UNIVERSITÉ Clermont Auvergne

MASTER BIOLOGIE SANTE

Track « Integrative Biology, Physiopathologies »

Proposal for a Master 2 internship – 2024-2025

Title : Genetic and epigenetic control of DNA recombination

Laboratory : Genetics, Reproduction and Development Institute (iGReD)
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Summary : **Meiosis** is a specialized cell division that produces **gametes** and is thus at the heart of sexual reproduction in Eukaryotes. During meiosis, chromosomes pair and recombine, i.e. exchange genetic material with each other. **Meiotic recombination** has two main biological functions: it increases genetic diversity of gametes and ensures balanced segregation of chromosomes within the daughter cells. Any abnormality at meiosis can be responsible for **sterility** or **major genetic disorders** in the offspring.

We have recently shown in the model plant ***Arabidopsis suecica*** (a polyploid species which contains two sub-genomes, like durum wheat, rapeseed, and cotton) that recombination not only occurs between homologous chromosomes but also between chromosomes from different sub-genomes (Chéron et al, 2023). These events lead to important genomic and chromosomal rearrangements that can directly impact fitness and fertility of the plants.

Based on these data, the proposed project has two main objectives: (1) identify how often and where does recombination occur at local and genome scales and (2) how genetic and epigenetic contexts influence recombination profiles. It involves the generation of high-resolution maps of meiotic recombination (using Nanopore sequencing) and the analysis of DNA methylation and/or histone marks (isolation of meiocytes, chromatin immunoprecipitation…). This study seeks to provide insights into the **dynamics** of **polyploid genomes** and its regulation.

Methodologies (key words): Genetics, Molecular biology, Microscopy, Chromatin Immunoprecipitation, High throughput sequencing (Nanopore technology), Bioinformatics.

Publications of the research group on the proposed topic

- Chéron F, Petiot V, Lambing C, White C, Serra H (2023) Incorrect recombination partner associations contribute to meiotic instability of neo-allopolyploid *Arabidopsis suecica*. **New Phytologist** 241(5), 2025-2038
- Serra H, Svačina R, Baumann U, Whitford R, Sutton T, Bartoš J, Sourdille P (2021) *Ph2* encodes the mismatch repair protein MSH7-3D that inhibits wheat homoeologous recombination. **Nature Communications** 12, 1-10
- Serra H, Lambing C, Griffin CH *et al.* (2018) Massive crossover elevation via combination of HEI10 and *recq4a recq4b* during Arabidopsis meiosis. **PNAS** 115(10):2437-2442