattern, this contributes an important premating reproductive barrier between species. While the genetics and evolutionary history of *Heliconius* color pattern variation is well understood, we know relatively little of the specific genetic mechanisms contributing to the evolution of the corresponding visual preference behaviors.

Recently we have identified a major effect gene influencing visual preference differences between the sympatric species *H. melpomene* and *H. cydno* (see Rossi *et al* BioxRiv 2023). The student will follow up on this work and could take a number of different directions. One project would be to assess the genetic basis of visual preferences in another pair of *Heliconius* species, distantly related from *H. melpomene* and *H. cydno.* We know that color pattern differences are controlled by the same genes (but different mutations) across the *Heliconius* genus. Is there a similar genomic 'predictability' underlying behavioral evolution? In addition, in the *cydno-melpomene* group, a major preference locus is physically linked to one of these major color pattern genes, which may facilitate speciation (Merrill et al. PLoS Biology 2019). We would like to know if such linkage also exists for other species pairs (i.e. is there convergent genetic architecture), and if this is the case, ultimately whether this is due to the co-option of the same genes. Other projects on the genetics of sensory and behavioral adaptations in *Heliconius* butterflies are also possible. Projects could involve a number of different techniques, including (but not limited to): behavioral assays, linkage mapping, gene expression and population genomic analyses and CRIPR/Cas9 genome editing. Potential students are strongly advised to contact Richard Merrill (merrill@bio.lmu.de) to discuss projects.

References:

– Rossi, M.**,** Hausmann, A.E**.**, Alcami, P., Möst, M., Wright, D.S., Kuo, C.-Y., Lozano-Urrego, D., Maulana, A., Melo-Flórez, L., Rueda-Muñoz G., McMahon, S., Linares, M., McMillan, O., Pardo-Diaz, C., Salazar, C. & Merrill, R.M. (2023) Adaptive introgression of a visual preference gene. ***BioxRiv*****:** https://doi.org/10.1101/2023.07.12.548653

– Hausmann, A.E., Kuo, C.-Y., Freire, M., Rueda-M, N., Linares, M., Pardo-Diaz, C., Salazar, C., & Merrill, R.M. (2021) Light environment influences mating behaviours during the early stages of divergence in tropical butterflies. ***Proc Roy Soc B*** 288: 20210157

– Montgomery, S.H., Rossi, M., McMillan, O. & Merrill, R.M. (2021) Neural divergence and hybrid disruption between ecologically isolated *Heliconius* butterflies. ***PNAS*** 116: e2015102118

– Merrill R.M., Rastas P., Martin S.H., Melo, M.C., Barker S., Davey, J., McMillan W.O., Jiggins, C. (2019) Genetic dissection of assortative mating behavior. ***PLoS Biology*** 17: e2005902

– Merrill, R.M., Dasmahapatra, K., Davey, J., Dell'Aglio, D., Hanly J.J, Huber B., Jiggins C.D., Joron, M., Kozak K., Llaurens V., Martin S.H., Montgomery S.H., Morris, J., Nadeau N.J., Pinharanda A.L., Rosser N., Thompson M.J., Vanjari, S., Wallbank R.W., Yu, Q. (2015) The diversification of *Heliconius* butterflies. What have we learned in 150 years? ***J Evol Biol*** 28: 1417-38

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Reseach group website: https://www.evol.bio.lmu.de/research/merrill/index.html

Apply: Please send your application through the online portal of the Graduate School Life Science Munich (LSM).