

Proliferative changes were encountered only in the costal cartilages and bone marrow and the predominant picture was one of destruction. The walls of small vessels were found completely disintegrated and those of larger vessels frequently were entirely destroyed locally, and although the presence of intravascular hemolysis was not established, the histologic study of tissues from scorbutic pigs gave the impression that a lytic process almost universal in extent was present, and that the hemorrhages were due to destruction of the walls of blood vessels through lysis.

Marked fetal scurvy was also obtained and presented all the characteristics of scurvy in the mature guinea pig.

In a study of the blood, McCormick found a decrease in the number of erythrocytes, hemoglobin and color index, and an apparent decrease in fragility, a relative decrease in the number of lymphocytes and an absolute increase in the polymorphonuclears. There also was an increase in the reticulated and nucleated blood cells and leucocytes. A large series of counts on normal animals, as well as a first count on the experimental animals, served as a basis for comparison. None of the scorbutic animals had a rise in temperature, as determined by rectal measurements.

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#### **Permeability of the Upper Respiratory Mucous Membrane for Bacteria and Their Products.**

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Observations made in this laboratory during the past year or two have disclosed the fact that, in the case of the rabbit at least, bacteria and their products readily and invariably pass through the mucous membrane of the upper air passages when in contact with or growing upon its outer surface.

When virulent pneumococci are put into the nares they soon appear in the blood stream and set up a rapidly fatal infection. Less virulent organisms also find their way into general circulation but the resulting infection is frequently overcome and the animal recovers. If killed pneumococci are put into the nares the organisms themselves cannot be demonstrated in the blood but antibodies speci-

fic for them soon appear in the plasma, indicating that either the cocci or their products penetrated the mucous membrane. It is possible, of course, that the antibodies may be produced locally and then absorbed.

Similar results can be obtained with *Bact. leproseptica*—an organism natural to the host. The less virulent strains of this species often occur in the upper air passages of rabbits in the carrier state, but more virulent strains may produce local or general infections. The occurrence of these organisms in the upper air passages under any condition is followed by the appearance of antibodies in the blood serum. Here also a systemic immunity may be produced by putting killed cultures into the nares.

An observation along the same line has been made with *B. bronchiseptica*. This organism occurs very generally in the upper air passages of rabbits, chiefly in the carrier state. Apparently every rabbit exposed to *B. bronchiseptica* becomes a carrier, but rabbits raised under special conditions can be kept free of it. The serum of such rabbits does not contain any antibodies for this organism. This provides an excellent opportunity for determining the systemic effect of the carrier state. Samples of serum were collected from a number of rabbits which had never come in contact with *B. bronchiseptica*. The rabbits were then inoculated intranasally with a small amount of culture. Serum was collected on the sixth and eighth days following inoculation. The 3 sets of sera were tested for specific complement-fixation. All of the samples collected before inoculation were negative in a dilution of 1-4. The 6-day samples were all positive in dilutions varying from 1-8 to 1-32 and some of the 8-day samples were positive up to a dilution of 1-512. It is not believed that such rapid immunization would follow subcutaneous inoculation.

*Summary.* Virulent bacteria put in the nares of rabbits soon appear in the general circulation and produce septicemic infections. Less virulent bacteria also appear in the blood but may not cause infection. Killed bacteria put into the nares stimulate systemic antibody production. Bacteria occurring in the nasal passages in the carrier state stimulate a very rapid antibody response. These observations indicate that the mucous membrane of the upper air passages is readily permeated by bacteria and their products.