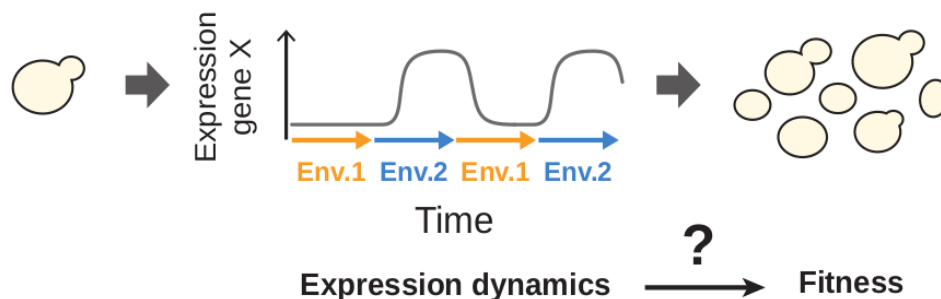


**MASTER 2 BMC
PARCOURS GENOPATH
ANNÉE 2024-2025**

Titre :

Cost and benefits of gene expression regulation in dynamic environments



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Sujet de stage :

One of the most fascinating and singular properties of life is its capacity to adapt to dynamically changing environments. Understanding the mechanisms that contribute to such adaptation is a fundamental challenge for evolutionary biology and also for biomedical research. Yet, the cost and benefits of regulating the expression of particular genes in fluctuating and steady environments remain largely unknown.

To fill this knowledge gap, we recently implemented in yeast cells a genetic system allowing us to control the temporal dynamics of expression of a target gene (auxin-inducible degron 2.0). The student will harness this tool to determine how the expression dynamics of genes involved in osmoregulation (*GPD1*, *FPS1*) or histone methylation (*BRE2*) contribute to growth when cells are exposed to diverse regimes of periodic and steady hyperosmotic stress. By performing competition experiments when

both gene expression and environments are allowed to fluctuate over time, we aim to understand how the regulation of gene expression can be shaped by natural selection.

This project will offer the opportunity to learn basic molecular biology techniques, CRISPR/Cas9 genome editing, flow cytometry, quantification of growth rates and computational analyses while addressing a fundamental biological question. **It is part of an ambitious european project (eGRIDE) for which funding for a PhD is available. Please contact Fabien Duveau if you are interested or need further information.**

Modèle et techniques utilisées : Yeast *Saccharomyces cerevisiae* • Molecular biology • CRISPR/Cas9 genome editing • Auxin-inducible degron 2.0 • Quantitative flow cytometry • Competitive growth assays • Data analysis with R.

Publications d'intérêt :

Barrere *et al.* 2023 <https://www.sciencedirect.com/science/article/abs/pii/S0960982223003196>

Yesbolatova *et al.* 2020 <https://www.nature.com/articles/s41467-020-19532-z>

Keren *et al.* 2016 <https://www.sciencedirect.com/science/article/pii/S009286741630931X?via%3Dihub>

Bleuven and Landry 2016 <https://royalsocietypublishing.org/doi/10.1098/rspb.2016.1458>

Duveau *et al.* 2018 <https://elifesciences.org/articles/37272>