

Microbial Source Tracking (MST) of faecal pollution in water

CSIRO offers targeted solutions to identify the point and nonpoint sources of faecal pollution in waterways

Elevated levels of faecally derived microorganisms in both catchment and recreational water pose a serious public health risk. The sources of these microorganisms may be human or animals. To enable appropriate management, faecal pollution source(s) identification is essential. For this purpose, CSIRO has developed a toolbox of cutting-edge molecular markers. These can identify faecal matter from horse, human/sewage, cattle, chicken, dog, bird, possum, pig and ruminants. Multiple markers are available for each animal species. For example, for sewage pollution tracking we use *Bacteroides* HF183, crAssphage, human adenovirus and human polyomavirus marker genes.

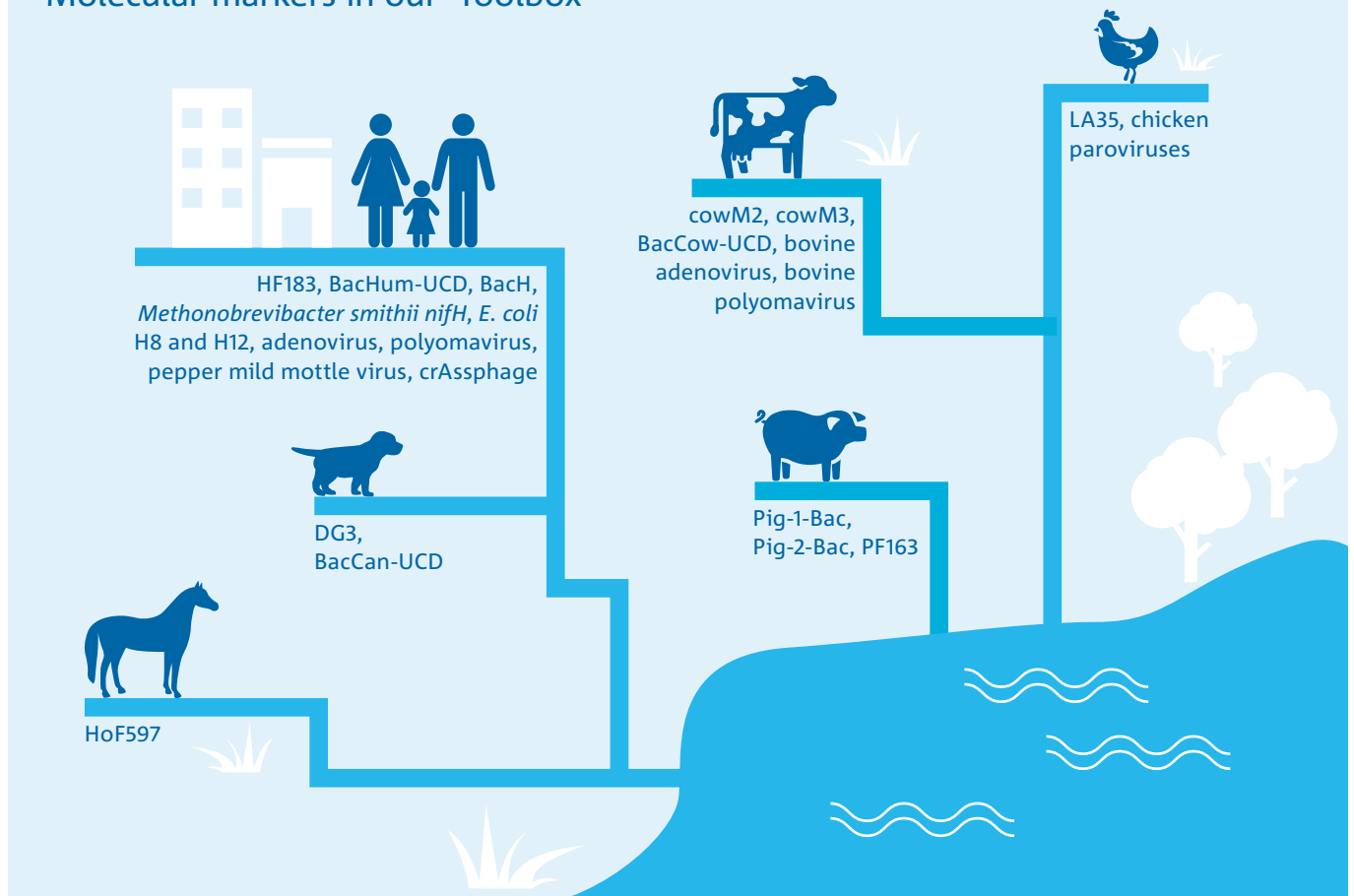
The application of this 'tool box' helps scientists to target solutions that minimise sources and reduce the human health risk.

Applications include:

- allocating contributions of various nonpoint sources
- faecal pollution remediation
- risk assessment
- beach and catchment water quality monitoring
- seafood safety.

Pathways to faecal pollution

Molecular markers in our 'Toolbox'



Besides using our cutting edge molecular markers in our toolbox to identify faecal pollution, CSIRO also provides expertise in data analysis, interpretation and guidance to clients and collaborators.

Next Generation sequencing approach

CSIRO uses library-dependent next generation sequencing to identify multiple sources of faecal pollution in waterways using SourceTracker (a Bayesian approach). This approach is not quantitative but provides information on the relative abundance of source-specific operational taxonomic units (OTUs) in water.

Additional microbial water quality parameters monitoring

Faecal indicator bacteria analysis is also performed using membrane filtration or IDEXX Quanti-Tray/2000 faecal indicator assays and quantitation of more than 50 enteric and opportunistic pathogens such as norovirus, enterovirus, adenovirus 40/41, *Legionella pneumophila*, *E. coli* O157:H7 and *Cryptosporidium parvum* and a wide range of antibiotic resistance genes (ARGs) using specific DNA/RNA amplification on environmental water, sediment and shellfish samples using molecular techniques.



Dr Warish Ahmed with the liquid handler machine, CSIRO Dutton Park.

World class laboratory and research

We have specialised facilities and a world-class microbiology and molecular microbiology laboratory for MST and pathogen research. The laboratory includes advanced instrumentation such as multiple real-time PCR platforms, a liquid handler, and ultracentrifuge, enabling rapid sample processing, and data generation. A wide range of services tailored to water utilities and health departments.

Our laboratory is staffed by several scientists with advanced degrees in microbiology, molecular microbiology and environmental science. In collaboration with global partners, we have developed cutting-edge technologies to provide a comprehensive assessment of faecal pollution sources in waterways, placing us at the forefront of MST research in Australia and South Pacific.

CSIRO research clients/partners and collaborators on MST:

- Sydney Water
- TasWater
- Seqwater
- Redland City Council
- Burchills Engineering Solutions
- AECOM Engineering Consultant
- US EPA
- University of South Florida (USA)
- University of Minnesota (USA)
- Drexel University (USA)
- Vienna Technological University (Austria)
- Stellenbosch University (South Africa)
- Griffith University (Australia)
- University of the Sunshine Coast (Australia)

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FOR FURTHER INFORMATION

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