The EPA MST Guide Document

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Who participated

USGS,NOAA,USDA
EPA-ORD, EPA-OW
Environment Canada
Regional & State Scientists
Academic Scientists

Current Status MST Guide Document

Under internal/external review; release in Jan 05

Guide Structure

RESEARCH & DEVELOPMENT

Building a scientific foundation for sound environmental decisions

When are MST Methods Useful

- To supplement sanitary surveys
  - Identify sources of beach contaminants
  - Identify sources of TMDL violations
- For risk analyses
  - Human vs animal
  - Domestic animal vs wildlife

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Why is a Guide Document Needed?

- Recent proliferation of new methods
  - Genomic
  - Phenotypic
  - Cultural
  - Non-cultural
  - Different levels of discrimination
- Most useful method depends on circumstances

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The Theory Behind MST

- Genomic Methods
  - Parallel evolution of host and intestinal flora
- Phenotypic Methods
  - Uses of different antibiotics for different animal species
  - Parallel evolution of host and intestinal flora

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Content of MST Guidance Document

I Introduction

- What is MST?
- Definitions of terms

II Decision Criteria

- When MST methods should be used
- Importance of sanitary surveys
- Decision tree

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Decision Tree

- Questions;
  - Is the problem adequately defined?
  - Has an adequate sanitary survey been conducted?
  - How many sources were identified?
  - Is the study area of manageable size?
  - What is the desired level of discrimination?

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III MST Approaches

- Summary descriptions of all current methods
  - Explanations of how they work
  - Summary tables with advantages and disadvantages
  - References

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IV Data Collection and Analysis

- Design sampling around study objectives
- General principles for sampling
- Library construction and validation
- Spatial and temporal variability
- Similarity measurement methods

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V Performance Standards

- Universal quality measures
- Method-specific controls
- Method-specific performance criteria

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VI Assumptions and Limitations

- Characteristics of source identifiers
  - Specificity
  - Distribution in host
  - Geographic range
  - Temporal stability
  - Survival in water

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VII Applications of MST Approaches

- Eight case studies are presented
- A glossary of MST terms is presented

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SUMMARY

- Content of The EPA Guidance Document
  - Decision criteria for choosing the appropriate method
  - Detailed method descriptions
  - Data collection and analysis
  - Performance standards
  - Assumptions and limitations
  - Case studies

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The Future of MST

- Technology is changing rapidly
  - New methods will arise
  - Some methods will become obsolete
- Library-independent methods will probably be the trend
- Epidemiological studies to assess risk

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New Approaches in MST

- Multiple markers to discriminate sources
  - Real-time PCR
  - Flow cytometry
  - Microarrays
- Novel targets based on function specific genes and host microbial interactions

Method

Filter 100 - 1000 ml water using 0.4 μm polycarbonate membrane

↓

Extract DNA from cells directly on membrane

↓

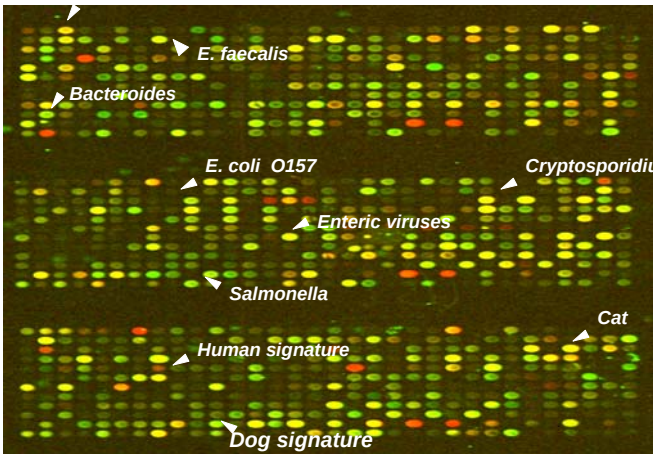
Real time PCR with TaqMan probes

↓

Quantitative analysis

Total time = ~ 3 hours

Microarray for Water Quality Assessment



Indicators

Pathogens

MST