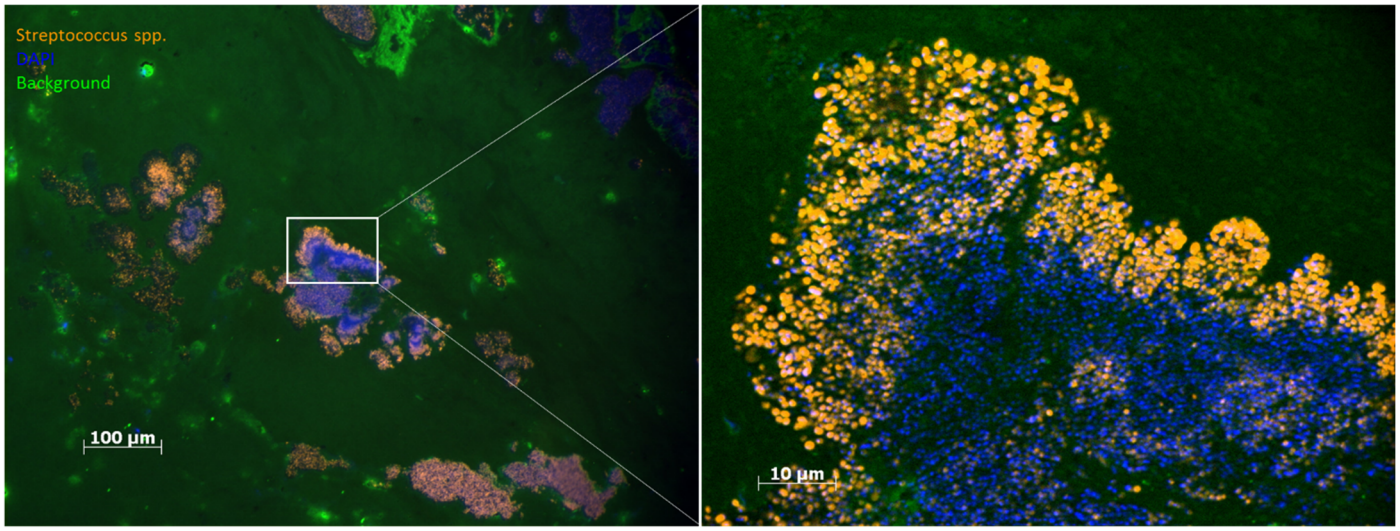
Fluorescence in situ hybridization (FISH) for the detection of microorganisms

FISH in microbiology is an innovative diagnostic method that combines the advantages of molecular biology, fluorescence microscopy and histology. FISH both identifies and visualizes microorganisms in the histological context; and at the same time, quantifies them by amount, localization and activity.



Streptococcal biofilm in a human heart valve. Left: overview with bacterial biofilms in blue and orange, in green the tissue background. Right: the higher resolution image shows in blue cocci with the nucleic acid stain DAPI; active microorganisms at the outer parts of the biofilm appear orange by hybridization with the *Streptococcus*-specific FISH probe. © A. Moter, Biofilmzentrum

FISH insights:

Who? Identification of microorganisms

Where? Spatial information by FISH allows identification of key pathogens in a mixed infection and the differentiation between contamination and infection.

How many? The amount of pathogens gives information important for therapy.

How active? FISH reveals the activity of the microorganisms and provides important information about the state of the infection.

Alive? The activity of the microorganisms points to their vitality and therefore therapeutic requirements (not possible with PCR/sequencing, since DNA of dead bacteria is detected as well).

Contamination? Differentiation between contamination of a sample and infection in the tissue

FISH enables the crucial microbiological diagnosis in life-threatening infections (for example cardiovascular infections), which otherwise would be associated with costly follow-up treatment.

Process description

FISH uses fluorescently labeled probes that bind sequence-specific to the ribosomal RNA (rRNA) of microorganisms. Bacteria and fungi are thus under the microscope detectable on a genus- or species-specific level; probes can for example detect either all bacteria, all staphylococci or just *Staphylococcus aureus*. FISH measures the (remaining) activity of the microorganisms based on their ribosome content on a single-cell-level. Upon successful treatment with an antimicrobial substance, the fluorescence signal is reduced as compared to active biofilms. Therefore, FISH directly detects the efficacy of antimicrobial substances by measuring the reduction of the FISH-positive cells and the entire biofilm mass. This effect is quantified by digital image analysis.

MoKi Analytics

MoKi Analytics is a start-up from Charité – Universitätsmedizin Berlin, established in 2017 by Prof. Dr. Annette Moter and Dr. Judith Kikhney. MoKi Analytics offers products and services for the innovative detection of microorganisms and biofilms by molecular biological techniques, such as FISH and nucleic acid amplification (PCR, sequence analysis, NGS, microbiome analysis). MoKi Analytics offers efficacy-testing services with standardized procedures. (Publication list upon request)

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