

Bacteriological Examination of Water, Food and Milk

WATER

Wide varieties of microorganisms pathogenic to humans are transmitted by contaminated water. Usually these organisms are inhabitants of the intestinal tract and are introduced into potable (drinking) water by fecal contamination. These organisms, as well as others, may also be transmitted by contaminated swimming or bathing waters.

Among the many organisms of fecal origin, which cause water-borne disease outbreaks, *Salmonella typhi* (typhoid fever) and *Shigella* (bacillary dysentery) have been the most frequently encountered in recent decades. *Vibrio cholerae* (cholera), *Camphylobacter* (dysentery) and *Escherichia coli* (dysentery) are also water-borne pathogens that occasionally cause disease in the U.S. In addition, viruses such as hepatitis and polio, as well as protozoans such as *Giardia* can be found in contaminated water.

Water was first implicated in disease transmission in the 1840's in London, England, where the most famous epidemiological report ever written was published by John Snow. It was called On Cholera. In the United States, much of the pioneering work on water sanitation and testing was done in the 1890's at the Lawrence Experiment Station in Lawrence, Massachusetts.

Using methods developed by Sedgwick from MIT, tests were devised that look for the presence of indicator organisms, that is, their presence indicates fecal contamination which implies the presence of pathogens. These organisms are called coliforms and when their presence is detected, specific indicators of fecal contamination *E. coli* and *Enterococcus faecalis* are then searched out.

FOOD

The foods we consume are rarely sterile, unless they are cooked and treated in some manner to eliminate contaminating organisms. In many instances these organisms have been introduced into the food we eat from the soil, food handlers or the equipment used in food processing

Regardless of the source of the microorganisms or the reasons for their being in the food, the microbes use our food as their food and excrete waste products into what will become our food when we eat it. Some of these waste products simply make the food taste or feel bad, these organisms are called food spoilage organisms. Other organisms may produce waste products that do not change the taste or texture of the food but are toxic to us. These organisms are called pathogens and the diseases they cause are called food poisoning. In other cases, the waste products of the microorganisms produce tastes or flavors we find tasty. These organisms are called food producers. Finally, there are organisms whose presence indicates that proper food handling and sanitary practices have not been followed. These are called indicator organisms.



The materials you see displayed here are typical of those found in small laboratories where food is tested for the presence of pathogens and indicator organisms. Much of this testing is done by food processors themselves but a significant amount of testing is carried out at the State Laboratories in Jamaica Plain, Massachusetts. In serious cases of food poisoning or case where contaminated food crossed state lines, the federal government might test the food for specific pathogens at the Centers for Disease Control in Atlanta, Georgia, or at local Food and Drug Administration Laboratories.

MILK

The dairy industry uses milk to manufacture such products as yogurt, buttermilk, cheese and ice cream. In North America, the major source of milk is cows although goat cheese is somewhat popular. In other countries, milk from horses, sheep, reindeer and zebras is used. Like other members of the food industry, the dairy industry must deal with both food spoilage and food-borne pathogenic organisms.

Although the presence of bacteria in mil was demonstrated from the earliest days of microbiology in the 19th century, it was not until 1922 that legislation was passed requiring the treatment of milk by the process called pasteurization. The impetus for this legislation was the pioneering work of Alice Evans who showed that the disease called brucellosis or undulant fever could be transmitted to humans from cows by milk. Other diseases that can be transmitted by contaminated milk are salmonellosis, listeriosis, tuberculosis, hepatitis and Q fever.

Although diseases are still transmitted by contaminated milk and milk products, the incidence has been drastically reduced by the introduction of mandatory pasteurization. Pasteurization exposes milk for short periods to high temperatures that destroy pathogens (but not all bacteria) but do not destroy the nutritional quality and taste.

Most milk testing today is done by the dairy industry itself under federal and state supervision in large creameries. However, before 1950, most testing was done in very small local creameries or by local boards of health. The equipment that you see here is typical of that used by local boards in the examination of milk. The photograph shows a working lab bench from this era with much of the equipment displayed here.

The dairy industry uses coliform and total bacterial counts as indicators of the sanitary quality, nutritional quality, and shelf life of the milk or milk product.

