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Living systems are made up of a multitude of interlocking levels of organization, involving cooperation and conflict. Cooperation and the selection of systems operating in a coordinated manner has allowed so-called "major" evolutionary transitions, towards new scales of individuality, such as the eukaryotic cell. Nevertheless, natural selection continues to operate at all scales, generating possible evolutionary conflicts between the different components of the individual.

Our research is in line with this perspective, and aims to better understand the nature and evolutionary implications of the interactions between the multiple components of organisms, from genes to symbiotic bacteria, viruses and transposable elements. We also explore the impact of these interactions on the dynamics of genetic information, through horizontal transfer, or on genetic innovation and adaptation, through domestication. Our research, mainly experimental, but also theoretical, is implemented on arthropod models, and is mainly related to genetics and evolutionary genomics.

These interactions are addressed in the team at the following scales:

- **Interactions between loci within genomes (intra-genomic) (CV, MF, MB)**, through the evolutionary dynamics of **transposable elements**, studied in natural populations of Drosophila melanogaster and D. simulans, as well as species of agronomic or societal interest, such as the invasive species D. suzukii or the tiger mosquito Aedes albopictus.
- **Interactions and co-evolution between eukaryotic hosts and bacterial symbionts** manipulating its reproduction or providing metabolic capacities that the insect host lacks **(LM, NK, FV, LZ)**. We are analyzing these interactions in hematophagous (bed bug, Cimex lectularius) and phytophagous insects (whitefly Bemisia tabaci and the drosophila D. suzukii) using approaches combining genetics, physiology and metabolomics.
- **Interactions between organisms (simple or composite) and their biotic or abiotic environments (NK, LZ, MB, LM, FV, JMD, JV, MF)**. For example, the immuno-regulatory impact of bacterial symbionts and transposable elements is evaluated in contexts of infection by pathogenic viruses. This research is based, among others, on experimental evolution of drosophila populations and transcriptomics. The impact of insecticides or oxidative stress is also studied on different models (fruit flies, parasitoids, bed bugs).
- **Interactions between organisms or consortium of organisms at the community level (JV, MB, SC)**, especially in parasitoid insects that have domesticated viral genes, allowing them to bypass the immune responses of their hosts. We are studying the frequency and adaptive implications of these events and, more generally, the factors structuring horizontal transfers in host-parasitoid communities.