Geomicrobiological and Geochemical Colloquium
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Microbial processes under the beam: correlative microscopy and chemical imaging to investigate single-cell metabolism and cell to cell interactions

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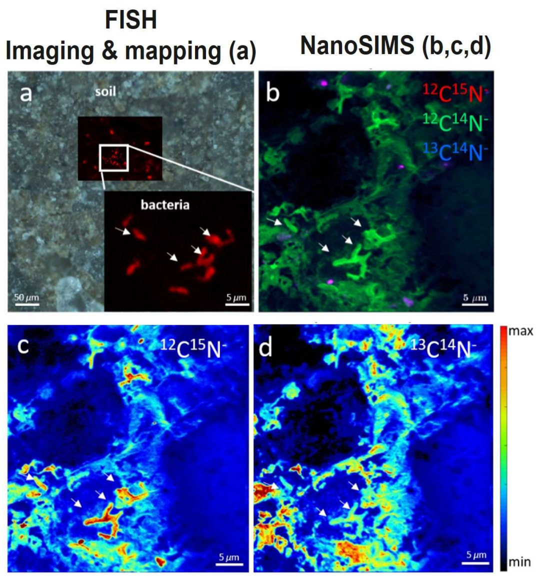
In person: A71 seminar room 513/515

Abstract

Unlocking the intricacies of taxonomically and metabolically diverse microorganisms within their natural habitats demands a spatial context. Advanced chemical imaging technologies, such as nano-scale Secondary Ion Mass Spectrometry (nanoSIMS), offer an unprecedented resolution for studying cell function. When coupled with stable isotope probing (SIP) and Fluorescence In Situ Hybridization (FISH), nanoSIMS enables metabolic tracking and quantification of cellular activity with nanoscale precision, through assimilation of isotope tracers into FISH-tagged cells. This powerful combination facilitates the in-situ study of uncultured microorganisms at single cell level, in the dynamic context of spatial and trophic relationships in biological systems. This is particularly relevant in scenarios involving rapid exchanges of nutrients and metabolites, such as microbe-host interactions, microbe-microbe relationships, single-cell ecophysiology, and interactions between cells and their organic or inorganic surroundings. This presentation showcases the application of SIP-FISH-nanoSIMS to address: i) carbon, nitrogen, and water flow between bacteria and higher organisms, and ii) the impact of antibiotics on microbial metabolism and the soil bacteria's ability to degrade antibiotics. These examples underscore the necessity for complementary approaches, combining meta-omics techniques for taxonomy and potential function insights with SIP-FISH-nanoSIMS chemical imaging for experimental exploration of predicted functions. Such complementarity is envisioned to provide a new level of resolution into the microbial identity-function conundrum, resolving the function and activity of distinct microbial guilds at unprecedented detail.



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