

Recommendations from a Satellite Meeting

International Symposium to commemorate the 90th anniversary of the discovery of Chagas disease, April 11-16 1999, Rio de Janeiro, Brazil

During this symposium the standardization of the nomenclature of *Trypanosoma cruzi* strains was discussed, in a parallel session, with a view to facilitating the use and understanding of a common nomenclature that would serve not only taxonomists but the general community of researchers working with *T. cruzi*.

The diversity in the behavior and morphology of *T. cruzi* isolates was soon recognized after the discovery of Chagas disease. Since then a variety of biochemical and molecular techniques have revealed the great genetic diversity present in strains of this parasite. Different investigators have described this diversity by using various terms. Correlation between this diversity and the complex epidemiological and clinical manifestations of the disease has however been hindered by the lack of a common nomenclature.

Recent studies have indicated a convergence among investigators regarding the clustering of strains of *T. cruzi*, into two principal groups. This consensus, together with the report of a meeting on the standardization of methods for *T. cruzi* classification held in Panama (unpublished document TDR/EPICHA-TCC/85.3 Geneva, WHO, 1985), form the basis of the following recommendations.

1. Isolates and strains of *T. cruzi* should be named as recommended by the meeting on Chagas disease held in Panama [*Rev Soc Bras Med Trop* 18 (Supl.): 1985] and the WHO expert committee on the control of Chagas disease (WHO Technical Report Series on Control of Chagas Disease, No. 811, Geneva, 1991) (see Annex A).
2. Isolates and strains of *T. cruzi* after their characterization by molecular techniques, such as multilocus enzyme electrophoresis (MLEE) and random amplification of polymorphic DNA (RAPD), or genetic loci, such as mini exon genes and 24S α rDNA, should be classified into the principal groups as follows:
 - a) strains should be designated as *T. cruzi* I when they are equivalent to Zymodeme 1 (Miles et al. 1977, 1978, Barrett et al. 1980), Type III (Andrade 1974), Lineage 2 (Souto et al. 1996), Group 1 (Tibayrenc 1995) Ribodeme II/III (Clark & Pung 1994) or similar;
 - b) strains should be designated as *T. cruzi* II when they are equivalent to Zymodeme 2 (Miles et al. 1977, 1978, Barrett et al. 1980), Zymodeme A (Romanha et al. 1979), Type II (Andrade 1974), Lineage 1 (Souto et al. 1996), Group 2 (Tibayrenc 1995), Ribodeme I (Clark & Pung 1994) or similar;
 - c) strains that have not been previously characterized or whose characterization is uncertain can be designated as *T. cruzi* (without the group designation suffix);
 - d) the designation of apparent hybrid strains such as those classified as Chilean Zymodeme 2b (Miles et al. 1984), Zymodeme B (Romanha et al. 1979), Type I (Andrade 1974), Group 1/2 typed by 24S α rDNA (Souto et al. 1996), genotype 39 (Tibayrenc 1995) will be decided later after further studies. A similar situation exists for strains equivalent to Zymodeme 3 (Miles et al. 1978, 1981);
 - e) *T. cruzi* I and *T. cruzi* II will be referred to as groups, while further studies on their evolution and inter- and intra-relationships are carried out and an improved terminology is developed, such as discrete typing unit (DTU) (Tibayrenc 1998);
 - f) among the institutions offering identification services and listed in Annex 1 of the WHO report mentioned above, the Laboratory of Parasitic Diseases, Department of Tropical Medicine, at the Instituto Oswaldo Cruz, Fiocruz, Av. Brasil 4365, 21045-900 Rio de Janeiro, RJ, Brasil, E-mail: octaviof@gene.dbbm.fiocruz.br, tel/fax: +55-21-280.3740, has offered to type uncharacterized strains into the principal groups.
3. The editors of scientific journals should request authors to use the correct nomenclature for strains of *T. cruzi* (see Annex A) in their manuscripts and where possible designate their strains *T. cruzi* I, *T. cruzi* II, or *T. cruzi*.
4. A further meeting should be held to implement a strain bank(s), a web-site on the internet as well as improve the designation of strain names in this document. In the meantime the web-site of the *Memórias do Instituto Oswaldo Cruz* where the online version of this document will be held has offered to post a list of strains classified into groups (see Annex B) and to update the list periodically as new results are provided.

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ANNEX A

Designation of isolates and strains

The code for the designation of strains and isolates should consist of four elements, separated by oblique strokes (examples of the four-element code are given in Annex B). The four elements are:

1. the kind of host animal or vector from which the strain was isolated. A four-letter code should be used, the class to which the animal belongs (M for Mammalia) followed by three letters indicating the generic name of the mammalian host or 000 if the host has not yet been identified (in Annex 1 of the WHO report Table A 1.1 gives the code letters to be used for mammalian genera). The WHO report did not provide the code letters for the triatomine vector. Therefore a suggestion for the coding of the vectors is proposed in Annex C;
2. the country in which the isolation was made. The country of isolation is indicated by a two letter code (in Annex 1 of the WHO report Table A 1.2 gives the code letters to be used);
3. the year of isolation. This is indicated by the full four digits. The previous system of using only two digits does not distinguish between the year 2000 and strains whose year of isolation is unknown. These isolates should be referred to as 0000;
4. the laboratory designation (e. g. laboratory code and serial number).

ANNEX B

Examples of strain designations using the four-element code (followed by the *T. cruzi* group designation)

MHOM/CO/0000/Colombia (*T. cruzi* I)
 MHOM/BR/1978/Sylvio-X10 (*T. cruzi* I)
 MDID/BR/1982/Dm-28c (*T. cruzi* I)
 TINF/CL/1945/Tulahen (*T. cruzi* I)
 MHOM/BR/1950/Y (*T. cruzi* II)
 MHOM/BR/1962/Berence (*T. cruzi* II)
 MHOM/BR/1977/Esmeraldo (*T. cruzi* II)
 MHOM/PE/1963/Peru (*T. cruzi*)
 MHOM/BR/1974/12-SF (*T. cruzi*)
 MHOM/BR/1968/Can-III (*T. cruzi*)

ANNEX C

Suggested table of species codes for labelling *T. cruzi* isolates according to the insect host.

Species included

- all New World Triatominae;

Species not included

- insects other than Triatominae;
 - Triatominae known only from the Old World (*Linshcosteus carnifex*, *L. chota*, *L. confusus*, *L. costalis*, *L. kali*, *Triatoma amicitiae*, *T. bouvieri*, *T. cavernicola*, *T. leopoldi*, *T. migrans*, *T. pugasi*, *T. sinica*);

Names included

- names recognized as valid by Lent and Wygodzinsky (1979);
 - names considered to be junior synonyms by Lent and Wygodzinsky (1979) but which have been in use since 1979;
 - names validly published since 1979, whether or not they have subsequently been placed in synonymy;
 - for species attributed to more than one genus since 1979, each binomial is listed, but with the same specific code;
 - names with incorrect spellings in Lent and Wygodzinsky (1979) have been corrected as follows:
 i) *Dipetalogaster maximus* (Uhler) is listed as *Dipetalogaster maxima* (Uhler) – mandatory change, article 34 (b), International Code of Zoological Nomenclature, third edition 1985 (-*gaster* is feminine);
 ii) *Cavernicola pilosa* Barber (incorrect original spelling) is listed as *Cavernicola pilosus* Barber – justified emendation, Article 32 (d) (- *cola* is masculine).

Formation of three-letter species codes

The following simple rules were found to be sufficient for assigning a unique code to each of the species listed.

- I) The first three letters of the specific name were used (e.g. BAR for *Triatoma barberi*) unless this would result in duplication.

II) If different names share an initial triplet, a letter unique to the rest of the specific name is chosen as the third letter of the triplet (e.g. COL for *Triatoma costalimai* and COC for *Belminus costaricensis*). If this is not possible, or if this would result in a triplet corresponding to the initial letters of another species on the list, one of the species is assigned a code as in I) above. Thus BRK for *Triatoma brailovskyi* and BRA for *Triatoma brasiliensis*. BRE is avoided in deference to *Rhodnius brethesi* and *Triatoma breyeri*.

III) If different species have the same specific name, the first letter of the genus is used as the third letter of the code (e.g. HEB for *Belminus herreri* and HEP for *Panstrongylus herreri*) unless the resulting triplet is preoccupied (thus LEV for *Cavernicola lenti*, because LEC is the code for *Triatoma lecticularia*).

Four-letter species codes

It is suggested that the first letter should be T for Triatominae rather than I for Insecta, to avoid duplication with the codes used for *Leishmania* isolates

Species	Genus	Suggested code	Species	Genus	Suggested code
<i>arthuri</i>	<i>Psammolestes</i>	ART	<i>incrassata</i>	<i>Triatoma</i>	INC
<i>arthurneivai</i>	<i>Triatoma</i>	ARN	<i>indictiva</i>	<i>Triatoma</i>	IND
<i>barberi</i>	<i>Triatoma</i>	BAR	<i>infestans</i>	<i>Triatoma</i>	INF
<i>bassolsae</i>	<i>Triatoma</i>	BAS	<i>jurbergi</i>	<i>Triatoma</i>	JUR
<i>bolivari</i>	<i>Triatoma</i>	BOL	<i>laportei</i>	<i>Belminus</i>	LAP
<i>borbai</i>	<i>Microtriatoma</i>	BOR	<i>lecticularia</i>	<i>Triatoma</i>	LEC
<i>brailovskyi</i>	<i>Triatoma</i>	BRK	<i>lenti</i>	<i>Cavernicola</i>	LEV
<i>brasiliensis</i>	<i>Triatoma</i>	BRA	<i>lenti</i>	<i>Panstrongylus</i>	LEP
<i>brethesi</i>	<i>Rhodnius</i>	BRT	<i>lenti</i>	<i>Triatoma</i>	LET
<i>breyeri</i>	<i>Triatoma</i>	BRY	<i>lignarius</i>	<i>Panstrongylus</i>	LIG
<i>bruneri</i>	<i>Triatoma</i>	BRU	<i>limai</i>	<i>Triatoma</i>	LIM
<i>carcavalloi</i>	<i>Triatoma</i>	CAL	<i>longipennis</i>	<i>Triatoma</i>	LON
<i>carioca</i>	<i>Parabelminus</i>	CAC	<i>lutzi</i>	<i>Panstrongylus</i>	LUT
<i>carrioni</i>	<i>Triatoma</i>	CAN	<i>maculata</i>	<i>Triatoma</i>	MAC
<i>chinai</i>	<i>Panstrongylus</i>	CHI	<i>malheiroi</i>	<i>Alberprosenia</i>	MAL
<i>circummaculata</i>	<i>Triatoma</i>	CIR	<i>mansosotoi</i>	<i>Microtriatoma</i>	MAN
<i>coreodes</i>	<i>Psammolestes</i>	COR	<i>martinezi</i>	<i>Torrealbaia</i>	MAR
<i>costalimai</i>	<i>Triatoma</i>	COL	<i>matogrossensis</i>	<i>Triatoma</i>	MAG
<i>costaricensis</i>	<i>Belminus</i>	COC	<i>matsunoi</i>	<i>Hermanlenticia</i>	MAU
<i>cuspidatus</i>	<i>Eratyrus</i>	CUS	<i>matsunoi</i>	<i>Triatoma</i>	MAU
<i>dalessandroi</i>	<i>Rhodnius</i>	DAL	<i>maxima</i>	<i>Dipetalogaster</i>	MAX
<i>deanei</i>	<i>Triatoma</i>	DEA	<i>mazzottii</i>	<i>Triatoma</i>	MAZ
<i>delpontei</i>	<i>Triatoma</i>	DEL	<i>megistus</i>	<i>Panstrongylus</i>	MEG
<i>diasi</i>	<i>Panstrongylus</i>	DIA	<i>melanocephala</i>	<i>Triatoma</i>	MEC
<i>dimidiata</i>	<i>Triatoma</i>	DIM	<i>melanosoma</i>	<i>Triatoma</i>	MES
<i>dispar</i>	<i>Triatoma</i>	DIS	<i>mexicana</i>	<i>Triatoma</i>	MEX
<i>domesticus</i>	<i>Rhodnius</i>	DOM	<i>mucronatus</i>	<i>Eratyrus</i>	MUC
<i>ecuadorensis</i>	<i>Rhodnius</i>	ECU	<i>nasutus</i>	<i>Rhodnius</i>	NAS
<i>eratyrisiformis</i>	<i>Triatoma</i>	ERA	<i>neglectus</i>	<i>Rhodnius</i>	NEG
<i>flavida</i>	<i>Triatoma</i>	FLA	<i>neivai</i>	<i>Rhodnius</i>	NEI
<i>funera</i>	<i>Triatoma</i>	FUN	<i>neotomae</i>	<i>Triatoma</i>	NEO
<i>gajardoi</i>	<i>Mepraia</i>	GAJ	<i>nigromaculata</i>	<i>Triatoma</i>	NIG
<i>galliardi</i>	<i>Triatoma</i>	GAL	<i>ninioi</i>	<i>Triatoma</i>	NIN
<i>garciabesi</i>	<i>Triatoma</i>	GAR	<i>nitida</i>	<i>Triatoma</i>	NIT
<i>geniculatus</i>	<i>Panstrongylus</i>	GEN	<i>obscura</i>	<i>Triatoma</i>	OBS
<i>gerstaeckeri</i>	<i>Triatoma</i>	GER	<i>oliveirai</i>	<i>Triatoma</i>	OLI
<i>gomeznunezi</i>	<i>Triatoma</i>	GOM	<i>pallescens</i>	<i>Rhodnius</i>	PAC
<i>goyovargasi</i>	<i>Alberprosenia</i>	GOY	<i>pallidipennis</i>	<i>Triatoma</i>	PAP
<i>guasayana</i>	<i>Triatoma</i>	GUS	<i>paraensis</i>	<i>Rhodnius</i>	PAR
<i>guazu</i>	<i>Triatoma</i>	GUZ	<i>patagonica</i>	<i>Triatoma</i>	PAT
<i>guentheri</i>	<i>Panstrongylus</i>	GUE	<i>peninsularis</i>	<i>Triatoma</i>	PEN
<i>hegneri</i>	<i>Triatoma</i>	HEG	<i>peruvianus</i>	<i>Belminus</i>	PER
<i>herreri</i>	<i>Belminus</i>	HEB	<i>petrochii</i>	<i>Triatoma</i>	PET
<i>herreri</i>	<i>Panstrongylus</i>	HEP	<i>phyllosoma</i>	<i>Triatoma</i>	PHY
<i>hirsuta</i>	<i>Paratriatoma</i>	HIR	<i>pictipes</i>	<i>Rhodnius</i>	PIS
<i>howardi</i>	<i>Panstrongylus</i>	HOW	<i>picturata</i>	<i>Triatoma</i>	PIR
<i>humeralis</i>	<i>Panstrongylus</i>	HUM	<i>pilosus</i>	<i>Cavernicola</i>	PIL

Species	Genus	Suggested code
<i>pittieri</i>	<i>Belminus</i>	PIT
<i>platensis</i>	<i>Triatoma</i>	PLA
<i>prolixus</i>	<i>Rhodnius</i>	PRX
<i>protracta</i>	<i>Triatoma</i>	PRT
<i>pseudomaculata</i>	<i>Triatoma</i>	PSE
<i>recurva</i>	<i>Triatoma</i>	REC
<i>robustus</i>	<i>Rhodnius</i>	ROB
<i>rubida</i>	<i>Triatoma</i>	RUD
<i>rubrofasciata</i>	<i>Triatoma</i>	RUS
<i>rubrovaria</i>	<i>Triatoma</i>	RUV
<i>rufotuberculatus</i>	<i>Panstrongylus</i>	RUF
<i>rugulosus</i>	<i>Belminus</i>	RUG
<i>ryckmani</i>	<i>Triatoma</i>	RYC
<i>salazari</i>	<i>Psammolestes</i>	SAL
<i>sanguisuga</i>	<i>Triatoma</i>	SAN
<i>scabrosa</i>	<i>Bolboderia</i>	SCA
<i>sinaloensis</i>	<i>Triatoma</i>	SIN
<i>sordida</i>	<i>Triatoma</i>	SOR
<i>spinolai</i>	<i>Mepraia</i>	SPI
<i>spinolai</i>	<i>Triatoma</i>	SPI
<i>stali</i>	<i>Rhodnius</i>	STA
<i>tertius</i>	<i>Psammolestes</i>	TER
<i>tibiamaculata</i>	<i>Triatoma</i>	TIB
<i>trinidadensis</i>	<i>Microtriatoma</i>	TRI
<i>tupynambai</i>	<i>Panstrongylus</i>	TUP
<i>turpiali</i>	<i>Panstrongylus</i>	TUR
<i>venosa</i>	<i>Triatoma</i>	VEN
<i>vitticeps</i>	<i>Triatoma</i>	VIT
<i>williami</i>	<i>Triatoma</i>	WIL
<i>wygodzinskyi</i>	<i>Triatoma</i>	WYG
<i>yurupucu</i>	<i>Parabelminus</i>	YUR

Notes: bibliographic references for names, descriptions and synonymies can be found in Carcavallo et al. 1998, Jurberg and Galvão 1997, Lent and Wygodzinsky 1979.

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