

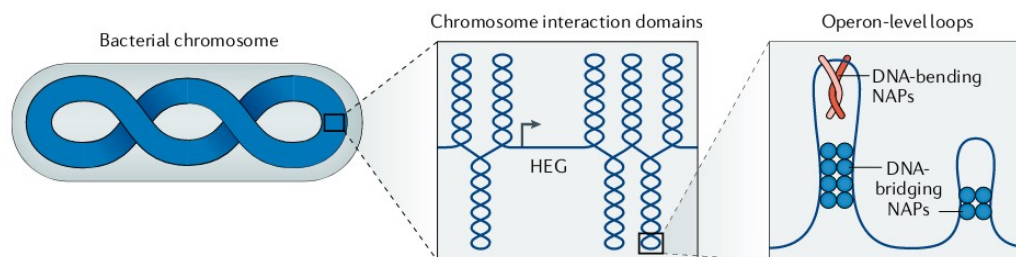
**Master 2 internship starting in January-March 2025 (4-6 months, with funded PhD thesis) :**  
**Modeling and dynamic simulation of DNA torsion in the regulation of gene expression**

**Contact:** Sam Meyer, [sam.meyer@insa-lyon.fr](mailto:sam.meyer@insa-lyon.fr).  
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**Keywords:** Computational biology, biophysics, systems biology, gene expression, stochastic simulation, statistical analysis, microbiology, chromatin, DNA supercoiling, omics data

**Profile of candidate:** Master/engineering student in math/informatics/physics/chemistry, with strong interest in computational modeling and biological questions.

**Internship stipend:** Full time, around 650€/month.



The internship is part of an international collaboration with the Xiao lab at Johns Hopkins University (Baltimore, USA), and will be followed by a fully funded PhD position.

We are looking for a student highly interested in interdisciplinary research, who will develop computational models and simulations of the interplay between transcription and DNA torsion (supercoiling), a fundamental physical property of the double-helix. This interplay is dynamic and double-sided, since transcription is both affected by (1) and generates torsional stress dynamically (2). This torsion propagates along the DNA, resulting in an interaction between neighboring genes that affects all organisms but escapes usual biological models (1,2), providing a deep relation between the physical state and the biological function of the genome (3). The candidate will develop stochastic simulations of the system and statistical analyses of experimental data provided by collaborators (from microscopy and high-throughput omics technologies), to confirm and quantify the investigated mechanism. Depending on the candidate's skills and preferences, more emphasis can be put toward physical modeling, computational simulation or statistical data analysis.

**Skills required:** The topic is intrinsically interdisciplinary, at the crossing of biology, physics, informatics, and we encourage applications of candidates from various backgrounds with a strong interest in understanding the fundamental processes of life. Experience with Python/R programming and numerical analysis is required, as well as proficiency in English. Knowledge in biology, statistics, numerical simulations and experience in handling biological data will be favored. Complementary experimental (wet lab) skills are welcome for secondary projects.

After the internship, the candidate is expected to follow in a fully funded 3-year PhD thesis, involving several visits to the US collaborators.

[1] Forquet et al. (2022), NAR 50, 7287-7297, <https://doi.org/10.1093/nar/gkac579>

[2] El Houdaigui et al. (2019), NAR 46, 5648-5657, <https://doi.org/10.1093/nar/gkz300>

[3] Martis et al. (2019), CSBJ 17, 1047-1055, <https://doi.org/10.1016/j.csbj.2019.07.013>