Ripples of Change: Need for Vigilance

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Questions

☐ Secure?
☐ Threats?
☐ Priorities?
Perspective

- Public health
- Water quality
- Waterborne infections
Secure?

- Depends
- Assess needs
- Public health
Threats?

☐ Waterborne infections

✓ Primary concern (WHO, 2011)

✓ Fecal contamination

✓ All types of pathogens
Threats?

Pathogens change

- Bacteria important historically
- New bacteria emerged
- Parasites came to fore
- Don’t forget viruses
Threats?

Monitored well?

- Weather
- Surveillance
- Testing
Current Test Limitations

“The most significant problems associated with pathogen measurement are the lag time involved in testing and... the large number of false results... The absence of *E. coli* does not assure the absence of more resistant fecal pathogens...”

The Honourable Dennis R. O’Connor
Walkerton Inquiry Commissioner
Current Tests

Filtration of sample then putting filtered membrane on culture media (grow bacteria)

Incubate cultures then cultures examined by lab tech for bacterial growth
Better Tools: Role of Metagenomics

“DNA analysis offers promise for the future”
Walkerton Inquiry Report

We need better tests

- Water quality test: Is fecal pollution present?
- New markers: Detect all types of microbes?
- Pollution attribution: Which species is the cause?
Some Current Team Work

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Curtis Suttle
Robert Holt
Karen Bakker
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Yann Joly

Collaborators
Hans Schreier, UBC
Kyle Garver, DFO
Timothy Lambert, MOH
Paul Hasselback, VIHA
These two things make metagenomics happen

☑️ Next-generation DNA sequencers allow millions of pieces of DNA to read from a processed water sample.

☑️ Computational tools compare DNA in a sample and determine what microbes are there.
Will it work?
What will we find?
New Informative Biomarkers
Development of Tests

PCR Test to Monitor Microbial Pollution

PCR Test for Pollution Attribution

Prototype kits validated with partners

Faster, more useful, more cost-effective monitoring
Threats?

- Framework complex
- New model: Quality?
- Multi-disciplinary possible?
- Risk management focus?
Threats?

☐ At tap
Threats?

Source-to-tap

Watershed
Raw Water Intake
(Treatment)
Tap
Community

Water Flow
Threats?

“... source protection planning must be carried out on an ecologically meaningful scale - that is, at the watershed level.”

The Honourable Dennis R. O’Connor
Walkerton Inquiry Commissioner
Watershed Stakeholders

Ministry of Agriculture and Lands
- Livestock
- Irrigation
- Water Purveyors

Ministry of Forestry
- Forestry

Ministry of Environment
- Conservation areas

Department of Fisheries and Oceans
- Fish habitat
- Water-based recreation

Ministry of Health
- Drinking water

Municipalities
- Urban areas

Water Quality

- Drinking water
- Municipalities
- Livestock
- Irrigation
- Water Purveyors
- Conservation areas
- Fish habitat
- Water-based recreation
Threats?

- Surveillance limitations

Detect only tip of iceberg
Threats?

- Waterborne infections
- Pathogens rapidly change
- Limitations of monitoring
- Focus is at tap
- Framework complex
Priorities?

- Immediate, ongoing
- Recurring themes?

Safe Drinking Water, Steve and Elizabeth Hrudey, IWA 2004
Priorities?

- Recurring themes
  - Pathogens pose greatest threat
  - Use multiple barriers
  - Trouble preceded by change
  - Use a risk approach

Safe Drinking Water, Steve and Elizabeth Hrudey, IWA 2004
Answers

- Secure? Don’t know
- Threats? Pollution
- Priorities? Define, improve, involve
Questions...
Answers?
Applied Metagenomics of the Watershed Microbiome (Genome Canada)

Phase I: Metagenomic Survey of Watersheds

Phase II: Develop PCR-Based Quality and Attribution Tests

Understanding stakeholder needs
Understanding regulatory framework