

guinea-pig feces. These two strains fail to agglutinate in any of the five type sera but the serum produced by the injection of the human strain agglutinates the guinea-pig as well as the human strain.

While tetanus bacilli can be readily separated by the agglutination reaction we have so far been unable to show that they have any cultural difference except that the Type III bacilli clump spontaneously. This is true not only of Tulloch's culture but of our nine strains. This spontaneous clumping is very constant for this group and makes agglutination tests difficult to read. We have endeavored, by various means, to avoid it, but so far have not been successful.

Tulloch has shown that the antitoxin prepared by the injection of toxin produced by one type of bacillus neutralizes the toxin formed by the other types. We have not studied this point to any extent but have found that commercial antitoxin neutralized the toxin formed by all of our cultures. While he was not able to show conclusively that antibacterial, as well as antitoxin antibodies, are desirable in sera his results point to this and also to the fact that the anti-bacterial antibody is specific for the type bacillus used for its production. This is an exceedingly important point and is worthy of more extended investigation.

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Tetanus carriers in experimental animals.

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The demonstration that human carriers of tetanus bacilli have antitoxin in their blood has opened up a number of problems, which we are attempting to solve on experimental animals. We had first to determine whether carriers could be produced in these animals and if so whether antitoxin would be formed. The results of this preliminary experiment we will report on here and subsequently we hope to give the results of our further studies.

That we would succeed in establishing tetanus bacilli in the digestive tract of guinea pigs was indicated by our finding that 27 per cent of our stock animals were already carriers and that these animals had antitoxin in their serum. On the other hand, we have failed to find a rabbit that carried these organisms nor have we detected tetanus antitoxin in the serum of a number of rabbits examined.

As we planned to use the animals for other experiments a large number of guinea pigs were selected whose stools were free from tetanus spores and whose serum showed no antitoxin. These animals were starved for a day and were then fed a large number of washed spores and bacilli from month old bouillon cultures which were added to their usual food. After the feeding the animals were placed in metal cages which were sterilized from time to time. In order to prevent, as far as possible, infection from the outside all bedding and, with the exception of green stuffs which were washed, all food was autoclaved before it was placed in the cages.

The results of the stool examinations made on these guinea pigs, approximately four months after the feeding of tetanus cultures, are summarized in Table I. We have no reason to

TABLE I.

| Type bacillus fed | Number of guinea pigs | Number infected | Number negative | Dead |
|-------------------|-----------------------|-----------------|-----------------|------|
| I | 25 | 16 | 7 | 2 |
| II | 25 | 19 | 6 | 0 |
| III | 25 | 19 | 4 | 2 |
| IV | 25 | 20 | 4 | 1 |

believe that the death of any of the guinea pigs was due to tetanus infection, as autopsy showed in the majority of cases a pneumonia. The digestive tract of rabbits has also been infected by feeding but the percentage of positive results is lower than in guinea pigs.

Some of the results obtained from the examination of the blood of these animals are given in Table II. They show that agglutinins, specific for the type fed, appear first but that anti-

TABLE II.

| Animal | Feeding | Date of examinations | Tetanus like bacilli in stools | Agglutination titre for | | | Antitoxin 0.5 cc. serum protects against M. L. D. |
|------------------------|--|----------------------|--------------------------------|-------------------------|---------|--------|---|
| | | | | Type I | Type II | Type V | |
| Rabbit No. 1 | On Dec. 27, 28 and 29, fed washed spore of Tetanus Type II | Dec. 12 | No | 10— | 10 | 10— | 0 |
| | | Jan. 8 | Yes | 20— | 160 | 10— | 0 |
| | | Jan. 20 | „ | 20— | 160 | 10— | 5 |
| | | Feb. 2 | „ | 20— | 160 | 10— | 5 |
| | | Feb. 17 | „ | 20— | 160 | 10— | 5 |
| | | Mar. 5 | „ | 20— | 160 | 10— | 5 |
| Guinea pig No. 1 | On Feb. 20, fed washed spores and bacilli of Tetanus Type II | Mar. 29 | „ | 20— | 160 | 10— | 10 |
| | | Apr. 29 | „ | 20— | 160 | 40 | 25 |
| | | May 28 | „ | 20— | 160 | 40 | 75 |
| | | Feb. 13 | No | 20 | 20— | 20— | 0 |
| | | Mar. 28 | Yes | 20— | 80 | 40 | 0 |
| | | Apr. 28 | „ | 20— | 80 | 20— | 10 |
| Guinea pig No. 2 | On Feb. 22, fed washed spores and bacilli of Tetanus Type I | May 26 | „ | 40 | 160 | 20— | 40 |
| | | Feb. 13 | No | 20— | 20— | 20— | 0 |
| | | Mar. 28 | Yes | 20 | 20— | 20— | 10— |
| | | Apr. 28 | „ | 80 | 20— | 20— | 10— |
| | | May 26 | „ | 80 | 20— | 20— | 40 |

toxin soon follows and increases in amount. It should be noted that the antitoxin is not specific for type as the toxin used in the tests was produced by Type V bacillus while the animals were carrying Types I or II. The sera of control animals bled at the same time as those that carried the bacilli as well as animals in which tetanus bacilli failed to become established in the digestive tract failed to show either agglutins or antitoxin.

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Schistosomiasis japonica: Egg deposition and the subsequent pathology in the intestines of experimentally infected dogs.

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Dogs were infected with the cercaria of *Schistosoma japonicum* either by subcutaneous injection or by immersing the dogs in infected water. Eggs were first recovered from the feces of one heavily infected dog on the twenty-seventh day after infection, and from other dogs at various intervals up to about forty days. The dogs were sacrificed at various intervals after the appearance of eggs in the feces, from the twenty-eighth to the seventy-seventh day. Portions of intestine were excised, often while the dog was still alive under ether anesthesia, and were fixed in Zenker's solution or 10 per cent formalin. Blocks were embedded in paraffin and sections were stained with hematoxylin and eosin. From five dogs, killed on the 28th, 33rd, 40th, 63rd and 65th days after infection serial sections were cut from the blocks of tissue which showed the most intense pathology. I wish to emphasize here two features of the pathology which have not been described previously.

1. *The earliest position of deposited eggs.* On the twenty-eighth day after infection nearly all the deposited eggs were in the stroma of the mucosa; a few were in the submucosa. The eggs were in large or small groups containing up to 200 eggs in one group. The eggs of each group usually radiated out into the