hours to rays of the same intensity caused no visible effects on form, rate of division or process of conjugation.

I have exposed the sperm of the toad to heat at 50° and 65° C. for from 15 to 20 minutes. This exposure destroys the fertilizing power of most of the spermatozoa but the few eggs fertilized by such sperm develop normally. Sperm exposed for from 15 to 20 minutes to the following solutions: $\frac{1}{40}$ per cent. formol, 12.5 per cent. ethyl alcohol, 1 per cent. NaCl, $\frac{1}{32}$ per cent. HCl and $\frac{1}{32}$ per cent. KOH, has the power of fertilizing toad eggs. Practically all of the resulting larvæ which have been preserved appear normal at the end of one month after fertilization of the eggs. Sperm exposed to stronger solutions of the same substances for 15 to 20 minutes seems to lose power of fertilizing. No abnormal larvæ have developed from the few eggs thus fertilized.

The short breeding season of the toads prevented as extended a series of experiments along these lines as had been planned.

103 (246)

On the absorption of toxins by the nerves.

By **CYRUS W. FIELD.**

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In an article published in the *Archiv für experimentelle Pathologie und Pharmakologie*, Vol. 49, Meyer and Ransom stated as a result of their experiments that tetanus toxin enters the central nervous system through the motor nerves, and moreover that it passes to the cord by way of the axis cylinder. Since that time Meyer (1905) has demonstrated that diphtheria toxin after injection into the experimental animal, could be demonstrated in the peripheral nerves. In a large number of experimental animals injected with both tetanus and diphtheria toxin, I have been able to show that the toxin could be demonstrated in the peripheral nerves leading from the inoculated area, and by the use of the right dose, and at a certain time, free toxin could be demonstrated in the cord, and yet the other tissues of the body including the blood, liver, spleen and kidneys showed no free toxin.

Not only is this true for diphtheria and tetanus but it is likewise true for the toxin produced from *B. Botulinus* and also for colloidal ferric hydrate. In the case of colloidal ferric hydrate, by removing the nerves and cord, and subjecting them to treatment with a solution of hydrogen sulphide, I was able to detect the presence of iron. By using small doses I was able to show the presence of these colloids in the nerves near the points of injection and in the spinal cord, but of none whatever in the other tissues, except at the points of inoculation.

Guillian has demonstrated practically the same phenomena by injecting a solution of ferric chloride into the sciatic nerves of dogs and rabbits, and later injecting into the general circulation potassium ferrocyanide. He found prussian blue only in the part of the nerve above the point of injection. He also injected india ink into the sciatic nerves of these animals, and in these cases he could find no limit of ascension, but the particles showed for only a short distance below the point of injection. He came to the conclusion that these substances travel by way of the lymphatics. As a result of this work I have drawn the conclusion that tetanus toxin does not travel by way of the axis cylinder, by any specific attraction of the nerve tissue for this toxin, but it passes up because the lymphatic flow of the nerve is passing constantly from the periphery to the center. It is for this reason that the toxin when injected subcutaneously or intramuscularly is taken up by the nerves and passes to the cord, and the first symptom to develop is the local tetanus, because these are the first cells that come in contact with the toxin.

It is a well known fact that in giving diphtheria or tetanus toxin intravenously a much greater dose is required to cause death than when either is injected subcutaneously or intramuscularly. The reasons for this are first, that the toxin injected into the blood may be combined with some of the blood elements and therefore rendered inactive; second, that by injection into the blood, the toxin is diluted to a very great extent, whereas when injected subcutaneously, a portion passes into the lymphatics of the nerves and is not mixed with the general body fluids, before it has reached the central nervous system.

Cernovodeanu and Henri have recently published the results

of a very interesting experiment which bears out this theory. By ligating all the muscles and blood vessels in the leg of a guinea pig and then injecting the guinea pig with over a hundred fatal doses of tetanus toxin below the ligatures, the pig did not develop tetanus, but they were able to demonstrate a slight amount of tetanus toxin in the sciatic nerve; in other words, all flow of lymph to the limb was prevented except that which entered through the skin, and therefore there was only a slight flow of lymph up to the nerve.

The conclusion is then that tetanus toxin does not travel up the nerve by reason of any specific attraction of the nervous tissues, but because the lymphatic flow in the nerve is from the periphery toward the center.

104 (247)

On the formation of a specific precipitin in rabbits after inoculation with colloidal platinum and colloidal silver.

By **CYRUS W. FIELD.**

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Some time ago in testing the precipitating effect of rabbit serum on various positive and negative colloids I found that such serum precipitated colloidal platinum and colloidal silver to a fair degree. Serum from one rabbit precipitated colloidal platinum completely at 1–100, slightly at 1–200 and not at all at 1–500. This serum precipitated colloidal silver completely at 1–10, partially at 1–100 and not at all at 1–250. After receiving three injections of colloidal platinum in three weeks this rabbit's serum then precipitated colloidal platinum completely at 1–1,000, slightly at 1–1,250 and not at all at 1–1,500. Whereas it precipitated colloidal silver completely at 1–100, slightly at 1–250 and not at all at 1–500.

Serum from another rabbit originally precipitated colloidal platinum completely at 1–50, partially at 1–100 and not at all at 1–250. The same figures held good for colloidal silver. After three injections of colloidal silver during three weeks, this rabbit's serum precipitated the colloidal silver completely at 1–500, partially at 1–1,000 and not at all at 1–1,250, whereas colloidal