

edible tissue of birds seems to retain a relatively large amount of ingested thallium there would seem to be no great danger that secondary poisoning in man might result from the eating of game birds poisoned with thallium, since a relatively large amount of such flesh would be necessary to contain a toxic dose of thallium for man.

## 6541

Experimental Infection with *Trypanosoma cruzi* from Intestine of Cone-nose Bug, *Triatoma protracta*.

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Kofoid and McCulloch<sup>1</sup> described *Trypanosoma triatomae* from the digestive tract of *Triatoma protracta* from San Diego, California. Its morphological resemblance to *Trypanosoma cruzi* from *Triatoma megista*, the insect vector of Brazilian human trypanosomiasis, was noted, but failure to find the trypanosome in the blood of the wood rat (*Neotoma fuscipes macrotis*) in whose nests infected *Triatoma* were taken, and the failure to infect young white rats by permitting infected bugs to feed upon them, led to the tentative opinion that the trypanosomes of the 2 species of bugs might not be identical. Findings here reported establish the identity of *T. triatomae* of California with *T. cruzi* of Brazil.

Examination of the blood of wood rats (*Neotoma fuscipes annectens*) from the vicinity of Berkeley, California, has shown them to harbor a trypanosome. This parasite, however, has the morphology of *T. lewisi*, the non-pathogenic trypanosome of the Norway rat. *Ceratophyllus fasciatus*, the common rat flea, which infests both the nests and bodies of the wood rats, has been found to contain trypanosomes in developmental stages, identical with those described by Minchin and Thomson<sup>2</sup> for *T. lewisi*. *Triatoma protracta* also lives in the nests of wood rats from this vicinity, but examinations of its digestive tract have never revealed trypanosomes in any stage of development. Experimental feeding of these bugs on wood rats naturally infected with *T. lewisi*, from the region of Berkeley has in 22 cases given only negative results.

<sup>1</sup> Kofoid, C. A., and McCulloch, I., *Univ. Calif. Publ. Zool.*, 1916, **16**, 113.

<sup>2</sup> Minchin, E. A., and Thomson, J. D., *Quar. J. Micr. Sci.*, 1915, **60**, 463.

The dilemma thus presented has been at least partially solved by the experimental infection of young albino rats of the Norway-albino hybrid strain in our stock by the intraperitoneal injection of the intestinal contents of a *Triatoma protracta* infected with *T. cruzi* (= *T. triatomae*) from San Diego. *Triatoma protracta* from Berkeley has been infected by feeding it upon animals experimentally infected by inoculation of intestinal fluid of infected bugs from San Diego.

Trypanosomes first appear in the peripheral blood in fresh smears and on stained slides in experimentally infected albino rats on the 16th to 27th day, but only in very small numbers. In the wood rat (*N. f. annectens*) the parasite was first detected on the 45th day after inoculation. In the opossum (*Didelphis virginiana*) the trypanosomes were detected on the 25th day.

Three albino rats which were inoculated intraperitoneally with heart blood from an infected rat, but in whose blood no trypanosomes had as yet appeared, were splenectomized on the 20th, 23rd, and 34th day respectively after inoculation. The trypanosomes appeared in the peripheral blood in the first rat only, on the second day after splenectomy. In the others the peripheral blood remained negative. Another albino rat was inoculated with citrated tail blood from an infected opossum, but its peripheral blood remained negative. On the 13th day after inoculation splenectomy was performed and this was followed by the appearance of trypanosomes in the peripheral blood of the rat 3 days later. An albino rat was inoculated by eating 6 infected *Triatoma protracta*, but its blood remained negative. On the 25th day after inoculation it was splenectomized and 2 days later trypanosomes appeared in the blood stream.

Two mice inoculated with citrated tail blood of a splenectomized albino rat infected by eating parasitized bugs did not show trypanosomes in their peripheral blood either before or after being splenectomized.

*Triatoma* known to be infected with trypanosomes were allowed to feed upon 15 albino rats, one wood rat, one deer mouse (*Peromyscus*), and 3 guinea pigs, both with and without careful prevention of contamination of the lesion by the feces of the bug, which are often discharged near the site of feeding. In none of the animals thus exposed were trypanosomes subsequently discovered in the peripheral blood.

The trypanosomes in the mammals experimentally infected con-

form precisely to the accounts given by Chagas<sup>3</sup> and others in morphology, attachment to corpuscles, and tissue invasion. The Leishmania-like stages of the trypanosome occur in heart muscle and are accompanied by the typical degenerative processes.

We therefore conclude that the trypanosome (*Trypanosoma triatomae*, Kofoid and McCulloch) of the cone-nose bug (*Triatoma protracta*) in California is identical with that found in *Triatoma megista* and in other Reduviidae of South and Central America known to be vectors of Brazilian human trypanosomiasis.

The determination of this identity extends the geographical range of the infected insect vector into the Southwestern United States. Mammals naturally infected have not as yet been discovered in this region, but further investigation by splenectomizing suspected mammals in regions where infected bugs are found may be expected to reveal the infection.

## 6542

**Comparative Physiological Action of Quaternary Ammonium Salts of the Epinephrine Series.\***

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The classical studies of Barger and Dale<sup>1</sup> on the relationships between chemical constitution and physiological action of compounds related in structure to epinephrine included 3 quaternary ammonium salts, hordenine methiodide, 3:4-dihydroxyphenylethyl trimethyl ammonium chloride and trimethylaminoacetocatechol chloride. These compounds were found to resemble nicotine, rather than epinephrine, in their physiological actions and the conclusion was tentatively drawn that the relative intensity of these effects paralleled the relative intensity of the sympathomimetic action of the corresponding amino or methylamino derivatives. It became of interest to see if this generalization would hold for other quaternary ammonium salts of the epinephrine group of com-

<sup>3</sup> Chagas, C., *Mem. Inst. Oswaldo Cruz*, 1909, **1**, 158.

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<sup>1</sup> Barger, G., and Dale, H. H., *J. Physiol.*, 1910, **41**, 19.