

Microbial Source Tracking

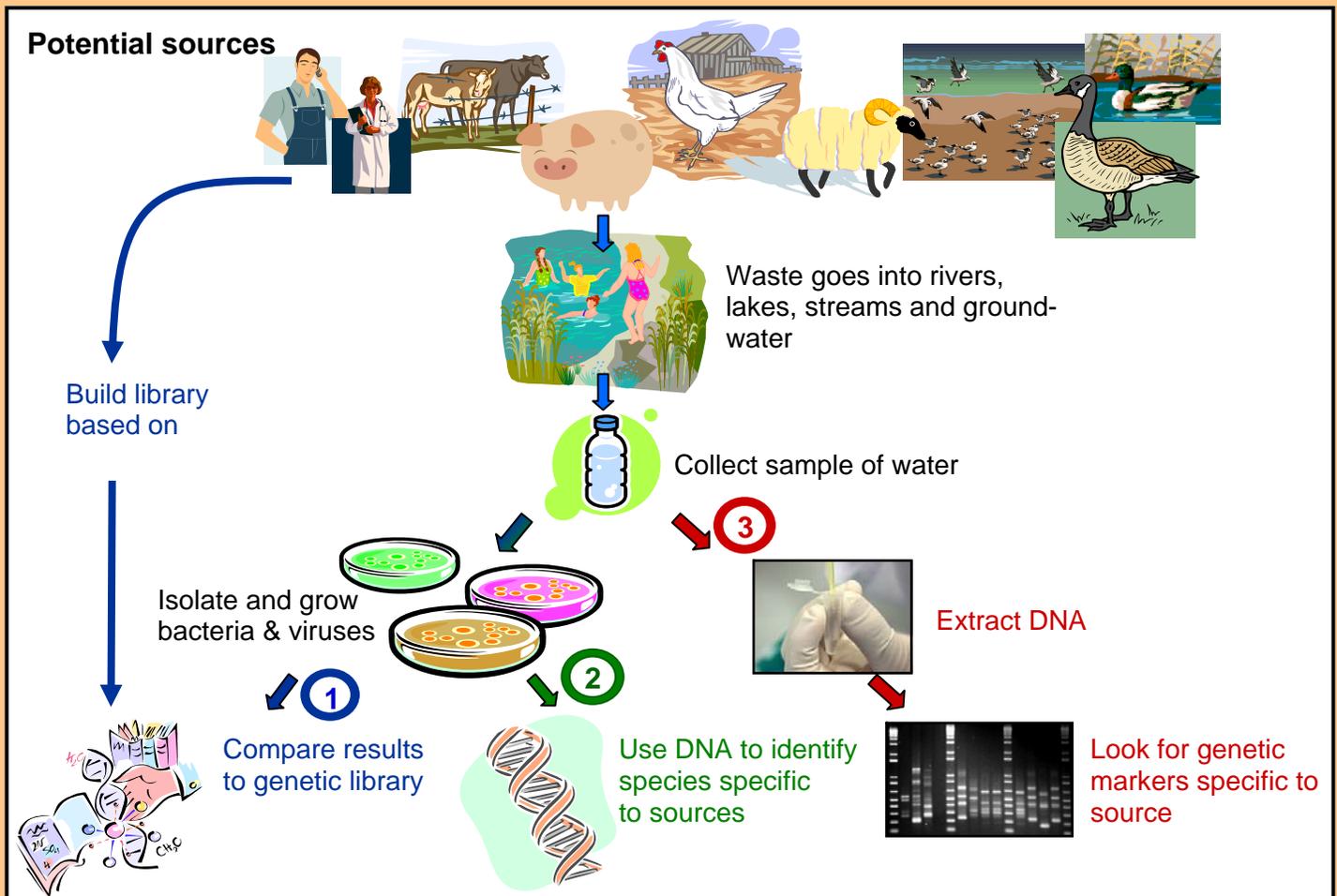
What is Microbial Source Tracking?

Microbial source tracking is a process of identifying a particular source (such as human, cattle, or bird) of fecal contamination in water, which is generally measured through fecal indicator bacteria, like *Escherichia coli* (*E.coli*) or Enterococci. The basic assumption of microbial source tracking is that there are characteristics unique to the fecal bacteria from a particular host and these characteristics allow researchers to identify the source of the contamination. Most of these target key genes that can be “fingerprinted” or tied to a type of mammal, human or bird.

How is Microbial Source Tracking Done?

There are several different methods for microbial source tracking:

- ① Library-dependent, culture based:** Samples are collected from all over a watershed and researchers grow bacteria in the lab to create a library from a variety of source organisms. Then, water samples are collected from rivers, lakes, or beaches and the bacteria in the samples are also grown in the lab. The results of the water sample are compared to the library to determine sources of contamination.
- ② Library-independent, culture based:** Water samples are collected and the bacteria and viruses in the samples are grown or cultured in the lab. The bacteria and viruses grown are known to be from specific hosts or sources of fecal contamination so there is no need to compare results to a library.
- ③ Library-independent, culture independent:** Water samples are collected and molecular techniques are used to isolate and identify DNA directly from the sample without first having to grow or culture the bacteria and viruses in the sample.



What are the advantages and disadvantages of these methods?

- ① **Library-dependent, culture based** methods are not the preferred MST method because of high failure rates and creating the required library is labor intensive. However, the method is relatively inexpensive, low tech, and widely available.
- ② **Library-independent, culture based** methods enhances the sensitivity of the method and can be used to assess the effectiveness of water treatment. The disadvantages of the method include cost, only a few genetic markers are currently available, and some markers may be rare and as a result require large samples of water to be collected.
- ③ **Library-independent, culture independent** methods provide test results quicker than culture based methods and can be used for organisms that are difficult to grow in the lab. The disadvantages of the method are similar to those for library-independent, culture based methods.

Isolates? PCR? What do those words mean?

The field of microbial source tracking uses many technical terms. Here are definitions for some of the most common terms:

- **Culture:** growing living cells in a laboratory medium
- **DNA:** deoxyribonucleic acid, the molecule that encodes genetic information for all living things.
- **E. coli:** *Escherichia coli*, a type of bacteria found in the feces of humans and other warm-blooded animals.
- **Enterococci:** bacteria belonging to the genus *Enterococcus*, two species (*Enterococcus faecalis* and *E. faecium*) are commonly found in human intestines and feces.
- **Genetic or DNA fingerprints:** Fingerprinting identifies sections of DNA that are typically unique to an individual or species.
- **Genotype:** the genes an organism carries; the genotype can refer to a single gene or to all genes
- **Host-specific markers:** any trait used to identify a fecal source to its host or source species, including chemical markers, fingerprints, and DNA sequence targets for host-specific PCR.
- **Isolate:** a particular species or strain of microorganism
- **Library:** a set of bacterial isolates or patterns from fecal samples of known origin, tested using a statistical method of discrimination
- **PCR:** polymerase chain reaction; a method to make many copies of a specific sequence of DNA
- **Phenotype:** observable characteristics of an organism

For More Information

Pathogen Workshop Microbial Source Tracking Paper by Drs Kate Field and Troy Scott
<http://www.cws.msu.edu/documents/MicrobialSourceTrackingWhitePaper.pdf>

USGS Water Quality Information Microbial Source-Tracking and Detection Techniques
<http://water.usgs.gov/owq/microbial.html>

EPA Source Tracking Fact Sheet
<http://www.epa.gov/owm/mtb/bacsortk.pdf>

USGS Water Quality Information Microbial Source-Tracking and Detection Techniques
<http://water.usgs.gov/owq/microbial.html>

MSU Center for Water Sciences Pathogen Workshop Site
http://www.cws.msu.edu/pathogen_wkshop.htm



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