

*A m^r St René Caillaud
Secrétaire général de l'Institut de France
hommage de l'auteur
L. Pasteur*

QUELQUES RÉFLEXIONS

SUR LA

SCIENCE EN FRANCE,

PAR

M. L. PASTEUR,

MEMBRE DE L'INSTITUT.



PARIS,

GAUTHIER-VILLARS, IMPRIMEUR-LIBRAIRE

DU BUREAU DES LONGITUDES, DE L'ÉCOLE POLYTECHNIQUE,
SUCCESSEUR DE MALLET-BACHELIER,
Quai des Augustins, 55.

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1871

MOODY MEDICAL LIBRARY ■ THE UNIVERSITY OF TEXAS MEDICAL BRANCH AT GALVESTON MAY 1978

THE **Bookman**

COVER ILLUSTRATION: Cover of Louis Pasteur's paper of 1871, "Quelques réflexions sur la science en France," inscribed and signed by him. Pasteur Collection, UTMB Library.

The defeat of France by Prussia prompted Pasteur to reissue his warning about the neglected state of French science. He pointed out the disparity between the government support of science in France and in Germany, and partly attributed the defeat of his country to the neglect of science. "Take interest, I beseech you," Pasteur pleaded, "in those sacred institutions which we designate under the expressive name of laboratories. Demand that they be multiplied and adorned; they are the temples of wealth and of the future."

COVER DESIGN by Jody Armand, Public Information Office, UTMB.

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THE PASTEUR COLLECTION
AT UTM LIBRARY

Perhaps no figure in the history of science is as famous as Louis Pasteur (1822-1895). He carried out pioneering work in microbiology and immunology and his efforts to improve the wine and beer industries of France resulted in a new technique--pasteurization, a word which is now part of our common vocabulary. In the mid-1840's Pasteur began an impressive series of investigations into the optical activity of organic compounds, and then moved to the study of fermentation and spontaneous generation. By the mid-1850's he was involved in the study of silkworm diseases, a topic which would eventually lead him to investigating a number of infectious diseases, anthrax, fowl cholera, rabies, erysipelas and rabies, and in developing appropriate vaccines.

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During nearly half of a century, from 1847 to 1892, Pasteur published approximately 600 communications--books, scientific papers, essays, brief notes and letters. It is not very often that a student of history has access to such a wealth of primary material. He is particularly fortunate

The following sources have been used in preparing this paper:

Gerald S. Sutton, "Louis Pasteur," Biography of Scientific Biography, vol. 10 (New York: Charles Scribner's Sons, 1974), pp. 350-416.

René J. Dubos, Louis Pasteur: Free Lance of Science (Boston: Little, Brown and Company, 1960).

René J. Dubos, Pasteur and Modern Science (New York: Anchor Books, 1960).

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here at UTMB, for virtually every piece of work that Pasteur published during his lifetime is available in one form or another in the History of Medicine Collection at the Moody Medical Library. The following pages are devoted to a discussion of the highlights of the Pasteur Collection in this library, and the significance of certain Pasteur papers in the history of science and medicine.

Shortly after Pasteur received the degree of docteur ès science from École Normale in Paris, he established himself as a skillful experimenter and created a new area of investigation: the relationship of optical activity to crystalline structure and chemical composition of organic compounds. He first discovered isomerism by separating the two forms of tartaric acid and showed their different behavior under polarized light. Later his work on racemic acid and its crystalline structure won him a prize from the Société de Pharmacie in 1853. Most of Pasteur's important papers on crystallography, and "Recherches sur la dissymétrie moléculaire des produits organiques naturels," which summarized his views on molecular asymmetry and optical activity at the end of his research into this problem, are available in original reprints in the UTMB Library.

Convinced that assymmetric molecules are always associated with living activity, Pasteur next undertook the study of fermentation. He suspected, contrary to the common belief, that the process involved in fermentation was not basically chemical in nature, but involved the activity of minute living organisms. Motivated by the idea of helping the wine industry in Lille, where he spent three years as professor and dean of the Faculté des Sciences, he set out to discover the causes of diseases of wine. He showed that the yeast used in the manufacture of alcohol from grain and beet sugar consisted of living "ferments." In two papers, "Mémoire sur le fermentation appelée lactique," and "Mémoire

sur la fermentation alcoolique," published in 1857 and 1860 respectively, Pasteur summarized the results of his investigations. Regarded as marking the beginning of scientific microbiology, these papers proved the existence of microorganisms in fermentation and defined the favorable conditions for the process. Pasteur further suggested that diseases, like various types of fermentation, may be caused by particular types of germs.

Pasteur next became preoccupied with the origin of living "ferments." According to the theory of spontaneous generation, the lower forms of life originated de novo from organic materials during the souring of milk and the putrefaction of meat. Pasteur wondered whether microorganisms involved in these processes were present in the atmosphere or were generated spontaneously. By careful experiments, he was able to demonstrate that each minute organism is derived from a pre-existing organism and that spontaneous generation does not take place. He applied this theory to the preservation of beverages and perishable foods, and introduced the technique of heat treatment -- a process which has been since called pasteurization.

No one emphasized more strongly than Pasteur himself the implications of the above studies on fermentation and spontaneous generation for the development of medical science. Simply, Pasteur revealed the enormous medical potential of microbiological studies. In the late 1870's, at a time when Pasteur was beginning to undertake his study of animal diseases, he contemplated writing a book on the germ theory of disease. "If I ever wrote a book entitled Studies on contagious or transmissible diseases," noted Pasteur, "it could properly begin by a reproduction of my memoir of 1862, (Mémoire sur les corpuscles organisés qui existent dans l'atmosphère: Examen de la doctrine des générations spontanées) and of part of the whole

of my memoir of 1860 (Mémoire sur la fermentation alcoolique),...."²

Continuing with his outline for the projected book, Pasteur stated that his papers on putrefaction,^{3a} butyric fermentation by an anaerobic vibrio,^{3b} and diseases of wine^{3c} and of silkworms^{3d} would come next in the development of the theory of contagious diseases. Again, I must note that all of these original reprints are part of the Pasteur Collection here in this library, and individuals can get first-hand experience by following the progression of Pasteur studies, starting with fermentation and spontaneous generation, proceeding through diseases of wine and of silkworms, and leading to the concept of infectious diseases.

The year 1877 marked the beginning of Pasteur's contribution to the establishment of immunology and the germ theory of disease. In that year he published his first paper on anthrax, a disease which was then affecting a large number of farm animals. In the next decade came a series of papers by Pasteur and his collaborators, C. Chamberland, J. Joubert, and Emile Roux, dealing with their experimental work on anthrax, fowl cholera, swine erysipelas and rabies. Most of this important work stemmed from Pasteur's observation that his experimental chickens, which had been inoculated with old cultures of cholera, became resistant to infection with more virulent cultures. He

²Dubos, Louis Pasteur. Free Lance of Science, p.247.

³These papers mentioned by Pasteur are as follows:

a)"Examen du rôle attribué au gaz oxygène atmosphérique dans la destruction des matières animales et végétales après la mort. Recherches sur la putréfaction," 1863.

b)"Animalcules infusoires vivant sans gaz oxygène libre et déterminant des fermentations," 1861.

c)"Études sur les vins," 1863-1864.

d)"Nouvelles études expérimentales sur la maladie des vers a soie," 1866.

concluded from this incidence that attenuated forms of microbes could be employed in immunizing animals and perhaps men.

In 1882 Pasteur began investigating rabies, and discovered that the microorganism involved in transmitting rabies was so small that it could not be seen under the microscope. The next stage was the development of techniques to attenuate the virulence of nerve tissues obtained from rabid animals. The material thus obtained was used to vaccinate dogs against rabies, and the treatment was later extended to people. Again, numerous reprints defining the various phases of Pasteur's and his collaborators' work on infectious diseases and their treatment are contained in the Pasteur Collection in this Library.

Pasteur collected the results of the research summarized above in book form during his lifetime. His books and monographs include the following titles: Études sur le vin: Ses maladies, causes qui les provoquent (Paris, 1866); Études sur le vinaigre, sa fabrication, ses maladies, moyens de les prévenir (Paris, 1868); Études sur la maladie des vers à soie, 2 vols. (Paris, 1870); Études sur la bière: Ses maladies, causes qui les provoquent, ...avec une theorie nouvelle de la fermentation (Paris, 1876), translated into English as Studies on fermentation; the diseases of beer, their causes and the means of preventing them (London, 1879); Le traitement de la rage (Paris, 1886). All of the above titles, as well as the complete works, Oeuvres de Pasteur (1922-1939), edited in 7 volumes by his grandson Pasteur Valléry-Radot, are available in the UTMB Library. The latter set also contains a number of letters, manuscripts and notes which were not published by Pasteur, and reports by commissions of the Académie des Sciences.

Most of Pasteur's letters and manuscripts are owned by the Bibliothèque Nationale in Paris. The Institut Pasteur in Paris houses Pasteur's personal library, his laboratory instruments and equipment, a collection of pictorial

materials, and assorted memorabilia. Other related manuscripts are scattered in various libraries in Europe and the United States.⁴ UTMB Library owns about a dozen documents in Pasteur's hand and most of them deal with appeals for funds to support his researches.

In conclusion, the Pasteur Collection at UTMB Library includes many significant and valuable items documenting Pasteur's contributions to crystallography, microbiology and immunology. First editions of his books, original reprints, some of which have been inscribed or signed by Pasteur, and letters and manuscripts in his hand highlight the collection. In addition, there are a number of portraits and busts of Pasteur, and a microscope dating from the 1860's which was employed by him.

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History of Medicine Collection

⁴Geison, "Louis Pasteur," p.414.