Title : Origin of Novelty in Genomes of Phytoplanktonic eukaryotes

Level : Master 1st or 2nd year (4 to 6 months)

Contact : gwenael.piganeau@obs-banyuls.fr

Abstract: Marine picophytoplankton comprise the smallest free-living photosynthetic eukaryotes, with a simple cell organization (one single mitochondrion and one single chloroplast), contained within a cell of 1 µm diameter. These microalgae are at the base of the food chain in coastal areas and the analysis of their genome sequences disclosed a huge genetic diversity and ancient divergence. Within the *Ostreococcus* genus, at least 4 species have been identified, with a genetic divergence greater than that observed in Mammals. Strikingly, each newly sequenced genome contains several hundreds species-specific genes, likely involved in the ecological niche differences of these species. Here, we propose to investigate the mechanisms that generate these species-specific genes. Several different mechanisms can lead to new genes; gene duplication and divergence, emergence from non-coding sequences, or horizontal gene transfer.
We will take advantage of the genomic data available within the *Ostreococcus* species complex, the Chlorophyta phylum, and the metagenomic data available from the pan-oceanic TARA-Oceans survey, to quantify the relative importance of different mechanisms on the origin of novelty in these enigmatic microalgae.

Keywords : bioinformatics, orphan genes, duplication, horizontal gene transfer, rewiring, picoeukaryotes

References

Long M, Betrán E, Thornton K, Wang W (2003) The origin of new genes: glimpses from the young and old. Nat Rev Genet, 4:865–875.

Piganeau G, Grimsley N, Moreau H (2011) Genome diversity in the smallest marine photosynthetic eukaryotes. Research in Microbiology 162(6):570-7.

Tautz D, Domazet-Lošo T (2011) The evolutionary origin of orphan genes. Nat Rev Genet, 12:692–702.

Vandepoele, K., Van Bel, M., Richard, G., Van Landeghem, S., Verhelst, B., Moreau, H., van de Peer, Y., Grimsley, N., and G. Piganeau. (2013) pico-PLAZA, a genome database of microbial photosynthetic eucaryotes. Environmental Microbiology. 15(8):2147-2153.