# Notes on Serum Therapeutics.*

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## TETANUS.

The tetanus bacillus was discovered in 1894 by Nicolaier. Kitasato, at a later period, obtained pure cultures, which he proved to be capable of causing the disease in animals. As already mentioned, the same worker, along with Behring, first succeeded in obtaining tetanus antitoxin.

### Curative Action.

It is possible to obtain antitoxin of extraordinary preventive power, as tested experimentally by injecting the serum previously to the toxin. The experimental results are equally as satisfactory when the two are mixed together at the time of injection, but as a curative agent its power is far less than that of the corresponding antitoxin for diphtheria, because the disease is usually only discovered after serious lesions of the nervous system have already been produced, over which, unfortunately, the antitoxin can exert little influence.

At the same time, it must be remembered that even after symptoms have appeared toxin still circulates in the blood, or may still be in process of formation at the site of infection. There is no doubt that the injection of antitoxin can neutralise this free toxin and combine with any toxin which may be produced after its injection. Though it cannot restore damage done to the nervous elements, it may prevent further nervous elements from being attacked.

Koehler, dealing with statistics of ninety-six cases treated by antitoxin, found the death-rate to be 30·4 per cent., which is certainly much below the normal death-rate, viz., 86 per cent. On the other hand, Steuer from his statistics could demonstrate no improvement over cases treated without antitoxin. Only time and further observations can decide the value of the method.

### Dosage.

Five injections in separate situations (in all 100 c.c.) should be made subcutaneously at once, and be repeated on the two following days, and a final injection should be given, even in favourable cases, ten to fourteen days after the first injection.

Intravenous and intracerebral injections have also been recommended.

The intracerebral injection of serum, recommended by Roux and Borrel, gives, with guinea-pigs, curative results superior to any other method.

If intracerebral injection is employed on the human subject, a serum free from all antiseptic, and so powerful that a dose of 2 to 3 c.c. is sufficient, must be used. Antitoxin for this operation is prepared, without the addition of antiseptics, at the Institute. Hence, in applying for the antitoxin, the purpose for which it is intended to be used ought to be stated.

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### Prophylactic Action.

Behring recommends the same quantities as dosage for horses as are used for man.

Whatever doubts may be entertained of the value of this antitoxin as a curative agent, as a prophylactic agent its power is fully established. In veterinary practice, where it has been used under test conditions, it has proved almost infallible. Nocard has collected the results of the experience of prophylactic injections gained by sixty-three veterinary surgeons during a period of twenty-two months.

Two thousand seven hundred cases, both operative and traumatic, were selected from those in which by experience they knew that tetanus was most likely to occur. Not one of these 2,000 animals died of tetanus, whereas in the practice of the same veterinary surgeons, during the same period, but not so treated, 259 cases of tetanus occurred.

In case of severe wounds, such as compound fractures, where there has been much soiling of the wound, and especially if earth has found its way into the depths of the wound, a prophylactic injection of tetanus antitoxin is strongly indicated.

In severe shell wounds in time of war, and where the wounded have been lying for any time in contact with the earth, a prophylactic dose, 20 c.c. subcutaneously, would be advantageous.

## STREPTOCOCCUS INFECTION.

The streptococcus pyogenes is the most important causal organism in septic infections such as acute abscess, erysipelas, and puerperal septicæmia.

There is great difference of opinion as to whether all these streptococci belong to one species, or whether there are streptococci which, though morphologically and culturally indistinguishable, are yet not identical. Around this question hinges one of the great problems of the serum therapeutics of such conditions.

Marmorek first succeeded in obtaining anti-streptococcic serum. In immunising the horses, he used cultures of streptococci which had been elevated in virulence by passage through rabbits.

The sera of diphtheria and tetanus owe their action to their "antitoxic" properties. In the case of the anti-streptococcic serum the active agent is little, if at all, due to an antitoxin, but to "antibacterial" substances, which occasion the death and destruction of the organisms.

Van de Velde showed that the serum of the horse, prepared by injecting one streptococcus, would protect rabbits against that particular streptococcus, but not against certain other streptococci. The contradictory clinical results obtained with the serum may be largely due to this circumstance. To obviate this difficulty he suggested that a large number of races of streptococci should be used in immunising the horses, and thus a "polyvalent" serum be obtained. The anti-streptococcic serum supplied by the Lister Institute is a polyvalent one prepared in this way.

Although the experimental results are not at all

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