

Signature Projects

Our CBNS Signature Projects draw on the capabilities of our expert researchers to solve the big questions in bio-nano research.

SENSORS AND DIAGNOSTIC FOR MANAGING BLOODSTREAM INFECTIONS

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THE PROJECT

Bloodstream infections (BSIs) are a major cause of morbidity and mortality world-wide, and a key contributing factor is the lack of appropriate diagnostic tests and devices to direct treatment at the early stage. People undergoing medical treatments that leave them immunosuppressed (e.g. chemotherapy, bone marrow transplants, HIV treatment) are at highest risk of fatalities related to systemic infections. Furthermore, empirical use of antibiotics has led to the development of antibiotic resistance, leading to a shrinking number of effective drugs. The most common causes of BSIs are bacterial agents, followed by fungal and viral agents, respectively. However, fungal infections are associated with the highest mortality (often > 50%), and viral infections are commonly associated with secondary bacterial infections, hence all three groups are important. Here we aim to design sensors that allow early detection and monitoring of bloodstream infections, with special emphasis on designing systems that can be used to inform treatment decisions.

THE BIG QUESTION

- Can we develop new concepts and technologies for early detection and monitoring of bloodstream infections which can be used to guide anti-microbial treatment?

The benefits of this research

- CBNS researchers will develop new sensors and monitoring tools that can be used to guide potentially life-saving treatment decisions. In a research context, we will push the boundaries in terms of what is currently possible – especially in the areas of detecting extremely small concentrations of sepsis biomarkers in body fluids, and also moving from exclusive *in vitro* detection towards *in vivo* sensing.

Our goals

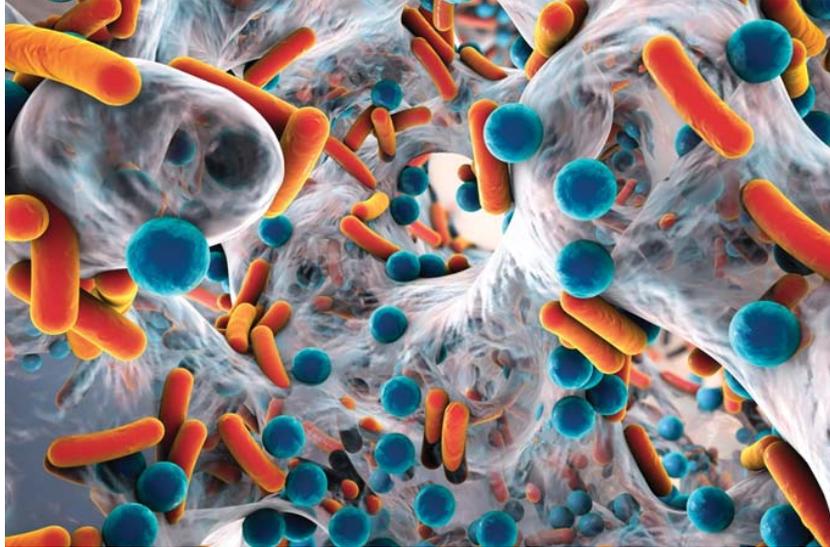
This project has two clear goals, related to *in vitro* and *in vivo* biosensing:

- Re-purposing glucose meters as ultra-sensitive immunosensors for *in vitro* monitoring of host immune response to infections.
- Inventing new implantable nanoparticle-based microbial sensors for real-time early detection monitoring of BSI in high-risk patients.



Sepsis; bacteria in blood. 3D illustration showing rod-shaped bacteria in blood surrounded by red and white blood cells.

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3D illustration showing a biofilm formed *in vivo* containing antibiotic-resistant bacteria. Once microbial biofilms are established, they are significantly less susceptible to antibiotics. Furthermore, most BSIs originate from biofilms formed on medical devices or anatomical sites.

Signature Project collaborations: Sensors and diagnostic for managing bloodstream infections

Institution	Collaborator
University of Queensland	Professor Stephen Mahler Associate Professor Kris Thurecht
University of New South Wales	Professor Pall Thordarson



Australian Government
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