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Genome evolution in polyploid Xenopus

Whole genome duplication doubles the number of chromosomes in the nucleus and leads to polyploidy. This process is a motor of evolutionary changes as it provides new genetic material and a novel source of variation. There are advantages and disadvantages in being polyploid and thus polyploidisation is an extraordinary process to study. Polyploid animal organisms need to manipulate not only their genome but also their complete biology to survive and establish new populations. Thus, by studying such polyploid organisms, we can access their incredible biology and molecular diversity.

Our scientific goal is to better understand genome evolution after whole genome duplication in vertebrates and the impact of polyploidy on fundamental biological processes. The EVOPOLY project aims to study the consequences of higher order polyploidization on different genetic and cellular processes in a unique amphibian animal model. We will use an integrative approach to study the consequences of ploidy levels going from two to twelve, naturally occurring in various *Xenopus* frog species. To do so, we want to combine advantages of *Xenopus*, an outstanding vertebrate model organism for developmental genetics, cellular biology, biochemical and regeneration studies, to the study of these unique successive events of polyploidisation.

We will use large-scale genomics and transcriptomics followed by bioinformatic analysis to build homoeolog gene catalogs and measure gene expression in tetraploid, octoploid and dodecaploid *Xenopus* species. We will analyse the DNA replication program in three different polyploid species to measure the effect of ploidy on this cellular process. We will quantify the developmental trajectories, measure cell sizes and estimate the number of cells in selected organs. Finally, we will compare the regenerative ability of three *Xenopus* species differing by their ploidy level. Besides bringing more insights into the scientific literature on the diploid *X. tropicalis* and the tetraploid *X. laevis*, our project will also produce a knowledge base to study the expanding implications of polyploidy in a vertebrate.

Understanding the biological properties of these vertebrates having different ploidy levels will provide new avenues to understand how genome duplication triggers evolutionary innovations in a changing environment. It can also help understanding the pathological behaviour of some polyploid cells like in cancer and other diseases.

Hellsten, U., Harland, R.M., Gilchrist, M.J., Hendrix, D., Jurka, ., Kapitonov, V., Ovcharenko, I., Putnam, N., Shu, S., Taher, L., Blitz, I., Blumberg, B., Dichann, D., Dubchak, I., Fletcher, R., Gerhard, D., Goodstein, D., Graves, T., Grigoriev, I., Grimwood, J., Kawashima, T., Lindquist, E., Mead, P., Mitros, T., Ota, Y., Poliakov, A., Pollet, N., Robert, J., Salamov, A., Sater, A., Schmutz, J., Terry, A., Vize, P., Warren, W., Wells, D., Wills, A., Zimmerman, L., Grainger, R., Grammer, T., Khokha, M., Richardson, P. and Rokhsar, D. (2010) The genome of the western clawed frog Xenopus tropicalis. Science 328:633-6.

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