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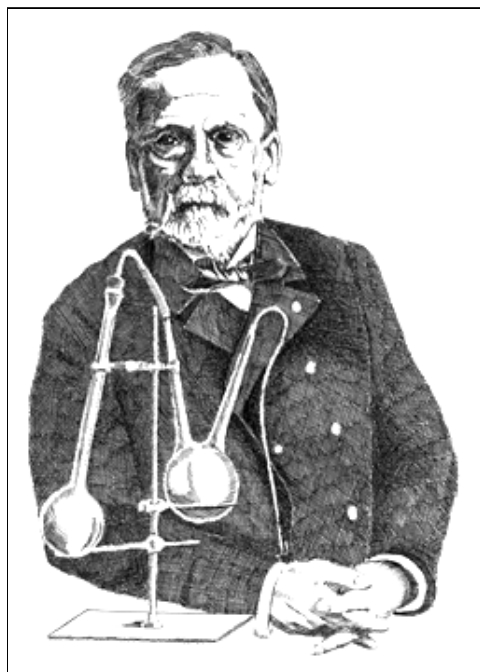
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## Louis Pasteur (1822-1895)

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*Line drawing of Louis Pasteur drawn by David Wood from Genentech, Inc. Graphics Department.*

If one were to choose among the greatest benefactors of humanity, Louis Pasteur would certainly rank at the top. He solved the mysteries of rabies, anthrax, chicken cholera, and silkworm diseases, and contributed to the development of the first vaccines. He debunked the widely accepted myth of [spontaneous generation](#), thereby setting the stage for modern biology and biochemistry. He described the scientific basis for fermentation, wine-making, and the brewing of beer. Pasteur's work gave birth to many branches of science, and he was singlehandedly responsible for some of the most important theoretical concepts and practical applications of modern science.

Pasteur's achievements seem wildly diverse at first glance, but a more in-depth look at the evolution of his career indicates that there is a logical order to his discoveries. He is revered for possessing the most important qualities of a scientist: the ability to survey all the known data and link the data for all possible hypotheses, the patience and drive to conduct experiments under strictly controlled conditions, and the brilliance to uncover the road to the solution from the results.

On the discipline of rigid and strict experimental tests he commented, "Imagination should give wings to our thoughts but we always need decisive experimental proof, and when the moment comes to draw conclusions and to interpret the gathered observations,

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imagination must be checked and documented by the factual results of the experiment."

The famous philosopher Ernest Renan said of Pasteur's method of research, "This marvelous experimental method eliminates certain facts, brings forth others, interrogates nature, compels it to reply and stops only when the mind is fully satisfied. The charm of our studies, the enchantment of science, is that, everywhere and always, we can give the justification of our principles and the proof of our discoveries."

The pattern of logic in Pasteur's scientific career and the brilliance of his experimental method are well documented. It all started from studying crystal structure. As a student at the Ecole Normale, Pasteur observed that the organic compound tartrate, when synthesized in a laboratory, was optically inactive (unable to rotate the plane of polarized light), unlike the tartrate from grapes, because the synthetic tartrate is composed of two optically asymmetric crystals. With careful experimentation, he succeeded in separating the asymmetric crystals from each other and showed that each recovered optical activity. He then hypothesized that this molecular asymmetry is one of the mechanisms of life. In other words, living organisms only produce molecules that are of one specific orientation, and these molecules are always optically active.

This hypothesis was tested again by utilizing a synthetic tartrate solution that had been contaminated with mold. He found that this solution became more optically active with time and concluded that the mold was only utilizing one of the two crystals. Later in his career, he was approached with a contamination problem in alcoholic fermentation, which was thought to be an entirely chemical process at the time. After careful examination, he found that the fermenting solution contained optically active compounds and concluded that fermentation was a biological process carried out by microorganisms. This hypothesis, called the germ theory, was followed by many elegant experiments that showed unequivocally the existence of microorganisms and their effect on fermentation.

The germ theory was the foundation of numerous applications, such as the large scale brewing of beer, wine-making, pasteurization, and antiseptic operations. Another significant discovery facilitated by the germ theory was the nature of contagious diseases. Pasteur intuited that if germs were the cause of fermentation, they could just as well be the cause of contagious diseases. This proved to be true for many diseases such as potato blight, silkworm diseases, and anthrax. After studying the characteristics of germs and viruses that caused diseases, he and others found that laboratory manipulations of the infectious agents can be used to immunize people and animals. The discovery that the rabies virus had a lag-time before inducing disease prompted the studies of post-infection treatment with weakened viruses. This treatment proved to work and has saved countless lives.

All of these achievements point to singular brilliance and perseverance in Pasteur's nature. His work served as the springboard for branches of science and medicine such as stereochemistry, microbiology, bacteriology, virology, immunology, and molecular biology. Moreover, his work has protected millions of people from disease through vaccination and pasteurization.

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