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PASTEUR

When a pupil at the École Normale, 1843–46

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MICROBES & TOXINS

By Dr. ETIENNE BURNET
OF THE PASTEUR INSTITUTE OF PARIS

WITH A PREFACE BY
ÉLIE METchnIKOFF

Translated from the French

by
Dr. CHARLES BROQUET and W. M. SCOTT, M.D.

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Élie Metchnikoff
TO

DR. ÉMILE ROUX

Director of the Institut Pasteur
INTRODUCTION

The publication in the *Bibliotheque de Philosophie Scientifique* of a volume dealing with micro-organisms was entirely indicated, for microbiology is taking every day a larger and larger place in the realm of knowledge and philosophy. Although discovered more than two hundred years ago, microbes were long neglected, and it was only during the second half of last century that their true rôle was ascertained.

Ehrenberg in the middle of the nineteenth century had already perceived the importance of microscopic organisms in the evolution and life of our planet. The discovery of the fossil remains of Diatoms and Foraminifera led him to appreciate the great part these minute creatures have played in the building up of the earth's crust.

There were not lacking men of science disposed to attribute to micro-organisms an important action in the phenomena of fermentations and of disease, but it was only after the labours of Pasteur that this truth was definitely established and became part of our common heritage of knowledge.

Relations had long been perceived between the animal kingdom and the vegetable, animals furnishing carbonic acid and nourishment to plants, while these, on their side, nourish the animals with their organic matter and provide them with oxygen. Later it was recognised that between these two kingdoms there lies the domain of the microbes. It is the
microbe which transforms the animal material supplied by
dead bodies and dejecta into simpler substances, nitrates, and
salts of ammonia, capable of assimilation by those plants which
supply us with food. Further, it is the microbe which renders
pleasant to the taste certain animal and vegetable food-
products, as, for example, the juice of the grape, the extract
of malt, cabbages, apples, and milk, transforming these
respectively into wine, beer, sauerkraut, cider, kephir, various
kinds of cheese, etc.

Thanks to Pasteur the activity of micro-organisms was
established in every case of putrefaction and fermentation;
and, with this fact to start from, it became more easy to tackle
the problem of infectious diseases.

Putrefaction and suppuration have been recognised for cen-
turies as being phenomena of the same order. Decomposing
pus, faecal matter smelling of putrefaction, urine issuing from
the bladder in a state of decomposition, all indicated that an
illness, a state of suffering, was equivalent to an infection of the
body.

Although certain microbes, such as the bacteridium of anthrax,
had been observed before Pasteur's great discoveries, it was only
as a consequence of these discoveries that the fundamental rôle
of microscopic organisms in disease was understood. The
labours of Lister in surgery, and of Davaine and Koch on the
"black blood of anthrax" first authorised the application of
Pasteur's doctrine to surgery and medicine.

Pasteur himself with his pleiad of disciples was in the midst
of this activity, an activity which in a very few years revolu-
tionised medical science and endowed medicine with more
than one preventive vaccine such as those against anthrax and
rabies.

The Pasteur school in France and the school of Koch in
Germany have succeeded in elucidating many medical problems
of the highest importance and have drawn valuable practical
conclusions from these.

Thanks to all this work, work which has increased during
these last years in extraordinary fashion, a universe of micro-
organisms, beneficent and mischievous, has been revealed to humanity; and it is this new knowledge which has so largely contributed to the diminution in disease and death at the present day and which holds out to man the hope of a more happy future.

The micro-organisms inhabiting our bodies have set going there a poison factory, which cuts short our existence, and by secreting poisons which penetrate all our tissues, injures our most precious organs, our arteries, brain, liver, and kidneys.

Man balked of his full term of life feels himself unhappy and is ready to accept any solution to the problem of gaining happiness. And the progress of microbiology leads us to hope that this science will one day liberate man from his fear of the grave and permit him to attain the true object, the true conclusion of life.

It is time for bacteriological science to leave the laboratory and the lecture theatre, and to take its place before the great public, in order that its benefits may receive the widest and readiest application.

It was very natural for the creator of this “Library of Scientific Philosophy” to apply to the Pasteur Institute for an account of the actual position of science with regard to microbes and toxins. Not only was the movement started from Pasteur’s laboratory and continued in the Institute bearing his name, and still sheltering one of his most illustrious collaborators in the person of Dr. Roux, but it is in this Institute that every branch of microbiology is undergoing active study. To take colloids and the physico-chemical laws which govern their activity, we have at the Institut Pasteur studies on ferments and fermentations as well as on the chemical processes which lie at the root of life and of recovery from disease. In this Institute also there are zealous workers in the field of infective microbes and the means of combating them.

Several laboratories are specially set apart for researches on tropical diseases, and finally the Pasteur Hospital has been created for patients suffering from all sorts of infectious maladies.

If Pasteur were to see his Institute again, he would be
astonished at the great changes which have taken place in it and in the science of microbiology in general. It would take him some time to overtake and realise the progress attained. And yet in spite of all that has been done there remains still much work for the future. Many scourges still await a remedy.

In the case of tuberculosis, although extraordinary advances have been made in its study, the final solution of the problem is still reserved for the future. The great question of cancer, so important and so difficult, has been hardly more than opened. There remain to be discovered the microbes of many diseases, e.g., hydrophobia, scarlatina, and measles, which are perhaps filtrable micro-organisms, invisible with the best microscopes.

The field of infectious diseases is extending wider and wider with the progress of microbiology. We find that certain diseases thought to be diseases of metabolism are beginning to be classed in this group. Arterio-sclerosis, an affection so widespread and so apt to cut short our existence, results from the activity of our intestinal flora. Perhaps before long it will be possible to explain diabetes, gout, and rheumatism by the injurious activity of some variety of microbe.

Even in those problems of hygiene which affect society in general microbiology is taking the predominant rôle. The grand problem of a rational food supply, which used to be thought capable of solution by inventions of chemistry and physics, will necessarily have to be studied by microbiological methods, in view of the fact that the intestinal bacteria play one of the most important parts in everything that concerns nutrition. It is not sufficient to state the nutritive value of a food in terms of the calories which it contains; it will still be necessary to define precisely its relations to the intestinal flora from the point of view of the production of microbic poisons.

M. Gustavé le Bon asked me to put together in a little volume for his Library a summary of what is known about microbes and toxins. I advised him to apply rather to one of my young colleagues, and I indicated in particular Dr. Burnet. I am happy to find that I could not have chosen better. In spite of the great difficulties there are in attempting to describe
within a limited space the result of the innumerable labours which have accumulated on microbes and their poisons and which have been pursued in the most varied directions, M. Burnet has succeeded in accomplishing the task in a remarkable fashion. I am sure that those who read will share my opinion, and I wish this book the most widespread popularity.

ÉLIE METCHNIKOFF.

Paris, 1911.