Centre for Nanoscale BioPhotonics
ARC CENTRE OF EXCELLENCE

MEDIA RELEASE

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Highly sensitive detection method puts *Staphylococcus aureus* up in lights

A fast, definitive and highly sensitive detection method for pathogenic *Staphylococcus aureus* (*S. aureus)* has been developed – and its versatility means it can be used across multiple other diagnostic options that requires identifying the intra/extra cellular RNA or single-stranded DNA sequences of specific organisms or cells.

Time-Gated Luminescent *in Situ* Hybridization (LISH) involves the joining of a luminescent DNA probe to a specific target nucleic acid (RNA or genomic DNA) within a cell. Time-Gated microscopy imaging eliminates the inherent natural fluorescence background signal usually emitted by biological samples so that the luminescence from the labelled RNA/DNA stands out with high contrast.

Reported in the journal 'Molecules', the innovative approach relies on direct attachment of a single TEGylated Europium chelate to DNA that binds to intracellular rRNA and is then detected using the LISH technique. Researchers at the ARC Centre of Excellence for Nanoscale BioPhotonics (CNBP) tied the probe to *S. aureus* and then used LISH to differentiate it from the closely related but less pathogenic *Staphylococcus epidermidis*. The ability to rapidly and accurately identify *S. aureus* is essential for appropriate use of antibiotics and timely intervention for infection control in patients and those at risk including the elderly.

"After short excitation, the long-lived luminescent emission from the labelled DNA probe can be detected without interference from natural background fluorescence from the biological sample," says Dr Nima Sayyadi, Research Fellow at the Macquarie University node of the CNBP and lead author on the paper.

"This allows us to find the "needle in the haystack" because only the "needle" lights up. While our approach does not as yet enable drug resistance strains to be separately identified, this is subject to ongoing research."

The most practical approach currently for *S. aureus* identification in hospital first requires the culturing of cells for at least half a day to 2 days to provide a positive infection result in a blood specimen and then a series of tests which are performed and completed manually by a technician with the results usually taking a day or two. This new approach allows detection of the organism in less than 2 hours.

Project Lead and CNBP node leader at Macquarie University, Professor James Piper AM, who is also an author on the paper, says the LISH approach can also be used to label antibodies and molecules as well as DNA, unleashing a range of applications. The use of these technologies is central to rapid detection of infectious disease.

“We’ve also done work in prostate cancer and bladder cancer where the target cell can be quickly and easily identified in urine samples,” he says.

“CNBP is successfully undertaking highly innovative and transformational research in luminescence based detection of single cells in human body fluid samples and we are now seeking to further develop real world applications to benefit the health of the community.”

CNBP scientists affiliated with Macquarie University worked on this break-through development.

<ENDS>

RESEARCH PAPER:
Time-Gated Luminescent in Situ Hybridization (LISH): Highly Sensitive Detection of Pathogenic *Staphlyococcus aureus*
https://www.mdpi.com/1420-3049/24/11/2083?type=check_update&version=1

IMAGES AVAILABLE:

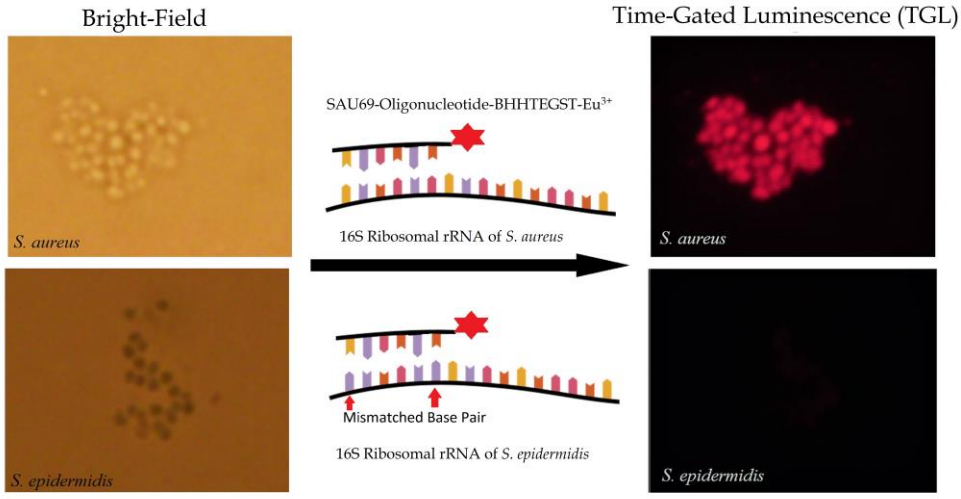

Figure 1. Both *S. aureus* and *S. epidermidis* exposed to luminescent DNA probe. The probe aligns with *S. aureus* rRNA and has mismatches to the *S. epidermidis* rRNA. Consequently, labelled *S. aureus* cells illuminated under

TGL microscopy (top right image) verses not labelled *S. epidermidis* (bottom right image); Left images are the bright field of microscope slides.

Images of Dr Nima Sayyadi:
https://flic.kr/p/2gcdsSz

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ABOUT:
The Centre for Nanoscale BioPhotonics (CNBP) is an Australian Research Council Centre of Excellence led by the University of Adelaide, with research focused nodes also at Macquarie University, RMIT University, Griffith University and UNSW Sydney. A $40m initiative, the CNBP is focused on developing new light-based imaging and sensing tools, that can measure the inner workings of cells, inside the living body. http://cnbp.org.au/

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