comes into play in any specific case depends upon the nature of the material which is swallowed. We said that *liquid* is squirted down, but I am quite sure that thick syrup is not squirted farther than the upper part of the esophagus, if so far. We said that semi-liquids or semi-solids are also thrown down. We came to this conclusion from observations made on the swallowing of bread thoroughly softened in water. Possibly in this case a separation took place and the water was thrown down while the bread or some of it stuck to the wall of the gullet and was later gathered up by the peristalsis. It is not improbable that this is what occurs when a mixture of bismuth and water is swallowed. The water may be squirted down, while a large part of the bismuth may stick to the wall and be gathered up later by the succeeding peristalsis — and it is the latter which is probably seen through the fluoroscope.

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Immunity against trypanosomes.

By **F. G. NOVY.**

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It is an establised fact that rats which have recovered from an infection with *Tr. Lewisi* are immune to subsequent inoculation with that species of flagellate. The same holds true for cattle, sheep, goats, etc., that have recovered from the infection caused by the pathogenic trypanosomes, such as nagana, surra and dourine. This condition of active immunity is seemingly possible only in those species of animals that are relatively insusceptible, for with really susceptible species the infection is always fatal.

Heretofore all experiments on artificial immunity against trypanosomes have been made on animals that have recovered from the effects of the parasite which has been living and multiplying in the blood-vessels of that animal. Now that cultures of some of these organisms, as for example *Tr. Lewisi* of the rat and *Tr. brucei* of nagana, are possible it was desirable to ascertain whether or not they could be used to immunize against the virulent organisms. It may be said, in passing, that cultures of both of these trypanosomes, even after they have passed through a hundred generations or subcultures in the course of two years, do not be-

come attenuated by such prolonged consecutive passage but readily infect susceptible animals.

We have shown, however, that cultures of *Tr. brucei* can be attenuated by exposure for about two days at 34° C. By repeated injections of cultures thus treated, attempts have been made to immunize rats and guinea-pigs against *Tr. brucei* but thus far these have been but partially successful. That is to say, there has been at most a survival for a few days of the treated as compared with the untreated animals. The failure to immunize with such cultures is attributable in part to the excessive susceptibility, of the animals employed, to infection with *Tr. brucei*, and in part to the existence of a negative phase following the injections. It is desirable to repeat these experiments with less susceptible animals.

In view of the fact that rats invariably recover, some soon, others late, from infection with *Tr. Lewisi*, and the further fact that rich cultures of this organism are readily obtainable, it is evident that this species is well adapted for studies on immunity. Up to the present time it has not been satisfactorily shown that trypanosomes elaborate toxins or that they confer immunity by means of soluble or intracellular products. The latter problem was approached by means of plasmolyzed cultures. To effect solution of the trypanosomal cells the cultures were taken up in distilled water and dialyzed in collodium sacs. Usually after one or two hours of such dialysis in distilled water the trypanosomes completely disappear and the intracellular matter apparently passes into solution. By means of such cultures it has been shown that rats which receive three or more injections on alternate days, on subsequent inoculation with a minimal infective dose of fresh trypanosomal blood from a rat, do not become infected, whereas controls are positive. With such solutions it is possible to hyperimmunize rats so that 0.5 c.c. of the immune rat blood protects against a simultaneous and separate injection of the infective blood.

Protection is seemingly obtained against *Tr. Lewisi* by simultaneous and separate injection of the infective blood and plasmolyzed culture, followed 24 hours later by a second injection of the latter. Repeated injections of too large a quantity of the plasmolyzed culture and at too short an interval leads to a negative phase, the presence of which is indicated by the unusually early appearance of trypanosomes in the blood after inoculation with the virus.

Inasmuch as it may be said that the plasmolyzed material does not represent a true solution, a series of experiments were made with the filtered (Berkefeld) plasmolyzed liquid. While these experiments go to show that immunity can probably be induced by such filtered soluble products, they are not as decisive as they should be and for that reason will have to be repeated. The chief reason for this uncertain result is the rather frequent failure of the control rats to develop infection. Although young rats (50–80 grams) were used to guard against previous infection with trypanosomes, it is certain that a large percentage of the rats, as purchased on the market, have acquired an immunity against *Tr. Lewisi.* That the immunity encountered is really acquired and not natural is shown by the fact that we have many times isolated *Tr. Lewisi,* by means of the cultivation method, from rats which on repeated examination were found to be free from parasites and hence were supposed to be normal.

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On secondary transplantation of a sarcoma of the rat.

By **SIMON FLEXNER** and **J. W. JOBLING.**

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At a meeting of the Society held on October 17, 1906, we presented specimens of a sarcoma of the rat which was being transplanted successfully.[1] In the course of the transplantations the percentage of successful issues has reached approximately one hundred. In many series, every transplanted fragment developed into a tumor, and in none of the latter series has the percentage of "takes" fallen below ninety. The tumor having reached this maximum of infectivity, it was thought desirable to ascertain to what extent secondary transplantation would succeed. The method followed was to inoculate rats, in which a tumor nodule was already present, with another fragment of the tumor tissue. The second inoculation was made, as a rule, on the side of the body opposite the existing nodule, but in a few cases it was made in the tissues adjacent to the first nodule. After the second growth had developed to the size of a pea or bean, the rats were

[1] This volume, p. 12.