Biology

Name of PI: Wiebke Schuett

Project Title: Environmental change and intraspecific behavioural variation

Project Description: We aim to investigate how environmental conditions and environmental change influence individuals' behaviour and associated traits (e.g. life-history, morphology and physiology) and assess the reproductive consequences. We are particularly interested in understanding why individuals of the same species may be differently able to cope with certain environmental conditions (and their change). The ability to deal with different environmental conditions might for instance, be explained, by personality differences (i.e. consistent among individual behavioural differences in a species). We use insects as model organisms, but other organisms may be possible to study. The study will provide novel insights into behavioural ecology and will enhance our understanding of how species cope with environmental change, which is important for designing effective conservation measures.

Name of PI: Alexandros Bousios

Project Title:The contribution of transposable elements to the evolution of gene regulatory networks in plants

Project Description: Most extant eucaryotic DNA is derived from transposable elements (TEs), DNA sequences that can independently make a copy of their sequence and integrate it in a new chromosomal location. To do this, TEs carry within their sequence their own few genes and, importantly, their own cis promoter motifs. This latter fact provides an unprecedented opportunity to the host genome to co-opt the cis-motifs for its own use when they turn beneficial, for example when the insertion of a new TE copy changes favourably the expression of a downstream gene as a result of the presence of the TE cis-motifs.

We will attempt to identify such 'co-opted' motifs in the genome of maize and related species by using a specific TE family, termed Sireviruses, that have well-characterized cis-motifs in plants. We will identify regions where only the cis-motifs have remained, while the rest of the TE has decayed beyond recognition, and test if these motifs are conserved across species, and if they reside in regions that characterizes enhancers such as open chromatin areas with low methylation and specific epigenetic modifications. This work will generate new evidence for the

importance of TEs for the evolution of host regulatory networks. Previous experience on bioinformatics is beneficial.

Name of PI: Alexandros Bousios

Project Title: The impact of transposable elements on the genome biology of plant species

Project Description: Transposable elements (TEs) constitute the majority of eukaryotic genomes, and are major drivers of both genomic and phenotypic evolution. Elucidating their impact and interactions with the host genome is crucial for understanding host genome biology and evolution. One of the most intriguing aspects of TEs is that they often capture fragments of host genes. The effect of this process is largely unknown, but we have shown in plants that it often causes loss of function for some genes combined with their translocation to non-syntenic heterochromatic and highly-methylated loci.

We hypothesize that these genes are en route to pseudogenization. To test this hypothesis formally, we will take advantage of the numerous fully-sequenced maize and rice genomes and attempt to link capture, translocation, methylation and expression of genes across a wide range of genotypes. In addition, we will attempt to test if gene capture by TEs represent a mechanism by which genomes return back to their original gene number after polyploidization events. This process, termed genome fractionation, is well-studied but the mechanistic basis of gene deletion is unknown. This project will rely substantially on computational approaches, so previous experience on bioinformatics will be highly beneficial.

Name of PI: Dave Goulson

Project Title: Impacts of particulate pollution on bees and other insects

Project Description: Insects are broadly in decline. Some drivers of this decline are well understood, but others less so. Particulate pollution is known to harm humans, but what harm does it do to insects? Very little is known. Gaseous exchange occurs via passive diffusion through the trachea in insects, which might easily be impeded by particulates in the air. These may also have direct toxicity, or interfere with olfaction. This project will use lab and field experiments to assess impacts of particulate pollution on insect health.