

## BACTERIOLOGY

## On the Lungs as a Filter.

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*Mr. Chairman and Gentlemen:*

The Committee on Ventilation wish to bring to your notice a translation from the French of a paper, which contains some very interesting information on matters relating to the respiratory function, as well as to the history of the development of infectious diseases. The paper was read by M. Bouchard before the Academy of Sciences, Paris, France, December 5th, 1887, and is a report of certain bacteriological work done by Messrs. J. Strauss and H. Dubreuil.

"Lister first made the observation that air introduced into the pleural cavity as the result of a simple fracture of the ribs produces effects quite different from, and much less serious than those which result from a pneumothorax, following a penetrating wound of the chest. This fact, he adds, was a mystery to me, until, thanks to the germ theory, I understood that one of the offices of the bronchi is to filter the air which enters the lungs, and thus prevent particles of dust, which are inhaled from entering the air-cells.

Lister's explanation was experimentally confirmed by Tyndall, who showed that expired air is, to use his own expression, "optically pure;" that is to say, that when it is traversed by a beam of light in a darkened room it does not show a luminous track. Expired air is therefore free from every particle held in suspension, which is capable of diffusing light.\*

We have undertaken to verify by bacteriological methods, the fact in physics, which has been described by Tyndall. We used flasks, each of which was provided with two tubes and filled with alkalinised and sterilised bouillon. The tube through which the expired air entered the flask was drawn out to a point at its lower end, which reached to the bottom of the liquid, so that the expired air escaped in tiny bubbles through a considerable depth of bouillon, and naturally ought to rid itself in its passage, of any solid particles which it might contain.

In a certain number of our experiments, the bouillon, which was kept at a temperature of 72° F

\*See Tyndal on Germs.

was thickened with gelatine in order to prolong the contact of the air bubbles with the liquid. about half an hour's time was devoted to each flask, so that the liquid in each of them was traversed by from 250 to 300 litres† of expired air. The flasks were then left for several days in an oven at a temperature of 95° F.

The greater number of these flasks remained sterile; a few only lost their clearness through a growth of micro-organisms or a crop of moulds. These instances were, however, exceptional, and doubtless were partly due to errors in manipulation such as the introduction of a little saliva along with the breath or a too forcible expiration, etc.‡

These experiments of ours therefore entirely confirm those made by Tyndal. They go to show that expired air, in addition to being "optically pure" is almost completely free from germs. The lung is therefore, as Lister said, a filter for germs.

The mechanism of this filtration is easily understood, if we reflect how the air circulates in the lungs through bronchi, which become extremely small and are lined with epithelium.

Many other experimenters have endeavored to find pathogenic microbes in expired air; but always, so far as we know, unsuccessfully. M. Gaucher has made a great number of experiments on the air expired by consumptive patients, but he has never succeeded in finding in it the bacillus of Koch, or its spores. M. M. Charrin and Karth have made similar experiments with a like result.

From all these facts we may conclude that, as far as microbes are concerned, men or animals shut up in a confined place purify the air instead of fouling it by their respiration, and this is so, because the air of expiration contains fewer microbes than that of inspiration.

This observation of ours, however, does not in any way contradict the fact, which was long ago demonstrated by Messrs. Pasteur, Lemaire, Miquel, and others, that is to say, that microbes are abund-

†Litre = 35 oz., 1 dr., 43 m. Expiration was performed slowly, after a long slow inspiration.

‡We have also endeavored to determine the exact spot in the respiratory tract where the stoppage, and doubtless the destruction also of the microbes, introduced during the act of breathing, takes place. For that purpose we have examined the lungs of a certain number of the larger animals, such as horses and oxen, just after they had been slaughtered, but neither the colorations obtained, nor the cultures made have given us indications sufficiently exact to permit us to express a definite opinion on this subject.