

W. H. Cutler

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MUCOUS MEMBRANES OF THE
RESPIRATORY TRACT.

BY

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(University of California).

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(PRELIMINARY REPORT.)

WITHOUT entering into the explanation of immunity and its various theories, with which you all are familiar, I desire to give you to-day a brief report of my research work regarding the natural resistance of the mucous membranes of the respiratory tract against the invasion of bacteria.

The experimental pathology recognizes at present two kinds of immunity: the natural and the acquired. The natural immunity not only exists within our body, but it also shows its activity on the mucous membranes; this is plainly demonstrated by the fact that bacteria are constantly carried to the surface of the upper respiratory organs by inhaling as well as by introducing our food

* Read before the American Laryngological Association at its twentieth annual congress.

without producing any local or general infection in our healthy body. On the other hand, should we take any of these bacteria from normal mucous membranes and place them in proper culture media, we will observe a rapid multiplication; and if replaced in sufficient quantity on the original mucous membranes, they will produce a certain diseased condition of these tissues.

Various authors have regarded the nasal mucous membranes free of bacteria, which statement, though, has been corrected by the careful investigations of Park and Wright, who also postulate that "for bacteria which have developed in the blood or secretions of other individuals the bactericidal power of the nasal mucus is little or nothing, and can not be depended upon to prevent an infection from virulent bacteria, if they are carried into the nose."

Hugenschmidt, in the annals of the Pasteur Institute, referring to the saliva of the mouth, claims that it also has no germicidal power, but that wounds in this part of the body are free from infection—due to active phagocytosis, which he claims is induced by the power of saliva to stimulate migration of leucocytes.

My own researches have shown that the comparative scantiness of bacteria in the nose is due only to mechanical (physiological) devices, and I have been convinced that the activity of bacteria, if not too many in number, is checked by a certain "biological" process—induced by chemotaxis.

Several scientists have been investigating the nature of this immunizing process, with the result that a chemical constituent of the mucus, such as mucin, is antagonistic to bacteria, although this theory has of late been contradicted. In my lectures on chemical physiology

(as assistant to the chair of physiology at the University of Wurzburg) fourteen years ago, I demonstrated that this cellular product prevents only "mechanically" the invasion of bacteria, as I was able to cultivate bacteria on artificial media containing mucin, obtained from the submaxillary glands of animals. Claude Bernard had already partly advanced a similar statement that the epithelium of these membranes, as well as the secretions, offered a natural protection. To strengthen this argument, we find that the bronchial tubes in the living animal are sterile, while after death they become invaded by a very large number of bacteria; proving also that the immunizing process must depend upon a "protoplasmic activity" in the living body. This natural defense is attributed by Buchner and others to the paraplasmic action of leucocytes, while H. Kossel maintains that the nuclein acid contained in the nuclear substance of the cell may have the germ-destroying power.

The results of my own researches are:

1. The *natural resistance* of the mucous membranes depends principally on the "activity of leucocytes."
2. The *action of these leucocytes on bacteria* does not consist in their "total" destruction—as observed in disinfection either by heat or by a chemical (coagulation)—but it consists in greatly "diminishing their activity" to form poisonous products (toxines, etc.).

This is explained, that leucocytes produce "*enzymes*," which are able to "impair the chemical structure of the bacterium body." These enzymes have apparently no effect on albumin or albuminoid substances, but they are able at blood temperature to convert cane sugar into glucose and to influence fluid starch and cellulose.

Therefore the cytoplasmatic defense of mucous membranes consists in disabling the foreign cell in its activity, either to form poisonous products or to enter their tissues. In other words, the bacteria are "slumbering" on the mucous membranes, just as we meet such "latent life" in the vegetable kingdom, and in this "inactive state" the bacteria are carried away from our mucous membranes by the secretions and excretions.

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