# CENTENNIAL CELEBRATION OF BIRTH OF LOUS PASTEUR AND GREGOR MENDEL

## I. PASTEUR'S CONTRIBUTION TO BACTERIOLOGY AND MEDICINE

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Thomas Carlyle has well said, "Universal history, the history of what man has accomplished in the world is, at bottom, the history of the great men who have worked here."

In medicine the achievements of certain individuals have added greatly to the wisdom and happiness of the world. Among the outstanding figures the name of Louis Pasteur is perhaps the greatest Pasteur made a dozen discoveries any one of which would have secured his fame for all time.

The late Nicholas Senn says, "The discovery of the microbic cause and real nature of inflammation was the first great triumph of scientific medicine, and has contributed more to the prolongation of human life, and the mitigation of human suffering than all previous medical knowledge which has accumulated from the time medicine was first practiced and taught. We owe this discovery to two men, Pasteur and Lister, who have conferred a greater benefit upon the human race than any two mortals since the world began."

Pasteur has been called the "father of bacteriology." He did not discover bacteria but he took the somewhat philosophical, haphazard speculations concerning bacteria that had been carried on for two hundred years previously, and in a few years established a new science, a science that has had many brilliant achievements. He put biology upon a stable basis by settling and setting aside once and for all the dispute over spontaneous generation.

The works of Pasteur constitute one unbroken chain of triumph. He was in his day pre-eminent in chemistry. In his studies as to the cause of chemical changes during fermentation he became convinced that certain living mirco-organisms, bacteria and yeasts, were the true cause—that these changes, the products of fermentation, were caused by living substances; that the different kinds of fermentation products as lactic acid, buteric acid, alcohol,

reduction of organic matter. etc. were caused each one by a specific germ. Not satisfied with mere speculation and arguments he went to work to prove his contentions by elaborate pains-taking and convincing experiments.

No man in the history of the world ever stirred up as much opposition to himself. He stood on the threshhold of a new chemistry and he directed the thought of the world in another direction by his explanation of fermentation. He stood at the dividing of the ways in medicine—the medicine of the past, mysterious, empirical—and that of the future. Old opinions and traditions die hard. Leibig and his chemical theory of fermentation must give way to facts as pointed out by Pasteur. The speculative philosophies as to the nature and cause of disease as well as the cure of disease must give way to facts.

The practical side of science always appealed to Pasteur. In his studies on buteric and alcoholic fermentations he applied his knowledge in a practical way. Having discovered the cause of fermentation, yeasts and bacteria, he learned how to control these fermentations and saved two of the important industries of France —wine and beer making. It was only a step to a disease that was devastating another of France's principal industries, the silk worm industry that was hopelessly groping for relief. When M. Dunas implored Pasteur to take up the study of this disease he refused, saying he knew nothing about silk worms—but a sense of patriotism impelled him to begin the study and in a year he had learned that the death of the silk worms was due to bacterial diseases which could be controlled by proper selection of healthy worms and the destruction of the germs that caused the disease.

The practical side of the study of anthrax among cattle in France led Pasteur to another of his great discoveries. Pollander had discovered the anthrax bacillus in 1850 but had never succeeded in convincing the scientific world that the bacillus was the real cause of the disease. Not even the studies of Koch were convincing as he was unable to explain how the disease was transmitted. Twenty-six years after Pollander's first discovery Pasteur not only convinced the world that the anthrax bacillus was the cause of anthrax in cattle but showed how it was transmitted, and also that the disease could be prevented by immunizing animals with attenuated cultures of anthrax bacilli. For the first time in history the way was opened to vaccination and immunization on a scientific basis.

To a man like Pasteur these were not isolated facts, they were laws, part of a great universal system. He saw that the same

laws that govern the diseases of wine govern the disease of beer and vinegar, that they govern the diseases of silk worm, pebrine and flacherie, and that they govern the diseases of animals as anthrax and chicken cholera. They are the laws of disease and apply to all communicable diseases whether in vegetable or animal creation We therefore find him narrowing down his activities to pathology.

To understand the significance of Pasteur's work in pathology or medicine let us review the conception of disease prior to 1866. As a speculative philosophy contagious diseases were said to be due to contagium vivum—living virus. Just what this mysterious virus really was, how it entered the body or how disease was produced, could not be explained in any scientific way. Henle in 1840 had written his brilliant paper on contagious diseases and had laid down some very specific laws, but as his conclusions were not based on experimental work, they were not convincing and not generally accepted.

At the same time Virchow in Germany had brought forth cellular pathology and the famous principles of heterotopy and the heterochomia. Disease was due to a chemical change in the cells and not a living substance brought forth from without.

Other illustrious scientists of the day, Helmholtz, Du Bois Reymond, Ludwig, explained all physiological phenomena of the living being by forces of physico-chemical order.

Not only Pasteur but several other men of the time had begun to see the similarity of the process of fermentation and diseases in animals and man. Pasteur with his twenty years of experimental work on fermentation and silk worm disease was better prepared from a technical point to work out the experiments on bacteria in their relation to disease and to prove his conceptions. Although Devine, Reyner and Koch had studied the anthrax bacillus and apparently proven it to be the cause of anthrax diseases the laboratory experiments of Pasteur finally brought forth the final proof that bacteria and not an invisable, intangible virus was the cause. His experiment was simple. A drop of blood from an animal sick with anthrax was placed in a 50c.c. of fresh, slightly alkaline urine. A series of cultures, ten in all, were transferred. Each time one drop of inoculated urine was transferred. The result was that the original blood had been practically lost in the dilutions but the anthrax bacillus which grew and multiplied remained and a few drops from the last culture produced anthrax in animals. However his real discovery with anthrax came when he showed that by the use of attenuated cultures, immunity to the disease

could be produced. The final proof of this experiment was dramatic. The Society of Agriculture of Melun had proposed to Pasteur a public trial of his new method. Twenty-five sheep were to be vaccinated and later inoculated with anthrax. Another twenty-five sheep unvaccinated, were inoculated at the same time. On April 28th and May 17th, 1881 the twenty-five sheep were vaccinated against anthrax and on May 31st the entire lot of sheep, fifty in all, were inoculated with anthrax On June 2nd the results were recorded. Imagine the anxiety of Pasteur during these two days, but as he predicted the 25 vaccinated sheep remained well while the other died. He had convinced the skeptics and a new doctrine in the control of diseases was born.

From anthrax in sheep he turned to rabies in dogs and man. Although he did not succeed in isolating an organism for this disease, and no one since his time has succeeded, he did discover a successful method of preventable inoculation against the disease—the well-known Pasteur treatment. The technical difficulties on the study of rabies seemed at that date unsurmountable. After many failures Pasteur finally hit upon the idea of inoculating spinal cord substance of a rabied animal into the brain of a dog. This established a sure method of inoculation and a short incubation period. Then the problem of attenuating the virus arose and was solved by serial inoculation of rabbits and the dehydration of the cord. The results were that the virus could be attenuated to any desired degree and gradually increasing doses used.

In closing let me quote from an address by Stephen Paget, "To change the whole outlook of medicine and surgery Heaven took and trained a 'Pure Scientist'—who had never done an operation or written a prescription; a man who had to screw up courage even to look at some of the ordinary sights of a hospital—took this non-medical man of science and set him to be the head of all heads of the medical profession, to have them all obedient to his teachings and proud of the very sound of his beloved name."