

The Chancellor of Ghent University has the honour of inviting you to attend the public defense of the doctoral dissertation of

### **Cristina García-Timmermans**

Title of the doctoral dissertation:

#### *Raman microscopy for phenotyping microorganisms*

The public defense will take place virtually the **9th of October 2020, at 16h**. You can join in following this link: <https://tinyurl.com/y5dbndkj>. Please select "Listen only" or mute your microphone, and do not share your video or screen. Questions can be asked via chat after the presentation.

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#### **Abstract of the doctoral research**

Single cell phenotypic differences arise even in monoclonal populations. This allows them to survive, increase their fitness or organize the spatial structure of the population. However, the methods most commonly used to study microbial populations (*i.e.*, sequencing techniques and omics) analyse all the cells of the same sample together in bulk. Although this is valuable information, bulk techniques only inform on the average behaviour of populations, masking single-cell heterogeneity.

In this manuscript, we discuss the use of Raman spectroscopy as a single-cell tool to study bacterial phenotypic heterogeneity. First, we propose a standard way to acquire and report Raman spectra. Secondly, we compare the resolution of Raman spectroscopy with another single-cell tool, flow cytometry. Thirdly, we automatically define phenotypes based on their Raman spectra using dimensionality reduction and/or clustering methods. Then, we quantify single-cell phenotypic diversity using the Hill diversity framework with Raman spectra. Finally, we show how these tools can be used as screening and monitoring tools in bioproduction.

Raman spectroscopy presents an opportunity to study phenotypic heterogeneity at the single-cell level and to describe, explain, predict and manage microbial communities.

#### **Brief Curriculum Vitae**

Cristina García-Timmermans is originally from the Canary Islands, Spain. She received her Bachelor's degree in Medical Biochemistry in 2009, and moved to Paris to obtain her Master's degree in Interdisciplinary Approaches to Life Sciences in 2015. During this time, she gained experience working with yeasts, bacteria, viruses and human cells. She also developed skills in scientific communication and data analysis. Cristina participated in the synthetic biology competition iGEM, winning the prize for the Best New Application with the Paris Bettencourt team in 2014. She also co-founded the startup "Eco-Smart Solutions", developed in the accelerator L'Open Lab.

Cristina joined the Center for Microbial Ecology and Technology (CMET) in 2016. Her research led to multiple articles in peer-reviewed journals and contributions at international conferences. For three years, she was the liaison with an industrial partner (BePro, China), and reported to its stakeholders once a year. She co-founded the Be4Diversity team, and co-organized the Women in Science day in 2019 and 2020. She also co-organized an international mini symposium in microbial flow cytometry in Ghent University in 2019, and tutored 2 students during their master dissertation.