

# Tropical Diseases

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ON ITS “tropical diseases” Web page, the World Health Organization (WHO) lists eight diseases that occur exclusively or especially in the tropics and states that, for all practical purposes, the designation refers to infectious diseases that proliferate in hot and humid weather conditions. Some of these diseases are caused by protozoa, such as malaria, leishmaniasis, Chagas’ disease and sleeping sickness. Others are caused by worms, including schistosomiasis, onchocerciasis and lymphatic filariasis. One is viral, dengue fever. The eight WHO tropical diseases are transmitted to humans by various means, but always include a vector that is generally a hematophagous insect. Schistosomiasis has no vector, but rather intermediary hosts – snails – that release in water the infectious forms for humans.

The designation “tropical diseases” was not invented by the WHO and has been part of the medical vocabulary since the 19<sup>th</sup> century. It arose at no particular date and was gradually consolidated, as microorganisms came to be acknowledged as the causal factors of diseases and had their transmission mechanisms elucidated. The colonial expansion of England, France and other minor partners, including the United States, into the Caribbean and the Pacific, unfolded a new world full of exploitable riches, but also of unknown or unwonted diseases. Since most of the new colonies were located in the tropics, these curious and exotic diseases were said to be “tropical”. Aiming to agglutinate knowledge on pathologies from the tropics, several medical societies were founded, including The Society of Tropical Medicine of Philadelphia (later American Society of Tropical Medicine) in 1903 and The Royal Society of Tropical Medicine and Hygiene in 1909. Patrick Manson, the man who developed the “mosquito theory” for the transmission of infectious diseases and who founded the London School of Hygiene and Tropical Medicine in 1899, was the first president of the Royal Society. These institutions officialized the designation “tropical diseases” in medical terminology.

From the start, however, many scientists, especially those from the tropics, disputed the “tropical diseases” designation, because it implicitly denoted some sort of biogeographic curse or fate. Inflexible, they concurred with Afrânio Peixoto, whose first course as tenured professor of Hygiene at the Rio de Janeiro Medical School, a few years after the creation of the Royal Society, emphatically proclaimed that “climatic diseases do not exist”. Underlying Peixoto’s arguments and those of many of his contemporaries, is a manifest objection to the view that the “tropical climate” was somehow responsible for the “tropical diseases”,

and not the precarious living and economic conditions of the populations of the tropics. The first half of the 20<sup>th</sup> century witnessed the aggravation of conflicting positions, both by doctors and laypeople, regarding the root causes of “tropical diseases”. These positions consolidated into two antagonistic views of tropical diseases: a) “they are diseases of colonized, exploited, miserable populations that by mere chance are concentrated in the tropics”; b) “they are diseases of insalubrious, canicular, foul regions susceptible to every form of disease unknown to the civilized world”.

Foto Acervo do Arquivo da Academia Brasileira de Letras



*Afrânio Peixoto (1876-1947).*

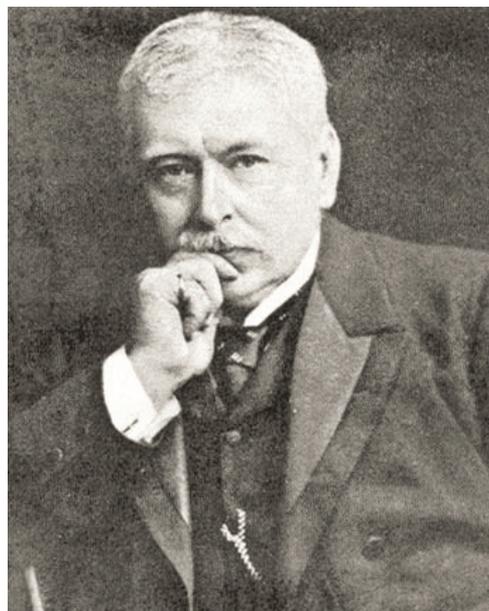


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*Patrick Manson (1844-1922).*

There is certainly a strong component of underdevelopment in tropical diseases, a belated consequence from colonial times, but there is also a certain tropical fate, the consequence of heterogeneous geological and biological evolution. We propose to analyze this duality, but it must be stressed that every human ailment is tropical in principle, since the human species emerged from the tropics and brought along its diseases. The diseases that humankind acquired throughout history (some of them quite recently) from its partners in the journey – such as dogs, cats, rodents, birds and even our close relatives, the primates – are the exception, not the rule.

*Malaria* is a good starting point for our analysis. The microorganisms that cause the disease are parasitic protozoa of red blood cells, comprising four species of the genus *Plasmodium*. Of all the Earth’s animals, these four species parasitize only humans, to whom they are transmitted by mosquitoes that transport them from the sick to the healthy (albeit not for long). These hematophagous mosquitoes, archenemies of humankind, are called *Anopheles* and appeared on our planet millions of years before human plasmodia species and comprise thousands

of species around the world. The four species of plasmodia have accompanied humankind since *Homo sapiens* and *Plasmodium* ssp left Africa together to populate the Earth. In each corner of the planet – cold, temperate or tropical – this duo has relied on the complicity of a priorly existing species of *Anopheles* to proliferate and perpetuate itself. The Man-Plasmodium-Anopheles triad took over the world. With the exception of the polar regions, no inhabited nook or cranny managed to avoid malaria, which became a universal scourge. Likewise, no nation – modern or ancient – managed to escape. Europe itself fell victim to malaria since the time it was invaded by *Homo sapiens* over 50,000 years ago and remained in the disease's hold until the 20<sup>th</sup> century, regardless of religion or social regime. Malaria is a universal, pandemic disease that is not restricted to the tropics, unlike smallpox and the plague.

However, malaria is listed by the WHO among the tropical diseases and, indeed, that is how it is seen today. If we examine the current world distribution of malaria, we will see that it prevails and has greater incidence in countries located between the Tropic of Cancer and the Tropic of Capricorn, that is, between latitudes 27° 23' north and south. Exceptions are the Middle Eastern countries, notably Afghanistan, northern India and parts of southern China, where malaria is residual. Nevertheless, it is true that malaria is nowadays concentrated in the tropics and this fact brings us to an initial conclusion: if malaria was once pandemic, the disease was not and certainly is not now linked to any tropical biogeographic fate. It might have thrived, and did indeed thrive, in any region of the globe, tropical or otherwise, but if it now tends to be concentrated in the tropics, there must be some other reason. Actually, this reason is underdevelopment and the consequent poverty of the tropical populations.

Aware of this fact, agencies such as Unicef, the World Bank and the WHO itself launched the Special Program for Research and Training in Tropical Diseases (TDR) thirty years ago, focused on infectious diseases that disproportionately afflict the “poor and outcast populations” of the world. The TDR immediately added tuberculosis and leprosy to the WHO's list of classical tropical diseases; others were included at various times in the Neglected Tropical Diseases list (NTD): trachoma, Buruli ulcer, dracunculiasis, dengue fever, yaws. The list currently contains fourteen neglected diseases and, paradoxically, this number tends to grow as health conditions of underdeveloped populations improve. This is because only one of these diseases is on the verge of eradication, dracunculiasis, whereas the others, ignored until now because of ailments seen as more important, gain visibility in the world sanitation scenario.

Tuberculosis is a good illustration of a disease that affects poor, tropical populations. It has always been a universal disease, caused by a bacterium and transmitted by direct contact between humans. Like malaria, it has not spared any historical moment or population on the planet. Together with the poor and the dispossessed, it has recruited victims from the sons and daughters of nobility, of

the European *belle époque* and of the imperial splendors of the East. Over the last decades, however, tuberculosis has specialized in poor populations – those lacking proper infrastructure, technical personnel and health resources – and has shown a special predilection for those already infected by AIDS. The global prevalence of tuberculosis is still high, with more than 9 million new cases every year. In absolute number of new cases, China, India and Russia are still the countries that pay the greatest tribute to the disease, but in terms of relative incidence per number of inhabitants, the tropical countries, particularly those in Africa, detain the leadership.

A conspicuous “overall poverty” can be found in countries where malaria and tuberculosis proliferate. Because they were universal diseases until yesterday, their prevalence today is not conditioned to the climatic peculiarities of the tropics. Rigorously speaking, tropical countries are very heterogeneous and have little in common geographically. They extend from the heights of the Andes to the lowlands of Africa, through swamps to deserts, from the rain forests and water worlds of Oceania to the semiarid *caatingas* [bushlands of stunted vegetation] and savannas of Brazil and Africa. In terms of weather, the only thing the tropical world as a whole has in common are moderate winters, a result of their shared isotherms. Furthermore, in social terms the tropics are equally heterogeneous, with a wide range of ethnicities and religions, both autochthonous and imported. Nothing is peculiar to, or exclusive of the tropics. Except “overall poverty”, which is truly shared by all tropical countries.

Of the 50 countries with the lowest GDP, all are tropical; the same is true for all countries with per capita income below \$2,500 a year. With one or two exceptions, such as Afghanistan, tropical countries have at least 50% of their population living below indigence levels and 60% to 80% of these populations survive on less than 1 dollar a day. It is not surprising that income distribution inequality in tropical countries is the highest in the world; what is surprising is that life satisfaction indices are unexpectedly high in some of these countries – somewhat of a comfort, to be sure.

With scarce resources, and these often put to bad use, tropical countries invest parsimoniously in health care. The health indicators tabulated by the WHO show that the worst infant mortality rates and the lowest ratios of doctors, nurses and hospital bed per inhabitant are found among tropical countries. Should we conclude that there are indeed no “climatic diseases” and that all evil comes from the penury and the indolence that prevail in the tropics?

No, most certainly not. The economic component might be the most important one, but a constant element of biogeographic fate is not absent from the sad scenario of tropical diseases. Let us view some examples.

*African trypanosomiasis*, or sleeping sickness, the quintessential tropical disease, is caused by two subspecies of the large group *Trypanosoma brucei*, both of them specialized in humans. The disease exhibits a certain clinical polymorphism, but in the predominant and more serious form, after a long period

of subclinical silence, the central nervous system becomes severely compromised – and paralysis, lethargy, progressive obnubilation and death eventually set in. Its initial name, “Negro lethargy”, was changed to “sleeping sickness” as white settlers increasingly contracted it. The disease is now treatable, but treatment is expensive and difficult to administer. In the 19<sup>th</sup> and 20<sup>th</sup> centuries, millions of Africans fell victim to it (in 1990, an estimated 300,000 to 500,000 people were infected). The disease takes the form of itinerant epidemic outbreaks and never occurred outside Africa – it has never been reported anywhere else in the world, whether in the tropics or not. Trypanosomiasis is present over a large belt of African territory, home to approximately 70 million people, extending from the Indian Ocean to the Atlantic, and from the Sahara desert to the Kalahari, sparing only the north and south edges of the continent. Why is this so? Because the disease is transmitted by a voracious hematophagous fly that lives and proliferates only within those geographical limits. This area is known as the “tsetse belt”, roughly between latitudes 20° N and 20° S.



Agência Reuters/Paulo Whitaker - 10.1.2003

*Tamirez da Paz, 8 years old, hold white mice in the Brasília Teimosa neighborhood in Recife (PE).*

There are many tsetse species (genus *Glossina*) that disseminate distinct trypanosomes among wild mammals, reptiles and birds. This becomes economically important, as they can transmit diseases among domestic animals: bovines, ovines, caprines and equines. Pigs are a preferred victim of the tsetse and also harbor trypanosomes, including human trypanosomes. The human trypanosomes – *Trypanosoma brucei gambiense* and *T. b. rhodesiense* – are transmitted by tsetse flies from the *palpalis* and *morsitans* groups, respectively. The *palpalis* glossinas proliferate in ancillary woods or shrublands near deposits

of water and normally feed on the blood of large reptiles, such as crocodiles; the *morsitans* glossinas prefer the savannas and preferably bite wild ruminants. But neither fly is found outside the tsetse belt. In spite of the intense slave traffic, neither glossinas nor African trypanosomiasis settled in the New World. Numerous other flies did, however, including the common housefly and the blowfly; but the tsetse never. Nor did it expand to the East, notwithstanding the immemorial trade routes between Africa, India and the Middle East. The absolute geographic faithfulness to Africa of the glossina explains the tropical fate of sleeping sickness, which is truly a tropical disease – or rather, a strictly African one.

Onchocerciasis is another disease faithful to Africa, but not as intensely so. This essentially tropical disease is caused by a nematode, *Onchocerca volvulus*, found in the human dermis, where small male worms (approximately 4 cm) and generous female worms (approximately 50 cm) wind and coil and form skeins that become nodules or dermal tumefaction, not always suppurative but always unsightly. The nodules show a marked preference for exposed parts of the skin, specially the face and the scalp, but in naked or seminude populations these nodules (or onchocercoma) can be found everywhere in the body. The worms reproduce in the recesses of the dermis, where the female hatch larvae called microfilariae (approximately 0.5 cm) that move about subcutaneously and can reach the humors of the eye chamber, cornea and retina, causing inflammatory reactions that often lead to blindness. In Equatorial Africa, nearly 18 million people harbor onchocerca worms – 250,000 of them already blind. So great is the suffering, but also the human solidarity involving the disease that the gardens of the WHO in Geneva exhibit a full-size sculpture of a child leading a blind, onchocercotic old man. Indeed, so great is the suffering and the solidarity that the pharmaceutical company that manufactures Ivermectin, the active drug against the filariae, decided to donate the drug, free of charge, to anti-onchocerciasis programs.

Onchocerciasis is also known as *river blindness*, because it is restricted to the populations living near the clear water rivers and streams in whose currents the disease's vectors breed. These are flies of the genus *Simulium*, the black flies of the English or the popular *borrachudo* of Brazil: the filariae that the flies ingest along with the blood from the patients migrate toward the proboscis, where they change into larvae ready to infect new individuals. Brought by migrant slaves and others, the disease traveled from Africa to the New World, where it found permissive black flies and prospered in the equatorial and supraequatorial regions of Ecuador, Colombia, Venezuela, Central America and southern Mexico. In Brazil, it is restricted to the native and indigenous populations of the Amazon region, particularly the state of Roraima. In the New World, the disease affects no more than a few thousand people and, in general, does not lead to blindness, probably because the filariae in this side of the Atlantic have less affinity for the retina and cornea. Considering the enormous population, broad distribution and

voraciousness of Brazilian black flies, it is strange that the disease does not occur more often and that it is absent from the northeast to the south of the country, where the *borrachudos* abound and where slave traffic used to thrive. Could onchocerciasis be a specifically equatorial disease, that is, a subtype of tropical disease? Perhaps the temperature and humidity of the equatorial regions of Africa and the New World are the only climatic factors that allow the development of filariae in black flies – or perhaps black flies capable of transmitting the disease can only proliferate in these regions. Be as it may, onchocerciasis is, and has always been, a disease restricted to the tropics, underlining the biogeographic fatalism of tropical diseases.

Lymphatic filariases are equally restricted to the tropics. These are caused by the nematode worms *Wuchereria bancrofti*, found all over the tropical world, and *Brugia malayi*, found only in southeast Asia. The males are always small (approximately 4 cm), the females corpulent (approximately 9 cm) and they live and mate in the lymphatic nodes of men and women (and of no other animal species). The females hatch microfilarial larvae that enter the bloodstream. The worms can become quite numerous after successive infections and can then occlude the lymphatic vessels, leading to the accumulation of lymph upstream. When lymphatic drainage is compromised, ingurgitation of the compromised regions follows (usually the lower members and the scrotum), generating the so-called elephantiasis. Filariases have been reported in the upper Nile since antiquity and the statue of at least one pharaoh shows signs of elephantiasis of the leg. Enormously inflated scrota are commonplace both in African statuettes 1,500 years old and in contemporary patients. More than 120 million people are infected by filariae around the world, including approximately 50,000 in Brazil. Nearly 40 million individuals have been incapacitated or deformed by elephantiasis.

It is estimated that more than 1 billion people are at risk of contracting one of the filariae, which are transmitted from human to human by the omnipresent and cosmopolitan ordinary mosquitoes. Dengue fever's *Aedes* and malaria's *Anopheles* can also transmit filariae, but these insects are not the most important ones. Arguably, the most important of all is the common mosquito of the genus *Culex*. The microfilariae that are sucked with the blood of an infected individual develop inside the mosquitoes and are transmitted to other potential patients. However, multiple infections are required for the disease to manifest. The agents used to treat filariasis, the same as the ones for onchocerciasis, are donated free of charge by the laboratories that produce them – a rare but dignifying example of the pharmaceutical industry. The filariases are under pressure from intensive global and local control programs, and their incidence tends to diminish around the world. But one fact draws attention: the vectors for filariases, the common mosquitoes, are everywhere and bite all types of people – nobles and paupers, pariahs and popes – since time immemorial, but filariases have only been reported in the tropics. Is some kind of biogeographic fatalism

at work here? Temperature? Humidity? Undoubtedly it is, but no one knows exactly which.

The two major schistosomiasis afflict 200 million people, half of them in Africa, the remainder in the Middle East and South America, especially in Brazil and Venezuela. Three milder and less important schistosomiasis are restricted to southeast Asia, including China and Japan. They are all caused by worms and conveyed by snails. The adult worms live in the intestinal or vesical veins, and their eggs are eliminated, respectively, through the feces and urine of the patients. *Schistosoma mansoni* lives in the intestinal veins (portal system) and the eggs that do not reach the intestine may reflow into the liver, causing foci of inflammation that heal as fibroses, leading eventually to cirrhosis and its serious consequences. *Schistosoma haematobium* lives in the veins of the vesical plexus and its eggs may cause fibroses and minor urinary hemorrhages; if these become chronic, the consequence can be anemias of variable clinical gravity. The Mansonian schistosomiasis of Brazil was imported from Africa at the time of the slave trade, establishing in the east and northeast, with scattered foci all over the country. In the 1950s, the disease afflicted 6 million Brazilians.

Haematobic schistosomiasis never managed to set foot in Brazil, in spite of the slave trade, and currently prevails in equatorial and subequatorial Africa, with ramifications in the Nile river valley, Algeria, Tunisia and Saudi Arabia. Larvae (miracidia) emerge from eggs that the worms deposit in repositories of fresh water, and invade snails of the genus *Biomphalaria* in Brazil and Africa, and of the genus *Bulinus* in Africa. The larvae multiply within the snails and generate other larvae (cercariae), which then abandon their snail and go swimming after the humans (who use this infected repositories of water for their basic needs, especially in Africa). *Schistosoma haematobium* never gained foothold in the New World, because it never adapted to the *Biomphalaria*, neither in Brazil nor in Africa, and requires certain species of *Bulinus* exclusively to proliferate – which, in turn, did not adapt to the Americas. *Schistosoma mansoni* was brought from Africa by the slaves and found in Brazil numerous species of *Biomphalaria* in which to proliferate. The schistosomiasis (and, in particular, haematobic schistosomiasis) are a convincing example of geographic fatalism: in spite of the intense traffic past and present between every geographic region, they refuse to leave Africa – at most, they make some small incursions into Madagascar and the Near East.

The leishmaniasis are caused by different species of *Leishmania*, intracellular protozoa of humans and domestic and wild animals. The cutaneous leishmaniasis found in Amazonia are an unquestionable example of the “tropical curse”. Other leishmaniasis occur not only in tropical regions, but also somewhat further north, including the Mediterranean countries. Strictly speaking, they should not qualify as tropical, or as diseases of outcast populations, because they occur in many regions of the developed world, such as the Iberian peninsula, Italy, Greece and Turkey. The most serious leishmaniasis, caused by *Leishmania*

*donovani*, is the so-called visceral leishmaniasis (or kala-azar, or black fever), reported for the first time in India, but present also in Africa and Latin America. Approximately 500,000 new cases are reported each year. The disease, with its chronic and debilitating development, results from the proliferation of leishmanias in the macrophages of the spleen, liver and bone marrow. It is difficult to diagnose and, if untreated, fatal. India, Brazil, Ethiopia and Sudan, as well as the north African countries, are the greatest victims. It was a major health issue in China, but is now under control there. In the present decade, Brazil has been reporting 3,000 new cases per year, a number that is not so terribly frightening when compared to the 600,000 new cases of malaria or 100,000 of tuberculosis.

Other leishmanias cause cutaneous or mucosal-cutaneous ulcerations that are unsightly and deforming, but rarely fatal. Among these are the Old World leishmanias, particular those from the East, including some as benign as *Leishmania tropica*, and dozens of New World species, notably *L. braziliensis*, identified by Gaspar Viana, which is aggressive and deforming on account of the lesions to the buccal and pharyngeal mucosas, sometimes leading to the destruction of the nasal cartilage. According to WHO estimates, the world sees 1 million new cases per year, 30 thousand of them in Brazil. But the New World leishmanias are not post-Colombian, that is, they were not imported from the Old World; on the contrary, they autochthonous and probably prevailed here since the arrival of *Homo sapiens* 30,000 to 10,000 years ago, judging from the typical lesions found in Inca mummies and in statuettes dated more than 2,000 b.C.

Leishmanias are transmitted to humans by a group of minuscule flies, known as *sand flies* and by many other regional names. They all belong to the Phlebotomidae family. In the Old World, they belong to the genus *Phlebotomus*; in the New, to the genus *Lutzomyia*. The sand flies are voracious hematophagous and feed on all sorts of vertebrates: amphibians, reptiles, birds and mammals, disseminating trypanosomes and leishmanias among them. Different species of sand flies seek out human leishmanias in different hosts: the visceral leishmanias, especially in infected humans or dogs. Actually, in most of the world, sick humans are the reservoir of visceral leishmaniasis, but in Brazil dogs still play a very important role as reservoirs. In Brazilian cutaneous leishmaniases, the main reservoirs are the abundant wild rodents, ubiquitous in the Amazon forest and in recently deforested areas.

Visceral leishmaniasis occurs in houses or near houses but is susceptible to control, as attested by China, where mass treatment, spraying with insecticides and the elimination of dogs reduced the prevalence of kala-azar in the 1950s, from 500,000 cases to no more than 200.

On the other hand, cutaneous-mucous leishmaniases, particularly those in the Amazon region, seem to be more difficult, if not impossible, to control. The lutzomyias are to be found everywhere in the forest; day and night they bite their preferred victims, the omnipresent rodents who are unending reservoirs of leishmanias. When humans interfere in this cycle, in this veritable ocean of

lutzomyias and leishmanias, they run the risk of being bitten by one and infected by the other. The risk is greater in recently settled areas where deforestation and the flight of rodents have turned humans into a more important than usual source of food for the lutzomyias. This cannot be avoided; it is the ineluctable curse of the rain forest. It is not possible to spray the entire forest, or exterminate all rodents and other reservoirs. Such destruction would cause more harm than the disease itself. One must wait for an effective vaccine, which is still not even in the horizon, to neutralize this type of tropical voodoo.

Combined, “poverty” and “tropics”, more than any of these factors alone, have always been cruel to humankind, conspiring to turn the lives of millions into a living hell. This situation is clearly expressed in an index – the Disability-Adjusted Life Years (Daly), a time-based measure conceived by the WHO to assess a disease’s burden that combines years of life lost due to premature mortality and years of life lost due to time lived in states of less than full health. In short, the Daly measures the life time lost to premature deaths or debilitating sickness by the global or regional population (as desired). One Daly unit equals one year of life. For “tropical diseases”, the Daly indices listed by the WHO are: malaria, 46.5 million years lost by humankind; tuberculosis, 35 million; filariases, 5.8 million; leishmaniasis, 2 million; schistosomiasis, 1.7 million; sleeping sickness, 1.5 million; Chagas’ disease, 667 thousand; dengue fever, 616 thousand; onchocerciasis, 484 thousand; leprosy, 199 thousand. With regard to the number of deaths per year, the situation is equally regrettable: tuberculosis, 1.5 million; malaria, 1.2 million; visceral leishmaniasis, 51 thousand; sleeping sickness, 48 thousand; dengue fever, 19 thousand; schistosomiasis, 15 thousand; Chagas’ disease, 14 thousand. Finally, whereas life expectation in Japan is approximately 8 decades, in many countries in tropical Africa it is no more than 4 decades.

But what is becoming increasingly clear is that the “tropical fate” can be significantly reversed by economic and sanitary development in general, or by the timely allocation of specific resources.

The control of American trypanosomiasis, or Chagas’ disease, in Brazil is a patent example of how this is possible. Chagas’ disease is caused by *Trypanosoma cruzi*, which only occurs in the New World, and has been separated from its sleeping sickness-causing relatives for at least 100 million years, ever since Africa and South America disjoined. The concomitant divorce of the faunas and floras also underlined the continental disjunction of trypanosomes and vectors. The ancestors of the glossinas (tsetse) survived in Africa, while the ancestors of triatomine bugs colonized South America. One could not find a more clear-cut case of tropical “biogeographic fate”. More fortunate Europe inherited neither of these ancestors.

The triatomine bugs, commonly known as “*barbeiros*” in Brazil, are hematophagous hemiptera with species distributed in three main genera – *Triatoma*, *Panstrongylus* and *Rhodnius* – that proliferate in different biomes in North, South and Central America. Species of *barbeiros*, also called kissing bugs,

can be found both in burrows or caves and in treetops, especially of palm trees. They feed on the blood of a wide range of mammals, from armadillos to primates, and are generalists with regard to their victims. Marsupials and armadillos must have been the original hosts of *T. cruzi* and, thanks to the hematophagous promiscuity of the kissing bugs, they must have then disseminated to the various orders of mammals in South and, later, North America. Humans were probably included in the promiscuous list of victims since their arrival in the Americas, some 30,000 to 10,000 years ago, but only became regular and constant feeders of the kissing bugs when they brought them home and domesticated them together with mammals infected by *T. cruzi*. It is surmised that this is what happened to the pre-Colombian populations of the Andes, who raised guinea pigs (*Cavia* spp) as foodstuff, whom the kissing bugs (*Triatoma* spp) also fed on.

From then on, the kissing bugs, particularly *Triatoma infestans*, adapted so well to human households and their inhabitants (humans, dogs and other animals) that they started to prefer humans for their bloody banquets and to live and procreate in the so-called house of man. They loved the long, dark and hot tunnels of the wattle and daub houses that were found all over Brazil. At night, *T. infestans* emerged from these tunnels to bite humans, preferably in the tender palpebral region or anywhere in the face – thus the Brazilian name *barbeiro* [barber] or kissing bug. While they munch away, these bugs defecate on the very face that feeds them. In their feces are the infectious trypanosomes that travel along the orifice of the bite and reach the underlying cells, which they invade and where they multiply. Cells crammed with trypanosomes eventually burst, releasing them into the bloodstream, whereby they reach other cells. The kissing bugs become infected by ingesting blood with circulating trypanosomes. In humans, the trypanosomes show predilection for the neurons of the autonomous nervous systems and for the muscle cells of the heart. The progressive destruction of these cells is responsible for the symptoms of the chronic stage of the disease: lesions to the heart's motor systems, with arrhythmias, blockages and even cardiac arrest; lesions to the fibers of the heart, diminishing its contractility and leading to heart failure; lesions to the nerve cells of the stomach's sphincters and of the sigmoid flexure, which progressive occlusion and enlargement of the esophagus and the colon. Death can occur already in the acute phase or at any moment of the chronic phase, but the disease generally extends for several years. Treatment with medication is complicated, not very efficient in the chronic phase, and has many risks and side effects.

Chagas' disease and malaria were the most serious endemic diseases of Brazil. Until the 1970s, approximately 20 million Brazilians were infected by *T. cruzi* and until 1980 there were at least 120,000 new cases of the disease each year. By then, however, it was already known that controlling the disease was possible, because the state of São Paulo had reduced the number of new cases by spraying insecticide in households infested by the kissing bugs. In the 1980s, Argentina, Brazil, Chile, Paraguay, Uruguay and the Panamerican Health



*On October 6<sup>th</sup> 1999, Dr. Gro Harlem Brundtland, Director General of the World Health Organization, unveiled, in the headquarters of the WHO in Geneva (Switzerland), a monument on the occasion of the 25th anniversary of the fight against onchocerciasis in Africa.*

Organization (OPAS) launched an intensive program to fight the kissing bugs: the Southern Cone Chagas Initiative. The program was an absolute success. In Brazil, after only a few years of systematic and well-planned spraying, the number of new cases fell practically to zero. Chagas' disease transmitted by domestic kissing bugs (*Triatoma* and *Pastrongylus*) proved to be controllable. A few sporadic cases of household transmission still occur, but these are only residual foci of a disease on the verge of extinction as a result of permanent health surveillance.

Unfortunately, many Latin American countries did not carry out similar programs. Bolivia, for example, still has an incidence of more than 80,000 new cases per year. In countries north of the Equator, the main transmitters of *T. cruzi* to humans and dogs are the kissing bugs of the genus *Rhodnius* and the domestic *Triatoma dimidiata*. Strategies to control transmission, although different from those adopted by the Southern Cone countries, are clearly possible, and Central American countries have organized themselves to implement their own regional program: the Central America Chagas Initiative.

In Brazil, as elsewhere, including the United States, *T. cruzi* is still present in mammals and kissing bugs in the wild, and neither the partners nor their partnership will be extinguished in the next million years. Thus, new foci of Chagas' disease can emerge at any moment, and have indeed emerged in small communities densely populated by infected mammals and kissing bugs. Amazonia is a propitious scenario for such events. In addition, a few scattered foci



Foto Agência France Presse/Elmer Martinez - 17.5.2005

*In Honduras, Ecuador, a specialist holds a triatomine bug of the Triatoma dimidiata genus.*

of Chagas infection have been caused by the ingestion of fruit juices (especially assai) and of sugar cane accidentally grinded together with kissing bugs infected with trypanosomes of wild animals. These outbreaks of oral infection usually strike dozens of people at once, but are always limited. Both types of episodes can occur at any moment, but Chagas' disease as a nationwide scourge is something that will never happen again. Yet, if the tropical biogeographic fate of kissing bugs and trypanosomes has not changed and both villains are still everywhere and scot-free, can we trust this to be so? Yes, because, as stated, development neutralizes biogeographic fatalism and sanitation has become a reality in Brazil. The number of mud huts has fallen and those that remain are regularly sprayed with insecticides provided by the health authorities. Financial resources have been made available and health surveillance is permanent. Undoubtedly, development is the best antidote to the tropical fate.

From this viewpoint, the two conflicting positions of the early 20<sup>th</sup> century on the roots of "tropical diseases" turn out to be not antagonistic at all, but rather complementary: biogeographic fate and underdevelopment are both the genitors of "tropical diseases". Indeed, certain diseases, if it were not for underdevelopment, would simply not exist today. There examples are numerous and the WHO groups them under the heading "neglected diseases". Yaws or frambesia is a skin treponematosis and, like syphilis, can be easily treated with penicillin; the disease only exists because afflicted populations have no access to health services. Buruli ulcer, rare or undiagnosed in the New World, comes from a mycobacterium that causes extensive cutaneous lesions, usually in the lower members, in populations living near rivers or in marshy areas. Trachoma, a chlamydial eye infection, occurs only sporadically in Brazil, but victimizes 80 million poor people around the world, 6 million of which have been made blind. Not to mention the intestinal verminoses, less alarming but still prevalent in underdeveloped countries, side by side with cholera and generic child diarrheas. All and any of these could be called either tropical diseases or diseases of underdevelopment. The eclectic name "neglected diseases", adopted by the WHO, comprises all of them, without distinguishing the tropics as a causal factor. It is much more appropriate.

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## Internet

ORGANIZAÇÃO MUNDIAL DA SAÚDE: <http://www.who.int> (data at: Data and Statistics, WHOSIS, TDR, Tropical diseases e Neglected Tropical Diseases).

ORGANIZAÇÃO PANAMERICANA DE SAÚDE: <http://www.paho.org> (for health data in the Americas search Health Data).

CENTRE FOR DISEASES CONTROL: <http://cdc.com> (for information on infectious diseases). ASSOCIATION AMICALE DE LA SANTÉ NAVALE et D'OUTRE-MER: <http://www.asnom.org> (for information on tropical diseases).

BANCO MUNDIAL: <http://web.worldbank.org> (for economic data and statistics).

*ABSTRACT* – We discuss the biogeographic and economical components of tropical diseases or of neglected diseases in general as defined by the WHO. Tropical diseases result from a conjunction of biological, ecological and evolutionary factors, which are determinant of their selective occurrence in the equatorial region between the Cancer and Capricorn tropics. We submit that there is indeed tropical fatality in this geographical distribution. However, the continued prevalence of tropical diseases in tropical countries basically results from their precarious economy and is an immediate consequence of the underdevelopment.

*KEYWORDS*: Neglected diseases, Topical diseases, Underdevelopment.

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