Master 2 research internship in Integrated Structural & Cell Biology in Grenoble

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Title of the M2 research internship:
Nucleoid organisation and dynamics of the radioresistant bacterium, Deinococcus radiodurans, in response to extreme irradiation.

Project summary:
Deinococcus radiodurans is one of the most radiation resistant microorganisms on earth. This non-pathogenic bacterium is particularly well suited for studying nucleoid organisation and dynamics because it is a relatively large bacterium that displays an outstanding ability to survive very high doses of DNA-damaging radiation. Thanks to a highly efficient DNA repair machinery and an unusual genome organisation, D. radiodurans is capable of withstanding many hostile environments found on earth (desiccation, temperature fluctuation), but also in outer space such as cosmic and solar radiation.
In this spherical bacterium, genomic DNA is compacted at several levels by nucleoid-associated proteins in order to fit into the nucleoid, while remaining accessible to the mechanisms of DNA replication, repair and transcription. At present, the organisation of bacterial nucleoids is still only partially understood due to their small size (< 1µm3).
The main objective of this internship is to explore nucleoid organisation and dynamics in D. radiodurans in response to irradiation (UV light and γ-radiation) using 3D conventional spinning-disk fluorescence imaging of live cells. Membrane and DNA dyes or engineered strains expressing labelled nucleoids-associated proteins will be used to follow the changes in DNA compaction and nucleoid shape after exposure to UV- or γ- radiation. In parallel, the bioenergetic state of the cells and in particular the levels of respiration will be measured using an O2 electrode and flow cytometry, to follow cell recovery. This project requires a background in microbiology and cell imaging, and a basic understanding of cell metabolism.

Keywords:
nucleoid organisation, radiation resistance, 3D cell imaging

Relevant publications of the team:
Floc'h K, Lacroix F, Servant P, Wong YS, Kleman JP, Bourgeois D, Timmins J. (2019). Cell morphology and nucleoid dynamics in dividing Deinococcus radiodurans. Nat Commun. 2019 Aug 23;10(1):3815.

Floc'h K, Lacroix F, Barbieri L, Servant P, Galland R, Butler C, Sibarita JB, Bourgeois D and Timmins J. Bacterial cell wall nanoimaging by autoblinking microscopy. Scientific Reports (2018) 8 (1) p. 14038.

Timmins J, Moe E. (2016). A Decade of Biochemical and Structural Studies of the DNA Repair Machinery of Deinococcus radiodurans: Major Findings, Functional and Mechanistic Insight and Challenges. Comput Struct Biotechnol J. 2016 Apr 7;14:168-176.