# History of Food Microbiology

As a discipline, Food Microbiology does not have a precise beginning. Events which stretched over several centuries ultimately led to the recognition of the significance and role of microorganisms in foods. Food borne disease and food spoilage have been part of the human experience since the dawn of our race. Although the actual cause of these problems would remain a mystery for thousands of years, many early civilizations discovered and applied effective methods to preserve and protect their food:

7000 BC – Evidence that the Babylonians manufactured beer (fermentation). Wine appeared in about 3500 BC. In early civilizations (and even today in underdeveloped countries where modern sanitation is lacking), alcoholic beverages like beer and wine were much safer to consume than the local water supply, because the water was often contaminated with intestinal microorganisms that caused cholera, dysentery and other serious diseases.

6000 BC – The first apparent reference to food spoilage in recorded history.

3000 BC – Egyptians manufactured cheese (fermentation) and butter (fermentation, low $a_w$). Again, fermented foods such as cheese and sour milk (yogurt) were safer to eat and resisted spoilage better than their raw agricultural counterparts. Several cultures also learned to use salt (low $a_w$) to preserve meat and other foods around this time.

Remains of paintings from the tomb of Ipy in Egypt, documenting production of cheese.

1000 BC – Romans used snow to preserve shrimp (low temp), records of smoked and fermented meats also appear.
Even though early human cultures discovered effective ways to preserve food (fermentation, salt, ice, drying and smoking), they did not understood how these practices inhibited food spoilage or food borne disease. Their ignorance was compounded by a belief that living things formed spontaneously from nonliving matter (Theory of Spontaneous Generation).

1665 – An Italian physician, Franceso Redi demonstrated that maggots on putrefying meat did not arise spontaneously but were instead the larval stages of flies. This was the first step away from the doctrine of spontaneous generation.

1683 – Anton van Leeuwenhoek from the Netherlands examined and described bacteria through a microscope. At about the same time, the Royal Society was established in England to communicate and publish scientific work, and they invited Leeuwenhoek to communicate his observations. He did so for nearly 50 years until his death in 1723. As a result, Leeuwenhoek's reports were widely disseminated and he is justifiably regarded as the <u>person who discovered the microbial world.</u>

1765 – Italian named Spallanzani tried to disprove the theory of spontaneous generation of life by demonstrating that beef broth which was boiled and then sealed remained sterile. His work was criticized because they believed $O_2$ was excluded $O_2$, which they thought was vital to spontaneous generation.

1795 – The French government offered 12,000 francs to anyone who could develop a practical way to preserve food. A French confectioner named Nicholas Appert was issued the patent after showing that meat could be preserved when it was placed in glass bottles and boiled. This was the beginning of food preservation by canning.

1837 – Schwann demonstrates that healed infusions remain sterile in the presence of air (which he passed in through heated coils), again to disprove spontaneous generation. (Critics suggest heating somehow changed the effect of air as it was needed for spontaneous generation.)

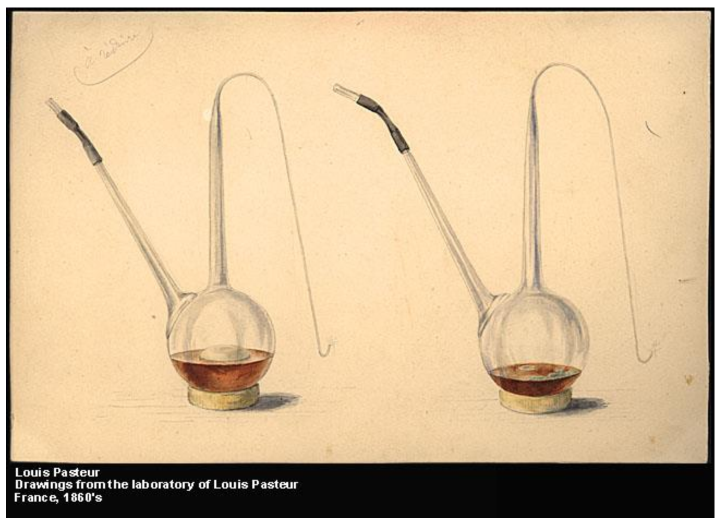
G. Spallanzani.

F. Redi.

The first person to really appreciate and understand the causal relationship between microorganisms in infusions and the chemical changes that took place in those infusions was Louis Pasteur. Through his experiments, Pasteur convinced the scientific world that all fermentative processes were caused by microorganisms and that specific types of fermentations (e.g. alcoholic, lactic or butyric) were the result of specific types of microorganisms.

In 1857 he showed that souring milk was caused by microbes and in 1860 he demonstrated that heat destroyed undesirable microbes in wine and beer. The latter process is now used for a variety of foods and is called pasteurization. Because of the importance of his work, Pasteur is known as the founder of food microbiology and microbiological science. He demonstrated that air doesn't have to be heated to remain sterile using his famous swan-necked flasks that finally disproved spontaneous generation.

Pasteur.




In the U.S. many food industries hesitated to adopt industry wide microbiological standards until they were economically threatened by the publicity which surrounded outbreaks of food borne disease. Several nasty outbreaks of botulism in the early 1920s finally prompted the U.S. canning industry to adopt a very conservative heat treatment, known as the 12D process, that reduces the probability of survival of the most heat resistant *C. botulinum* spores to one in a billion ($10^{-12}$). This practice continues today, and since 1925, the canning industry has produced more than a trillion containers with only 5-6 known incidents of botulism. Most of these incidents involved faulty containers, not under processing.

At about the same time, the dairy industry was driven to implement microbiological control over milk because of several notorious outbreaks of milk-borne typhoid fever, diphtheria, tuberculosis and brucellosis. Public health authorities established requirements that addressed animal health, sanitation, pasteurization (which had an immediate and very effective impact on the problems), and refrigeration, with all of these steps reinforced by bacterial standards. As a result, pasteurized milk was one of our safest foods by the mid-1900s.

In one of the more unusual episodes of early food microbiology, the New York state government institutionalized a woman who came to be known as “Typhoid Mary.” Mary was an asymptomatic typhoid carrier that worked as a cook for several families near the turn of the century. Over ten years, 7 outbreaks of typhoid were directly traced to her and estimates suggest she may have been responsible for 51 cases of typhoid fever. New York authorities arrested her and sought to have her gall bladder removed but eventually released her when she agreed never to work as a cook again. When another outbreak was traced to her a few years later, she was arrested as a threat to public safety and institutionalized until her death in 1938.

As we eliminate microbes from food we create an environment free of competition which may allow opportunities for other microorganisms to grow and cause disease. For this reason, there is considerable interest in identifying safe bacteria (e.g. lactic acid bacteria) which, when deliberately added to food, would inhibit growth of pathogens but would not rapidly spoil the product themselves (though some lost shelf life seems inevitable).