Decolonising Parasitology: The Case of *Trypanosoma brucei rhodesiense*

Dietmar Steverding[1,*] and Kevin M. Tyler[2]

[1]Bob Champion Research and Education Building, Norwich Medical School, University of East Anglia, Norwich Research Park, James Watson Road, Norwich NR4 7UQ, UK

[2]BioMedical Research Centre, Norwich Medical School, University of East Anglia, Norwich NR4 7TJ, UK

*Correspondence: d.steverding@uea.ac.uk (D. Steverding)

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Abstract

Trypanosoma brucei rhodesiense was named after Rhodesia which in turn was named after the British imperialist and white supremacist Cecil Rhodes. In the light of the Black Lives Matter movement and contemporary consciousness of post-colonial legacy, it seems opportune to reconsider the subspecies name. Pros and cons of renaming *T. b. rhodesiense* are discussed.

Many tropical parasite species were discovered and described at the turn of the 20th century. Most of these research efforts were driven by colonial powers (but not exclusively, e.g. the pioneering work of Oswaldo Cruz (1879-1934) and Carlos Chagas (1872-1917) on Chagas disease in Brazil). Cures for diseases caused by parasites were sought in order to protect military and civilian personnel working in the colonies, and to sustain the native people who provided the labour and local administration needed to maintain a colonial economy and to maximise the economic return. Most of the investigations were carried out by colonial military personnel and by Europe-based scientists. A frequent practice in naming newly discovered parasite species was (and still is) to name them after their appearance, disease characteristics, geographical regions where they were first discovered, discoverers, or in honour of distinguished personalities.

The Discovery of *Trypanosoma* (*brucei*) *rhodesiense*

The identification of the causative agent of human African trypanosomiasis or sleeping sickness is a story of inter-colonial and international collaboration but also a story of serendipity and rivalry [1]. The species *Trypanosoma brucei* was discovered as a causative agent of nagana disease or cattle trypanosomiasis by the Scottish pathologist and microbiologist David Bruce (1855–1931) in 1895 while working for the Army Medical Service [2]. The first unequivocal report of trypanosomes in the blood of a human came from the British Colonial surgeon Robert Michael Forde (1861–1948) in 1901 when examining a steamboat captain in The Gambia [2]. However, he thought it was a worm. It was the English physician Joseph Everett Dutton (1874–1905) who identified the organisms as trypanosomes a few months later and proposed the name *Trypanosoma gambiense* in 1902 [3]. In 1910, the British parasitologists John William Watson Stephens (1865–1946) and Harold Benjamin Fantham (1876–1937) described a trypanosome organism obtained from an English sleeping sickness patient who got infected in the Luangwa Valley (between Mzaza and Feira) in former North-Eastern Rhodesia in September 1909 (**Figure 1**) [4]. At that time the Luangwa

Valley was known to be heavily infested with *Glossina morsitans*, a tsetse fly species unknown in transmitting sleeping sickness in those days [4]. Stephens and Fantham distinguished this newly discovered trypanosome organism from *T. gambiense* on the basis of morphological differences [4]. As they thought they were dealing with a new trypanosome species, they proposed the name *Trypanosoma rhodesiense*.[4]. Today, *T. gambiense* and *T. rhodesiense* are referred to as subspecies of *T. brucei* and have been termed *T. brucei gambiense* and *T. brucei rhodesiense*, although the subspecies/species status of the latter is controversial (see **Box 1** and below) [2,5].

T. b. rhodesiense and Its Eponymous Association with Cecil Rhodes

The naming of *T. b. rhodesiense* followed that of *T. b. gambiense*, which was named after the region where the first case of human infection with this parasite occurred, The Gambia [3]. Accordingly, as the first reported case of sleeping sickness caused by *T. b. rhodesiense* was from Rhodesia, the species was named after this historical region in southern Africa [4]. This territory was demarcated by the British South Africa Company, which comprised three protectorates, North-Eastern Rhodesia, Barotseland-North-Western Rhodesia, and Southern Rhodesia (**Figure 1**). North-Eastern Rhodesia and Barotseland-North-Western Rhodesia were amalgamated in 1911 to form Northern Rhodesia, which has been Zambia since 1964. The name Rhodesia was first used by white settlers in the 1890s who informally called their new home after the British mining magnate and politician Cecil John Rhodes (1853-1902), the founder and managing director of the British South Africa Company. In 1895 the British South Africa Company adopted the name Rhodesia for this southern African territory and the British government followed suite officially in 1898.

Cecil Rhodes was an ardent imperialist and believed in the supremacy of the "*English race*". This racial attitude is confirmed in a letter of 1877 which Rhodes wrote when he was about 22 years old [6]. He also advocated vigorous settler colonialism and was an integral participant in southern African and British imperial policy [7,8]. Cecil

Rhodes was always a controversial figure, but since the 1950s, opposition to his memorials has been escalating. Particularly in South Africa, protesters have demanded his monuments be taken down. In recent years, the Black Lives Matter movement has given fresh impetus to the demand to remove memorials of Cecil Rhodes. For example, in June 2020, the governing body of Oxford Oriel College bowed to student pressure and voted to remove a Rhodes statue from the facade of the college [i]. In response to the Black Lives Matter protests against institutional racism, the Rhodes Art Complex in Bishop's Stortford, Hertfordshire, England, was changed to South Mill Arts in August 2020 [ii]. In this context, it seems timely to re-evaluate the subspecies name *T. b. rhodesiense*.

Renaming *T. b. rhodesiense*: What Are the Options?

There are three options to deal with the controversial subspecies epithet "*rhodesiense*". The first option is to leave it as it is. The second option is to revoke the subspecies status of *T. b. rhodesiense* while the third option is to give *T. b. rhodesiense* a different subspecies epithet. In the following paragraphs, the pros and cons of the second and third options are discussed.

The second option would be in agreement with previous molecular and genetic studies (reviewed in [9,10]) and phylogenetic relationship analysis [11], which all concluded that *T. b. rhodesiense* is only a phenotypic variant of *T. b. brucei* while *T. b. gambiense* type 1 constitutes a valid (sub)species of *T. brucei*. The only characteristic that distinguishes *T. b. rhodesiense* from *T. b. brucei* is the ability of the former to infect humans. The human infectivity of *T. b. rhodesiense* is associated with a single gene, the serum resistance associated (*SRA*) gene [12,13]. Indeed, it has been demonstrated that transferring the *SRA* gene into *T. b. brucei* was alone sufficient to confer resistance to human serum [13]. An accidental laboratory infection with a *T. b. brucei* strain expressing the *SRA* gene proved unequivocally that human infectivity of *T. b. rhodesiense* is solely based on this gene [14]. In addition, it has been shown that

it is possible to experimentally cross *T. b. brucei* and *T. b. rhodesiense* in the laboratory (reviewed in [15]). Some of the hybrid clones acquired copies of the *SRA* gene and were resistant to lysis by human serum, indicating that they inherited the human infectivity phenotype [15]. Furthermore, population genetics studies have evidenced that there is gene flow between *T. b. brucei* and *T. b. rhodesiense* [15]. These studies all strongly suggest that *T. b. rhodesiense* is not a valid subspecies but just a host range variant of *T. b. brucei*. Revoking the subspecies status of *T. b. rhodesiense* leaves the phylogenetically distinct *T. (b.) brucei* and *T. (b.) gambiense* as the two aetiologic agents of human African trypanosomiasis and ameliorates the need for a subspecies nomenclature. The major consequence of doing so is that human infective isolates from surveillance of livestock and tsetse will not be differentiated for human infectivity by their nomenclature unless a suffix (such as SRA+/-) is also adopted. It has the advantage that as well as being more socially acceptable *T. brucei* SRA+ is also more accurate scientifically than *T. b. rhodesiense*. Abolishing the subspecies status of *T. b. rhodesiense* may also cause practical problems in everyday laboratory handling of this parasite. For example, the risk of a mix-up between non-human pathogenic and human pathogenic variants of *T. b. brucei* due to labelling errors may increase. In addition, *T. b. brucei* and *T. b. rhodesiense* are usually assigned to different hazard groups [iii], with *T. b. rhodesiense* being classified as a biological agent that can cause serious disease in humans. The classification of a biological agent in two different hazard groups may cause its own problems with respect to risk assessment and application of appropriate control measures. However, the assignment of a biological agent that includes both pathogenic and non-pathogenic strains in different hazard groups is not unprecedented. For example, the non-pathogenic *Escherichia coli* laboratory strain K-12 is usually assigned to Hazard Group 1 while the verocytotoxigenic *E. coli* strain O157:H7 is classified into Hazard Group 3 [iii]. Revoking the subspecies status of *T. b. rhodesiense* could also raise concerns by clinicians, particularly if the "*brucei*" epithets were retained as it is crucial for them to know with which human-pathogenic *T. brucei* subspecies a patient is infected. This

knowledge is important as different drug regimens are used for the treatment of East African and West African sleeping sickness caused by *T. b. rhodesiense* (then *T. brucei*) and *T. b. gambiense*, respectively, so it may be wise to readopt the use of *T. gambiense*. However, in either case, revoking the subspecies status of *T. b. rhodesiense* may not cause any problems for the treatment of sleeping sickness patients as both forms of the disease have distinct geographical distribution with Uganda being the only country in which both forms of sleeping sickness co-occur but in different regions without overlapping.

For the third option one would need to find a suitable replacement for the subspecies epithet "*rhodesiense*". This should follow the previous naming of the human pathogenic subspecies of *T. brucei*, which was according to the locations of the first reported cases of infection. As the first documented case of *T. b. rhodesiense* infection was from North-East Rhodesia (**Figure 1**) [4], which since 1964 is part of present-day Zambia, the logical choice would be to rename the subspecies as *T. b. zambiense*. As the three British South Africa Company protectorates, North-Eastern Rhodesia, Barotseland-North-Western Rhodesia, and Southern Rhodesia were initially collectively known as Zambesia [iv], *T. b. rhodesiense* could alternatively also be renamed as *T. b. zambesiense*. An obstacle to the renaming is the law of priority, which is a basic principle of the International Code of Zoological Nomenclature [v]. This law states that "*the valid name of a taxon is the oldest available name applied to it*" [v]. However, a name can be invalidated by any ruling of the International Commission on Zoological Nomenclature [v].

Whatever the decision may be, the major obstacle of all remains the more than 100 years of literature published on *T. b. rhodesiense* and East African sleeping sickness. It is easy to remove a statue from public view but it is impossible to erase a species name from the scientific record.

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Resources

[i] https://www.bbc.co.uk/news/education-53487991

[ii] https://www.independent.co.uk/news/uk/home-news/cecil-rhodes-arts-complex-theatre-name-change-black-lives-matter-protests-a9655221.html

[iii] https://www.hse.gov.uk/pubns/misc208.pdf

[iv] https://www.britannica.com/place/Zimbabwe/The-British-South-African-Company

[v] https://iczn.org/the-code/the-international-code-of-zoological-nomeclature/

[vi] https://commons.wikipedia.org/wiki/File:Rhodesia_map_EB1911.png

[vii] https://commons.wikipedia.org/wiki/File:Zanbia_Zimbabwe_Locator.png

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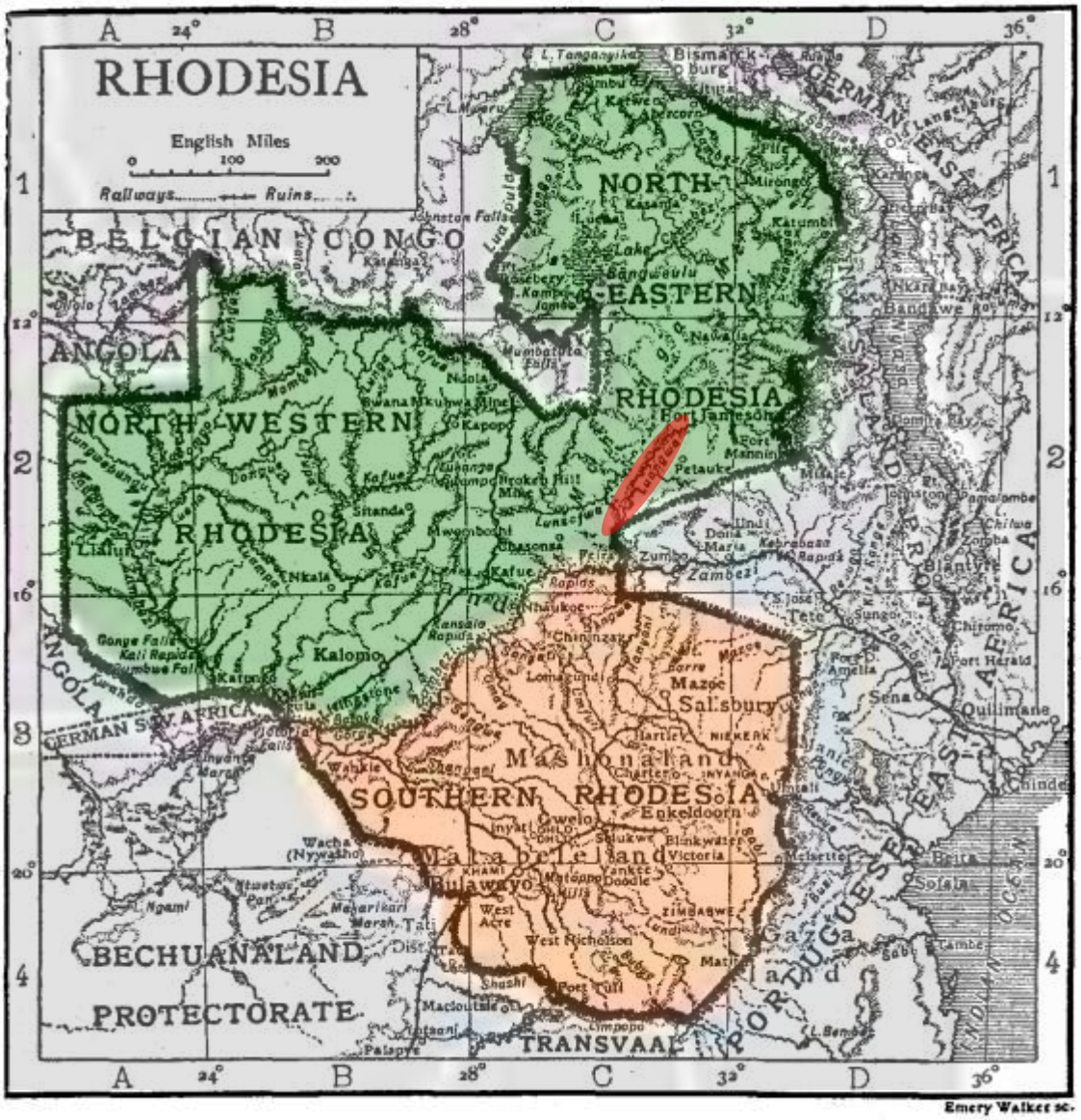
Box 1. How the three subspecies nomenclature became adopted

In the early years of parasitological research, species discovery and identification relied mainly on the description of morphological and biological features. Accordingly, the discovery of sleeping sickness trypanosomes was solely based on morphological description [3,4]. However, when *T. rhodesiense* was discovered, it was thought by some (the so-called "British" school including Bruce himself) that this trypanosome was identical to *T. brucei*, because the two species were morphological indistinguishable, and both were transmitted by the same group of tsetse flies (*G. morsitans* group) and showed equal virulence to animals [9,10]. In contrast, others thought (the so-called "German" school) that *T. rhodesiense* and *T. brucei* were distinct species mainly based on the fact that isolates of *T. brucei* were non-infectious to humans [9,10]. Further evidence for *T. rhodesiense* being a distinct species came from the Tinde experiment, which showed that a strain of *T. rhodesiense* did not lose its human infectivity after prolonged serial cyclical passages (23 years) through tsetse flies and sheep [9,10]. However, human infectivity of *T. rhodesiense* and non-human infectivity of *T. brucei* were shown not to be absolute characteristics of the two species [9]. Eventually, the British protozoologist and parasitologist Cecil Arthur Hoare (1892-1984) demoted both sleeping sickness trypanosome species to subspecies of *T. brucei* [9,10].

Figure 1. Map of historical Rhodesia. The protectorates North-Eastern Rhodesia and North-Western Rhodesia, which were amalgamated into Northern Rhodesia in 1911 (Zambia since 1964), are shown in green. The protectorate Southern Rhodesia (Zimbabwe since 1980) is shown in orange. The region where the first documented case of a human *T. b. rhodesiense* infection presumably occurred is highlighted in red. The map has been created by merging a 1911 Encyclopædia Britannica illustration [vi] and a map indicating the location of Zambia and Zimbabwe [vii].

Figure 1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TRANSVAAL
GERMAN EAST AFRICA
Salisbury
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Mashonaland
Matabeleland
Zambezi
Kalomo
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