

# PROCEEDINGS OF THE ROYAL SOCIETY.

## SECTION B.—BIOLOGICAL SCIENCES.

### *Trypanosome Diseases of Domestic Animals in Uganda.\**

#### II.—*Trypanosoma brucei* (Plimmer and Bradford).

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[PLATES 1 AND 2.]

*Synonym*: "Jinja trypanosome," Sleeping Sickness Commission, Royal Society, 1903.

#### INTRODUCTION.

This species was only met with on one occasion during the work of the Commission in 1909. This was in the blood of an ox from the Mabira Rubber Estate (latitude  $0^{\circ} 30' N.$ , longitude  $32^{\circ} 55' E.$ ). The manager wrote that the animal came from the Bukedi District, about 100 miles to the north (latitude  $1^{\circ} 50' N.$ , longitude  $32^{\circ} 40' E.$ ). Not much is known of this district, as it has only recently come under administration, and therefore it is impossible to say whether the ox was infected in Bukedi or on the journey south.

This is the species of trypanosome which was first discovered by Bruce, in 1894, in Zululand, to be the cause of Nagana, or tsetse-fly disease. During the work of the Sleeping Sickness Commission of the Royal Society in 1903, it was also met with in a herd of cattle from the same district of Bukedi, and then described as the "Jinja trypanosome."† It is impossible to name with any certainty the trypanosome seen in 1903, which affected the horses, camels, and dogs of the Abyssinian Boundary Commission. This was described as the "Abyssinian trypanosome." Its morphology, as given

\* Continued from 'Roy. Soc. Proc.,' B, 1910, vol. 82, p. 479.

† 'Reports of the Sleeping Sickness Commission of the Royal Society,' No. VI, p. 112.

in the coloured plate,\* shows it to be similar to *Trypanosoma brucei*, so that in all likelihood it was either this species or the closely related *Trypanosoma evansi*. As camels were infected, it was more probably the latter.

In regard to the third kind of trypanosome found in 1903, and referred to as the "Mule trypanosome," no opinion can, at present, be given.

As to the remaining trypanosome seen in 1903, and known as "Pordage's ox trypanosome,"† an examination of the old specimens at once disclosed its identity. It is *Trypanosoma vivax* (Ziemann); and this accounts for the fact that the blood of the ox injected into a monkey and a dog had no effect, these animals being refractory to *Trypanosoma vivax*.

#### MORPHOLOGY OF *TRYPANOSOMA BRUCEI*, UGANDA, 1909.

This species is interesting on account of its well-marked dimorphism, in which *Trypanosoma gambiense* resembles it. There are two varieties—the long and slender with free flagellum, and the short and stumpy without free flagellum. The shortest are only 13, and the longest 35 microns in length.

In this paper the long and slender are considered to be those which measure from 25 to 35 microns; the short and stumpy from 13 to 21 microns. Those trypanosomes which measure 22, 23 or 24 microns are called intermediate. The general character of these forms may be given, shortly, as follows:—The long and slender have a narrow extended posterior extremity, an elongated oval nucleus, a well-developed undulating membrane thrown into many waves, folds or plications, and a long free flagellum (see Plate 2, figs. 1 to 5). The short and stumpy, on the other hand, have a rounded posterior extremity, somewhat like the head of a turtle, a round or oval nucleus lying transversely to the long axis of the trypanosome, a well-developed undulating membrane thrown into bold folds, and no free flagellum (see Plate 2, figs. 11 to 16). The intermediate have a short free flagellum, a posterior extremity resembling that of the short and stumpy form but narrower, an oval nucleus, and a well-developed undulating membrane (see Plate 2, figs. 6 to 10).

##### A. *Living, Unstained.*

No observations were made in Uganda on this species of trypanosome in the living, unstained condition.

##### B. *Fixed and Stained.*

The blood films were fixed, stained, and measured as described in the 'Proceedings.'‡

\* *Ibid.*, No. VI, plate 2, p. 113.

† *Ibid.*, No. IV, p. 48.

‡ B, 1909, vol. 81, pp. 16 and 17.

*Length.*—The following table gives the length of this species as found in Uganda, in the ox, monkey, dog, guinea-pig, and rat. Only one trypanosome was found in the blood of the original Mabira ox. It measured 24 microns. In the monkey only 11 trypanosomes could be found. In all the others, 20 trypanosomes have been drawn and measured. These were taken as they came, except that dividing forms were passed by.

Table I.—Measurements of *Trypanosoma brucei*, Uganda strain, 1909.

| Date.            | No. of expt. | Animal.    | Day of disease. | Method of fixing and staining. | In microns.     |                 |                 |
|------------------|--------------|------------|-----------------|--------------------------------|-----------------|-----------------|-----------------|
|                  |              |            |                 |                                | Average length. | Maximum length. | Minimum length. |
| 1909.<br>Aug. 12 | 1461         | Ox         | Not known       | Osmic acid and Giemsa          | 24·0            | 24·0            | 24·0            |
| Sept. 30         | 1627         | Monkey     | 26th            | " "                            | 24·8            | 30·0            | 19·0            |
| Aug. 26          | 1479         | Dog        | 41st            | " "                            | 26·5            | 32·0            | 22·0            |
| " 30             | 1479         | "          | 45th            | " "                            | 22·0            | 29·0            | 16·0            |
| Sept. 30         | 1479         | "          | 76th            | " "                            | 23·5            | 34·0            | 20·0            |
| Oct. 11          | 1644         | Guinea-pig | 33rd            | " "                            | 20·7            | 34·0            | 15·0            |
| " 18             | 1644         | "          | 40th            | " "                            | 27·1            | 34·0            | 17·0            |
| Sept. 9          | 1482         | Rat        | 5th             | " "                            | 24·7            | 30·0            | 21·0            |
| " 13             | 1482         | "          | 9th             | " "                            | 23·5            | 31·5            | 19·0            |
| " 16             | 1643         | "          | 8th             | " "                            | 19·6            | 21·0            | 18·0            |
|                  |              |            |                 |                                | 23·6            | 34·0            | 15·0            |

It will be seen from the above table that *Trypanosoma brucei*, Uganda strain, 1909, varies in length between 15 and 34 microns. Doubtless, individuals could be found slightly longer or shorter than this if they were hunted for. In Table I, as already mentioned, the 20 trypanosomes drawn are the first met with, except that dividing forms are left out, and this rule is adhered to throughout.

The average length of the 172 trypanosomes dealt with in Table I is 23·6 microns; but, as this does not give much information, the following table has been prepared. This represents by means of dots the length of each of 160 trypanosomes, in eight preparations of 20 each. Although *Trypanosoma brucei* is described as a dimorphic species, it must not be supposed that there is any strict line of demarcation between the long and slender and short and stumpy forms. There are the intermediate forms. This table is also useful in showing at a glance the distribution of the various lengths.





This division of *Trypanosoma brucei* into long, intermediate, and short forms is, of course, quite artificial, as the one form passes into the other by insensible gradations. It may, however, prove of some use in the identification of this species. In the same way a series of measurements of the various parts of the trypanosome body may also prove useful. The following table gives the distance between the posterior extremity and the micronucleus, the micronucleus and the nucleus, the size of the nucleus, the distance between the nucleus and the anterior extremity, and the length of the free flagellum.

*Breadth*.—The long and slender forms average 1·5 micron; the short and stumpy 2·5 microns.

*Shape*.—As already mentioned, this is a markedly dimorphic species, composed of long, slender forms with free flagella, and short, stout forms without free flagella. It is curious that the long forms may preponderate in the blood one day and the short forms another. For example, as will be seen from Table I, the trypanosomes in the guinea-pig's blood on October 11 were mostly short forms, giving an average of 20·7 microns, while a week later they were mostly long forms, giving an average of 27·1 microns. Note also Rat 1643, with an average of 19·6 microns, and Rat 1482, with an average of 24·7 microns.

This species may be compared with Dutton and Todd's *Trypanosoma dimorphon*, and in truth the coloured drawings given by them in their original plate\* (figs. VII, IX, and X) are very similar, if not identical, in shape and size with *Trypanosoma brucei*. Fig. X, the long, slender form with free flagellum, is 30·5 microns in length. Fig. VII, the short, stumpy form without free flagellum, is 16 microns in length. As to fig. VI, on the same plate, stated to represent the "tadpole form," one would suspect from its general shape and appearance that it had no connection with the others. But in regard to figs. VII and X, anyone comparing Dutton and Todd's plate with the coloured plate accompanying this paper must be struck with the close resemblance between these two forms of *Trypanosoma dimorphon* and *Trypanosoma brucei*. Is it possible that Dutton and Todd were dealing with *Trypanosoma brucei* when they described *Trypanosoma dimorphon*?

*Contents of Cell*.—The protoplasm which is stained a pale blue is often dotted over with chromatin granules, especially in the anterior half (Plate 2). In well-stained preparations the distribution and number of these granules is sufficient, according to McFadyean, to differentiate this species from *Trypanosoma evansi*. This was also pointed out by Laveran

\* 'First Report of the Trypanosomiasis Expedition to Senegambia (1902),' University Press of Liverpool, 1903.

Table III.—Measurements of the various Parts of *Trypanosoma brucei*, Uganda strain, 1909.

| Experiment.             | Posterior extremity to micronucleus. | Micronucleus to nucleus. | Nucleus. | Nucleus to anterior extremity. | Free flagellum. | Total length. |
|-------------------------|--------------------------------------|--------------------------|----------|--------------------------------|-----------------|---------------|
| Long and Slender Forms. |                                      |                          |          |                                |                 |               |
| 1644                    | 4                                    | 5                        | 3·5      | 11·5                           | 10              | 34            |
| 1644                    | 3                                    | 7                        | 4        | 10                             | 10              | 34            |
| 1644                    | 3                                    | 6·5                      | 3·5      | 13                             | 7               | 33            |
| 1644                    | 2·5                                  | 7·5                      | 3        | 10                             | 8               | 31            |
| 1644                    | 2                                    | 7                        | 3·5      | 12·5                           | 5               | 30            |
| 1644                    | 2                                    | 7                        | 3        | 11                             | 7               | 30            |
| 1644                    | 2                                    | 7                        | 3        | 8                              | 10              | 30            |
| 1482                    | 1                                    | 7                        | 3        | 11                             | 8               | 30            |
| 1627                    | 2                                    | 6                        | 2·5      | 10·5                           | 9               | 30            |
| 1627                    | 3                                    | 7·5                      | 2·5      | 13                             | 4               | 30            |
| 1644                    | 2                                    | 6                        | 3        | 12                             | 6               | 29            |
| 1644                    | 3·5                                  | 5·5                      | 3·5      | 9·5                            | 7               | 29            |
| 1644                    | 2                                    | 6·5                      | 3        | 12·5                           | 5               | 29            |
| 1644                    | 2·5                                  | 7                        | 3        | 6·5                            | 10              | 29            |
| 1482                    | 2                                    | 6                        | 3·5      | 9·5                            | 8               | 29            |
| 1644                    | 3                                    | 6                        | 3        | 8                              | 8               | 28            |
| 1644                    | 2                                    | 7                        | 3        | 16                             | —               | 28            |
| 1482                    | 1·5                                  | 6·5                      | 2·5      | 13·5                           | 4               | 28            |
| 1482                    | 1·5                                  | 8                        | 2·5      | 8                              | 8               | 28            |
| 1627                    | 1                                    | 7·5                      | 2·5      | 11                             | 6               | 28            |
| 1627                    | 1                                    | 7·5                      | 2·5      | 8                              | 9               | 28            |
| 1644                    | 2                                    | 7                        | 3        | 10                             | 5               | 27            |
| 1644                    | 2                                    | 6                        | 3·5      | 8·5                            | 7               | 27            |
| 1627                    | 1                                    | 7                        | 3        | 9                              | 7               | 27            |
| 1482                    | 2                                    | 7·5                      | 2        | 11·5                           | 4               | 27            |
| 1644                    | 2                                    | 6                        | 2·5      | 10·5                           | 5               | 26            |
| 1482                    | 2                                    | 7                        | 3        | 9·5                            | 4·5             | 26            |
| 1644                    | 2                                    | 6                        | 3        | 7                              | 7               | 25            |
| 1644                    | 2                                    | 7                        | 3·5      | 8·5                            | 4               | 25            |
| 1644                    | 1·5                                  | 5·5                      | 3        | 10                             | 5               | 25            |
| 1482                    | 2                                    | 5·5                      | 2·5      | 10                             | 5               | 25            |
| 1482                    | 1                                    | 6                        | 3        | 11                             | 4               | 25            |
| 1482                    | 2                                    | 6·5                      | 3        | 8·5                            | 5               | 25            |
| 1627                    | 2                                    | 6                        | 2·5      | 8·5                            | 6               | 25            |
| Average...              | 2·1                                  | 6·6                      | 3·0      | 10·2                           | 6·4             | —             |
| Intermediate Forms.     |                                      |                          |          |                                |                 |               |
| 1644                    | 1                                    | 6                        | 2·5      | 14·5                           | —               | 24            |
| 1482                    | 2                                    | 6·5                      | 3·5      | 8                              | 4               | 24            |
| 1482                    | 1                                    | 6                        | 3        | 10                             | 4               | 24            |
| 1482                    | 1·5                                  | 6                        | 3        | 9·5                            | 4               | 24            |
| 1644                    | 1                                    | 5                        | 2·5      | 14·5                           | —               | 23            |
| 1644                    | 1                                    | 7·5                      | 2·5      | 12                             | —               | 23            |
| 1482                    | 1                                    | 6                        | 3        | 8·5                            | 4·5             | 23            |
| 1482                    | 2                                    | 5                        | 2·5      | 8·5                            | 5               | 23            |
| 1482                    | 2                                    | 5                        | 4        | 9                              | 3               | 23            |
| 1482                    | 1                                    | 5·5                      | 3        | 9                              | 4·5             | 23            |
| 1482                    | 2                                    | 5                        | 3        | 10                             | 3               | 23            |
| 1627                    | 1·5                                  | 7                        | 3·5      | 4                              | 7               | 23            |
| 1644                    | 2                                    | 6·5                      | 3        | 5·5                            | 5               | 22            |
| 1644                    | 1                                    | 7                        | 3·5      | 6·5                            | 4               | 22            |
| 1482                    | 2                                    | 5·5                      | 2        | 12·5                           | —               | 22            |
| 1482                    | 1·5                                  | 6                        | 2·5      | 7                              | 5               | 22            |
| 1627                    | 1                                    | 6                        | 2        | 7                              | 6               | 22            |
| Average...              | 1·4                                  | 6·0                      | 2·9      | 9·2                            | 3·5             | —             |

Table III—*continued*.

| Experiment.               | Posterior<br>extremity to<br>micronucleus. | Micronucleus<br>to nucleus. | Nucleus. | Nucleus to<br>anterior<br>extremity. | Free<br>flagellum. | Total<br>length. |
|---------------------------|--|-----------------------------|----------|--------------------------------------|--------------------|------------------|
| Short and Stumpy Forms.   |  |                             |          |                                      |                    |                  |
| 1644                      | 1  | 6                           | 3        | 11                                   | —                  | 21               |
| 1644                      | 1  | 5·5                         | 2·5      | 12                                   | —                  | 21               |
| 1644                      | 1  | 5·5                         | 2·5      | 12                                   | —                  | 21               |
| 1482                      | 2  | 5                           | 3        | 11                                   | —                  | 21               |
| 1643                      | 1  | 4·5                         | 2·5      | 13                                   | —                  | 21               |
| 1627                      | 1·5  | 6·5                         | 3        | 7·5                                  | 2·5                | 21               |
| 1644                      | 2  | 3                           | 3        | 12                                   | —                  | 20               |
| 1644                      | 1  | 5                           | 2        | 12                                   | —                  | 20               |
| 1643                      | 1  | 4·5                         | 2        | 12·5                                 | —                  | 20               |
| 1643                      | 1  | 4                           | 2·5      | 12·5                                 | —                  | 20               |
| 1643                      | 1  | 6                           | 2·5      | 10·5                                 | —                  | 20               |
| 1643                      | 1  | 5                           | 2·5      | 11·5                                 | —                  | 20               |
| 1643                      | 1  | 5·5                         | 2        | 11·5                                 | —                  | 20               |
| 1643                      | 1  | 5                           | 3        | 11                                   | —                  | 20               |
| 1643                      | 1  | 5·5                         | 2·5      | 11                                   | —                  | 20               |
| 1643                      | 1  | 4·5                         | 2·5      | 12                                   | —                  | 20               |
| 1643                      | 1  | 4                           | 2·5      | 12·5                                 | —                  | 20               |
| 1643                      | 1·5  | 5·5                         | 2        | 11                                   | —                  | 20               |
| 1643                      | 1  | 4                           | 2·5      | 12·5                                 | —                  | 20               |
| 1643                      | 1  | 5                           | 2        | 12                                   | —                  | 20               |
| 1643                      | 1  | 4·5                         | 2        | 12·5                                 | —                  | 20               |
| 1627                      | 1  | 6                           | 2        | 11                                   | —                  | 20               |
| 1644                      | 1  | 5                           | 2        | 11                                   | —                  | 19               |
| 1644                      | 1  | 3·5                         | 2        | 12·5                                 | —                  | 19               |
| 1643                      | 1  | 5                           | 2·5      | 10·5                                 | —                  | 19               |
| 1643                      | 1  | 5                           | 2        | 11                                   | —                  | 19               |
| 1643                      | 1  | 4·5                         | 2        | 10·5                                 | —                  | 19               |
| 1643                      | 1  | 5·5                         | 3        | 10·5                                 | —                  | 19               |
| 1627                      | 1  | 7                           | 3        | 8                                    | —                  | 19               |
| 1644                      | 1  | 4                           | 2·5      | 10·5                                 | —                  | 18               |
| 1644                      | 1  | 4                           | 2·5      | 10·5                                 | —                  | 18               |
| 1644                      | 1  | 3·5                         | 3        | 10·5                                 | —                  | 18               |
| 1644                      | 1  | 6                           | 2·5      | 8·5                                  | —                  | 18               |
| 1643                      | 1  | 4·5                         | 2·5      | 10                                   | —                  | 18               |
| 1643                      | 2  | 4                           | 2·5      | 9·5                                  | —                  | 18               |
| 1644                      | 1  | 5                           | 3        | 8                                    | —                  | 17               |
| 1644                      | 1  | 4·5                         | 2·5      | 9                                    | —                  | 17               |
| 1644                      | 1  | 6                           | 2·5      | 7·5                                  | —                  | 17               |
| 1644                      | 1  | 5·5                         | 2        | 7·5                                  | —                  | 16               |
| 1644                      | 1  | 5                           | 2        | 7                                    | —                  | 15               |
| Average ...               | 1·1  | 4·9                         | 2·4      | 10·7                                 | —                  | —                |
| Average of<br>three forms | 1·5  | 5·8                         | 2·8      | 10·0                                 | 3·3                | —                |

and Mesnil some years ago, when they wrote: "Avec un peu d'habitude on arrive au contraire à distinguer les deux Trypanosomes, quand on dispose de préparations bien colorées et riches en parasites."\*

*Nucleus*.—Is oval or elongated in shape in the long forms, a short oval in the intermediate, round or oval in the short, stumpy forms, and situated about the middle of the body.

\* 'Trypanosomes et Trypanosomiasés,' 1904.



*Micronucleus*.—Small and round, situated, on an average, 2·1 microns from the posterior extremity in the long and slender forms, 1·4 microns in the intermediate, and 1·1 microns in the short and stumpy.

*Undulating Membrane*.—This is well developed in this species and thrown into many folds and undulations. In this it differs markedly from *Trypanosoma vivax*.

*Flagellum*.—The flagellum in the long and slender forms is free and, on an average, 6·4 microns in length. In the short and stumpy forms there is no free flagellum.

COMPARISON OF *TRYPANOSOMA BRUCEI*, UGANDA, 1909, WITH *TRYPANOSOMA BRUCEI*, ZULULAND, 1894 (see Plate 1).

When *Trypanosoma brucei* was discovered in Zululand, in 1894, it was naturally thought to be the one and only trypanosome in Africa, and a detailed description seemed unnecessary. Now, however, since the number of species in Africa has increased to such an alarming extent, it is necessary to add to the old description by more detailed measurements. Luckily, many of the old Zululand preparations are still extant, so that it has been possible to do this. It must, however, be borne in mind that the Zululand preparations are some 15 years old, and were stained with carbol-fuchsin and not by Giemsa as in the case of the Uganda strain. They may, therefore, have shrunk to a greater extent than the more recently stained specimens.

Table IV.—Measurements of the Original Strain of *Trypanosoma brucei*, discovered in Zululand in 1894.  
*Trypanosoma brucei*, Zululand, 1894.

| Date.    | No. of expt. | Animal. | Method of fixing and staining. | In microns.     |                 |                 |
|----------|--------------|---------|--------------------------------|-----------------|-----------------|-----------------|
|          |              |         |                                | Average length. | Maximum length. | Minimum length. |
| 1/11/95  | 212          | Horse   | Osmic acid; carbol-fuchsin     | 22·4            | 32·0            | 14·5            |
| 1/11/95  | 212          | "       | " "                            | 20·6            | 32·5            | 14·0            |
| 7/11/95  | 219          | Donkey  | " "                            | 23·0            | 35·0            | 14·5            |
| 23/11/95 | 214          | Ox      | " "                            | 18·0            | 25·5            | 13·0            |
| 4/7/97   | —            | Monkey  | " "                            | 20·5            | 32·0            | 15·0            |
| 6/1/95   | 190          | Dog     | " "                            | 25·0            | 35·0            | 17·0            |
| 10/12/95 | —            | "       | " "                            | 24·0            | 32·0            | 17·0            |
| 14/1/96  | 233          | "       | " "                            | 27·8            | 34·0            | 18·0            |
| 25/1/96  | 244          | "       | " "                            | 20·6            | 33·0            | 15·0            |
| 7/2/96   | 229          | "       | " "                            | 28·7            | 35·0            | 19·0            |
| 9/7/97   | 433          | "       | " "                            | 19·7            | 29·0            | 17·0            |
|          |              |         |                                | 22·8            | 35·0            | 13·0            |

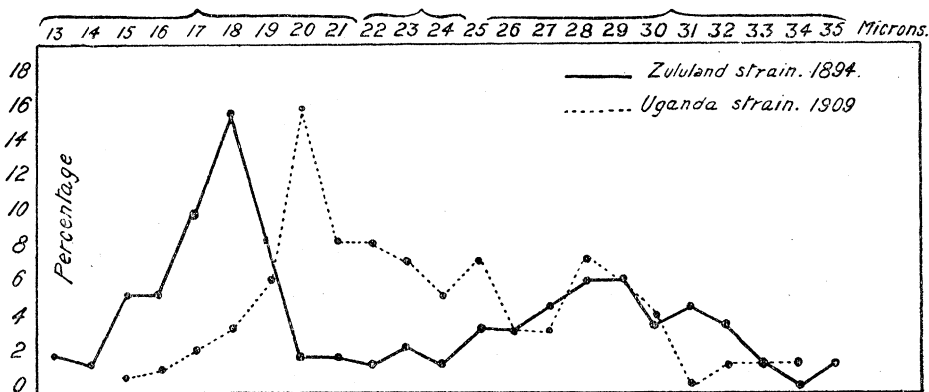




The average length of the *Trypanosoma brucei*, Uganda, 1909, was 23·6 microns, the maximum 34 microns, and the minimum 15 microns. The measurements of the two strains therefore correspond very closely.

Tables II and V can be compared in the following chart, which gives the curves of the distribution in respect to length of *Trypanosoma brucei*, Uganda, 1909, and *Trypanosoma brucei*, Zululand, 1894.

Chart giving Curves of the Distribution, by percentages, in respect of Length, made up from Tables II and V.



From these curves it will be seen that there is a marked resemblance between the two strains when represented in this way.

#### ANIMALS SUSCEPTIBLE TO *TRYPANOSOMA BRUCEI*.

Table VI shows the effect of inoculating various animals with *Trypanosoma brucei*, Uganda strain, 1909.

The number of experiments carried out on the various animals is too small for comparative purposes, but sufficient to show that cattle and the smaller laboratory animals are susceptible to this trypanosome.

#### CULTIVATION OF *TRYPANOSOMA BRUCEI*, UGANDA STRAIN, 1909.

No attempt was made in Uganda to cultivate this trypanosome.

#### CARRIER OF *TRYPANOSOMA BRUCEI*.

No experiments were made in the laboratory at Mpumu with *Glossina palpalis* as a carrier of this trypanosome, and no evidence is to hand as to how it is conveyed from sick to healthy animals in the district of Bukedi.

Table VI.

| Date.                | Expt. | Source of virus. | Period of incubation, in days. | Duration of disease, in days. | Remarks.   |
|----------------------|-------|------------------|--------------------------------|-------------------------------|--|
| Cattle.              |       |                  |                                |                               |  |
| 1909.<br>Aug. 11 ... | 1461  | Nat. infec.      | ?                              | —                             | Killed on 79th day.  |
| Goat.                |       |                  |                                |                               |  |
| Aug. 16 ...          | 1478  | Ox 1461          | —                              | —                             | Never showed trypanosomes; under observation 37 days.      |
| Monkey.              |       |                  |                                |                               |  |
| Aug. 16 ...          | 1480  | Ox 1461          | —                              | —                             | Died 10 days after inoculation; never showed trypanosomes. |
| Sept. 4 ...          | 1627  | Dog 1479         | 13                             | 69                            | Died of <i>T. brucei</i> .                                 |
| Dog.                 |       |                  |                                |                               |  |
| Aug. 16 ...          | 1479  | Ox 1461          | 8                              | 49                            | Died of <i>T. brucei</i> .                                 |
| Rabbit.              |       |                  |                                |                               |  |
| Sept. 8 ...          | 1645  | Rat 1482         | 26                             | —                             | Still alive after 67 days.                                 |
| Guinea-pig.          |       |                  |                                |                               |  |
| Aug. 16 ...          | 1481  | Ox 1461          | —                              | —                             | Never showed trypanosomes; under observation 18 days.      |
| Sept. 3 ...          | 1481  | Dog 1479         | 5                              | —                             | Still alive after 71 days.                                 |
| „ 8 ...              | 1644  | Rat 1482         | 26                             | —                             | „ „ 67 „   |
| Rat.                 |       |                  |                                |                               |  |
| Aug. 16 ...          | 1482  | Ox 1461          | —                              | —                             | Never showed trypanosomes; under observation 18 days.      |
| Sept. 4 ...          | 1482  | Dog 1479         | 5                              | 23                            | Died of <i>T. brucei</i> .                                 |
| „ 8 ...              | 1643  | Rat 1482         | 8                              | 22                            | „ „  |
| Mouse.               |       |                  |                                |                               |  |
| Aug. 16 ...          | 1483  | Ox 1461          | —                              | —                             | Accidentally killed on 9th day; never showed trypanosomes. |

## CONCLUSION.

With the evidence available, the Commission consider themselves justified in considering the trypanosome recovered from the Uganda ox to be identical with *Trypanosoma brucei*, the cause of Nagana in Zululand and other parts of South Africa.

DESCRIPTION OF PLATES.

PLATE 1.

- (1) *Trypanosoma brucei*, Zululand, 1894, stained carbol-fuchsin.    × 2000.

Figs. 1 and 2.—Long and slender forms.

Figs. 3 and 4.—Intermediate forms.

Figs. 5, 6 and 7.—Short and stumpy forms.

- (2) *Trypanosoma brucei*, Uganda, 1909, stained Giemsa.    × 2000.

Figs. 8 and 9.—Long and slender forms.

Fig. 10.—Intermediate form.

Figs. 11, 12 and 13.—Short and stumpy forms.

- (3) *Trypanosoma dimorphon* (?), Khartoum.    × 2000.

Figs. 14 and 15.—Long and slender forms.

Fig. 16.—Intermediate form.

Figs. 17, 18 and 19.—Short and stumpy forms.

PLATE 2.

*Trypanosoma brucei*, Uganda, 1909, stained Giemsa.    × 2000

Figs. 1-5.—Long and slender forms.

Figs. 6-10.—Intermediate forms.

Figs. 11-16.—Short and stumpy forms.

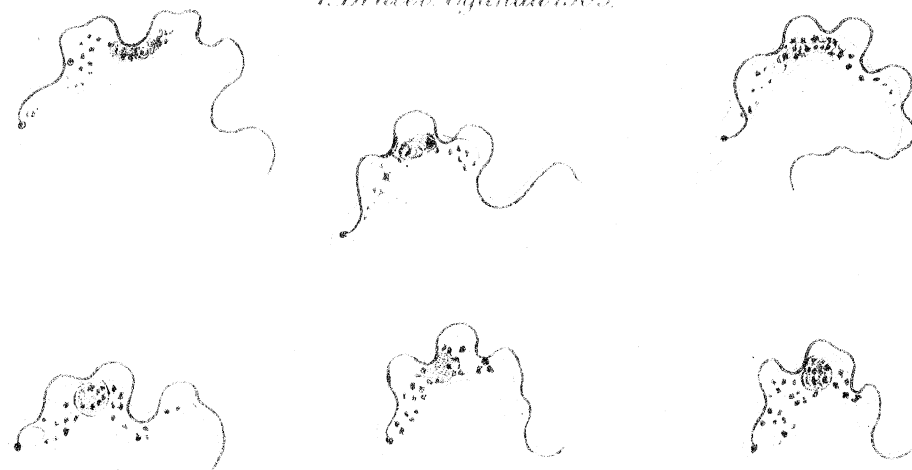




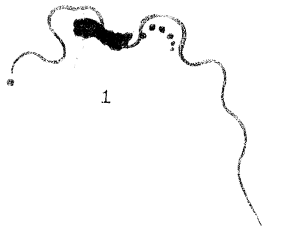
*T. Brucei*. Zululand 1894.



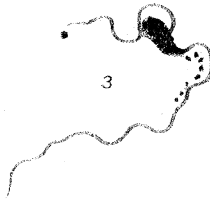
*T. Brucei*. Uganda 1909.



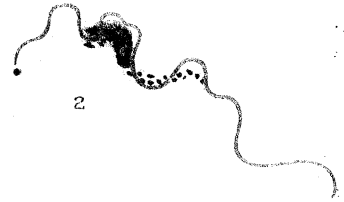
*T. Dimorphon?* Khartoum.



1



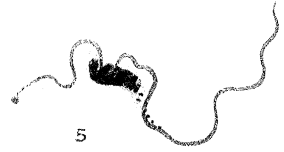
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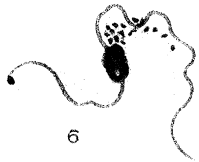


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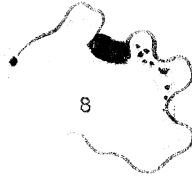


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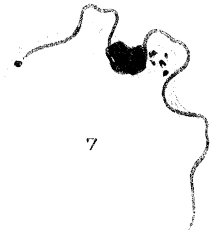
*Long & Slender*



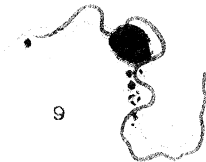
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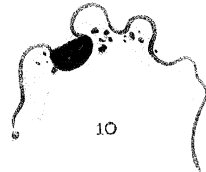
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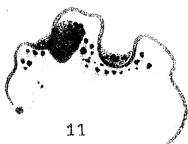


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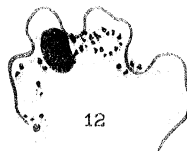


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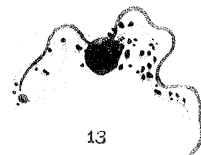
*Intermediate.*



11



12



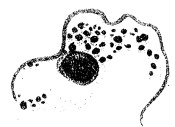
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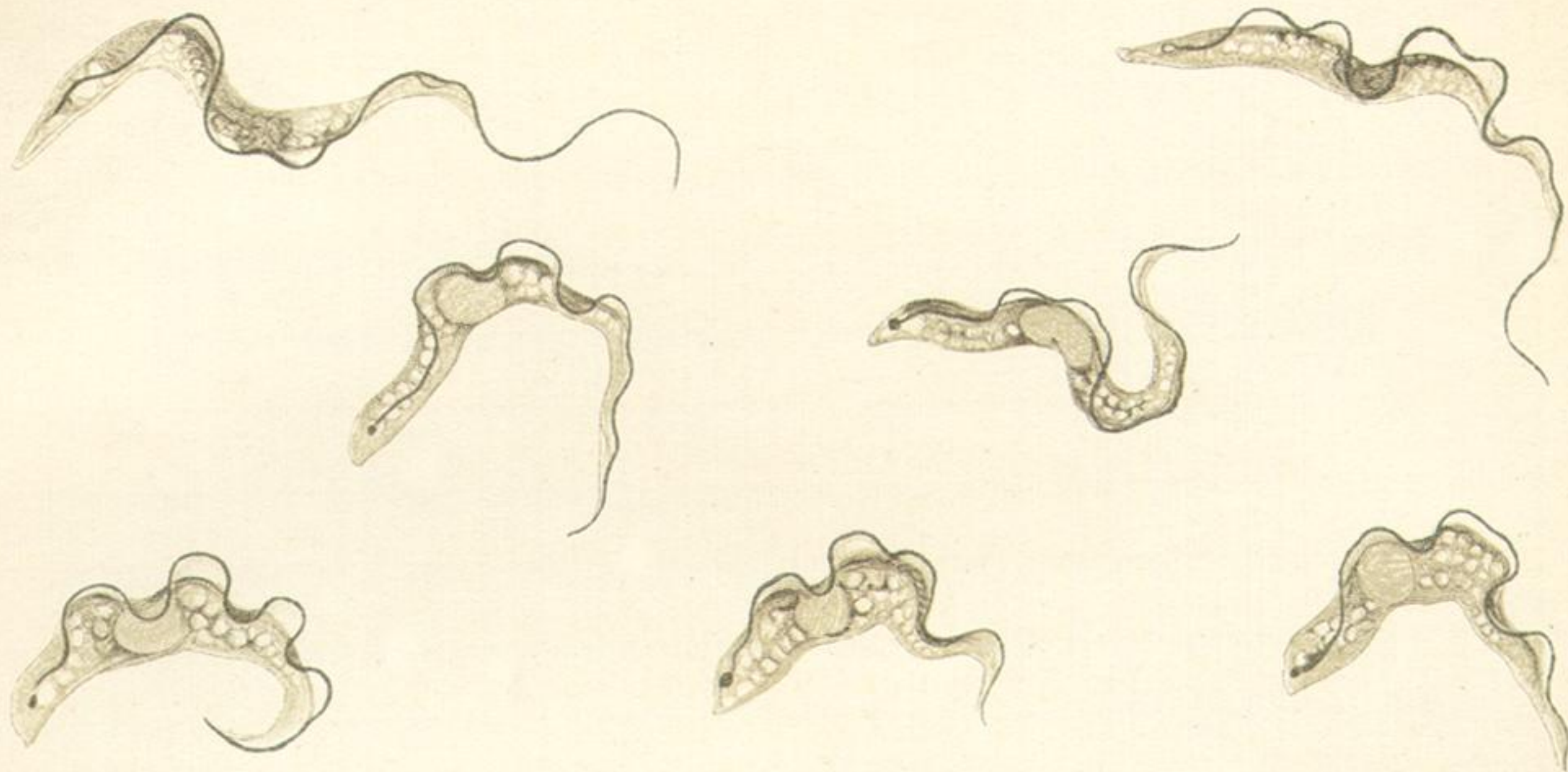
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16

*Short & Stumpy.*

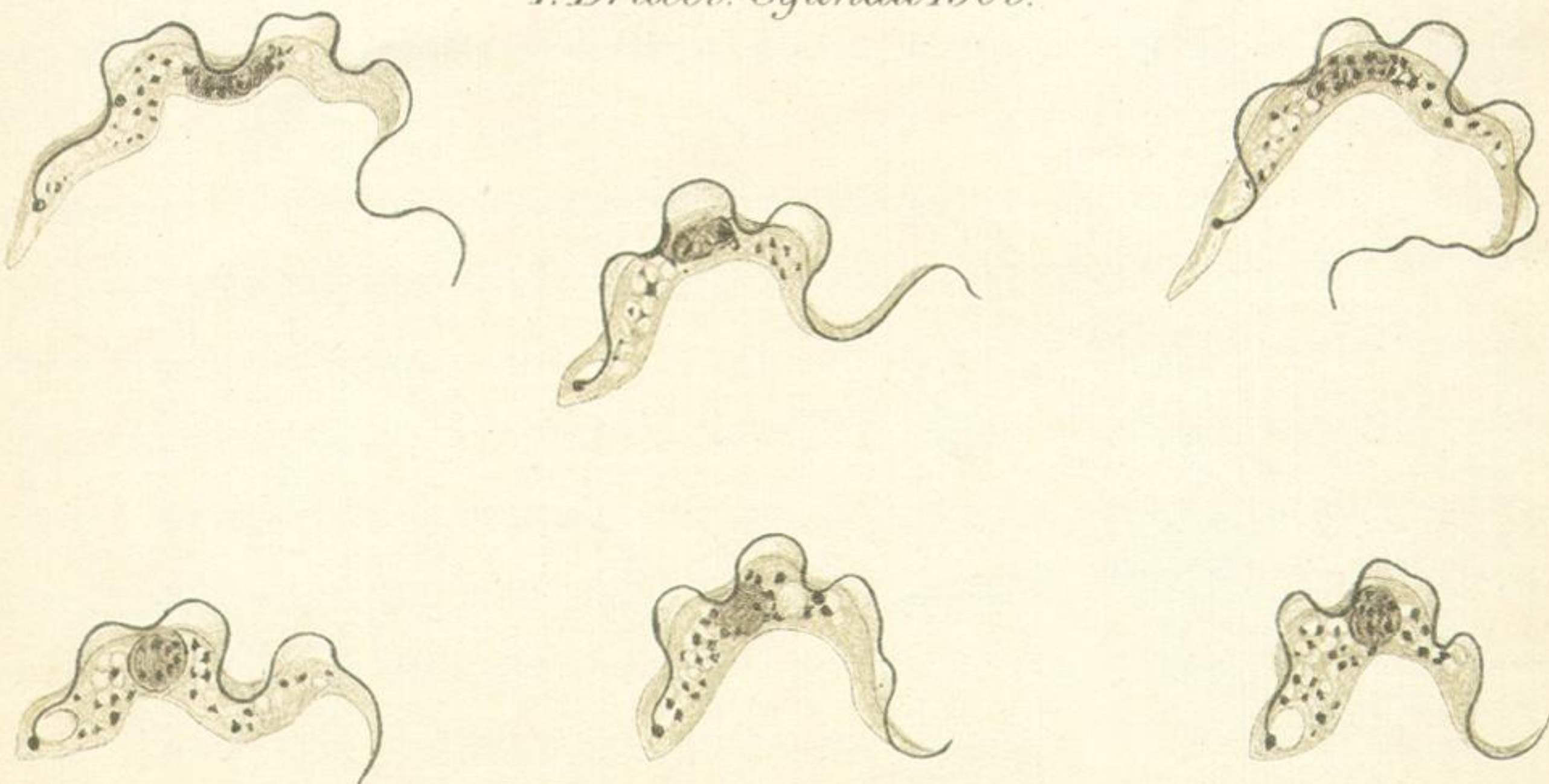




*T. Brucei. Zululand 1894.*



*T. Brucei. Uganda 1909.*

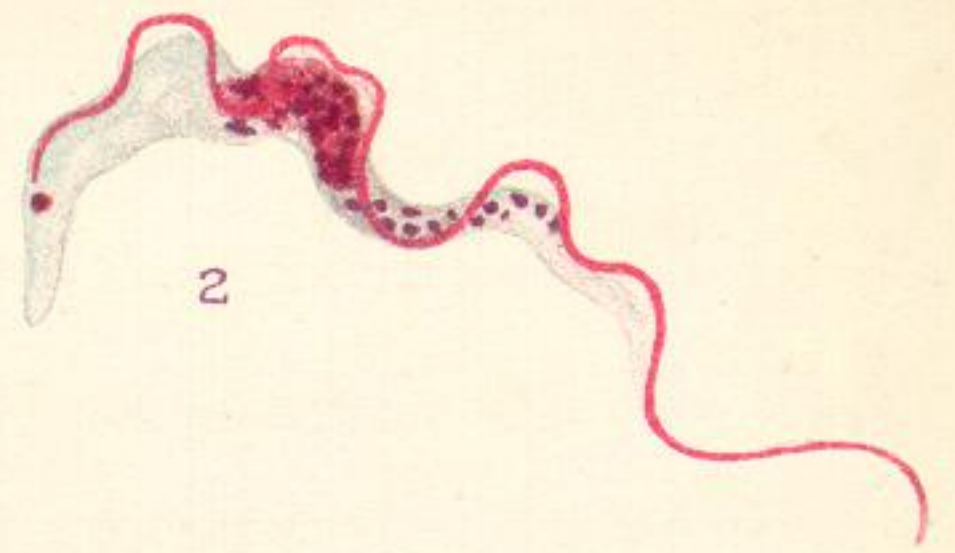


*T. Dimorphon? Khartoum.*

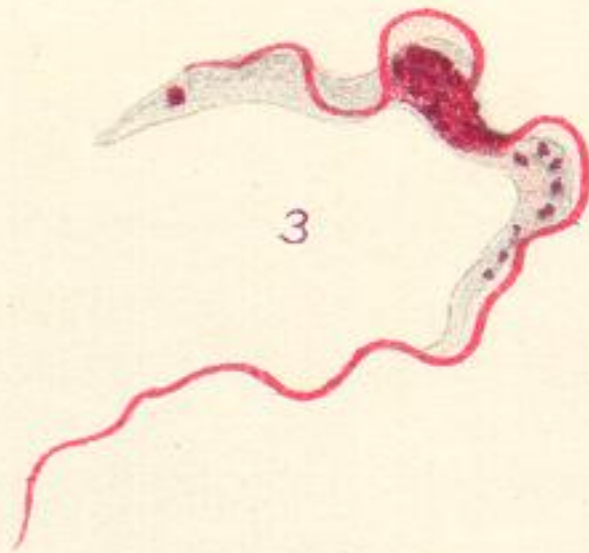




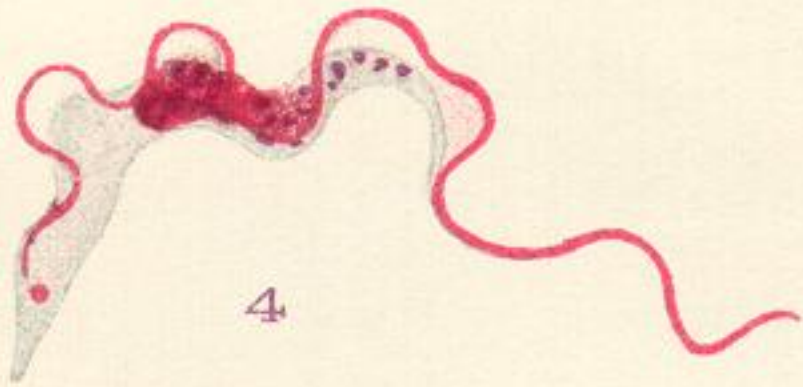
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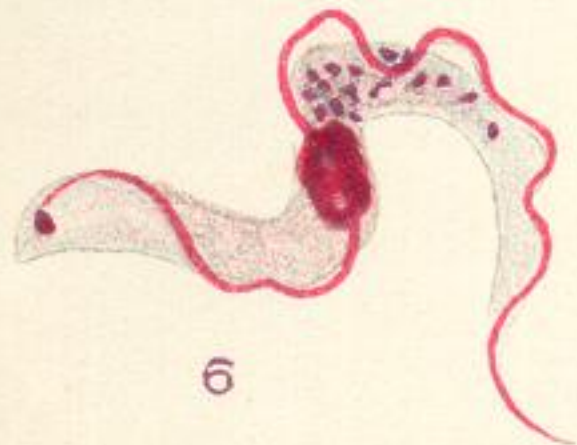


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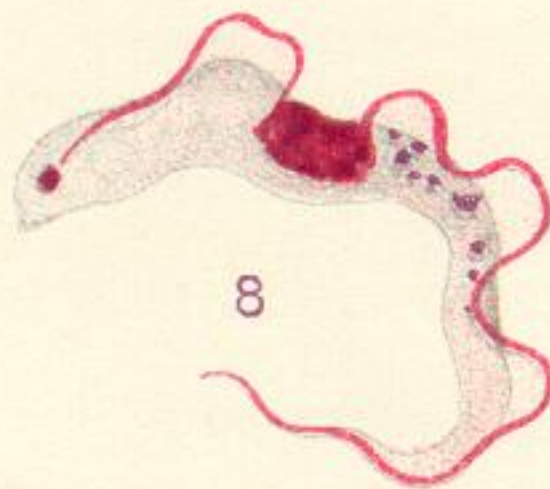


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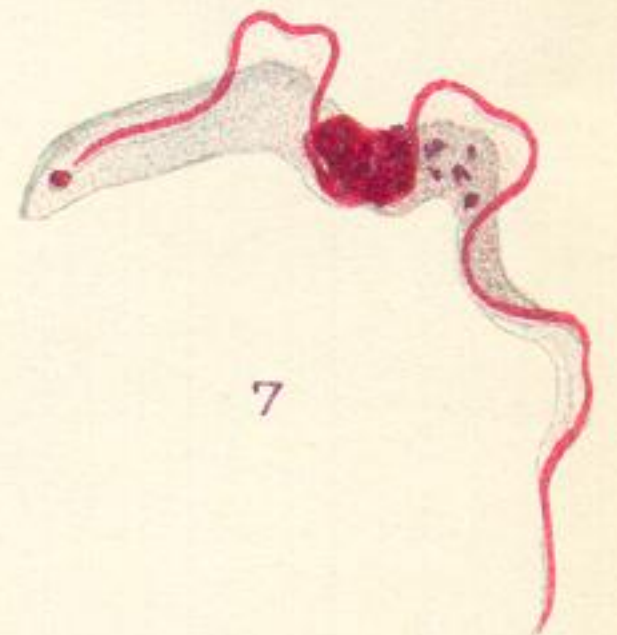
*Long & Slender.*



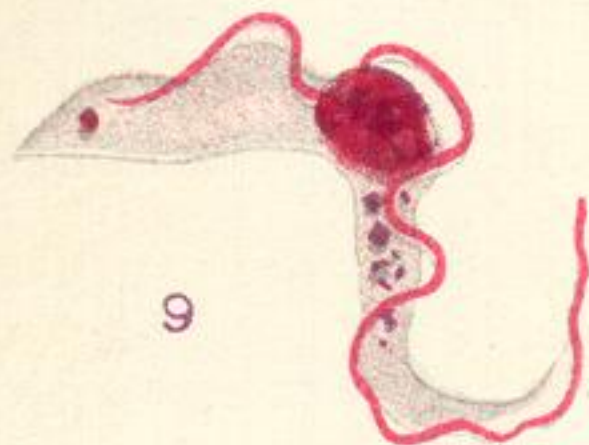
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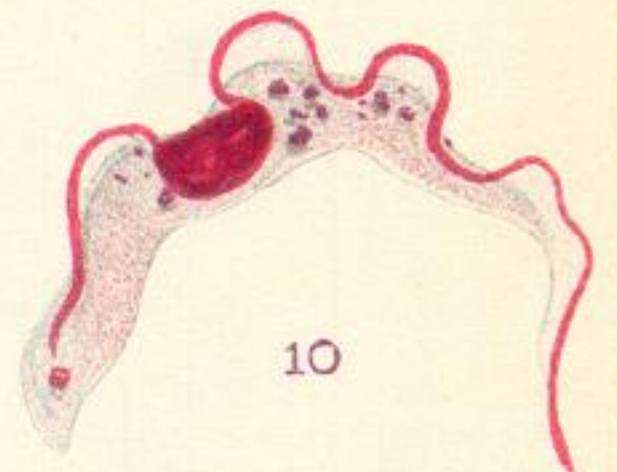
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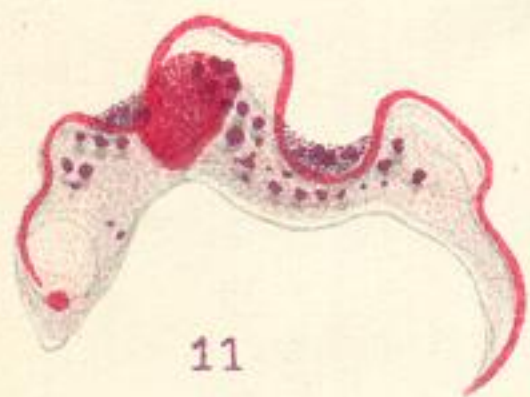


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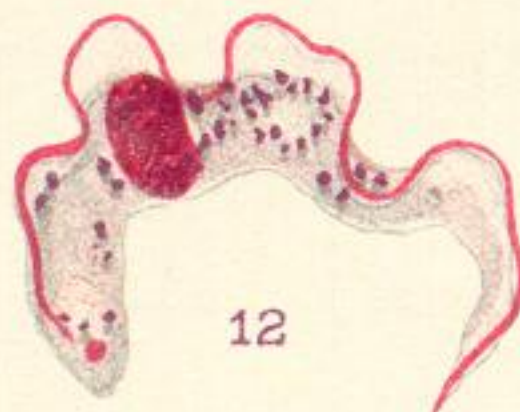


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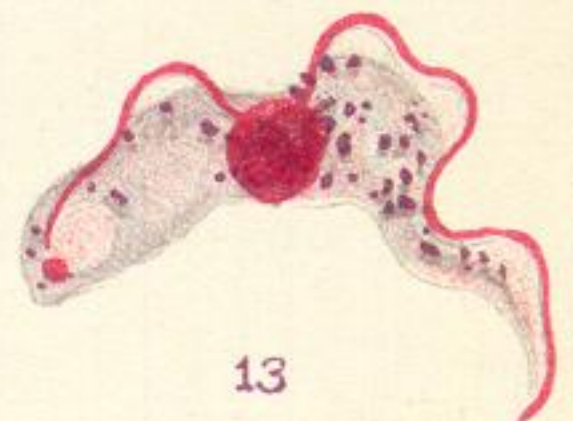
*Intermediate.*



11



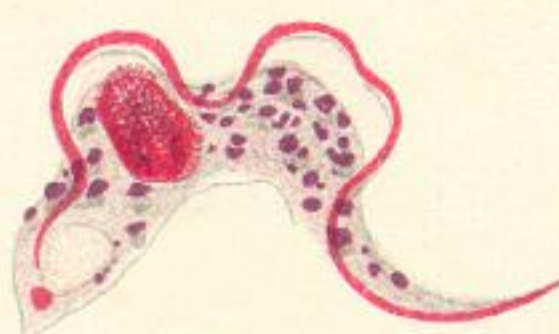
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13



14



15



16

*Short & Stumpy.*