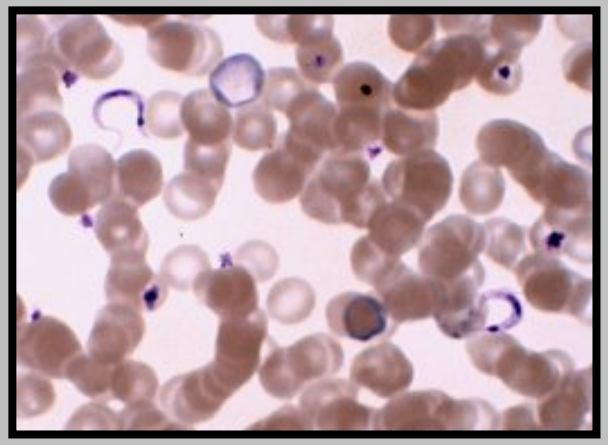
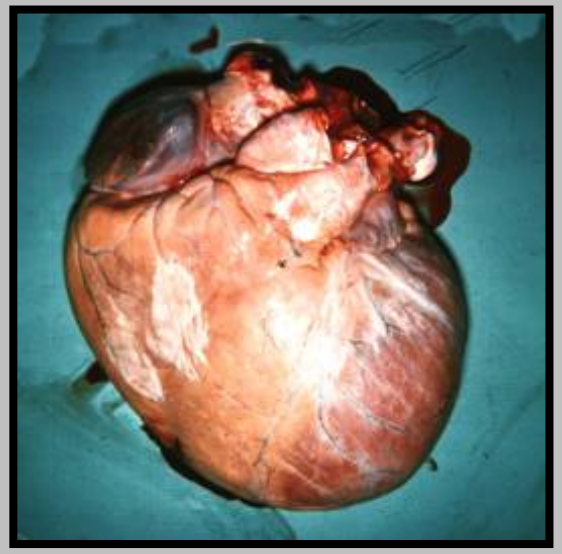
# The Kiss of Death

***Triatoma infestans***

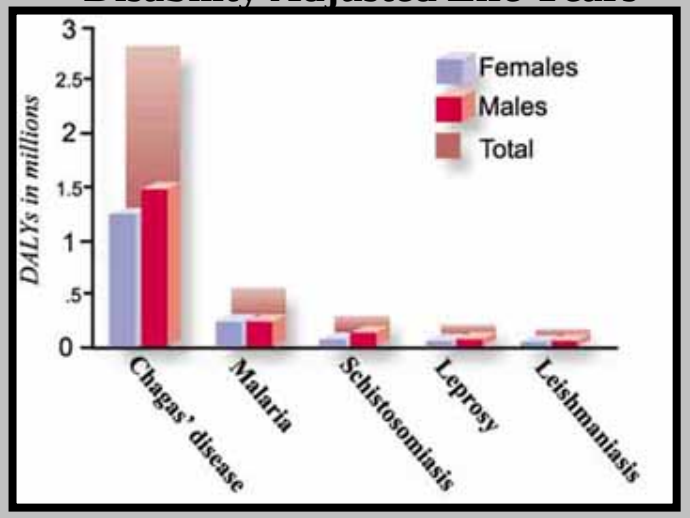
# Chagas Disease

## 15 - 18,000,000

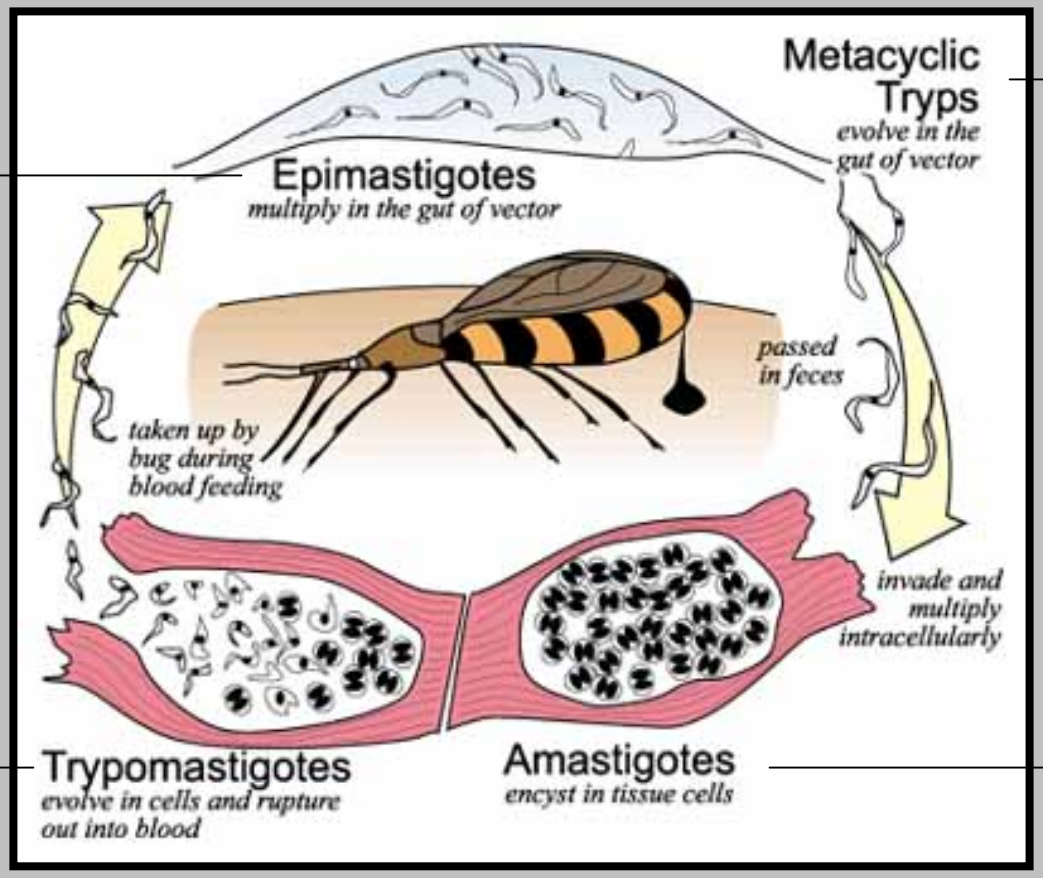


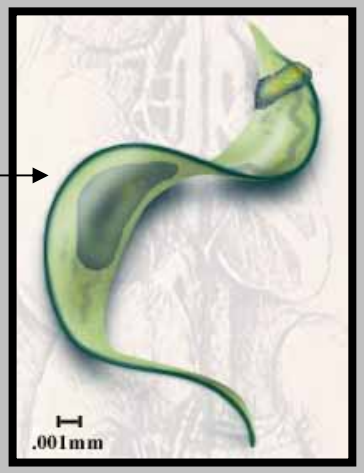


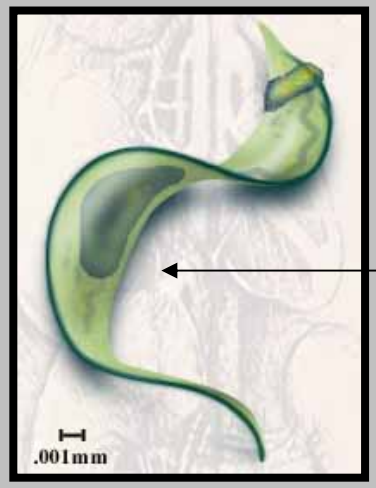
**Disability Adjusted Life Years**

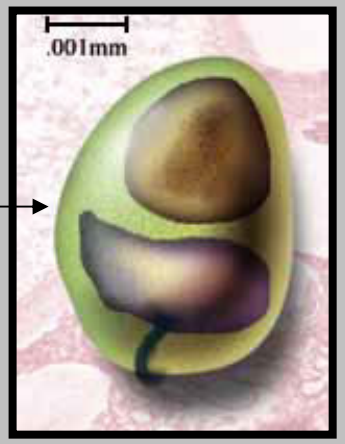


# *Trypanosoma cruzi* Life Cycle

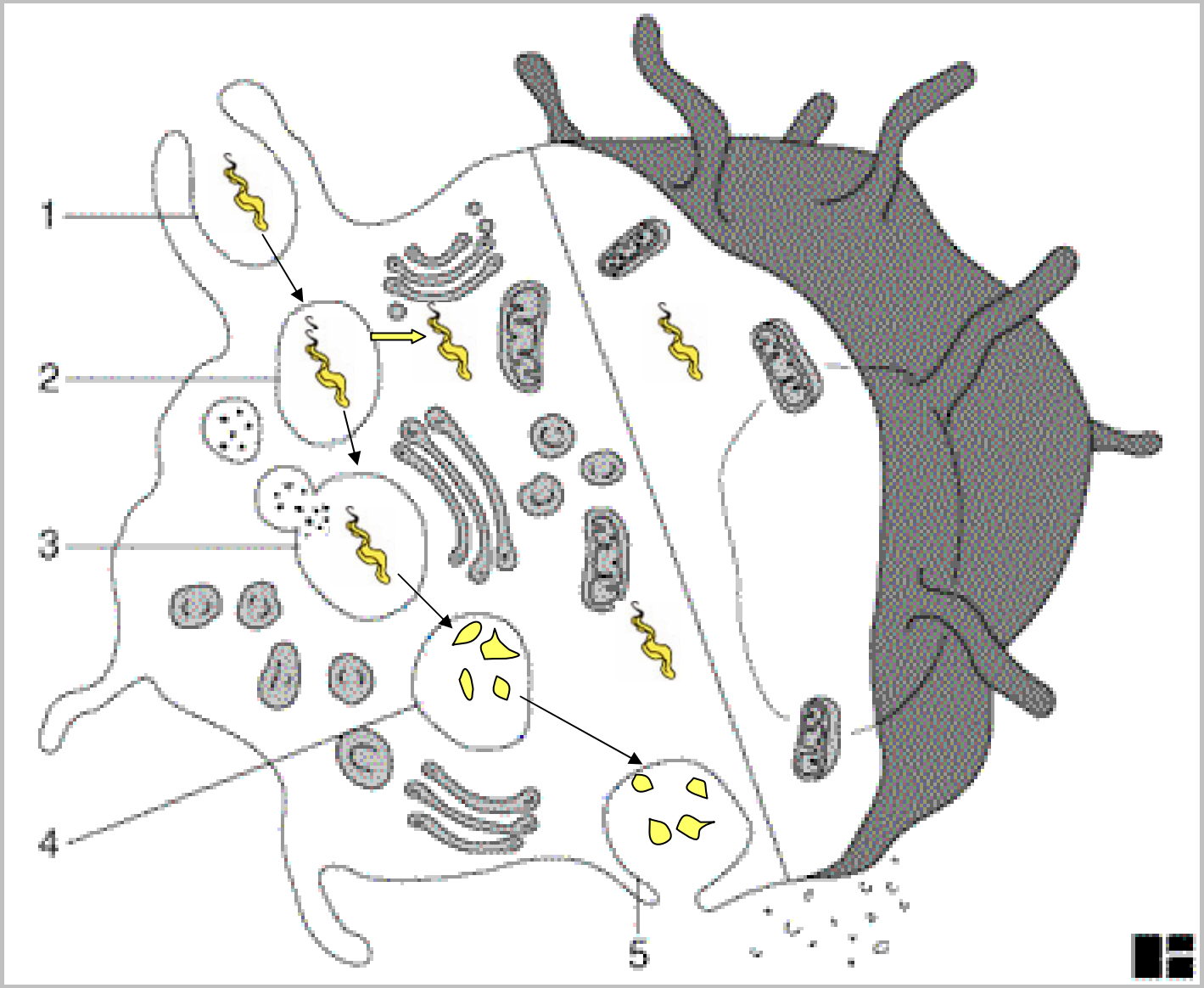


# *Trypanosoma cruzi*
# Intracellular survival



# *Trypanosoma cruzi* – Disease Distribution

# *Trypanosoma cruzi* strains

*Table 1 - Strains of* T. cruzi *from different areas of Brazil.*

| Area | State | Biodeme | Zymodeme | Nr | Origin |
|---|---|---|---|---|---|
| North | Pará | III | Z1 | 5 | human |
| Northeast | Ceará | II | Z2 | 1 | human |
| | | III | Z1 | 6 | animals |
| | Paraíba | III | Z1 | 3 | human |
| | Bahia: east[1] | II | Z2 | 23 | human |
| | southeast | II | Z2 | 1 | triat. |
| | north | III | Z1 | 8 | opos |
| Center W | Goiás[2] | II | Z2 | 28 | human |
| | MG and BA[3] | II | Z2 | 16 | human |
| | | III | Z1 | 15 | human |
| Center S | MG | II | Z2 | 3 | human |
| South | SP, SC, RS | I | Z2b | 2 | human opos. |
| | | II | Z2 | 1 | human |
| | | II | Z1 | 4 | triat. opos. |

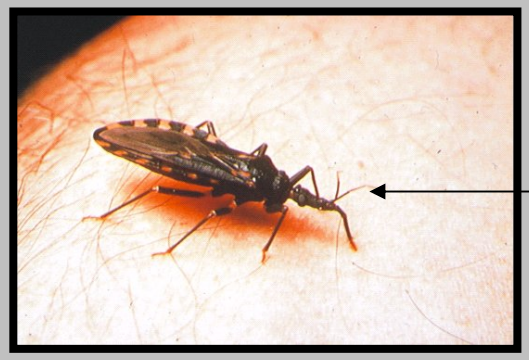
1 Recôncavo bahiano; 2 Mambaí-GO; 3 Montalvania-MG and neighboring localites of Bahia. BA = Bahia; MG = Minas Gerais; SP = São Paulo; SC = Santa Catarina; RS = Rio Grande do Sul.

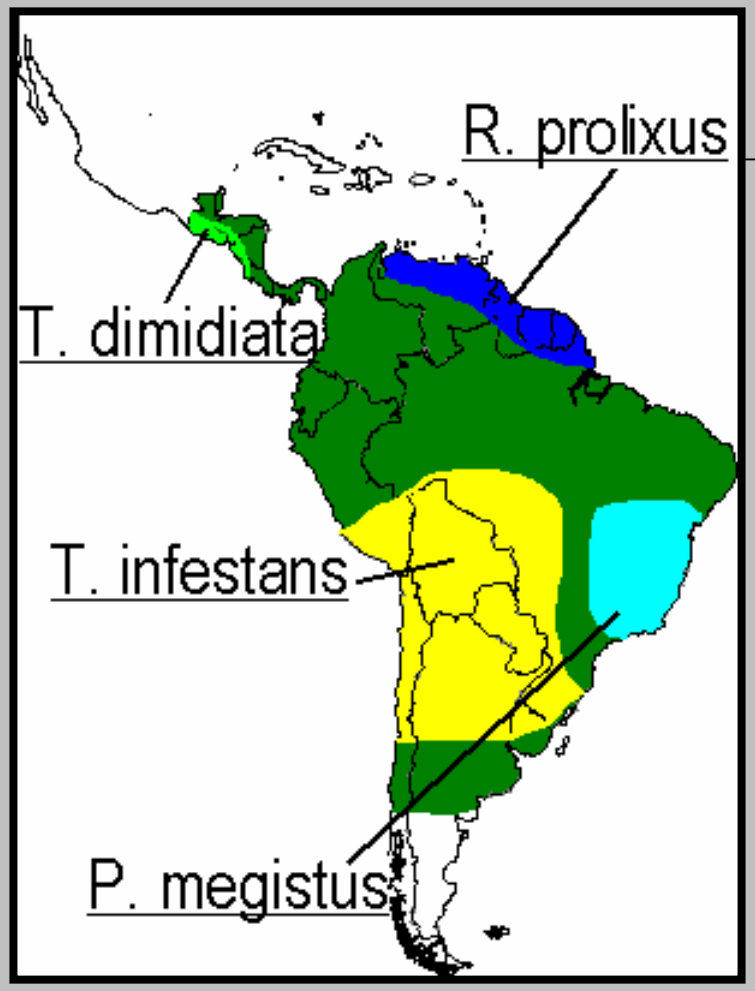
*Table 2 - Strains of* T. cruzi *from other countries of South and Central America.*

| Country | Area | Biodeme | Zymodeme | Nr | Origin |
|---|---|---|---|---|---|
| Argentina | San Luis (AWP) | I | Z2b | 1 | human |
| | San Luis (CA-I) | III | Z1 | 1 | human |
| | San Luis | - | Z2b | 1 | human |
| | Apipe Gde. | - | Z2b | 1 | human |
| | Corrientes | - | Z2b | 1 | human |
| | La Pampa (RA) | II | Z2 | 1 | human |
| Bolivia | Santa Cruz | III | Z1 | 1 | triat. |
| | Chiwisivi (C-8) | III | Z1 | 1 | triat. |
| | Chiwisivi (C-50) | - | Z2b | 1 | triat. |
| Colombia* | | III | Z1 | 1 | triat. |
| Peru** | | I | Z2b | 1 | human |
| Chile | Vale Elqui | II | Z2 | 3 | human |
| | Antofagasta | III | Z1 | 1 | triat. |
| Honduras | | III | Z1 | 2 | triat. human |
| Guatemala | | III | Z1 | 1 | human |

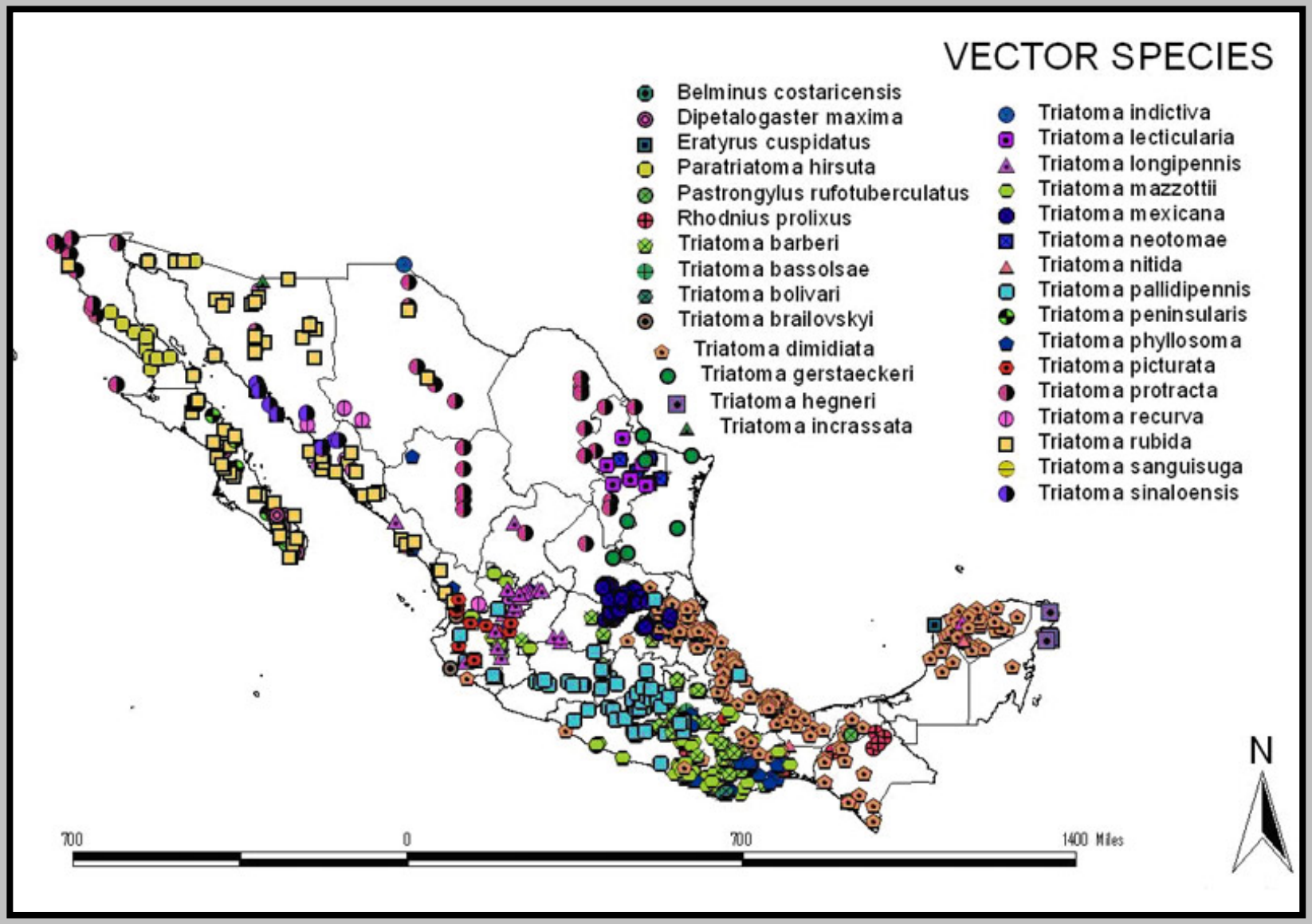
* prototype of Type III; ** prototype of Type I.

# *Trypanosoma cruzi* – Vector Distribution

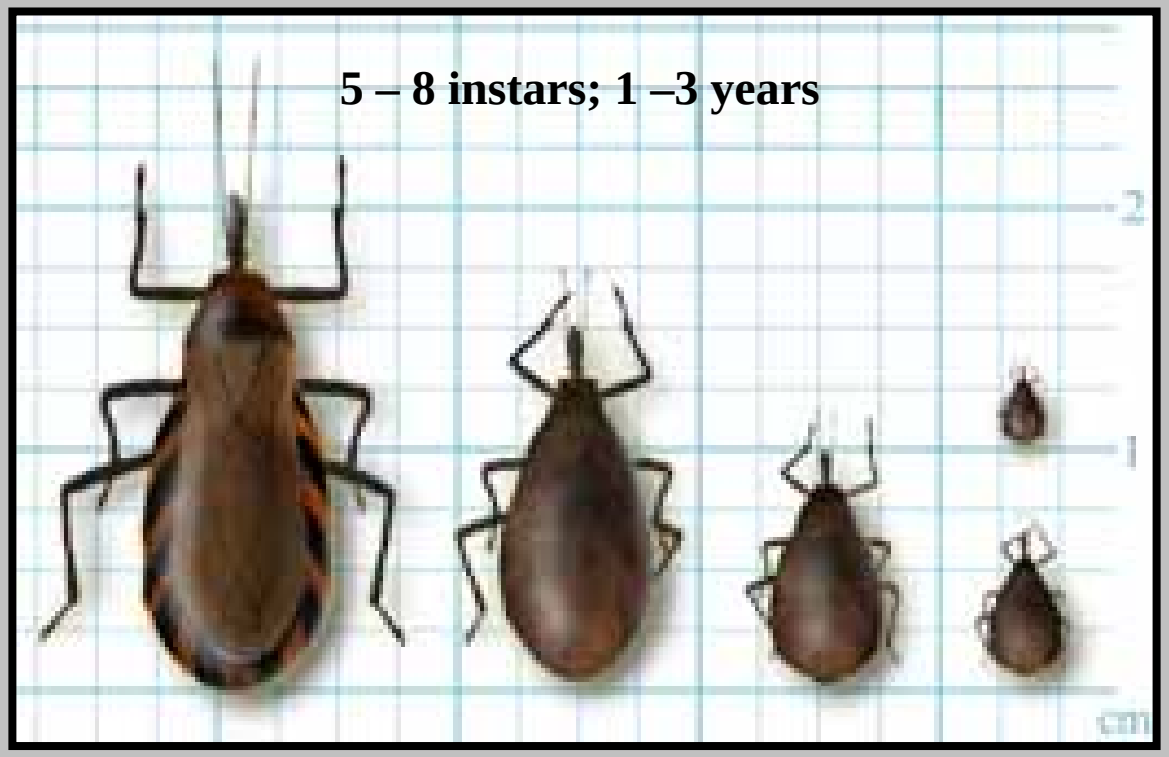




# *Trypanosoma cruzi* – Vector Distribution Mexico

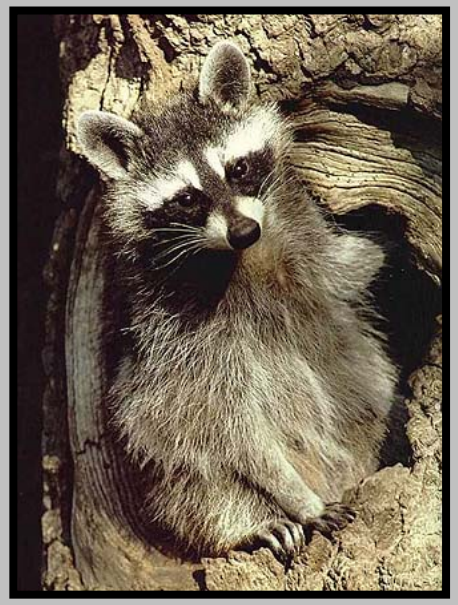


# Triatomid Biology



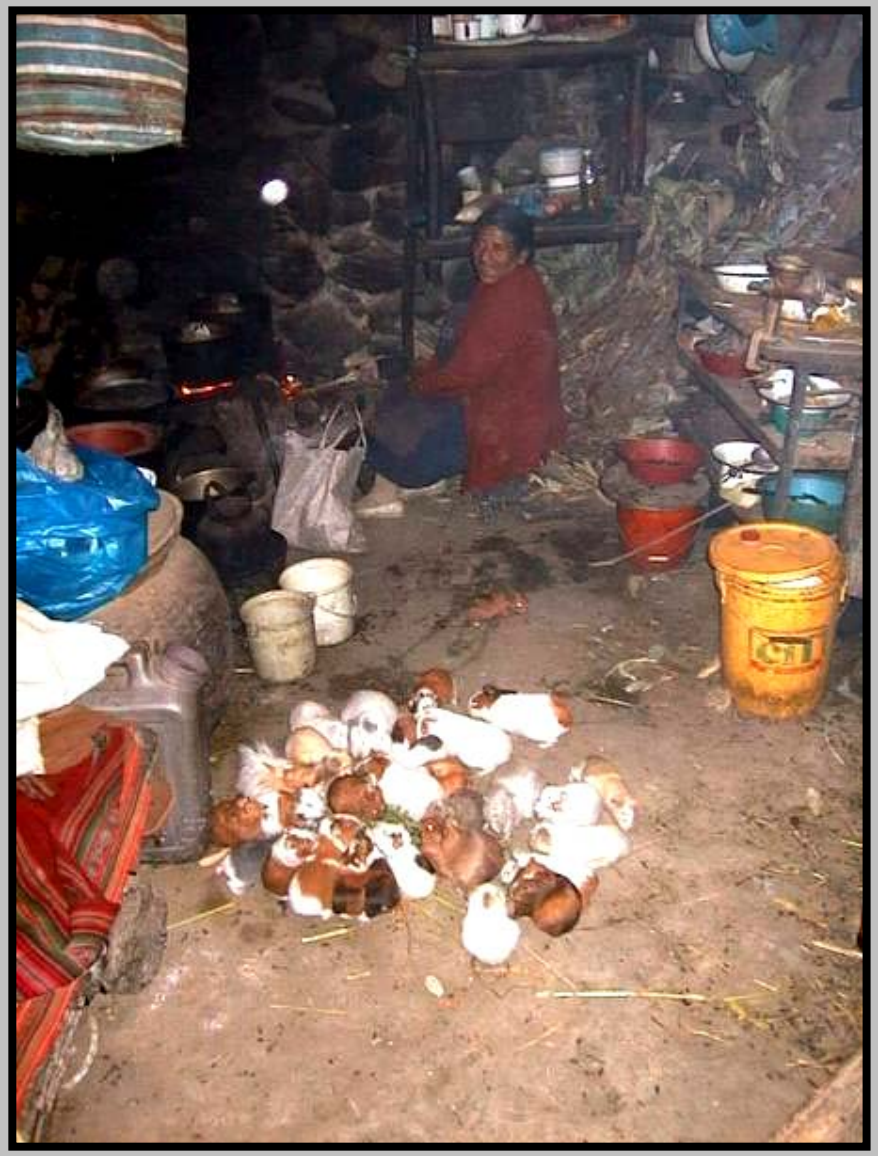
# Triatomid Ecology

# *Trypanosoma cruzi* - Reservoir Hosts

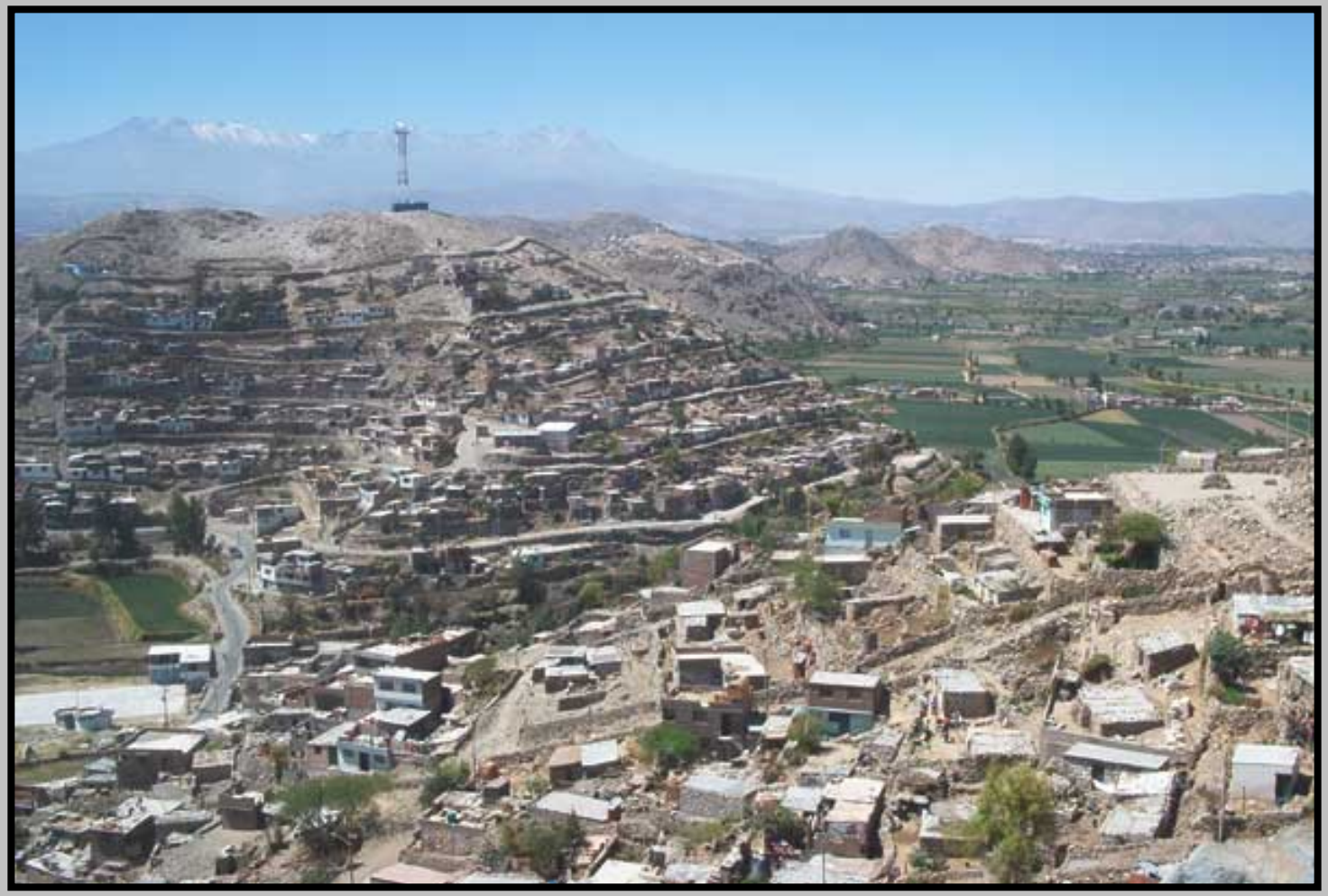


**33% pos - Virginia**

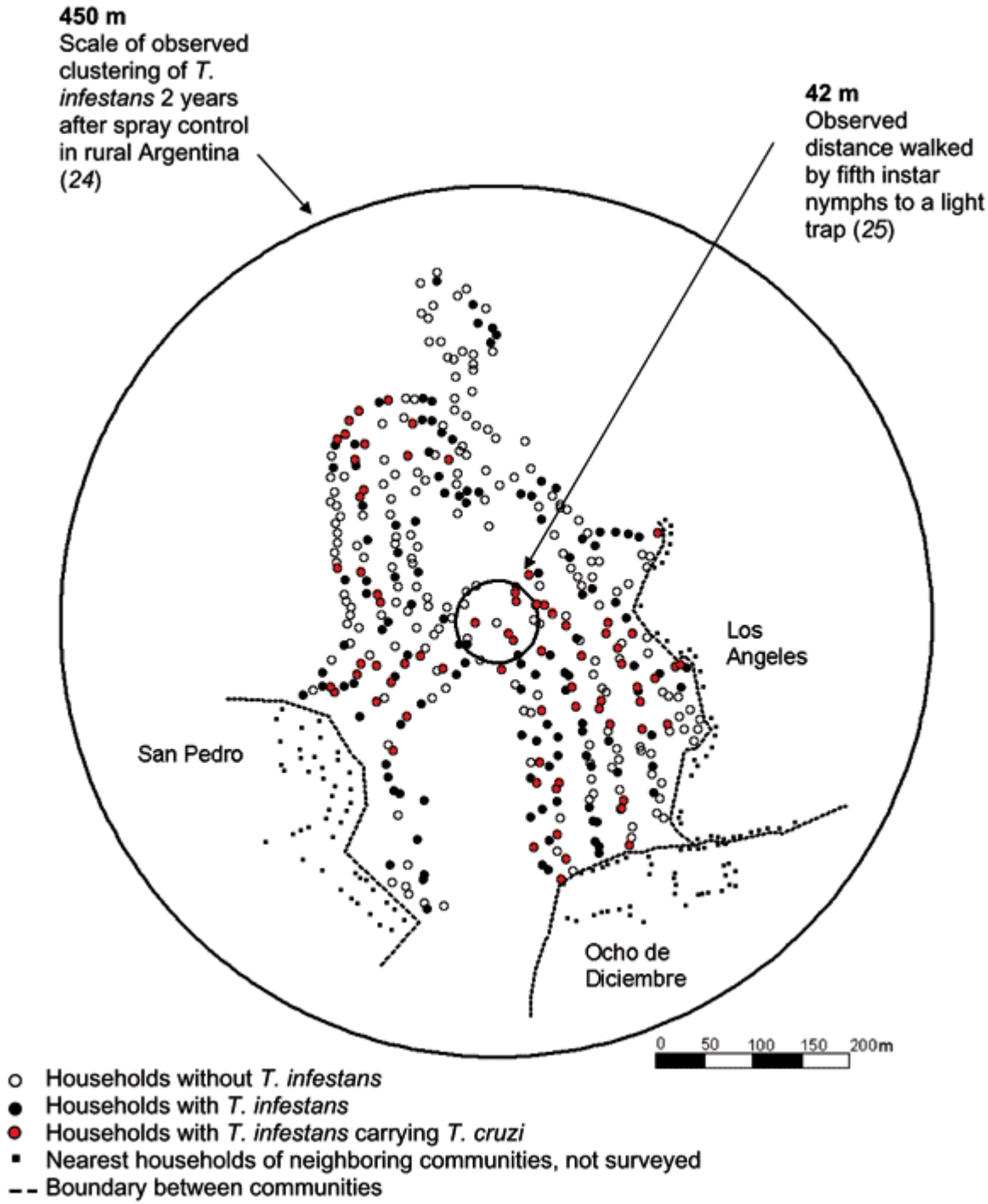
# *Trypanosoma cruzi* - Reservoir Hosts (cont.)



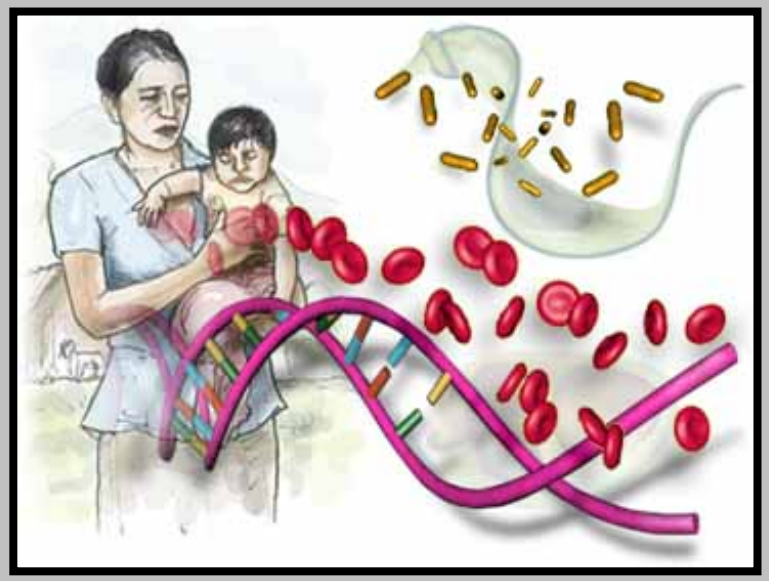
# Guadalupe, Arequipa, Peru



# Guadalupe, Arequipa, Peru



# Chagas Disease Transmission Routes Other Than Vectorborne



# *Trypanosoma cruzi* – Blood Transfusion Potential

| Country | No. of donors | Absolute no. of transfusion-transmitted infectious diseases[b] | | | | | Infection spreading index[c] /$10^4$ | Ratio of infections: donations |
|---|---|---|---|---|---|---|---|---|
| | | HIV | HBV | HCV | *T. cruzi* | Total | | |
| Bolivia | 37,948 | 2 | 49 | NA[e] | 832 | 883 | 233 | 1:43 |
| Chile[d] | 217,312 | 0 | 8 | 1681 | 236 | 1925 | 88 | 1:113 |
| Colombia | 352,316 | 8 | 32 | 2364 | 875 | 3279 | 93 | 1:107 |
| Costa Rica | 50,692 | 0 | 2[f] | NA | NA | NA | NA | NA |
| Ecuador | 98,473 | 9 | 33 | 92 | 20 | 154 | 16 | 1:639 |
| El Salvador | 48,048 | 0 | 12 | 82 | 85 | 179 | 37 | 1:268 |
| Guatemala | 45,426 | 0 | 49 | 226 | 33 | 308 | 68 | 1:147 |
| Honduras | 27,885 | 0 | 9 | 10 | 7[f] | 26 | 9 | 1:1072 |
| Nicaragua | 46,001 | 0 | 65 | 94 | 10 | 169 | 37 | 1:272 |
| Paraguay | 32,893 | 0 | 23 | NA | 41 | 64 | 19 | 1:514 |
| Peru[g] | 52,909 | 0 | 4[f] | 147 | 393 | 544 | 103 | 1:97 |
| Venezuela | 204,316 | 0 | 22[f] | 1312 | 57[f] | 1391 | 68 | 1:147 |

## Mexico City

TABLE I

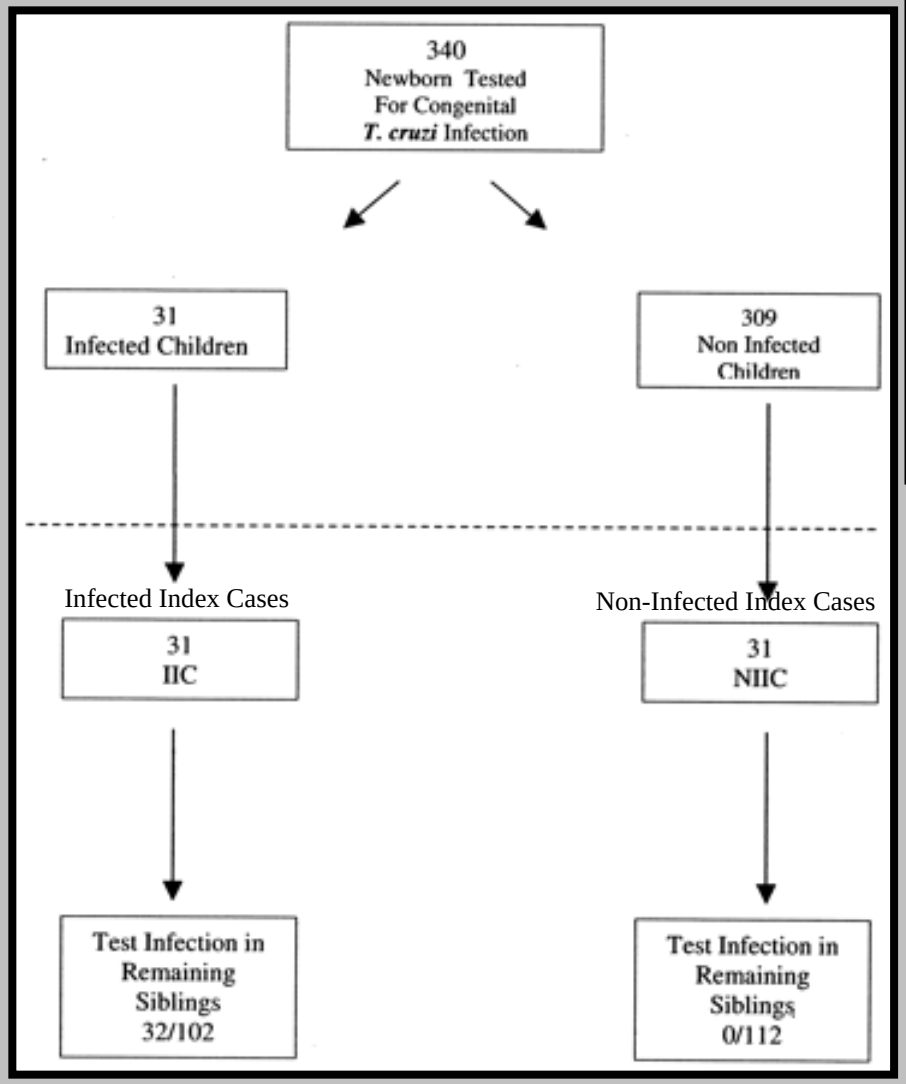
Seroprevalence in blood donors at the Instituto Nacional Cardiología "I. Chávez" in a period of five years (1999-2003)

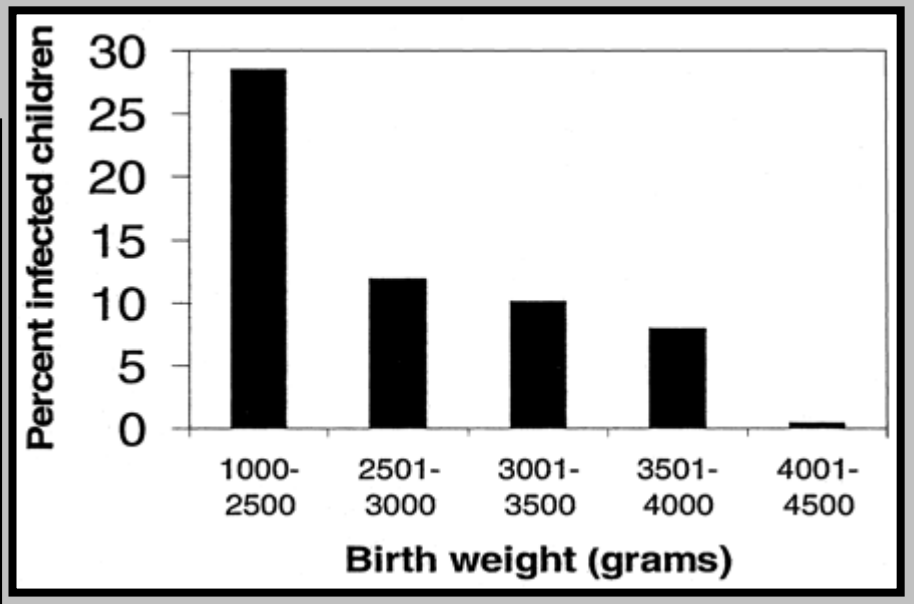
| Year | *T. cruzi* (%) | HVC (%) | HIV (%) | HVB (%) |
|---|---|---|---|---|
| 1999 n = 7673 | 25[a] (0.32) | 22 (0.28) | 15 (0.19) | 4 (0.05) |
| 2000 n = 8756 | 28 (0.31) | 24 (0.27) | 10 (0.11) | 9 (0.1) |
| 2001 n = 8932 | 20 (0.22) | 22 (0.24) | 6 (0.06) | 5 (0.05) |
| 2002 n = 8230 | 30 (0.36) | 37 (0.44) | 31 (0.37) | 7 (0.08) |
| 2003 n = 9457 | 58 (0.6) | 16 (0.16) | 4 (0.04) | 9 (0.09) |
| Total 43,048 | 161 (0.37) | 121 (0.28) | 66 (0.15) | 34 (0.07) |

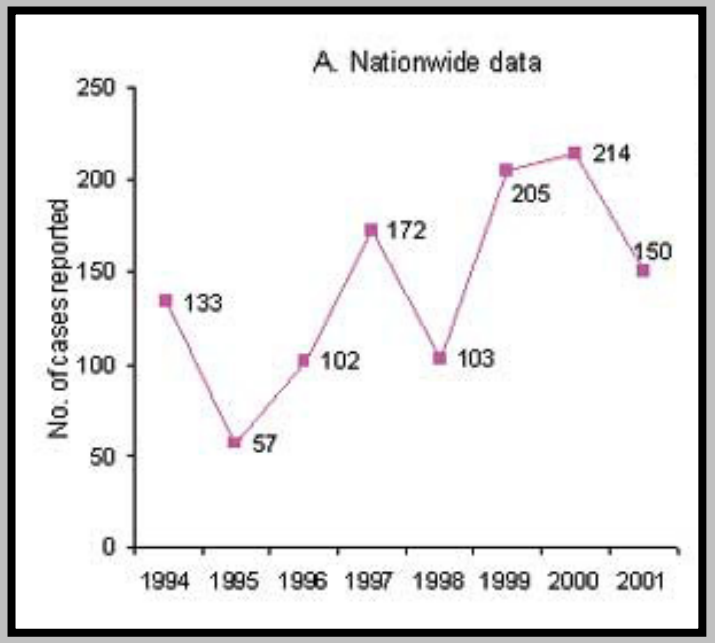
*a*: number of positive blood donors confirmed by at least two different tests. In the case of *Trypanosoma cruzi* by ELISA and IIF, for HIV, HVB and HVC by ELISA and Western blot and RIBA in exceptional cases (genome amplification).

# *Trypansoma cruzi* – Congenital Transmission

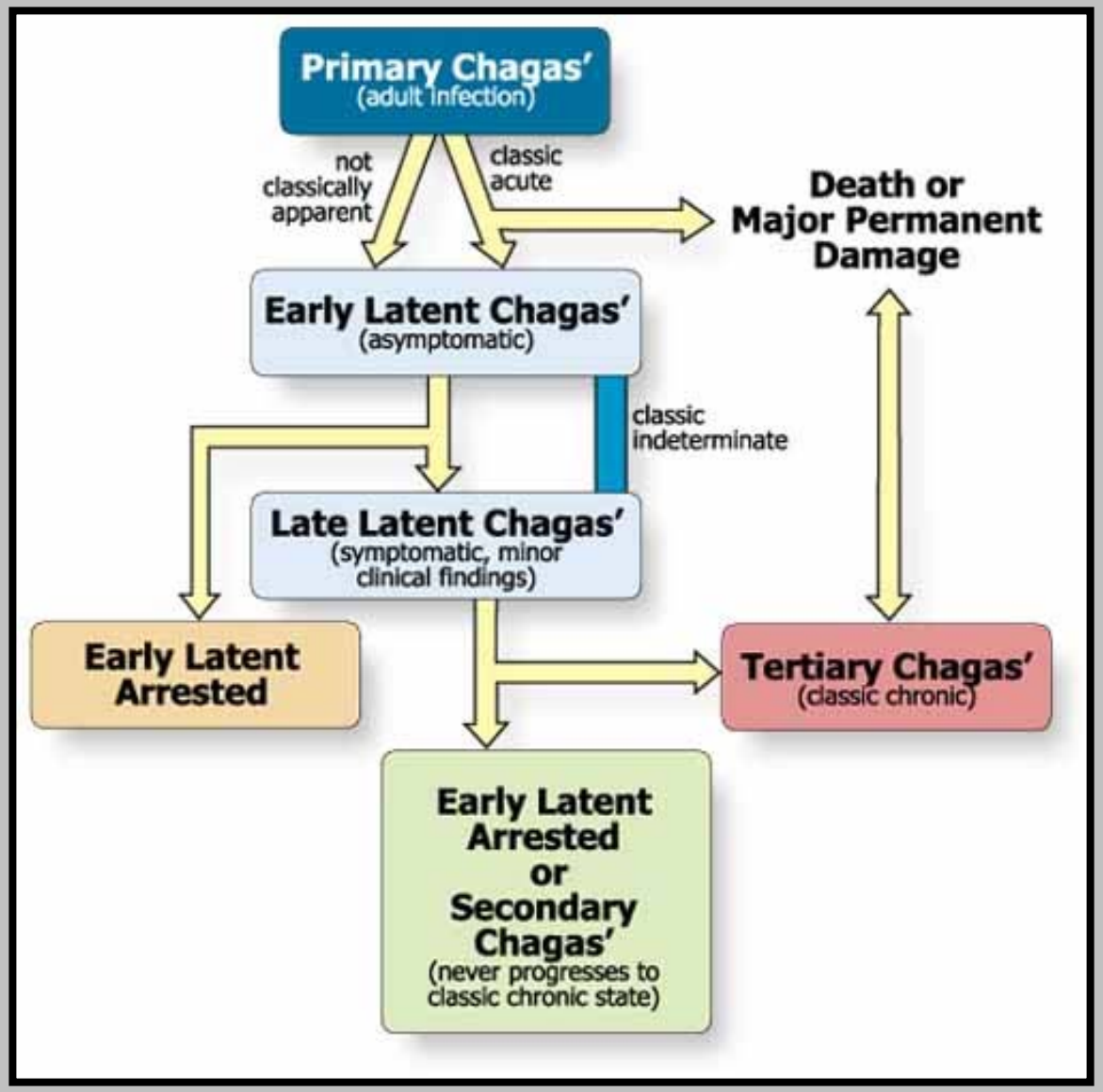
## ARGENTINA



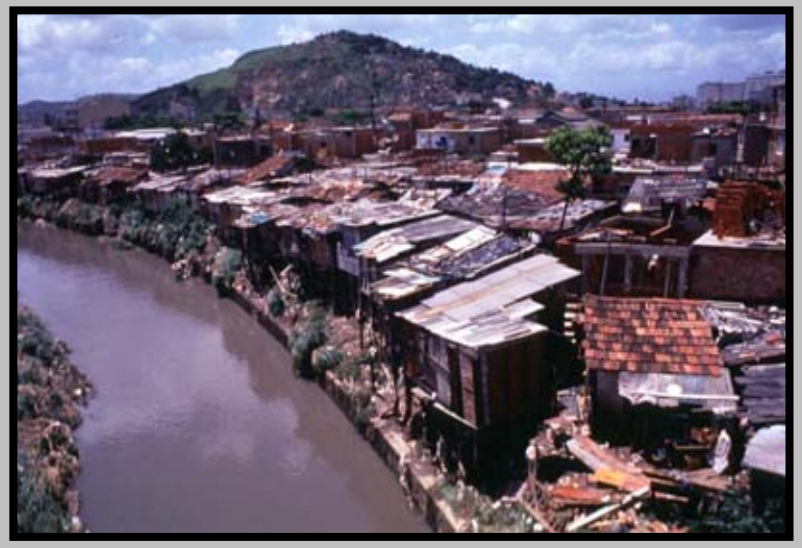



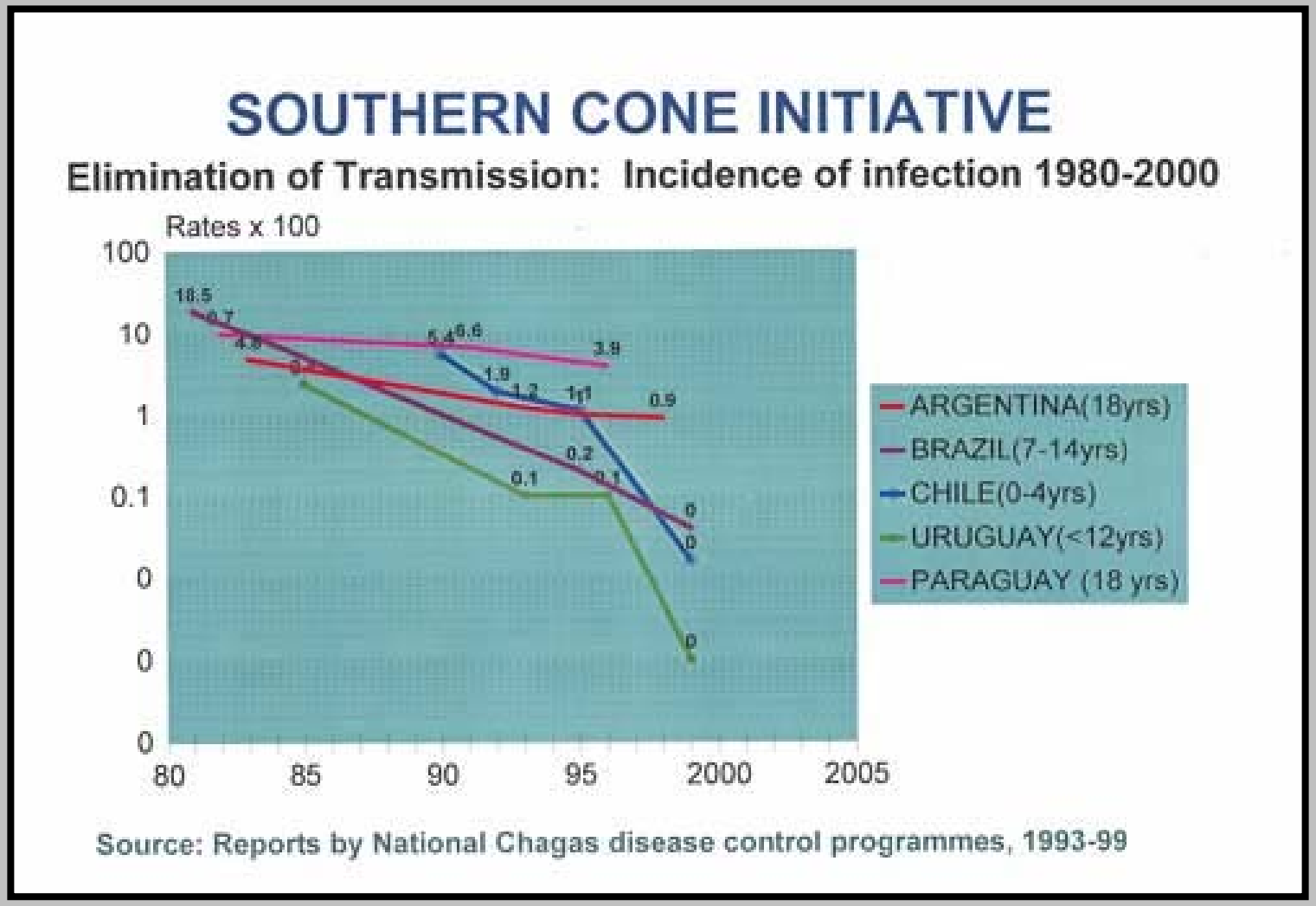
# Chagas Disease Outcomes



# Chagas Disease - Prevention and Control



# Chagas Disease – Southern Cone Initiative



# Chagas Disease Diagnosis and Treatment

Microscopy

ELISA

Xenodiagnosis

**Treatment**

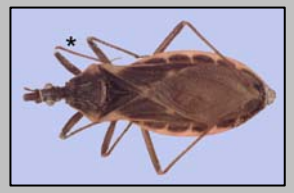
**Bensnidazole – early**
**Late stage disease ?**
**Future – TAK 187**
**(inhibits ergosterol)**

# Chagas Disease - Threat to the US

**Reservoir hosts**

**IMMIGRATION**

**Blood banks**



**Vectors**

**Organ transplants**

# *Trypanosoma cruzi* - Serology, U.S.

**Table 1. Seroprevalence of *Trypanosoma cruzi* in Three ARC Regions**

| | Los Angeles | Miami | Tulsa |
|---|---|---|---|
| Total no. donors | 1,038,496 | 180,942 | 100,089 |
| "Yes" respondents | 73,413 (7.1%) | 25,875 (14.3%) | NA |
| "Yes" tested | 71,560 | 25,353 | NA |
| EIA repeat reactive | 305 | 75 | 150 |
| Confirmed positive # | 137 | 19 | 3 |
| Confirmed positive rate | **1/7,600** | **1/9,500** | **1/33,000** |

# Arizona triatomids

*Paratriatoma hirsuta* Barber, 1938
*Triatoma incrassata* Usinger, 1939
*Triatoma indictiva* Neiva, 1912
**Triatoma lecticularia* Stål, 1859
**Triatoma neotomae* Neiva, 1911
**Triatoma protracta* Uhler, 1894
**Triatoma recurva* Stål, 1894
**Triatoma rubida* Uhler, 1894
**Triatoma sanguisuga* Leconte, 1855

*known sylvatic vector of *Trypanosoma cruzi*