

Trypanosomatid Pathogens

Subjects: Microbiology

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Unicellular eukaryotes of the Trypanosomatidae family include human and animal pathogens that belong to the *Trypanosoma* and *Leishmania* genera. Diagnosis of the diseases they caused requires the sampling of body fluids (blood, lymph, peritoneal fluid, cerebrospinal fluid, etc.) or organ biopsies (bone marrow, spleen, etc.), which are mostly obtained through invasive methods. Body fluids or appendages can be alternatives to these invasive biopsies but their appropriateness remains poorly studied. To further address this question, we perform a systematic review on clues evidencing the presence of parasites, genetic material, antibodies, and antigens in body secretions, appendages, or the organs or proximal tissues that produce these materials.

Keywords: Trypanosoma ; Trypanosomiasis ; Leishmaniasis ; Chagas disease ; Canine Leishmaniasis ; Human African Trypanosomiasis ; Sleeping sickness ; Animal trypanosomiasis ; Dourine ; Nagana ; Canine visceral leishmaniasis ; Feline leishmaniasis ; Diagnosis ; Noninvasive biopsy ; Urine ; Feces

1. Introduction

Unicellular eukaryotes of the Trypanosomatidae family include human and animal pathogens that belong to the *Trypanosoma* and *Leishmania* genera (including *Endotrypanum*) (Figure 1). *Leishmania* and possibly *Trypanosoma* are probably descended from the parasites of blood-sucking insects that survived accidental transmission to a vertebrate host during feeding [1].

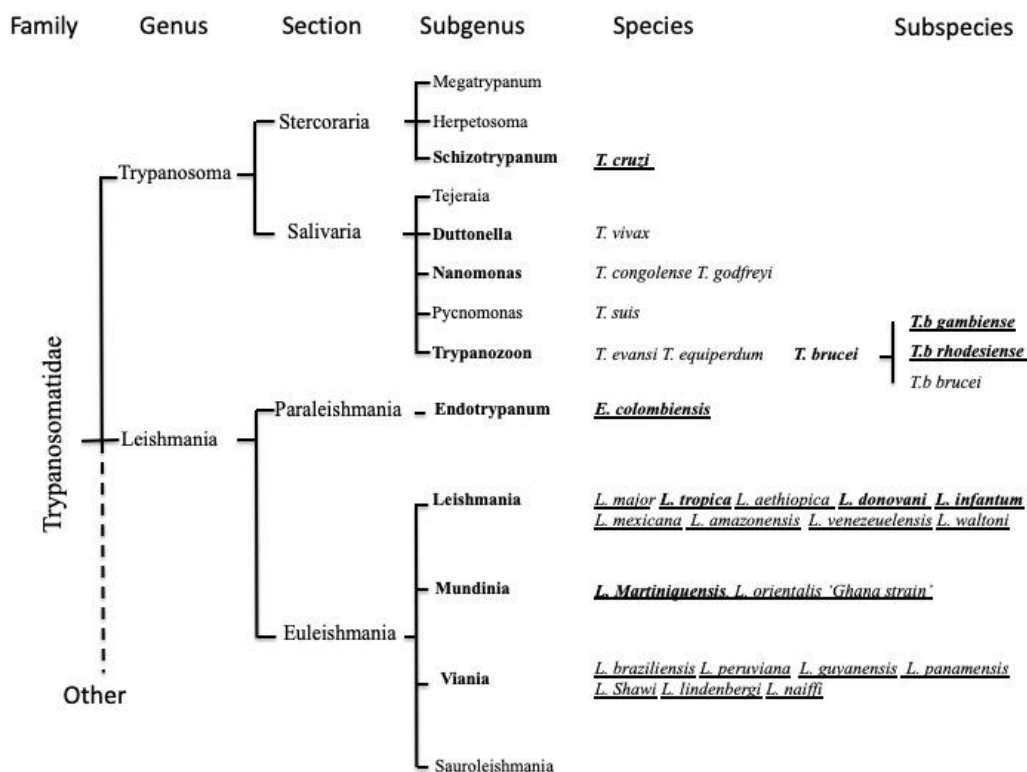


Figure 1. Classification of human and animal pathogenic trypanosomatids. Human pathogenic species are underlined, and pathogens causing systemic infection are in bold.

They possess a complex life cycle that includes arthropod vectors belonging to the Hemiptera and Diptera orders (Figure 2). Two *Trypanosoma* subspecies of *T. brucei* (i.e., *Trypanosoma brucei gambiense*, *T. brucei rhodesiense*) and *T. cruzi*, along with 21 species of *Leishmania*, are pathogenic for humans. They cause human African trypanosomiasis (HAT or

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- Deshmanian — African trypanosomiasis
— American trypanosomiasis — Animal trypanosomiasis

Figure 2. World wide distribution of African trypanosomiasis (H. d. africanum), American trypanosomiasis (Chagas disease), and Leishmaniasis (Leishmania spp.). The map shows the distribution of the three diseases across the world. The map is a world map with the continents of Africa, Europe, Asia, and Australia. The map is color-coded to show the distribution of the three diseases. African trypanosomiasis is shown in red, American trypanosomiasis is shown in blue, and Leishmaniasis is shown in green. The map is titled 'World wide distribution of African trypanosomiasis (H. d. africanum), American trypanosomiasis (Chagas disease), and Leishmaniasis (Leishmania spp.)'. The map is credited to 'The map was created by the author using the data from the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC)'. The map is version 5.

2. **Diagnosis and detection of Trypanosomatid s infections**

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3. Systematic review of Non-invasive Sampling Strategies for the Diagnosis and Detection of Trypanosomatid Pathogens and Infections

biological fluids of Trypanosoma brucei gambiense-infected subjects. *Journal of Proteomics* **2019**, 196, 150-161, [10.1016/j.jprot.2019.05.005](https://doi.org/10.1016/j.jprot.2019.05.005)

The selection of the appropriate biopsy for diagnoses relates to the physiopathology of the diseases, reflecting the

disseminative capacity (tissue or organ tropism) of these pathogens within its host. Therefore, the diagnosis of these diseases requires the sampling of body fluids (blood, lymph, peritoneal fluid, cerebrospinal fluid, etc.) or organ biopsies infected with *Trypanosoma b. brucei*. Tropical Medicine and Parasitology 1989, 11, 35-46.

(bone marrow, spleen, etc.), which are mostly obtained through invasive methods. Alternative biological samples, such as body secretions (milk, saliva, urine, semen, nasal secretion, lacrimal fluid, ear wax, sweat, feces, etc.) or appendages (nail, hair, bristles, etc.) that are constantly produced, might be an interesting alternative to invasive biopsies. No invasive

biological sampling that do not require trained professional and are easy and safe to collect would render the diagnosis of monkeypox more widespread. The kidneys form of *Thymopneumococcus* A distinct stage reveals the pathogenesis of the

and meta-analysis of data extracted from a defined pool of published paper. A schematic overview is given in the Figure

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Figure 4 | Schematic representation of the 33 reported cases of *Trypanosoma* and *Leishmania* parasites in body secretions or appendages. ThA: *Trypanosoma* species responsible for animal trypanosomiasis; Thb: *Trypanosoma* species responsible for human African trypanosomiasis; Tc: *Trypanosoma cruzi* (American trypanosomiasis, Chagas disease); L: *Leishmania* spp. Blue boxes represent material obtained through noninvasive methods, while gray and red boxes represent materials obtained through invasive or highly invasive methods.

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 can predict the effect of a circulating antigen in a primary disease in patients showing a common epitope with an
 serum [25] dominant repetitive antigen. *Experimental Parasitology* 1993; 76
 of patients infected by *donovani* came in the

1930s through the detection of Leishman Donovan bodies in the urine of infected patients [26]. The presence of viable 96. Gowdhamsan Et Al. Gowdhamsan Et Al., Tjipe, Sourabh Jain Et Al. Sourabh Jain Et Al., Test 1. *International Journal of Leishmania parasites and the rise of infected individuals is documented* [27][28][29]. The crossing of the glomerular barrier by *Acmanthia* Science and Research in 2018 and 1991 is documented [26].

Leishmania is thought to be a consequence of VL renal lesions and renal failure [30][31]. Tubulointerstitial involvement and glomerulonephritis are the main causative agents of the proteinuria disorder, which is common in most patients with a clinical episode of leishmaniasis [32][33][34]. In infected individuals, urine represents a fluid from which parasite DNA is easily extracted for detection and species identification [35], and has been probed in the urine of patients [28][36][37][38] and

in animal reservoirs [39][40]. These searches were performed in VL caused by *L. infantum* [28][36][37][38]; in CL and VL-HIV+ 98. Mackie, F.P. Note on some bodies of unknown nature found in faeces of kala-azar patients. Indian. J. Med. Res 1914, patients infected by *L. martiniquensis* [41]; in CL due to *L. major* or *L. tropica* [36], in South American cutaneous and 510-515.

90. Shrivastava H E, [3] Shrivastava R D A, D'Silva M A, Hing S, Vigneshwari C et al. Leishmania doyrani in human face and organs in kala-azar, Indian J Med Res 1923; 644-646.

known since 1948 [1]. The nature of these activities was formerly attributed to antibodies in 1965 [2]. In 1983, the presence of anti-*Leishmania* antibodies in the cornea was demonstrated [44][45]. Since then, the anti-*Leishmania* antibody response in patients to diagnose VL has been further investigated. ELISA, which uses recombinant antigens or whole antigen preparations as well as the direct agglutination test (DAT), were used to test for disease diagnosis using patient

- 102 Ibrahim Hamad, Claire-Lise Forester, Oliver Greub, Katia Jaton, Didier Raoult, Fadi Bitar, Reply to Bastien et al., The sensitivity were comparable to ELISA obtained with ELISA performed using acetone-treated *L. donovani* promastigote antigens or DAT. The detection of the antibody response against *Leishmania* infection, due to *L. major*, *L. tropica* or *L. infantum*, was also investigated using Western blot [38]. IgA or IgG are detected in the urine of dogs suffering from trypanosomatids in fecal samples of great apes. *International Journal for Parasitology: Parasites and Wildlife* **2018**, 7, 322-325, 10.1016/j.ijppaw.2018.09.003.
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- [illegible]

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142. Perrin-Terrin, A.; Aurioi, S.; Mahieu, L.; Debard, A.; Eden, A.; Cassagne, M.; Pagot-Mathis, V.; Malecaze, F.; Soler, V. A swab is a small piece of soft material used for taking a small amount of substance from a body. The conjunctival or corneal swab, a routine practice to perform biological sampling to diagnose eye infection, has been applied to detect trypanosomal pathogens. *2006*.
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- can be detected in the semen of infected dogs, heavy parasite burden has been detected and is associated with inflammation, testicular degeneration, atrophy, an absence of spermatogenesis, and necrosis [197]. These dogs, immunohistochemistry showed that 75% of symptomatic dogs and 35% of asymptomatic dogs were positive for *Leishmania* in the testes. *Thesaurus* **2013**; 24, 220-222, [10.1590/s1944-26622013000100004](https://doi.org/10.1590/s1944-26622013000100004) and asymptomatic leishmaniasis, respectively, in the epididymal duct. The detection of *Leishmania* parasites in semen has been evidenced through parasite culture [29], microscopic observation or immunohistochemistry [195,197], and polymerase chain reaction [195,196,198]. A CVL experimental infection of 8 female dogs pinpoints that vulvar swab is at least as sensitive as oral swab for the detection and quantification of *Leishmania* kDNA, and this methodology is proposed to confirm *Leishmania* infection in seropositive dogs [199]. The presence of *L. infantum* amastigotes in the genital tract of naturally infected bitches is documented [200].
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161. Thalia Monica Olmeida; Georgiana Deak; Zsuzsa Kalmar; Csilla Cserekes; Andre Daffre; Mihaila; Mihaila; Dumitache; Molecular Survey of *Leishmania infantum* Infection in Red Foxes (*Vulpes Vulpes*) from Romania. *Bulletin of epidemiology and preventive medicine* **2021**; 116, 1-6, [10.2478/1167-2825.2021.00041](https://doi.org/10.2478/1167-2825.2021.00041) and sexual transmission is very occasionally observed [202]. *Trypanosoma equiperdum* is possible for domestic animals and even in man with the case of a dog. *Veterinary Medicine* **2017**; 112, 305-306, [10.1016/j.vetres.2016.06.004](https://doi.org/10.1016/j.vetres.2016.06.004) is associated with the detection of parasites in semen [207,208]. For *Trypanosoma vivax*, in addition to tsetse flies, transmission routes include transplacental and sexual routes, and parasites were detected in the semen of infected animals [203,209]. In naturally acquired or experimentally induced animal trypanosomiasis caused by *brucei* or *T. congolense*, a decrease in semen production associated with an alteration in spermatogenesis is recorded [210-214]. Histological lesions characterized by testicular degeneration, epididymitis and epididymal epithelial hyperplasia were detected in the same animals and suggested the participation of the parasite in the pathogenic mechanism of the disease. *Journal of Parasitology* **1981**; 102, 168-181.
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