**Fluorescence in situ hybridization of microorganisms in the age of super-resolution microscopy**

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Fluorescence *in situ* hybridization (FISH) is frequently used in microbiology in general and microbial ecology in particular, to identify microbial cells in complex environmental samples, by targeting their rRNA with specific oligonucleotide probes. Recent methodological advances are allowing detection not only of rRNA, but also of genes (geneFISH), mRNA (mRNA-FISH) or of intracellular bacteriophages (phageFISH).

Super-resolution microscopy is a rapidly evolving field, comprised from a suite of microscopy methods able to surpass the resolution limit of light microscopy, which is diffraction limited to approximately half the wave length of the light used, meaning that two objects closer than 200-350 nm are observed as one. Super-resolution techniques, as for example Structured Illumination Microscopy (SIM) and “Blinking Microscopy” (e.g. Photoactivated Localization Microscopy – PALM, and direct Stochastical Optical Reconstruction Microscopy – dSTORM), achieve resolution limits of 100-130 nm and 20-50 nm, respectively.

Combining FISH methods with super-resolution microscopy techniques has the potential to advance the field of microbial ecology to a new level, by allowing sub-cellular localization of cell components within environmental microbes. Here I will present the latest developments in the sub-cellular detection of rRNA, genes and bacteriophages by using FISH on microbial cells.