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## EXTERNAL SOURCES OF INFECTION, ESPECIALLY THE AIR, THE GROUND AND THE FOOD.

THE following plain practical expose on the air, ground and food as sources of the infections of disease are extracts from an admirable and exhaustive address by Wm. H. Welch, M. D., Prof. of Pathology in Johns Hopkins University, Baltimore, delivered at the June annual meeting of the American Medical Association at Newport.

### THE AIR AS A SOURCE OF INFECTION.

It is universally admitted that many infectious agents may be transported by the air, but the extent of danger from this source has often been exaggerated. The methods for determining the number and kind of bacteria and fungi in the air are now fairly satisfactory, although by no means perfect. These have shown that while the number of living bacteria and fungi in the atmosphere in and around human habitations cannot be considered small, still it is greatly inferior to that in the ground or in most waters. Unlike fungus spores, bacteria do not seem to occur to any extent in the air as single detached particles, which would then necessarily be extremely minute, but rather in clumps or attached to particles of dust of relatively large size. As a result in a perfectly quiet atmosphere these comparatively heavy particles which contain bacteria rapidly settle to the ground or upon underlying objects, and are easily filtered out by passing the air through porous substances, such as cotton-wool, or sand. Rain washes down a large number of bacteria from the air.

That the air bacteria are derived from the ground, or objects upon it, is shown by their total absence, as a rule, from sea air at a distance from land, this distance na-

turally varying with the direction and strength of the wind.

A fact of capital importance and one of great significance is the impossibility of currents of air detaching [bacteria from moist surfaces. Substances containing pathogenic bacteria, [i. e. destruction to the body—infections] as, for instance, sputum containing tubercle bacilli or excreta holding typhoid bacilli, cannot, therefore, infect the air unless these substances first become dry and converted into fine powder. We are able to understand why the expired breath is free from bacteria and cannot convey infection, except as little particles may be mechanically detached by acts of coughing, sneezing, or hawking. Those bacteria, the vitality of which is rapidly destroyed by complete desiccation, such as those of Asiatic cholera, evidently are not likely to be transported as infectious agents by the air, if we except such occasional occurrences as their conveyance for a short distance in spray.

The only pathogenic bacteria which hitherto have been found in the air are the pus organisms, including the streptococcus in a series of cases of diphtheria, and tubercle bacilli; but no far-reaching conclusions can be drawn from the failure to find other infectious organisms when we consider the imperfection of our methods and the small number of observations directed to this point. The evidence in other ways is conclusive that many infectious agents—and here the malarial germ should be prominently mentioned—can be and often are conveyed by the air. . . . .

We are not, of course, to suppose that infectious germs floating in the form of dust in the atmosphere are dangerous only from the possibility of our drawing them