

Lister's Contribution to Preventive Medicine.

By Dr. C. J. MARTIN, F.R.S.

LISTER was one of the greatest discoverers in the realm of preventive medicine. His direct contribution equalled in usefulness that ever made by one man; for the antiseptic system of treating wounds relieved mankind from most of the danger and suffering attendant upon surgical operations and permitted the art of surgery to advance to unimagined achievements. His indirect contribution was great and far reaching, but is less easy of assessment.

The obliteration of wound infection which followed the successful practice of antiseptics was an enormous stimulus to research into the causation of infectious diseases generally. These researches received every encouragement from Lister, because he, like Pasteur, was convinced that infectious diseases would be found to depend upon the invasion of the body by the lower world of microbes. From 1851, when he was a house surgeon at University College Hospital, his attention had been focussed upon the causation of inflammation, suppuration, fever, and constitutional disturbance, which at that time almost invariably followed surgical operations. That suppuration was not inevitable was clear, because sometimes wounds healed without it, the edges uniting firmly together in a comparatively short time without any bodily illness. After many fruitless attempts to comprehend the process and causation of suppuration, Lister concluded that it would be wise to attack the problem from the beginning and to study the phenomena of inflammation occasioned in the simplest way. To this end he applied hot water and various chemical irritants to a minute portion of the web of a frog's foot and watched under the microscope the effect upon the blood-vessels and surrounding tissues.

Lister's paper on the early stage of inflammation, published in the *Philosophical Transactions* in 1858, is now classical. In it he showed that inflammation was a reaction of the tissues to a noxious stimulus from without. The problem was: When a wound became inflamed, what was the noxious stimulus? This question was ever present in his mind, but no answer was forthcoming, until in 1865 a scientific colleague directed his attention to Pasteur's studies on fermentation and putrefaction. The full significance of Pasteur's observations was immediately apparent to Lister, as his mind was prepared by his previous experimental work. Infection of wounds by germs, and the action upon the tissues of the products produced by them, would supply the cause he was looking for. Were all these untoward phenomena due to the putrefaction of the liquids exuded by the injured tissues? This inference was tested by ingenious experiments and its accuracy was proved, to the lasting benefit of mankind. It should be emphasised that Lister's discovery of the nature of wound diseases was one of the great steps in the progress of preventive medicine, and antedated by fifteen years the proof that any particular microbe was indeed the cause of disease.

At this time (1865) the enlightened medical world had grasped that Pasteur's discovery that particular fermentations were produced by specific microbes indicated the possible nature of the various *contagia viva* responsible for disease. It was appreciated that diseases bred true, as dogs and cats bred true, and that they did not arrive *de novo*, although their ultimate origin was as mysterious as the origin of species of higher animals or plants. The real nature of the *contagia* was pure guesswork.

The success of Lister's treatment of wounds was a powerful stimulus to the study of the cause of infectious diseases, but, occupied with the development of his antiseptic system of surgery, he could take little part in these researches. Nevertheless, in the intervals of a busy life, he did find time for bacteriological investigations of a fundamental character.

This new realm of scientific discovery yet lacked appropriate methods, and Lister had to forge his tools as required. He carried out these early researches in his back parlour. Their importance and the ingenuity of the methods he devised are dealt with in their proper perspective by Prof. Bulloch in another article in this week's issue of NATURE.

For fifteen years Lister was the principal representative and exponent in Great Britain of the new knowledge, bit by bit unfolded, of the relation of micro-organisms to disease. As his preoccupations increased with his renown, his personal contributions to bacteriological research, perforce, diminished, but the good effect of his encouragement increased.

Whenever the application of bacteriological discoveries to the public health was in question, Lister always took a prominent part. He was president of the Bacteriological Section of the International Congress of Hygiene in 1881, when Koch demonstrated his newly discovered methods of cultivation upon solid media and isolation of different bacteria. In 1890, Koch introduced tuberculin for the treatment of tuberculous infections. Lister, who had a profound respect for Koch, arranged for a thorough trial of the method in his wards at King's College Hospital. Unfortunately, the results, though encouraging at first, proved disappointing.

At the second Tuberculosis Congress in 1901, Lister was in the chair when Koch communicated the results of his experiments upon human and bovine tubercle which had led him to the conclusion that human and bovine tuberculosis were two distinct diseases and that there was no danger for human beings from the consumption of milk or meat from tuberculous cattle. Lister very courteously, but nevertheless trenchantly, criticised Koch's conclusions, pointing out that although the evidence adduced by Koch to show that human tuberculosis could not be communicated to bovines seemed convincing, his reasons for supposing the

reciprocal process to be unusual were far less satisfying. In view of Koch's pre-eminence as a bacteriologist and considering the importance of the question, the Congress moved for the appointment of a Royal Commission of inquiry. This suggestion was adopted by the Government. Lister was not a member of the Commission, but he took an active interest in its labours, and when it reported in 1911, it completely justified the criticisms made by him ten years before.

Another enterprise in the interest of preventive medicine which had Lister's sympathy and active support from its inception, was the foundation in England of an institute for the study of the causation and prevention of disease. The origin of the Lister Institute, as it is now called, was as follows. On July 1, 1889, a meeting was held at the Mansion House, London, for the purpose of taking steps to present M. Pasteur with a grateful acknowledgment from Great Britain of his gratuitous kindness in Paris to more than two hundred British patients who had been bitten by rabid animals. The acknowledgment took the form of a donation of £2000 to M. Pasteur for the use of the Institut Pasteur in Paris. At the same time the committee realised the want in the United Kingdom of an institute similar in character and purpose to the Institut Pasteur in Paris, or to the Hygienic Institute in Berlin, and others, established on the Continent for scientific research into the causation and prevention of the various infective diseases of men and animals.

With the idea of meeting this need the British Institute of Preventive Medicine was incorporated on July 25, 1891, and the objects of the Institute were set forth in a Memorandum of Association, namely:

(a) To study, investigate, discover, and improve the means of preventing and curing infective diseases of man and animals; and to provide a place where research may be carried on for the purposes aforesaid.

(b) To provide instruction and education in preventive medicine to medical officers of health, medical practitioners, veterinary surgeons, and advanced students.

(c) To prepare and to supply to those requiring them such special protective and curative materials as have been already found, or shall in future be found, of value in the prevention and treatment of infective diseases.

(d) To treat persons suffering with infective diseases or threatened with them, in buildings of the Institute or elsewhere.

(e) With a view to effecting these objects, to provide laboratories, to appoint a scientific staff, to institute lectures and demonstrations, to issue publications of the transactions of the Institute, and to found a library.

Lister succeeded the Lord Mayor as chairman of the committee after its first meeting, and was the first chairman of the council of the British Institute of Preventive Medicine. Among his colleagues were Roscoe, Huxley, Ray Lankester, Burdon Sanderson, Horsley, Cheyne, and Sir Andrew Clark. Lister was a regular attendant at the meetings of the council for many years and took the most active part in the management of the Institute.

The office of chairman of the council was for a while no sinecure, and the direction of the new Institute was an anxious task. During its early years it had great financial difficulties to contend with, and on more than one occasion its continued existence was almost despaired of. It was only by means of the enthusiasm and careful guidance of its council and the self-sacrifice of the small body of scientific men which composed its staff that it did not succumb to inanition.

It was also unfortunate in changing its birth name more frequently than is good for a young institution. In 1898 it became the Jenner Institute of Preventive Medicine in order to receive the donation of a sum of money collected to perpetuate the memory of Edward Jenner and his work. Afterwards it was found that a trading firm possessed the prior legal claim to this title, and a further change of designation being necessitated, it was decided to associate the Institute in future with the honoured name of its chairman. It thus, in 1903, became the Lister Institute of Preventive Medicine.

In the meantime the financial stresses which threatened the collapse of the Institute had been considerably relieved by substantial donations from the Berridge Trustees, the Grocers' Company, and a number of public-spirited men. The Duke of Westminster having granted, on terms which meant a large personal contribution, a fine site facing the Thames at Chelsea Gardens, the council proceeded to build one-half of the present headquarters of the Institute. These were opened in 1897.

The permanent income of the Institute was not, however, adequate to the requirements and capabilities of the enlarged establishment, until towards the end of 1898 it received, for the encouragement of research into the cause and treatment of disease, a most generous endowment of a quarter of a million sterling from Lord Iveagh. This endowment enabled the governing body to extend greatly the usefulness of the Institute and to increase the—up to that time—very inadequate staff.

The development of serum therapeutics in 1894 attracted general interest in preventive medicine. A few years previously Behring had discovered that by accustoming an animal to small but progressively increasing doses of tetanus poison, the serum of such an animal possessed the property of neutralising considerable quantities of the poison. This discovery was amplified and put to practical use for the treatment of diphtheria by Roux and Ehrlich, and rapidly established itself as the only rational and effective treatment for this disease.

The preparation of antitoxic sera was at once taken up by the Institute. Some temporary premises near London where horses could be accommodated were acquired, and as soon as the value of the remedy was established the council purchased a freehold property near Elstree, Hertfordshire, where a complete equipment for the production of anti-toxic sera and for research into serum therapeutics was installed.

Since then the activities of the Institute have

increased considerably, but two of the objects for which the Institute was founded, the education of medical officers of health and the treatment of patients, have been discontinued. Elementary education in bacteriology was soon afterwards adequately provided for by the medical schools, and the prophylactic treatment for hydrophobia, which was the particular treatment in view, was no longer required owing to the freedom of the British Isles from rabies.

The advantages which the Institute enjoyed from its association with Lister were, in the earlier days of its history, by no means confined to his guidance

as chairman of its council. To the scientific staff he was always a colleague. Whatever the nature of the problem they were occupied with, they were sure of his sympathy, and his knowledge and critical insight were ever at the disposal of the humblest worker. During the latter years of his life, although no longer able to take an active part in directing its affairs, he did not cease to take a keen interest in the welfare of the institution he had been largely instrumental in founding, and he manifested his confidence in its continued usefulness by making it joint beneficiary with the Royal Society under his will.

Some Aspects of Lister's Scientific Work.

By Prof. WILLIAM BULLOCH, F.R.S.

MY qualifications to write on certain aspects of Lister's scientific work rest on an acquaintance with his published writings. I have studied these critically by themselves and in relation to the writings on the same subjects by his contemporaries. For more than ten years I also had the great privilege of knowing Lord Lister in a manner which, considering the great disparity of our positions, I may say was almost intimate. As bacteriologist to the British Institute of Preventive Medicine I had to visit him as chairman almost weekly, to keep him in touch with the progress of the work in the antitoxin department. Even after I left the service of the Institute he frequently asked me to call upon him in connexion with scientific work in which he was interested. In this way I was a great deal in his company and, among the younger men of that time, probably saw more of him than any one else.

When I first knew Lord Lister he was sixty-eight, and I last saw him in 1909 when he was eighty-two years of age. Both then and since he impressed me as a great personality. He was deeply interested in all advances of medical knowledge and, although leading a very busy life, he strove to keep abreast of bacteriological literature, which was then pouring forth in an unbroken stream. I read through with him most of the complicated papers of Ehrlich and Bordet on hæmolysis. During the reading he would make many suggestions or criticisms which might clear up doubtful points. Finished with the work in hand, he would recur to his own work of early days and indicate the difficulties he had had and how he had overcome them. In a conversation we had on Oct. 23, 1905, he said to me—I wrote it down at the time: "If my works are read when I am gone, my papers on the pigmentary changes in the frog and on the early stages of inflammation will be the ones most highly thought of." These were not the mumbings of senility, for he was then intellectually clear and alert. I took it to mean that he wished to be considered as a scientist rather than a surgical craftsman.

In estimating Lister's scientific work it is essential to remember that he had no properly equipped laboratory as we understand the term

to-day. There were none such, or but few at the time. His laboratory was his study in his private home, and perhaps the best of his scientific work was that done in 11 Rutland Street, Edinburgh, during his first stay in the northern capital. His principal work on antiseptics was done during the Glasgow period, while his bacteriological work was begun and largely completed in his second Edinburgh period when he resided at 9 Charlotte Square.

The hours for Lister's scientific work were early in the morning and far into the night following a harassing day of active surgical work in private practice, or in the wards, operating theatre, and class-rooms of the Edinburgh Infirmary. He performed all his appointed duties in a most conscientious way, and he undertook his experimental work so that he might speak with first-hand knowledge on the themes which he had to teach. Many of the problems he felt impelled to investigate were obscure and complicated, but of the greatest practical importance. Some were not capable of solution then, and others have not yet been definitively cleared up. I refer in particular to his work on the coagulation of the blood and on the early stages of inflammation.

The coagulation of the blood has at all times excited wonderment, and the theories to explain it have been innumerable and are still being brought to light. In Great Britain notable advances were made in the eighteenth century by William Hewson, who unfortunately died of sepsis from a wound before he was thirty-five. In his short life he made, however, many discoveries. He proved that the red corpuscles were biconcave discs; he described their arrangement in masses like piles of money, an observation extended in 1827 by Lord Lister's father in association with Dr. Thomas Hodgkin. Hewson also clearly noted the existence of the white blood corpuscles and performed a large number of experiments on blood coagulation, although he never quite cleared up the mystery of its nature. His successors in the nineteenth century were not more happy. Coagulation of the blood was early studied by Lister. The problem was constantly before him in connexion with intravascular clotting