

favours a child." The supraclavicular pads of "fat" have disappeared entirely. The arms, too, and the legs have become more natural in appearance. The patient's own description of herself is that "her limbs feel looser." She can walk with ease a distance of five miles—a most striking fact when compared with her former lethargy. She enters into the games of other children and can carry a bucket of water from the spring—a thing unheard of in her life before. The hair is glossy and thick and her decayed teeth are being replaced by the second set gradually, three new teeth being present at the time of writing. From being a mute, silent member of the household she has become an active intelligent child. She engages in conversation of her own accord, whereas she would formerly scarcely reply to questions addressed to her. She can understand and enjoy a joke with the other members of the family. Her mother says that she has become a very "rough one." In her studies she has made remarkable progress. She could read only with great difficulty in January, but now she can read any child's picture-book with ease. Arithmetic formerly was far beyond her intelligence, but now she can add and subtract and do easy multiplication and division. In short, her condition both physically and mentally is one of progressive improvement. Menstruation has not yet appeared.

In closing the account of this unusually interesting case one might add that a comparison of the progress from March 12th and from April 12th seems to demonstrate clearly that to gain success in such cases a thoroughly reliable standardised preparation of thyroid must be used.

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## CONCERNING TRYPANOSOMA DIMORPHON DUTTON AND TODD: *T. CONFUSUM*, *SP. NOVA*.

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IN their original description of the trypanosome of Gambian horse disease, afterwards named *T. dimorphon*, Dutton and Todd<sup>1</sup> make reference to three types or forms which may be encountered in the course of infection either in naturally attacked or experimental animals. They describe these as "tadpole," "stumpy," and "long," and figure each in the plates accompanying their report. The following is a synopsis of the morphological characters noted by these authors. "*Tadpole*."—Represented in Plate 1, Figs. 6 and 8: "A very small organism, rather tadpole-shaped. .... The undulating membrane is narrow and seen with difficulty." The measurements in stained preparations are: length 11 to 13  $\mu$ , width 0.8 to 1.0  $\mu$ . "*Stumpy*."—Represented in Plate 1, Fig. 7: "A short thick body and a very short flagellum." The length varies from 16 to 19  $\mu$  and the width is from 3.4 to 3.5  $\mu$ . "*Long*."—"The long form, Plate 1, Figs. 9 and 10, is characterised by a long thin body and a long flagellum. The posterior end of the parasite may be long (pointed or square-shaped) or stumpy and conical. The deeply staining macronucleus is ovoid in shape and lies longitudinally. .... The length of such a parasite, including the flagellum, is 26 to 30  $\mu$ , width 1.6 to 2.0  $\mu$ . .... This type can be recognised in fresh blood by its rapid movements and long flagellum, and is usually most numerous in the blood of an infected animal a few days before its death."

Referring to the strain sent to them from Liverpool, Laveran and Mesnil write as follows<sup>2</sup>: "We have seen short parasites, 10 to 15  $\mu$  long, by 0.7 to 1.5 wide, but have never seen forms 3.5 wide in good blood films. .... We recognise the existence of a short form and a long form (average length 22  $\mu$ ), the width of the former being about 1  $\mu$  and of the latter about 1.5  $\mu$ . It is particularly with regard to the long form that we differ from the English investigators, who describe and figure a long free flagellum. According to our own observations, the protoplasm of the body is continued along the flagellum almost or quite to the

end. As a result, the really free part of the flagellum is very short, or even absent, in the long form as well as in the short."

Thomas and Breinl<sup>3</sup> make the following statement regarding the same strain as that employed by Laveran and Mesnil: "In no instance has the long form described by Dutton and Todd and possessing a long thin body and a free flagellum been seen; in this we are in accord with Laveran and Mesnil."

It is evident that the original description of Dutton and Todd has not been confirmed by those who have had the opportunity of working with the trypanosome brought back from the Gambia, insomuch that free flagellated forms have not been seen by subsequent investigators. The morphological descriptions of the other forms are in great measure substantiated, and there are no essential differences in the "animal reactions" established by various writers. Two hypotheses appear to have been offered to explain this discrepancy: (1) That for some inexplicable reason *T. dimorphon* has ceased to manifest itself as free flagellated forms; and (2) that Dutton and Todd were misled by a mixed infection of a trypanosome, which is now maintained as *T. dimorphon*, and a second which, like *T. brucei*, normally carries a free flagellum, and that this latter has since died out.

There is at the present time no evidence to show that a trypanosome can permanently vary its morphological features. Individual variations occur in every known species, sometimes to a marked degree; but despite the numerous generations which some trypanosomes have developed in laboratory animals it has never been suggested that a race differing in any essential morphological manner has been evolved<sup>4</sup> during the years some strains have been under continuous observation.

The hypothesis of a double infection, in the sense noted above, is improbable, even if the work had been conducted by less qualified observers than Dutton and Todd. A reasonably large amount of experimental work was carried out in the Gambia on the usual laboratory animals, and did the flagellated forms represent a specific entity, it is, to say the least, curious that its appearance in the blood should bear a more direct relation to the date of the host's death than to the date of inoculation. As an entity its appearance should have been made after a fairly regular incubative period, and not merely "a few days before death," as is reported to have been the case in naturally infected horses, nor, "as the disease progressed long and stumpy forms were seen, and the smaller tadpole-shaped parasites tended to disappear," which is the state recorded in experimental rats.

Again, insusceptibility towards trypanosomes is not an uncommon attribute of individual laboratory animals. In the experiments conducted by Dutton and Todd with the strain of Horse 1, six small animals remained uninfected after inoculation; it is highly improbable that all six should have possessed an equal degree of immunity to both trypanosomes (assuming the "tadpole" and "free flagellated" to be specifically distinct). And these six animals being resistant to both forms, it is curious that not one of all the other inoculated animals should have manifested resistance to the "tadpole," and should have shown up the "free flagellated" form alone. Neither of these hypotheses satisfactorily accounts for the disappearance of the flagellated form, but if we closely examine the evidence published in Dutton and Todd's report, an explanation may be traced therein which effectually accounts for this discrepancy. It is, in effect, that Dutton and Todd were dealing with at least two distinct trypanosomes in Gambian horses, and that the one they describe as *T. dimorphon* was never employed in Europe.

It will be observed that these investigators diagnosed trypanosomiasis in ten horses and studied the parasites in animals sub-inoculated from four—namely, Nos. 1, 5, 6, and 9. Four experimental animals were infected, from Nos. 5 and 9, but all died prior to May, 1903, so that neither strain reached England. Horse 6 was brought to England, only four sub-inoculations having first been made from it. This animal served as the origin of the strain employed by Thomas and Breinl, by whom it was sent to Laveran and Mesnil in Paris, where it is now maintained as *T. dimorphon*.

With the exception of these few experiments, all Dutton

<sup>1</sup> Liverpool School of Tropical Medicine, Memoir xi., 1903.

<sup>2</sup> Trypanosomes et Trypanosomiasis, Paris, 1904.

<sup>3</sup> Liverpool School of Tropical Medicine, Memoir xvi.

<sup>4</sup> Unless the variable trypanosome with which Martini worked can be so described. See Zeitschrift für Hygiene und Infektionskrankheiten, vol. 1., 1905, pp. 1-96.

and Todd's work was carried out on the strain of Horse 1. 40 animals were inoculated with it in the Gambia and the trypanosome was maintained for six generations in mice, rats, rabbit, guinea-pigs, dog, monkey, goats, and bovines. This horse died in 1902, but three animals, Goats No. 10 and 35 and Dog No. 11, in which trypanosomes had been seen, arrived in England in June, 1903. The other experimental animals were all dead, or had not become infected.

These three positive cases were taken over by Thomas and Breinl, who refer to them in their report as follows:—

*Goat, Experiment 35.* Inoculated by Dutton and Todd from Horse 1, November 28th, 1902, remained infected up to March 20th, 1903; it was then sent to England. In August, 1903, its blood was negative ..... and non-infective, even when injected in amounts of 2 and 3 c.c. It was reinoculated in October and became infected.<sup>5</sup>

*Goat 10.* Inoculated by Dutton and Todd, Oct. 15th, 1902 (from Horse 1). Appeared to have recovered in October, 1903. In March, 1904, it was killed by accident while being bled. A guinea-pig inoculated with 100 c.c. pure heart blood became infected after a prolonged incubation.

*Dogs.* Dutton and Todd brought back an adult bitch, Exp. No. 11, inoculated Oct. 16th, 1902, from Horse 1 and infected 6 days later. This animal, Aug. 31st, 1903, was well and strong, and its blood non-infective. It is still living, no parasites are seen, its blood in amounts of 2 and 3 c.c. is non-infective.

The guinea-pig inoculated from Goat 10 is therefore the only infected representative of this strain, and we have it on the authority of Dr. Thomas, who has very kindly placed his records at our disposal, that no further subinoculations were made. The strain of Horse 1, upon which the original description of *T. dimorphon* is based, has, consequently, never been employed in Europe. The strain which has been accepted as *T. dimorphon* is that of Horse 6.

If we may judge from the experiences of most workers on trypanosomiasis in Africa, it would be strange that ten horses from various parts of the Gambia Colony should have been infected by an absolutely identical trypanosome; it would be more probable that, in morphology or animal reaction, some of these organisms should show such differences as are nowadays held to constitute species. The imperative necessity for genealogical records of strains is fully exemplified in the present case. Even animals in the same herd may, as we have seen at Broken Hill and Kambole, show distinct trypanosomes; and it is not safe to rely upon the morphological characters alone unless peculiar as evidence of identity.<sup>6</sup>

We emphasise the correctness of Dutton and Todd's diagnosis of their species *T. dimorphon*, since in North-Western Rhodesia we have regained a form responding in all essential particulars.<sup>7</sup> In a forthcoming report we publish a series of micro-photographs illustrating the polymorphic character of this species, and demonstrating the free flagellated forms. By the best means in our power, those of observation and control inoculation, we are satisfied that the strain employed was not contaminated by such a form as *T. brucei*. The development of a free flagellum in guinea-pigs and the reappearance of "tadpole" forms in a sheep and a goat inoculated with such blood is, for us, confirmatory evidence of the rectitude of Dutton and Todd's observations.

As laid down in the original description, *T. dimorphon* is characterised by its ability to develop a free flagellum; no trypanosome which lacks this power should bear that name. It is therefore advisable, though the inconvenience is manifest, to adopt a specific designation for that form which is now maintained at the Institut Pasteur, Paris, as *T. dimorphon*, which, as we have shown, is a strain distinct from that investigated by Dutton and Todd.

With our limited knowledge regarding the classification of the genus *Trypanosoma*, and a lack of uniformity amongst protozoologists as to what characters are requisite to constitute a good species, there may be hesitation in offering or accepting a new name for a well-studied type. But in view of the evidence adduced, it appears necessary to regard that form now frequently referred to under the cumbersome titles

of *T. dimorphon sensu* L. and M., *sensu latiore*, &c., as distinct from *T. dimorphon* Dutton and Todd, and, both on the grounds of zoological requirements and those of simplicity, we suggest that the trypanosome carried to England by Dutton and Todd in Horse 6, and now maintained at the Institut Pasteur in Paris, should be known as *Trypanosoma confusum* Montgomery and Kinghorn, 1909.

In a note on the nomenclature of trypanosomes recently published,<sup>8</sup> we arranged in the group *dimorphon* the species *T. dimorphon* (*sensu* Dutton and Todd *et sensu* Laveran and Mesnil), *T. pecaudi* and *T. congolense*. While this arrangement may still be considered of service to the worker in the field, the definition of the group may, with advantage, be emended, since it would appear that *T. congolense* can hardly be considered dimorphic, though showing the characteristic "tadpole" of the group.

A. Trypanosome, pathogenic to most domestic animals and producing a rapidly fatal infection in the usual laboratory animals. (a) ..... of large and fairly constant size (20–35  $\mu$ ) and carrying a distinct free flagellum: monomorphic. Type: *T. evansi*. (b) ..... occurring frequently as an organism of small size (10–15  $\mu$ ) devoid of any free flagellum (tadpole forms): mono-, di-, or poly-morphic, being in some species capable of development into forms similar to those of the *evansi* group. Type: *T. dimorphon*.

B. Trypanosome, pathogenic to certain domestic animals and without apparent effect when inoculated into the usual laboratory animals. *T. nanum*, *T. vivax*, *T. cazalboni*.

We have no further remarks to make on the *evansi* and *nanum* groups, but it seems possible to analyse the *dimorphon* group in a manner which may be helpful to a worker in the field. We have already emphasised that this arrangement must be employed as a guide only, since accurate zoological classification appears impracticable at the present day, and final diagnosis should remain the prerogative of an acknowledged centre where all types are maintained.

*Group. Dimorphon.* Trypanosome, pathogenic towards most domestic animals and producing a rapidly fatal infection in the usual laboratory animals, occurring frequently as an organism of small size (10–15  $\mu$ ), devoid of any free flagellum (tadpole forms): mono-, di-, or poly-morphic. (a) *Monomorphic*, hardly changing from the tadpole forms: *T. congolense*. (b) *Dimorphic*, (a) occurring as tadpole forms and capable of development into trypanosomes of 22 to 24  $\mu$ , but devoid of a free flagellum: *T. confusum*. (b) Tadpole forms rarely, if ever, seen; occurs in blood of infected animals under two types, one or other of which may largely preponderate: (1) a "short" form of 14–20  $\mu$ , relatively very broad, with a wide developed undulating membrane: no free flagellum; and (2) a long form recalling the *evansi* group: intermediate forms are very exceptional. *T. pecaudi*. (c) *Polymorphic*, occurring commonly as tadpole forms, but capable of development into free flagellated forms recalling *T. evansi*: intermediate forms are common. *T. dimorphon*.

<sup>8</sup> Annals of Tropical Medicine and Parasitology, ii., 1909, 5, pp. 333–344.

THE VETERINARY CONGRESS.—The Ninth International Veterinary Congress was closed at The Hague on Saturday last after a successful week. The proceedings attracted 1400 members, of whom unfortunately only 50 were from the British Isles. Sir John McFadyean represented England, Professor Dewar Scotland, and Professor Mettan Ireland. The proceedings were under the patronage of H.R.H. Prince Henry of the Netherlands, Duke of Mecklenburg, who was present on more than one occasion. Mr. W. C. Schimmel, Professor of the State Veterinary School, officiated as president. Mr. F. Bullock, honorary secretary of the National Committee, made arrangements for the travelling and accommodation of the British party, and thanks to the courtesy of the Great Eastern Railway special concessions were granted to members travelling to the Hook of Holland. Entertainments were provided every evening, including a reception at the Palace by H.R.H. Prince Henry; also one by the Cabinet Ministers. On Thursday a banquet was held in the Kurhaus, at which about 600 members were present. A gala performance was given in the theatre at The Hague on Friday evening, and on Saturday the Congress was closed by the Minister of Agriculture, Industry, and Commerce. A great amount of useful work was accomplished.

<sup>5</sup> This may also be used as an argument that the strain of trypanosome subsequently inoculated (Horse 6) was not the same as that originally employed.

<sup>6</sup> It is not difficult to imagine a case where different animals of a herd are infected with such trypanosomes as *T. nanum* and *T. congolense*, which may be morphologically indistinguishable. The former is utilised by an observer in the field and found non-pathogenic to small animals; with a view that the trypanosome is identical, an animal infected with the latter is sent to Europe. The confusion that would result in the respective reports would be irreparable.

<sup>7</sup> Annals of Tropical Medicine and Parasitology, ii., 1908, 2, pp. 97–132.