

**Master 2 internship project
Year 2024-2025**

Laboratory/Institute: TIMC
Team: TrEE (<https://www.timc.fr/TrEE>)

Director: A. MOREAU-GAUDRY
Head of the team: F. PIERREL

Name and status of the scientist in charge of the project: Fabien Pierrel, DR CNRS

HDR: yes no

Address: Laboratoire TIMC, Institut Jean Roget 5ème étage, Université Joseph Fourier Campus Santé, Domaine de la Merci, 38700 La Tronche

Phone: 04 57 42 18 97 **e-mail:** fabien.pierrel@univ-grenoble-alpes.fr

Program of the Master's degree in Biology:

Microbiology, Infectious Diseases and Immunology Structural Biology of Pathogens
 Physiology, Epigenetics, Differentiation, Cancer Neurosciences and Neurobiology

Title of the project:

Characterization of isoprenoid quinones in environmental samples

Objectives (up to 3 lines):

Analyze the diversity of isoprenoid quinones present in different environmental samples by metabolomics; identify the quinones (some already known, some potentially new) by molecular network approaches; link the quinones to the producing species; purify and characterize the newly identified quinones.

Abstract (up to 10 lines):

Isoprenoid quinones are essential for the bioenergetics of most organisms, and their biosynthetic pathways are evolutionarily related (1). Recently, we identified a novel quinone in a specific clade of bacteria that helped unravel the origin of aerobic respiration ~3 billion years ago (2). Thus, characterizing the diversity of isoprenoid quinones and identifying their biosynthetic pathways can provide valuable information to better understand the evolution of bacterial metabolism.

We obtained 20 environmental samples containing diverse populations of microorganisms (already characterized by metagenomic sequencing). The quinones present in these samples will be analyzed by metabolomics and the mass spectrometric signatures corresponding to the quinones will be identified by molecular network approaches (3). Quinones will be linked to their producing species and putative biosynthetic pathways will be proposed. Novel quinones will be purified and characterized by biophysical techniques (nuclear magnetic resonance, high resolution mass spectrometry, electrochemistry).

Methods (up to 3 lines):

Quinone extraction and analysis by metabolomics, bioinformatics (basics in Python coding) to calculate molecular networks and analyze them, statistical analyses to associate quinones with producing species, quinone purification by flash chromatography and characterization (NMR, HRMS, electrochemistry).

Up to 3 relevant publications of the team:

(1) Abby et al., Advances in bacterial pathways for the biosynthesis of ubiquinone, [BBA Bioenergetics \(2020\) 1861:148259](#)

(2) Elling et al., submitted

(3) Nothias et al., Feature-based molecular networking in the GNPS analysis environment, [Nature Methods \(2020\) 905-908](#) ; article (3) is not from our team.

Requested domains of expertise (up to 5 keywords):

Biochemistry, bioinformatics, metabolomics