

THE FACTS ABOUT E. COLI

WHAT IS E. COLI?

Escherichia coli, or *E. coli* for short, is a common, rod-shaped bacterium that lives in human and animal intestines where it is present in large numbers. There are hundreds of *E. coli* strains, most of which are relatively harmless, some are even beneficial to humans.

WHAT'S THE PROBLEM?

While most *E. coli* strains are harmless, one exception is the *E. coli* strain O157:H7. This particular strain is a pathogen which produces a powerful toxin often referred to as Shiga toxin or verotoxin, which can cause severe illness. *E. coli* thrive in warm, wet, dark places that are rich in nutrients, such as human and animal intestinal tracts. Once excreted, the bacteria cannot survive the harsh conditions of the outside world; however, some manage to find their way into lakes and streams, or another host. Once in water or sediment, *E. coli* can persist for several weeks. Current research suggests that *E. coli* can survive, grow, and persist in moist beach sand.

SOURCES OF E. COLI

Some common sources of *E. coli* are runoff from developments, direct release of untreated sewage, leakage from sewage pipes, and droppings from sea gulls, waterfowl, and pets. Storm sewers can carry dog and cat feces off sidewalks or streets directly into streams. Improperly maintained septic systems may release pathogens into groundwater. Cattle, domesticated animals, wild animals, and birds directly release feces into streams and lakes.

TESTING FOR E. COLI

Since *E. coli* is found in human and animal waste, it is often used as an indicator to detect the presence of these wastes in the water. Many different laboratory methods exist to detect and count *E. coli*. Most of them are based on collecting a sample of water, and passing it through a 0.45µm membrane filter to capture any bacteria in the water. The filters are then placed on selective growth media, which are incubated for about 24 hours to produce colored colonies. The colonies can then be counted by hand using a filter grid or by using a routine automated colony counter. To isolate *E. coli* O157:H7 from human or animal feces, which usually contains many other strains of *E. coli*, distinct characteristics of *E. coli* O157:H7 are considered. It does not break down certain sugars as rapidly as 95% of other *E. coli* strains. Therefore, when using the sugar as a growth medium, *E. coli*

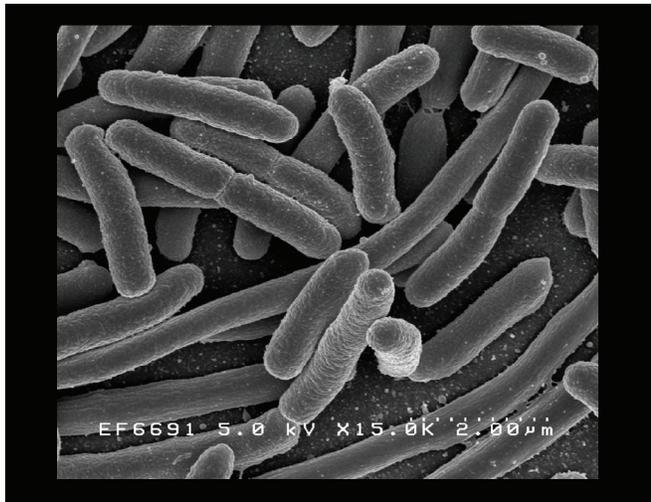


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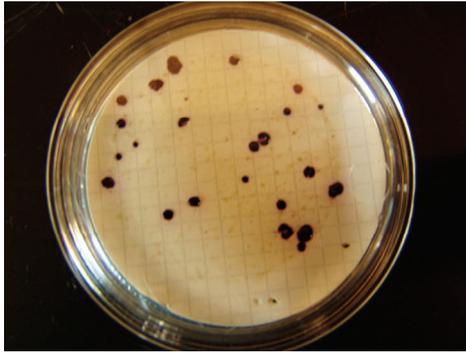


Photo courtesy of the Regional Science Consortium

O157:H7 displays a distinct growth pattern compared with other strains.

Polymerase chain reaction (PCR), which is the same technology used to solve crimes and paternity cases, can also be used to test beach water for bacteria. Small amounts of bacterial DNA can be traced and amplified in a PCR chain reaction using a fluorescent tag; so newly formed DNA emits a fluorescent signal. Researchers then use that signal to measure how much bacteria was originally present, thereby determining the bacteria levels in the water.

The PCR method takes about two hours and can be used to differentiate between *E. coli* of human and non-human sources. More rapid procedures are being developed including the rapid automatic and portable fluorometric assay system, which is hand held and capable of determining *E. coli* levels in as little as ten minutes. This technology uses antibodies tagged with fluorescence to search out the desired bacteria. However, currently antibodies are limited, and this method cannot yet be widely used.

WHAT DO WE DO ABOUT E. COLI?

When bacteria levels have risen to unacceptable levels, a two-tiered system is activated. The Great Lakes states and provinces all follow similar, but slightly different bacterial water quality standards. However, all bacterial water quality standards are based on estimates that ensure a low risk of illness in people. When the bacteria count is 235-999 colony forming units (CFUs) per 100 ml of water, a Swimming Advisory will be issued. During a Swimming Advisory, swimming is still permitted, but to reduce the risk of illness, it is



recommended that precautions be taken. When the bacteria count is above 999 CFUs, the beach is posted as Restricted Swimming and swimming is not permitted at that beach.

Fluctuating high levels of *E. coli* on public beaches is not an issue that can be resolved overnight. Numerous research initiatives are underway to address rising public concern over the frequency of public beach closings, as well as uncertainties relating to the source of contamination problems, monitoring, reporting, and closure practices.

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