CSIRO Flagship Cluster
Sensors Systems for Analysis of Aquatic Environments

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Flagship Cluster Goal

To develop an array of new technologies to be implemented in field-deployable biosensors for the detection of small organic molecules, nutrients and other analytes critical to the monitoring and management of aquatic environments. In turn the Cluster will provide innovative technologies that will support, through the CSIRO Future Manufacturing Flagship, the development of new manufacturing businesses that have a significant impact on the Australian manufacturing industry.

Vision

Australia's marine and fresh water ecosystems are some of the most prized aquatic environments in the world. Understanding those environments and the variability in their chemical and biological constituents is the key to preserving them, and sensors play a pivotal role in both achieving this understanding and protecting our valuable water bodies.

The development of reliable, cost-effective, user-intervention free sensors would allow for greater deployment, more accurate data collection and dynamic, remote monitoring of Australia's water resources for targeted analytes such as pesticides, viruses, or essential nutrients – chemical and biological parameters that are critical to the understanding of aquatic environments, but for which there are no suitable sensors currently available.

The Sensor Systems for Analysis of Aquatic Environments Flagship Cluster has been assembled to open new possibilities in the monitoring and analysis of marine and fresh water ecosystems. The cluster participants provide diverse capabilities in nanotechnology, biosensors, distributed sensor networks, the aquatic environment, in-field implementation and commercialization of new sensor technologies. Utilizing this wide range of expertise, the cluster aims to develop a range of new Australian made, user-intervention free sensors leading to the ideal scenario of a network of sensors to remotely monitor a range of critical analytes.

Ultimately, these systems would allow programs such as the CSIRO Wealth from Oceans Flagship to better diagnose changes in the ocean and potential effects on Australia's climate and marine ecosystems, or the CSIRO Water for a Healthy Country Flagship to better provide dynamic, timely reporting and forecasting of Australia's water resources. The Australian manufacturing industry will also benefit as the recipient of innovative technology. Early engagement with potential manufacturers will ensure technical and process issues will be identified and resolved during development to smooth the transition from the research labs to industry.

Research Portfolio

Five key technology themes will constitute the Flagship Cluster Research activities:

- **Immunosensors for Small Organic Molecules:** develop a prototype user-intervention free immunosensor for the detection of small organic molecules such as pesticides in fresh water and marine environments.
- **Portable Field Based Nutrient Sensors:** develop prototype maintenance-free field based sensors for *in-situ* monitoring of ammonia, phosphates, nitrates and nitrites.
- **Advanced Membrane Chemistry for Preconcentration and Calibration Free Sensing:** demonstrate a commercially viable strategy for analyte preconcentration and calibration-free ion selective sensors based on ion-selective electrodes for detection of key analytes such as metal ions, ammonia and phospates.
- **Microfluidic Sensing Platforms for Pathogens and Other Analytes:** develop a prototype field-deployable handheld microsensor for the detection of pathogens such as viruses.
- **Optimising Biogeochemical Sampling Strategies in Coastal Waters:** characterisation and integration of prototype nutrient sensors onto marine platforms and design of observing system arrays to inform biogeochemical models.

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