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**Anatomical changes produced by repeated intravenous injections
of streptococci in rabbits.**By **W. OPHÜLS** and **ELMER W. SMITH.***[From the Leland Stanford University.]*

Fifty rabbits received repeated intravenous injections of streptococci with the object in view of ascertaining what subacute and chronic lesions might be produced in this way, the idea being to simulate as much as possible chronic streptococcic septicæmia.

The streptococci were obtained from about two dozen different sources in the course of routine bacteriological examinations at autopsies, and surgical material. The doses injected were moderate. The injections were repeated as frequently as the animals seemed to be able to tolerate them. The animals lived from a few days to 261 days. The results were as follows:

Fourteen animals developed subacute septic endocarditis. The lesions were most commonly found on the left side of the heart, but the tricuspid valve was involved three times and there was severe infection of the pulmonary valve in one. All of the streptococci which produced endocarditis were of the non-hemolytic type. There was only one case in which arthritis and endocarditis occurred in the same animal.

Lesions of the myo-cardium were observed fourteen times. In four cases there were abscesses, in two purulent myocarditis, in two necroses, and in six chronic myocarditis.

There were thirty-one joints affected in ten rabbits. These joint lesions were often very severe and extensive, causing considerable destruction in the cartilage and synovial membrane and in a considerable number of cases involved the neighboring tendon sheaths to such an extent that some of the tendons were entirely necrotic. These joint lesions were produced by both hemolytic and non-hemolytic streptococci.

The musculature was remarkably free from all chronic changes, which is all the more surprising in view of the frequency with which acute changes have been described after intravenous injection of massive doses of streptococci.

In seven of the animals there were thromboses in the blood vessels of the lung, of which six were distinctly septic. Most of these thromboses followed the injection of non-hemolytic streptococci and they were most frequent after injection of the more virulent types of these organisms. Besides these lesions which were evidently produced by the injections, a considerable number of the animals died of severe bronchial pneumonia.

Seven rabbits developed renal lesions showing diffuse acute and subacute glomerulitis, frequently associated with more or less degeneration of the epithelium. No severe interstitial changes were observed. Three of these animals had endocarditis at the same time and three others amyloid degeneration.

The liver of a great many of the animals was diseased, but on account of the frequency with which rabbits suffer from coccidiosis it was impossible to determine whether any of the chronic changes were due to the injections. Some of the animals showed septic thrombi in the blood vessels and recent necroses of the parenchyma which were evidently caused by them.

The gall-bladder was infected in a great many rabbits and some of these cases showed as a result acute cholecystitis; others more chronic changes. Gall-stones were not found in any of the cases.

Fourteen cases showed pigmentation of the spleen or other evidences of blood destruction. Ten rabbits showed amyloid accumulations in the malpighian bodies. The earliest case of amyloid occurred on the forty-fourth day.

It is of some interest to note that four rabbits at autopsy showed an acute tonsillitis which however was probably due to secondary infection.

One of the rabbits developed an acute appendicitis and another an acute ulcer of the stomach. One rabbit died of intussusception.

Endarteritis was observed in four cases; in two of these the lesions were in the branches of the pulmonary artery; in one in the aorta and in one in the branches of the coronary artery. The lesions were comparatively recent and not very severe.

Examination of the central nervous system showed only slight lesions in the pia in a few places. One of the rabbits died as the result of an acute subdural hemorrhage.

So far as the organs of special sense are concerned, a few rabbits developed conjunctivitis, rhinitis and one otitis media. These were all probably due to secondary infections.

One rabbit developed a septic necrosis of the testicle; another one accidentally received a fracture of the rib which was apparently infected by way of the blood stream.

In conclusion it may be stated that the streptococci did not seem to exhibit any special affinity for the organ from which they were isolated nor did any of the strains show any particular affinity for special organs in the rabbits injected except for the fact that the non-hemolytic group seemed to favor the heart valves.

The details of these experiments will be published elsewhere by Dr. E. W. Smith.

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On serum proteins.¹

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Intraleural injections of aleuronat suspensions into rabbits caused a marked rise of serum globulins and a consequent upset of the protein quotient. Injection of ten cubic centimeters of blood serum from these animals into normal rabbits did not produce appreciable changes in the serum proteins of the latter animals. Apparently there is no factor concerned in the upset of the normal protein quotient which can be transmitted by injection of such homologous sera.

Injection of ten cubic centimeters of 1 : 30,000 homologous typhoid agglutinating serum intravenously into a normal rabbit caused a very slight, non-persistent rise of globulins in the serum of the injected animal. A normal rabbit which received ten cubic centimeters of 1 : 7,000 homologous staphylococcus agglutinating

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