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Tropical Diseases

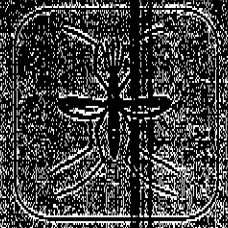
1990



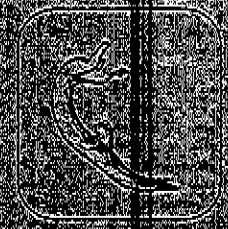
WHO Division of Control of Tropical Diseases (CTD)



*UNDP/WORLD BANK/WHO Special Programme for Research
and Training in Tropical Diseases (TDR)*



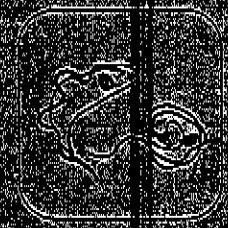
Malaria



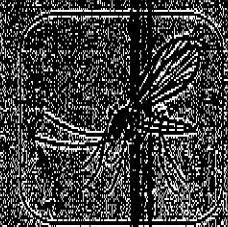
Schistosomiasis



Filariasis



Trypanosomiasis



Leishmaniasis



Leprosy

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Tropical Diseases 1990

Many people in the tropics suffer from poor nutrition, poor living conditions and a poor environment — and from the poor health that such conditions bring. They therefore suffer most of the diseases that affect mankind throughout the world. But on top of this burden, they must endure the heavy consequences of diseases specific to their situation: the so-called tropical diseases.

These diseases — such as malaria, schistosomiasis, lymphatic filariasis, Chagas disease, onchocerciasis, leishmaniasis, leprosy and African sleeping sickness—cause tremendous pain and suffering, from deformities to blindness, brain damage and death.

As Dr Hiroshi Nakajima, Director-General of the World Health Organization, puts it, "beyond their toll of individual illness and death, these tropical diseases impede national and individual development, make fertile land inhospitable, impair intellectual and physical growth, and exact a huge cost in treatment and control programmes".

Tropical diseases were once considered diseases of the rural poor. They still are; but today they are also becoming diseases of development, closely associated with people's need to earn income — for example, with the recent massive migration from rural to urban areas, and with new irrigation and mining projects. The diseases have become "the diseases of the new frontier": the diseases which rob people of their hope.

Nor are these diseases confined to the tropics. Tourism, trade, business travel and immigration are bringing cases of the diseases into the industrialized world, where health systems are unused to diagnosing them. Diagnoses often come too late, and case fatalities are unacceptably high. Tropical diseases should therefore be matters of global concern. They have been of the highest priority to the World Health Organization from its very first days of existence.

But tropical diseases are tenacious and have not easily given ground. There have been some successes: for example, since the 1950s, malaria has been eradicated from areas inhabited by 1.5 billion people, and mortality has been widely reduced; leprosy is declining in some countries because of the use of an effective new treatment; river blindness has declined in West Africa because of control of the blackflies that carry the parasite, and should decline further because of an effective new drug; Chagas disease vectors are being effectively controlled in Brazil and other parts of Latin America.

Yet even with these and other successes, the control of tropical diseases is nowhere near complete. Almost half a billion people still suffer from them. Existing tools for treatment and control need to be more widely applied, and new tools need to be developed. Advising on the use of existing tools, and the development of new ones, are two of the tasks of the WHO Division of Control of Tropical Diseases (CTD) and the Special Programme for Research and Training in Tropical Diseases.

The Special Programme for Research and Training in Tropical Diseases (TDR) — co-sponsored by the United Nations Development Programme, the World Bank and the World Health Organization — was conceived in response to a 1974 plea by the World Health Assembly for an intensive effort to develop improved techniques for the control of tropical diseases. TDR has two interdependent objectives: to coordinate and support scientific research aimed at developing new or improved approaches to diagnosis, patient care, treatment and control, and to strengthen (for example with training grants and institutional support) the research capabilities of endemic countries. TDR links some 5000 scientists in 135 countries, North and South, in a globally integrated scientific effort to achieve these objectives.

The Division of Control of Tropical Diseases (CTD) was established in January 1990, by uniting previously separate control activities for the different diseases into one programme. Thus, support of control activities will be strengthened and coordination improved. The mandate of CTD is to develop at global, regional and country levels strategies for the control of tropical diseases. It collaborates closely with TDR and helps promote the use of research findings emanating from this programme. CTD evaluates, adapts and makes available to the countries concerned existing or newly-developed control technologies and collaborates in drawing up practicable, manageable and sustainable strategies. It also encourages each affected country to establish a comprehensive control programme suited to its individual requirements. CTD will concentrate its efforts on the countries in greatest need for controlling tropical diseases to improve their chances of development.

Human commitment and resources are the most important features of TDR and CTD. Human commitment and resources are required of the world, if tropical diseases are not to become the great neglected diseases of mankind. The aim of this report is to demonstrate why that commitment and those resources are so necessary.



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Malaria

Malaria remains the most important of the tropical diseases - widespread throughout the tropics, but also occurring in many temperate regions. The disease exacts a heavy toll of illness and death - especially amongst children in endemic areas. It also poses a risk to business travellers, tourists and immigrants, and imported cases of malaria are increasingly seen in non-endemic areas such as Europe and North America. Epidemics are frequent in rural areas experiencing intense economic development. Treatment and control have become more difficult with the spread of drug resistant strains of malaria, and insecticide resistant strains of the mosquito vectors.

Causative agents: Single-celled protozoan parasites of the genus *Plasmodium*. Four species infect man:

- P. falciparum* - throughout tropical Africa, Asia and Latin America
- P. vivax* - worldwide in tropical and some temperate zones
- P. ovale* - mainly in tropical West Africa
- P. malariae* - worldwide but very patchy distribution

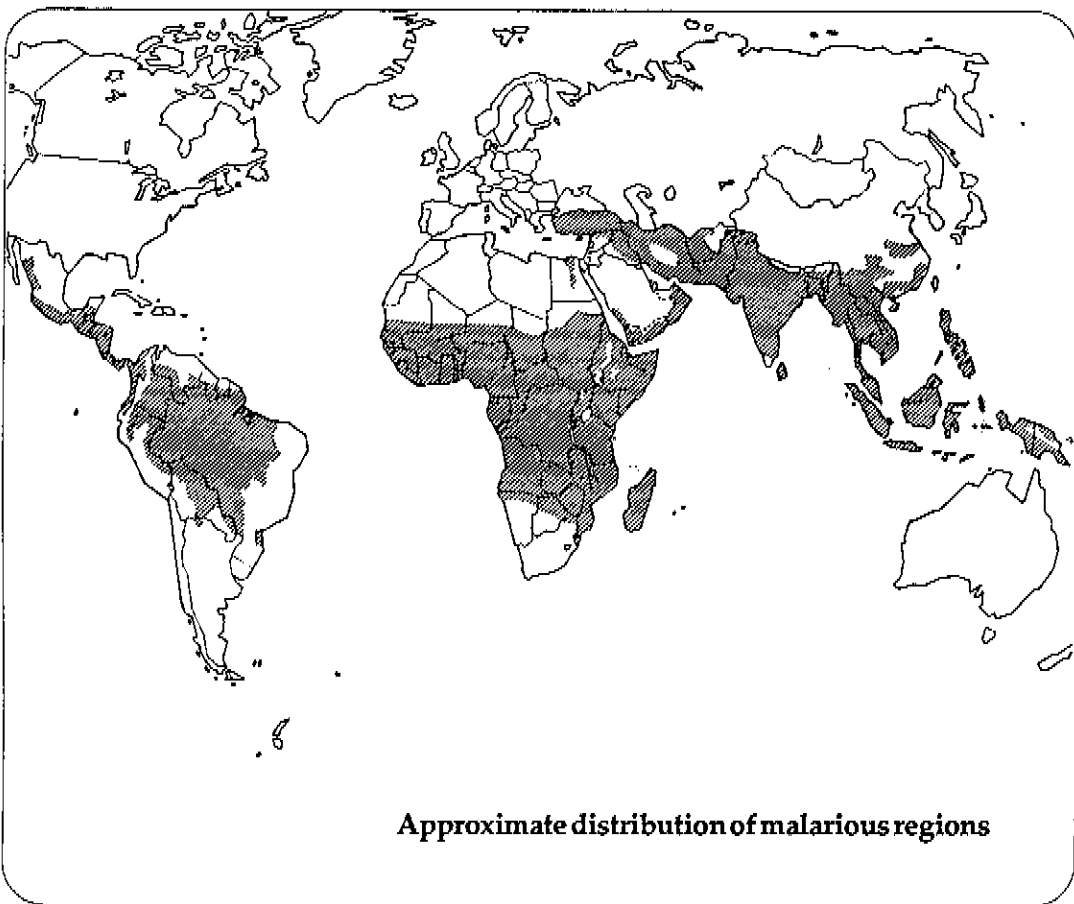
Estimated number of people infected: 267 million

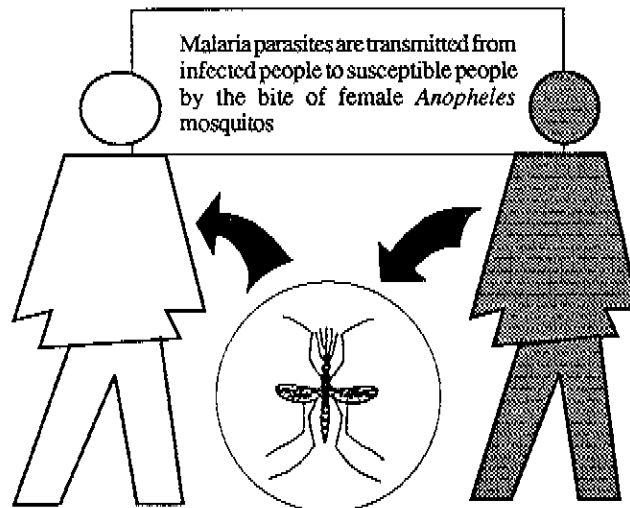
Estimated number of clinical cases: 107 million per year

Estimated mortality: 1-2 million per year

Number of countries affected: 103

Number of people considered at risk: 2 100 million





Transmission: Malaria parasites are inoculated by the bite of infected female mosquitos of the genus *Anopheles* (male mosquitos do not bite). The parasites multiply tremendously in the liver and in infected red blood cells. Vector mosquitos become infected by feeding on the blood of infected people, and the parasites then undergo another phase of reproduction in the infected mosquito.

Clinical symptoms: Malaria begins as a flu-like illness 8-30 days after the infected mosquito bite. Typical cycles of fever, shaking chills and drenching sweats may then develop. The periodicity of these cycles depends on the malaria species, coinciding with parasite multiplication and red blood cell destruction. Falciparum malaria may not show this cyclic pattern and can be fatal if untreated or if treated with insufficiently effective drugs (death may be due to parasitized red cells blocking the blood vessels supplying the brain — cerebral malaria — or damage to other vital organs).

In many parts of Africa, where malaria has long been highly endemic, people are infected so frequently that they develop a degree of acquired immunity, and may become asymptomatic carriers of the infection. This is reflected in the estimated number of people infected (267 million) compared with the estimated number of clinical cases of malaria (107 million per year). Epidemics of clinical malaria are often associated with numbers of non-immune people moving to highly-endemic areas (eg. in search of work) where they quickly succumb to the infection.

Over the last few years, epidemics or atypical increases in malaria incidence have been reported from several areas, including the Amazon region, Ethiopia, Madagascar, Sri Lanka and the Solomon Islands.

Control Priorities in Malaria

- Provide early diagnosis and treatment of clinical malaria to all affected populations, with particular focus on groups at highest risk of fatal malaria (eg. children, refugees, forest workers).
- Apply recent clinical research finding to improve the management of severe and complicated malaria in hospitals
- Promote personal protection measures (bednets, etc.) to reduce man-vector contact.
- Implement cost-effective vector control activities wherever appropriate.
- Develop and support a core of malaria specialists in endemic countries to improve planning and management of operational programmes against malaria.

include spraying houses with residual insecticides, and modifying aquatic breeding sites to make them unsuitable for development of anopheline mosquito larvae.

[*note, several strains of *Plasmodium* are resistant to one or more antimalarial drugs. Thus no prophylactic drug can guarantee protection]



Research Priorities in Malaria

Chemotherapy

- develop new antimalarial drugs
- improve clinical usage of existing drugs and drug combinations
- develop accurate ways to monitor drug resistance
- improve patient care through better understanding of disease pathology

Vaccine Development

- transmission blocking vaccines
- vaccines to prevent infection
- vaccines to prevent disease

Epidemiology and Vector Control

- field evaluation of new control approaches
- assess drug sensitivity of different parasite strains
- improve diagnostic methods
- vector incrimination and control methods

Schistosomiasis

Schistosomiasis is also known as bilharzia or bilharziasis after german pathologist Theodor Bilharz who first discovered the parasites in Egypt in 1851. The infection is widespread with a relatively low mortality rate but very high morbidity rate - causing severe debilitating illness in millions of people. It is often associated with water development projects, such as dams and irrigations schemes, where the snail intermediate hosts of the parasite breed in water where people swim, wash and fish.

Causative agents: Trematode flatworms (flukes) of the genus *Schistosoma*, transmitted from infected snails.

S. mansoni - Africa and Latin America

S. haematobium - Africa and the Middle East

S. japonicum - SE Asia and parts of Western Pacific region

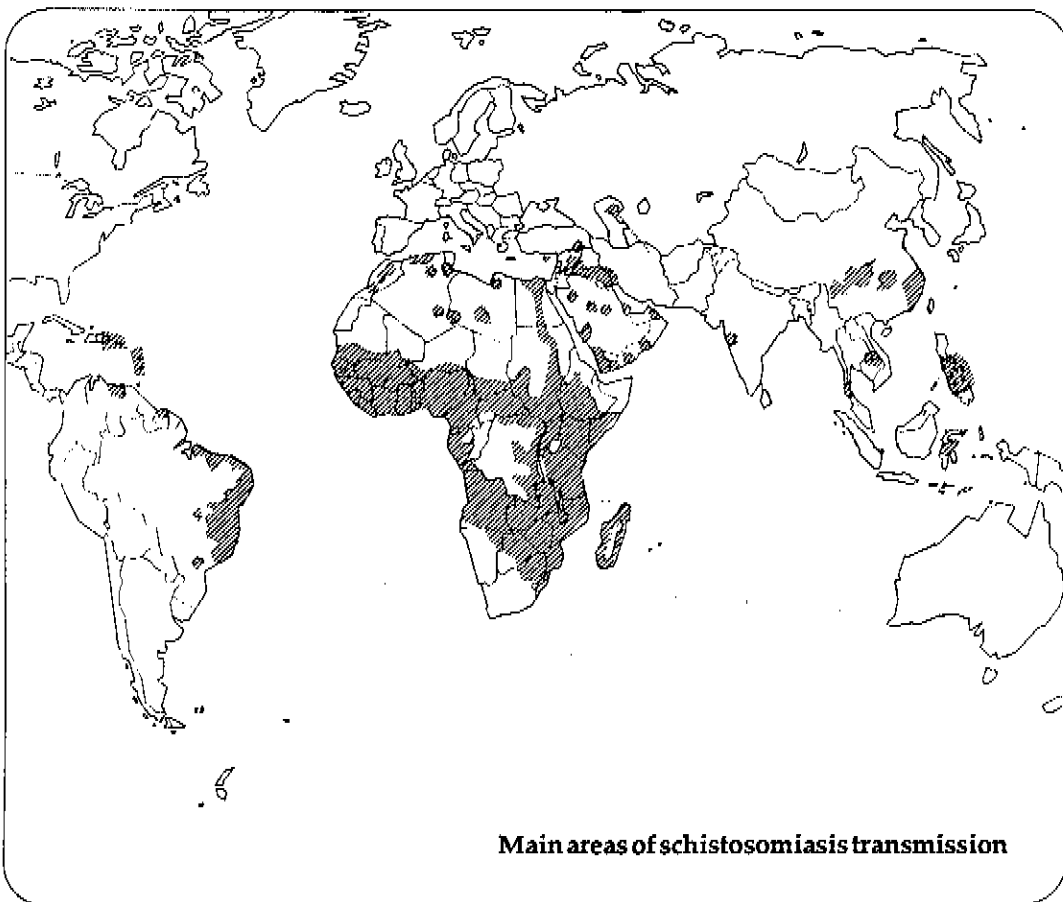
(also *S. intercalatum* in small foci in Africa, and *S. mekongi* in the Mekong river basin of SE Asia)

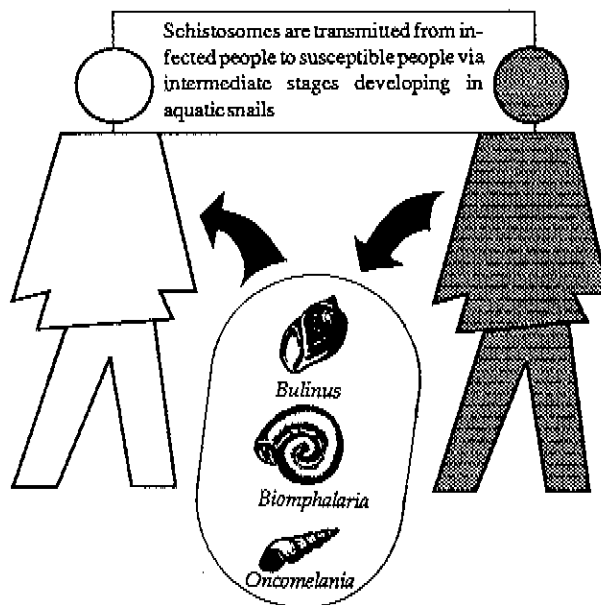
Estimated number of cases: 200 million

Estimated mortality rate: <200 000/year

Number of people considered at risk: 500-600 million

Number of countries affected: 76





Transmission: In water, larval stages of schistosomes (known as cercaria) are shed from infected snails and penetrate the skin of people in the water. The snails become infected by another larval stage of the schistosome (known as miracidia) which hatch from eggs passed in the urine or stool of infected people. *Schistosoma haematobium* is mainly transmitted by *Bulinus* snails, *S. mansoni* by *Biomphalaria*, and *S. japonicum* by the amphibious *Oncomelania*.

Clinical symptoms: Adult male and female schistosomes live together in blood vessels of different organs; they release eggs — some of which are passed out in the urine (*S. haematobium*) or stools (*S. mansoni*, *S. japonicum*), but some eggs become lodged in the tissues. Reactions to schistosome eggs lodged in the tissues are the cause of disease in schistosomiasis.

In urinary schistosomiasis (due to *S. haematobium*), damage to the urinary tract is revealed by blood in the urine. Urination becomes painful and there is progressive damage to the bladder, ureters, and then to the kidneys. Bladder cancer is quite common in advanced cases.

Intestinal schistosomiasis (due to *S. mansoni*, *S. japonicum* or *S. mekongi*) is slower to develop. There is progressive enlargement of the liver and spleen as well as damage to the intestine, due to fibrotic lesions around the schistosome eggs lodged in these tissues and hypertension of the abdominal blood vessels. Repeated bleeding from these vessels leads to blood in the stools, and can be fatal.

Control Priorities in Schistosomiasis

- Support for development of national control plans specific for particular endemic situations.
- Prevent morbidity and reduce transmission by systematic drug treatment of infected people.
- Health education to discourage people from urinating and defaecating in or near open waters.
- Encourage and support the use of simple diagnostic tests. (eg. indicators of haematuria for *S. haematobium* infection)



Research Priorities in Schistosomiasis

Biochemistry and Chemotherapy

- improved understanding of drug action and drug resistance
- rational design of new drugs
- biochemical mechanisms underlying pathology

Epidemiology and Snail Control

- improved methods for diagnosis
- drug delivery systems
- community participation and improved water supplies
- snail population biology

Vaccine Development

- analysis of human immune responses to infection
- synthesis and evaluation of protective antigens
- development of vaccines to counteract morbidity

Prevention: Avoid contact with streams and ponds where infected snails live. Never defaecate or urinate in or near open waters, so that snails have less chance of becoming infected.

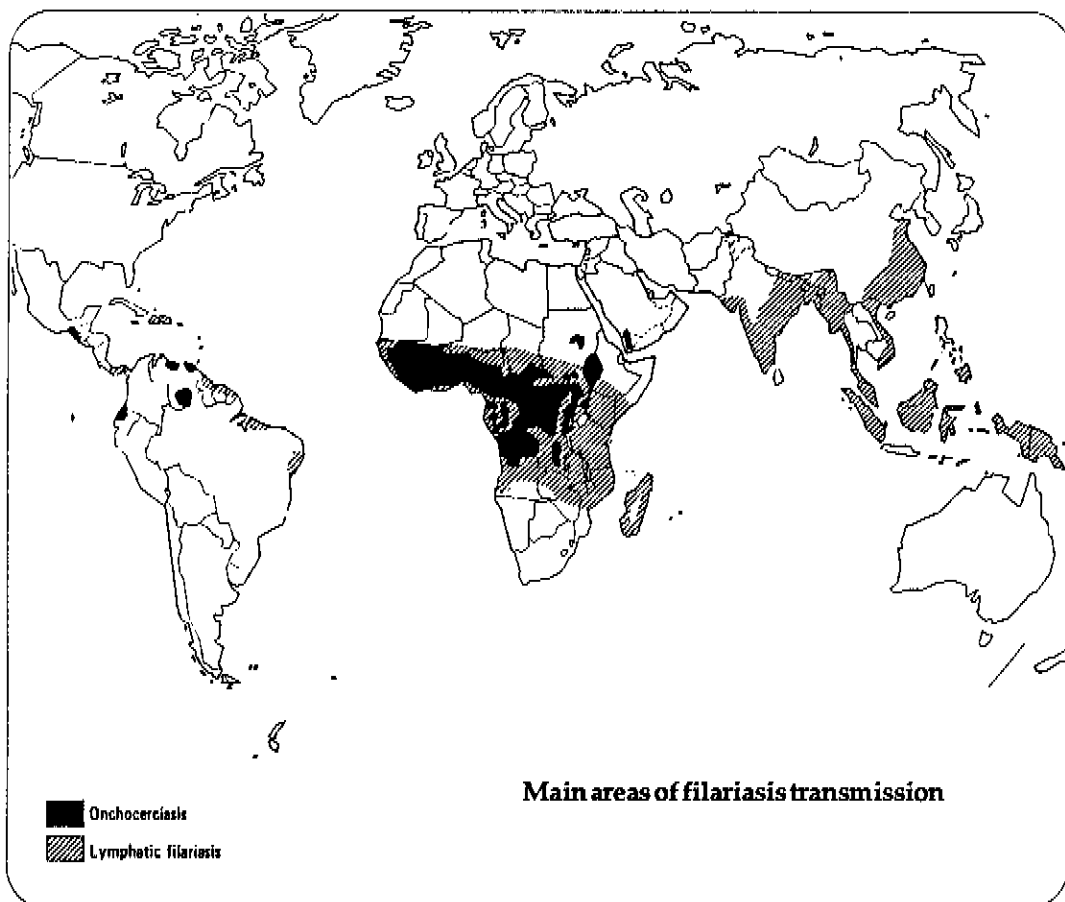
Treatment: Metrifonate (cheap, but requires 3 spaced doses, only effective against *S. haematobium*)
Oxamniquine (single dose, but only effective against *S. mansoni*)
Praziquantel - effective in a single dose against all species of schistosome

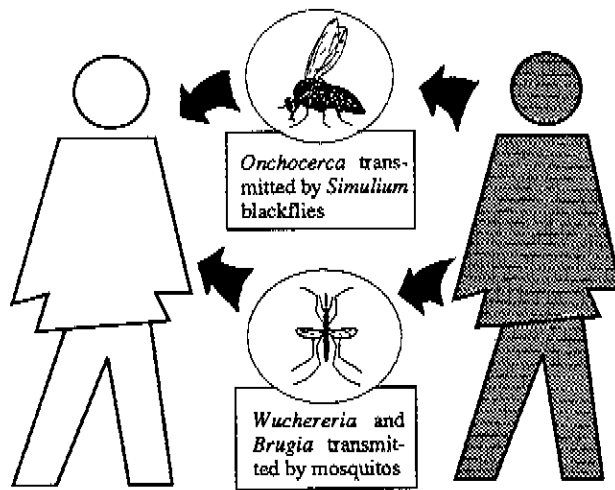
Filariasis

Filariasis affects the lives of a billion people, mainly in Africa, Asia and to a lesser extent in Latin America. The different types of filariasis are rarely life-threatening in themselves, but cause chronic suffering and disability. Lymphatic filariasis can lead to hugely swollen limbs (a condition known as elephantiasis) while onchocerciasis can lead to blindness.

Causative agents: Parasitic nematode worms of the family filariidae. Two types are of particular importance - onchocerciasis (also known as river blindness) due to *Onchocerca volvulus* transmitted by *Simulium* blackflies, and lymphatic filariasis (also known as elephantiasis) due to *Wuchereria bancrofti*, *Brugia malayi* or *B. timori*, which are transmitted by various species of mosquito. *Wuchereria* is mainly transmitted by *Culex quinquefasciatus* and some species of *Anopheles*, while *Brugia* is mainly transmitted by species of *Mansonia* mosquitoes.

	<i>lymphatic filariasis</i>	<i>onchocerciasis</i>
Estimated number of cases:	90 million	17.6 million (including 326 000 people blinded)
Number of countries affected:	76	34
Number of people at risk:	905 million	90 million





Transmission and Symptoms: Infective larvae of *Wuchereria* and *Brugia* are transmitted to man through the bite of infected mosquitoes. They develop as adult worms (macrofilariae) in the afferent lymphatic vessels, causing severe inflammation of the lymphatic system. Adult *Wuchereria* are often lodged in the lymphatics of the spermatic cord, causing scrotal damage and swelling. Elephantiasis - painful disfiguring swelling of the limbs - is a classic sign of late-stage disease. The adult worms can live for many years, giving rise to large numbers of larval forms (microfilariae) which circulate in the lymphatics and blood where they can be taken up by appropriate species of blood-sucking mosquito.

In onchocerciasis, infective larvae are transmitted through the bite of infected *Simulium* blackflies. Adult worms develop in subcutaneous nodules, releasing large numbers of microfilariae into the surrounding tissues. Most of the pathology of onchocerciasis results from the migration of microfilariae into the skin and eyes, leading to intense itching and disfiguring dermatitis, and ocular damage including blindness.

Control Priorities in Filariasis

Onchocerciasis

- Large-scale use of ivermectin to treat infected people in endemic areas, and so eliminate the risk of disease-induced blindness.
- Whenever appropriate, control of blackfly vectors by use of biodegradable insecticides to kill blackfly larvae in their riverine breeding sites.

Lymphatic Filariasis

- Mass treatment of infected people (using diethylcarbamazine at present) to reduce morbidity.
- Reduce man-vector contact, especially by use of insecticides and improved sanitation in urban areas.

avoiding mosquito bites in endemic areas (eg. using repellents, bednets, insecticides) and, since important mosquito vectors such as *Culex quinquefasciatus* often breed in polluted urban waters (such as blocked drains and sewers), urban sanitation can make an important contribution to reducing the risk of this disease.



Research Priorities in Filariasis

Chemotherapy

- develop an effective drug against adult filariae
- assess the role of ivermectin against lymphatic filariasis

Immunology

- improve diagnostic techniques
- determine ways to predict which people are most likely to develop severe disease

Epidemiology and Vector Control

- trials of candidate drugs and new treatment regimes
- new vector control approaches, including biological methods

Prevention and Treatment: In much of West Africa, transmission of *Onchocerca* has been greatly reduced through the activities of the 11-nation Onchocerciasis Control Programme (OCP). This has mainly involved regular release of biodegradable insecticides into the rivers to destroy the *Simulium* larvae. More recently, a newly-developed microfilaricide - ivermectin - has been introduced to treat infected people and halt the progression of disease.

Lymphatic filariasis has for many years been treated with diethylcarbamazine (DEC), but this drug is not always easy to administer and often has unpleasant side-effects. Ivermectin is now entering field trials against lymphatic filariasis in NE Brazil and parts of Africa, India, SE Asia and the Western Pacific region. Transmission of lymphatic filariasis can also be reduced by

African Trypanosomiasis

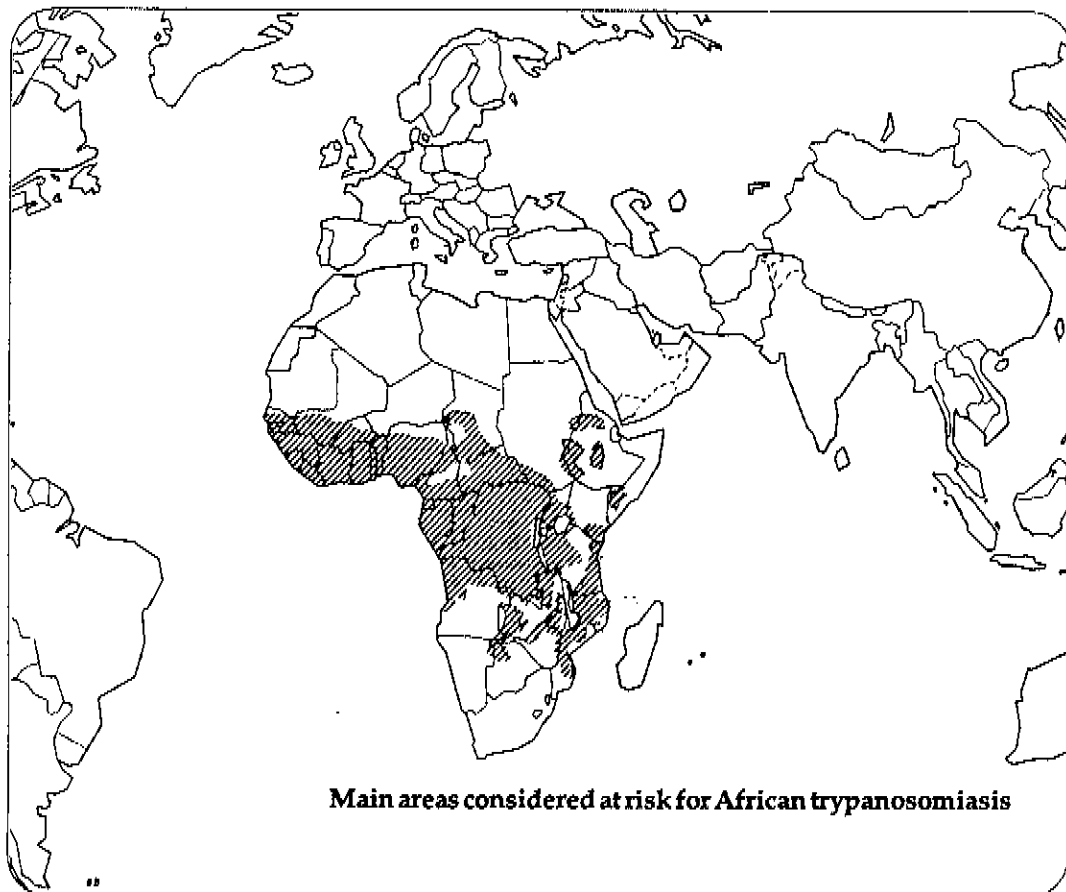
African trypanosomiasis or sleeping sickness is a severe disease, often fatal if untreated, due to trypanosome parasites transmitted by tsetse flies. The disease occurs in scattered foci throughout the subsaharan tsetse belts of Africa - an area of some 10 million sq km. It is closely related to a widespread cattle infection known as Nagana, which restricts cattle rearing in many areas of the continent. Although sleeping sickness claims relatively few lives today, the risk of severe epidemics means that surveillance and active control measures must be maintained throughout the endemic areas.

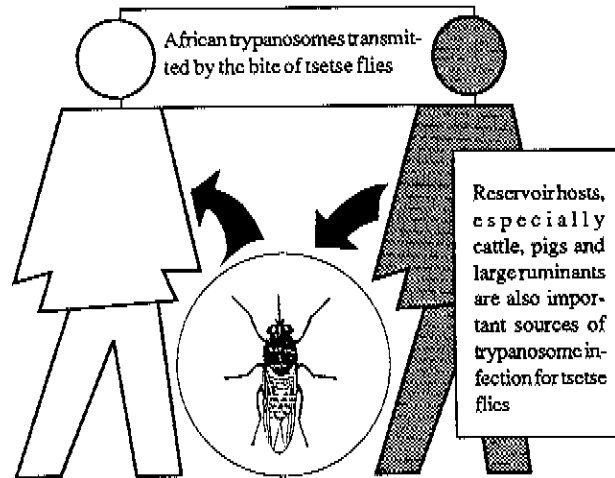
Causative agents: Protozoan parasites of the genus *Trypanosoma*, transmitted by tsetse flies. *Trypanosoma brucei rhodesiense* occurs mainly in East and southern Africa, with *T. b. gambiense* mainly in West and Central Africa. A third subspecies, *T. b. brucei* is responsible for the cattle disease, Nagana, but does not infect man.

Estimated number of cases: 25 000 per year

Number of countries affected: 36

Number of people at risk: 50 million





Transmission and Clinical Symptoms: Cattle and other large mammals are important reservoir hosts of trypanosomes. Tsetse flies can acquire a trypanosome infection by feeding on these infected animals—or on an infected person. The trypanosomes are then injected into the blood through the bite of an infected tsetse flies when it feeds again. The trypanosomes then multiply and invade most tissues.

In humans, infection with African trypanosomiasis leads initially to malaise, lassitude and irregular fevers. This is followed by a range of symptoms including headache, anaemia, joint pains and swollen tissues, progressing, as the parasites invade the central nervous system, to mental deterioration, coma and death. *T. b. rhodesiense* infection is usually acute, causing severe symptoms and death within a few days or weeks; *gambiense* infection tends to progress more slowly.

Control priorities in African trypanosomiasis

- Regular medical surveillance of the population at risk—diagnosis, followed by hospital treatment of confirmed cases.
- Ensure availability of diagnostic kits and drugs for treatment
- Reduce contact between humans and tsetse by using tsetse traps and selective insecticide applications to reduce tsetse numbers, together with vegetation clearance to remove tsetse resting and breeding sites.
- Encourage appropriate land use to minimize the range of breeding resting and feeding sites for tsetse flies.

parasite strains are now resistant to it. Suramin must be administered intravenously and can have adverse side-effects. Melarsoprol—an arsenical drug developed in the 1940s—is used against late-stage disease (although some resistant strains have been reported) but melarsoprol often incurs serious side-effects—sometimes fatal. Very recently, a new drug originally developed as an anticancer agent—DFMO (also known as eflornithine)—has given very promising results in field trials against *gambiense* infection, but seems much less effective against the more virulent *rhodesiense* form.



Research Priorities in African Trypanosomiasis

Immunology and Pathology

- improved diagnosis of active infection
- improved patient care through better understanding of susceptibility to infection and pathology of disease

Chemotherapy

- improve drug delivery and treatment
- strengthen facilities for clinical research
- rational design of new drugs

Epidemiology and Vector Control

- tsetse population modelling
- improved trapping techniques for tsetse flies
- improved methods for surveillance programmes
- community participation in tsetse control

Chagas disease

(also known as South American trypanosomiasis)

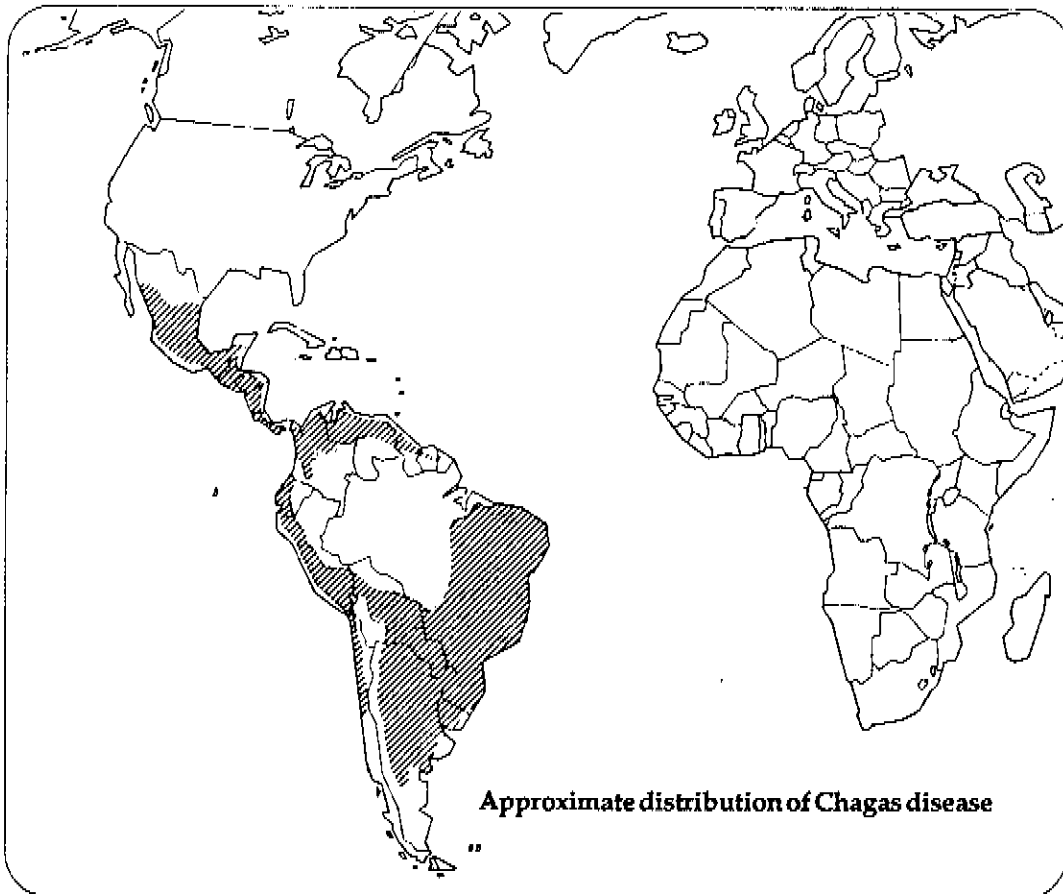
Chagas disease, which occurs only in the New World, gets its name from Dr Carlos Chagas - a Brazilian doctor who first described the disease in 1909. Remarkably, he also worked out the parasite's life-cycle, and identified the insects that transmit it and some of the small mammals that can act as reservoir hosts. He also made major contributions to studying the nature of the disease and how to prevent its transmission. Regrettably, the disease remains incurable, although transmission can be successfully interrupted by control of the insect vectors in houses and peridomestic habitats.

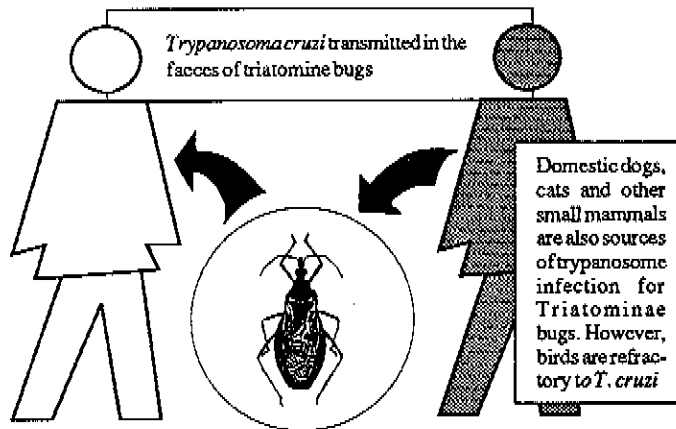
Causative agent: a protozoan parasite called *Trypanosoma cruzi*, transmitted by blood-sucking 'assassin bugs' (subfamily Triatominae).

Estimated number of cases: 16-18 million

Number of countries affected: all of Central and South America (occasional cases in southern USA)

Number of people at risk: 90 million





Transmission: *Trypanosoma cruzi* is transmitted by large blood-sucking 'assassin bugs' of the subfamily Triatominae. These insects (similar to large bedbugs) commonly live in the cracks and crevices of poor-quality houses in most rural areas of Latin America. They emerge from their cracks at night to bite and suck blood from the sleeping occupants. However, the parasites are not transmitted in the bite of insect. Instead, they are deposited with the insect faeces onto the skin. Scratching the bites probably helps the parasites penetrate and enter the bloodstream.

T. cruzi can also be transmitted by blood transfusion from infected people - this is increasingly a problem in blood banks and hospitals in some areas.

Clinical symptoms: Often, there is a small sore at the bite where the parasites entered the body. If this site is around the eye, that eyelid can develop a marked swelling (known as Romaña's sign). Within a few days, fever and swollen lymph nodes may develop, sometimes making the early stages of infection appear like malaria. This early acute phase of infection can be fatal, but more usually the patient survives to enter a symptomless phase which may last many months or years. During this period however, the parasites are invading most organs of the body, so that chronic symptoms eventually develop - often involving irreversible damage to heart and intestine. In such cases, the patient becomes progressively weaker, and may die from heart failure.

Control Priorities in Chagas disease

- Large-scale use of residual insecticide formulations in bug-infested houses and peridomestic habitats in endemic areas.
- Health education to increase public support for vector control programmes, encourage people to keep their domestic animals outside their houses, and sustain community-based vigilance schemes to advise control services of any reappearance of bug vectors in their houses.
- Housing improvement schemes to reduce the likelihood of bug colonization of houses in endemic areas.
- Systematic control of blood banks to avoid transfusional transmission of Chagas disease (and other blood-borne diseases such as syphilis, hepatitis-B and AIDS).



Research Priorities in Chagas disease

Epidemiology and Vector Control

- field evaluation of new vector control methods
- community participation in surveillance and control

Diagnosis

- standardize current methods of serodiagnosis
- improved methods for diagnosis, monitoring treatment and evaluating control activities
- improved testing and treatment methods to prevent transmission by blood transfusion

Treatment and Patient Care

- improve patient care through better understanding of pathology
- basic parasitological studies to find new ways for disease treatment and prevention

Prevention and control: For practical purposes, chronic Chagas disease is incurable (two drugs, nifurtimox and benznidazole, can be used for very early infections, but early diagnosis is difficult and adverse side-effects can occur). Moreover, because *T. cruzi* antigens may stimulate autoimmunity (immune attack on host tissues) the likelihood of a safe effective vaccine now seems very remote. Control therefore relies on insecticides to kill the triatomine bugs in houses, together with programmes of health education and low-cost housing improvements to render houses unsuitable for colonization by the bugs.

For the traveller, Chagas disease can be avoided by not sleeping in infested houses, and, if blood transfusion is required, using blood that has been treated with a blue dye (crystal violet) that eliminates the parasites from stored blood.

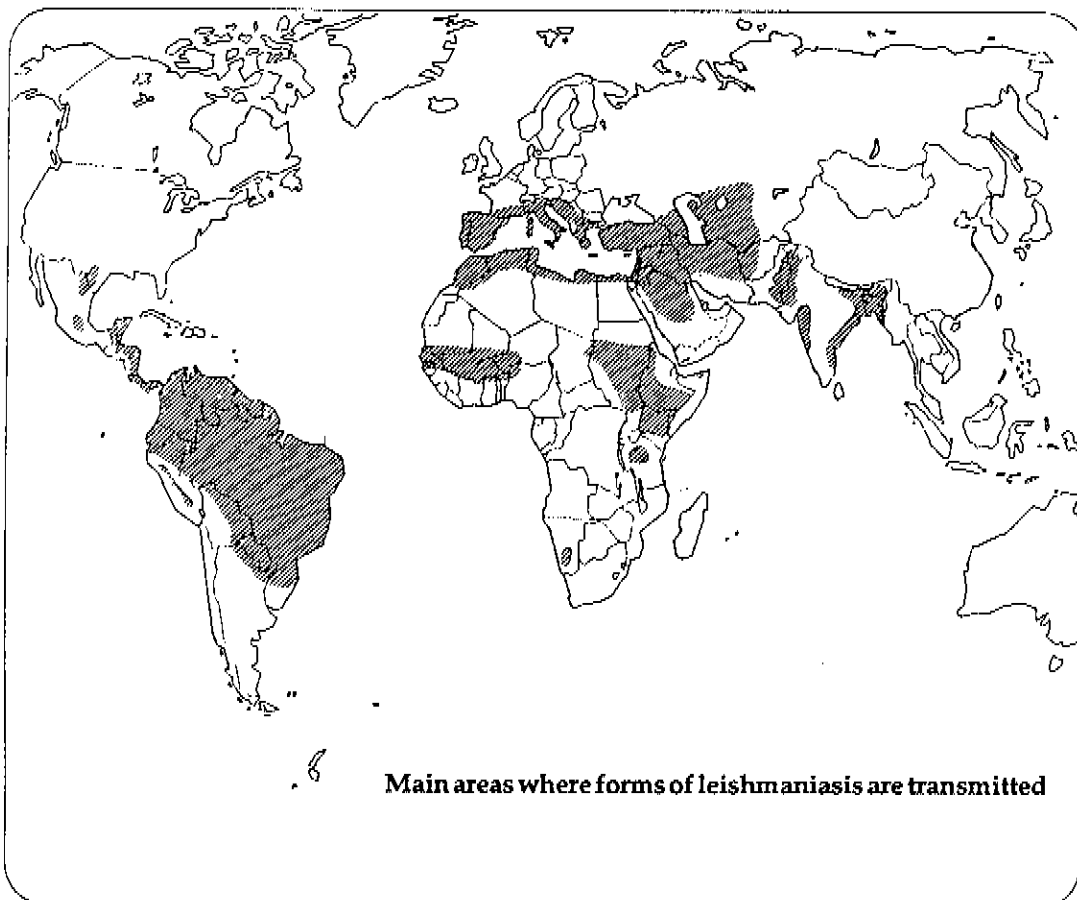
Leishmaniasis

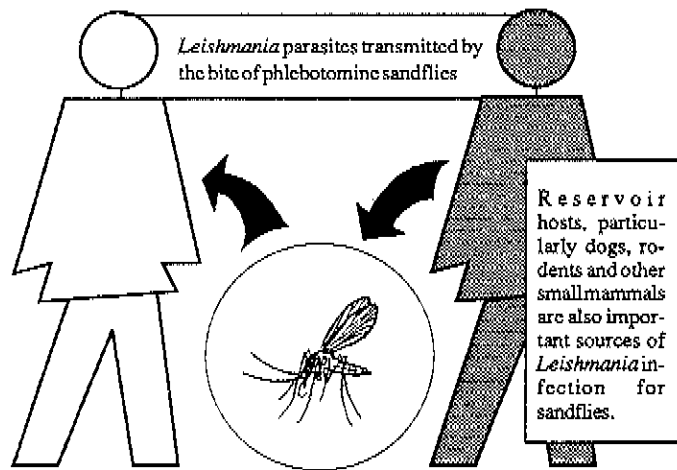
Leishmania parasites get their name from W.B. Leishman who developed in 1901 one of the earliest stains specific for this type of parasite. They are widespread in the New World and Old World (but not in SE Asia), and human infections are still found in many parts of Europe such as France, Italy, Greece, Malta, Spain, Portugal, Turkey and southern USSR. Although generally known for causing disfiguring lesions, epidemics of visceral forms of leishmaniasis have caused thousands of deaths.

Causative agents: Parasitic protozoa of the genus *Leishmania*, transmitted by infected sandflies. Several species and subspecies infect man, leading to symptoms ranging from simple self-healing skin ulcers (eg. due to *Leishmania major*) to severe life-threatening disease (eg. visceral leishmaniasis, known as Kala-azar, due to *L. donovani*).

Estimated number of cases: 12 million
Number of new cases per year: >400 000

Number of countries affected: 80
Number of people at risk: approx. 350 million





Transmission: Most forms of leishmaniasis are originally infections of small mammals (known as reservoir hosts) which play a major role in the epidemiology of this disease. Man becomes infected through the bite of infected sandflies (subfamily phlebotominae) - tiny sand-coloured biting flies that breed in moist soil, for example in forest areas, caves, or in the burrows of small rodents. Old World forms of *Leishmania* are transmitted by sandflies of the genus *Phlebotomus*, while New World forms are mainly transmitted by sandflies of the genus *Lutzomyia*. The sandflies become infected by feeding from infected reservoir hosts or from infected people.

In the mammalian host, *Leishmania* parasites invade cells called macrophages, where they multiply to eventually rupture the cell and invade more macrophages.

Clinical symptoms: About 20 species and subspecies of *Leishmania* are known to infect man. Each causes a different range of symptoms. The most common infection, due to *L. major* in Africa and Asia, leads to one or more simple skin lesions (with local names such as 'Baghdad ulcer', 'Delhi boil', 'bouton d'orient'). These generally heal after a few weeks or months to leave unsightly scars. In South America, mucocutaneous leishmaniasis (eg. due to *L. braziliensis*) also begins with simple skin ulcers, but these can spread to give hideous tissue destruction - especially of the nose and mouth. Visceral leishmaniasis (eg. Kala azar, due to *L. donovani*) is also a serious disease, usually fatal if untreated. Common symptoms include fever, malaise, weight loss, and then anaemia and swelling of spleen, liver and lymph nodes.

Control priorities in Leishmaniasis

- Improve reporting of disease distribution, prevalence and health impact
- Promote passive and active surveillance of the population at risk - diagnosis, followed by drug treatment of infected patients
- Promote additional control measures against vectors and reservoir hosts where appropriate
 - vector control by spraying houses with insecticides (especially for urban forms of leishmaniasis)
 - destruction of infected reservoir hosts (especially small rodents in areas of cutaneous leishmaniasis and dogs visceral leishmaniasis)
- Promote training of health personnel at various levels, in all aspects of case recognition, diagnosis, treatment and control.

In some areas (such as the Mediterranean region, parts of the Soviet Union and China, and periurban districts of other endemic regions) the risk of leishmaniasis transmission is reduced by destroying infected dogs and other reservoir hosts.



Research Priorities in Leishmaniasis

Epidemiology and Diagnosis

- development and evaluation of diagnostic tests for visceral leishmaniasis
- interaction between *Leishmania* and HIV

Vaccine Development

- field trials of candidate vaccines against cutaneous leishmaniasis
- development of defined and recombinant vaccines against cutaneous and visceral leishmaniasis

Chemotherapy

- basic biochemical studies
- new treatment regimes and combination chemotherapy with existing drugs
- evaluation of topical treatments for cutaneous leishmaniasis
- development of new drugs

Prevention and treatment: Simple cutaneous leishmaniasis will usually heal without treatment, leaving the person immune to further infection with that species of *Leishmania*. Thus, in many parts of the Middle East, infections are deliberately encouraged on the buttocks of babies in order to immunize them against further infections (thus avoiding disfiguring scars on the face). However, other forms of leishmaniasis are extremely difficult to treat, usually requiring a long course of pentavalent antimony drugs (Glucantime or Pentostam) and sometimes the antibiotic amphotericin B. Often however, infection can be prevented by avoiding sandfly bites (eg. using repellants or insecticides). Many forms of leishmaniasis are related to specific human activities that bring man directly into contact with sandflies. For example, cutaneous infections known as 'chiclero's ulcer' in Latin America is particularly associated with forest workers who encounter sandflies while collecting latex from chicle trees (to make chewing gum).

Leprosy

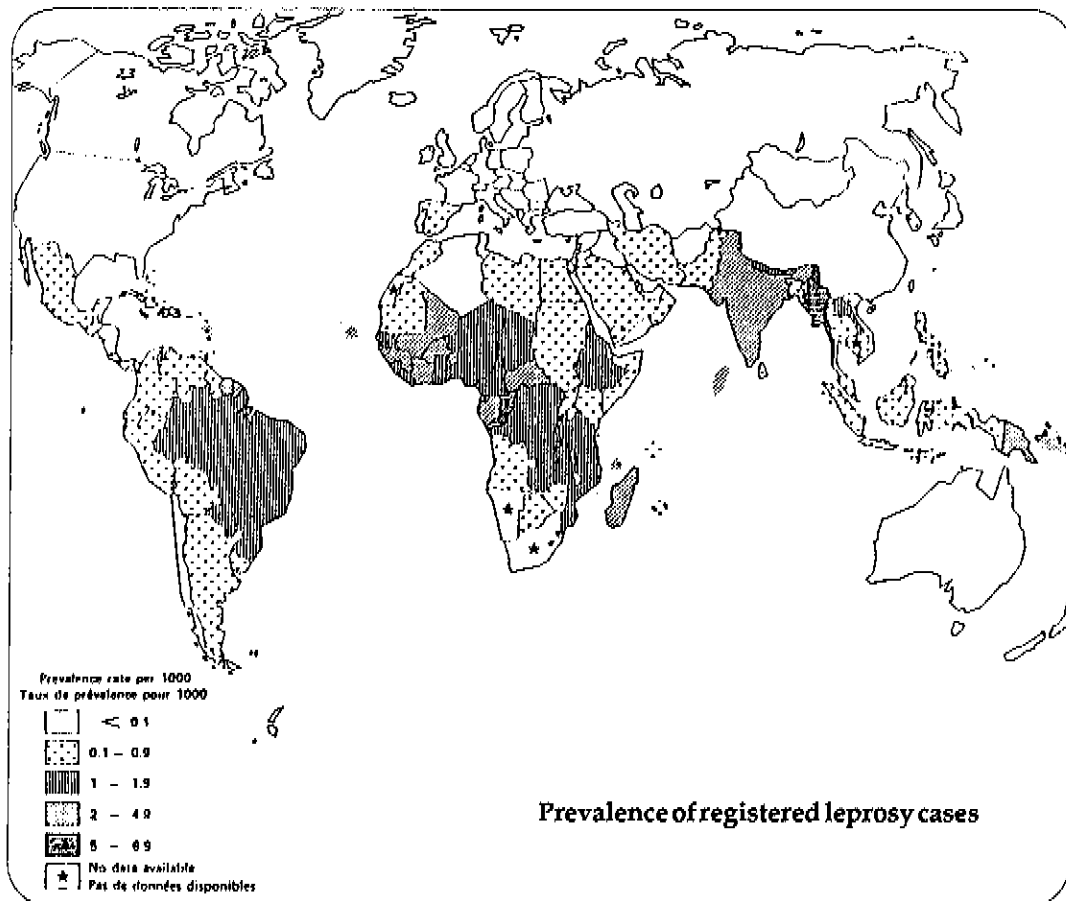
Leprosy is sometimes known as Hansen's disease or Hanseniasis, after Norwegian physician Armauer Hansen who in 1873 first identified its cause. Because of its psychological and social effects, leprosy is referred to in many languages as "the big disease."

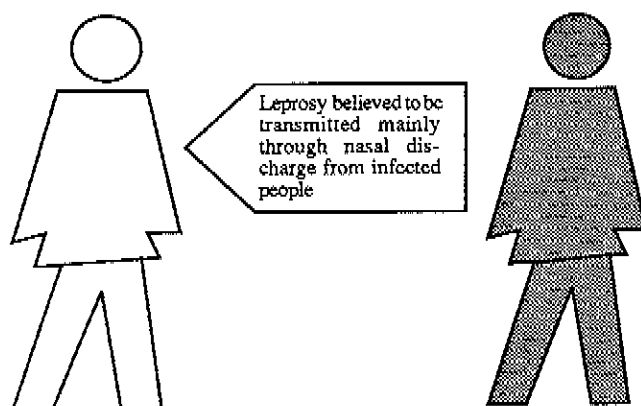
Causative agent: a slow-growing bacterium called *Mycobacterium leprae* (related to *M. tuberculosis*, the cause of TB)

Number of cases: 3.9 million officially registered cases in 1989
10-12 million estimated total

Number of countries affected: 121 with more than 100 registered cases

Number of people at risk: 1600 million resident in endemic areas





Transmission: Humans seem to be the only natural hosts of *M. leprae**. The bacterium is believed to be transmitted mainly from the nasal discharge of infected people, but might also be transmitted by skin contact. In the body, the bacteria grow mainly in nerve cells and macrophage cells in the skin.

Clinical symptoms: The clinical course of leprosy varies from asymptomatic infections to severe disfiguring disease. Skin lesions may appear and heal spontaneously. As the disease progresses (usually over several years), the skin lesions may become more frequent. These lesions range from depigmented patches - usually with loss of skin sensitivity - to multiple nodules with extensive skin thickening and folding. Loss of sensitivity in the skin often results in unnoticed burns or ulcers. Lesions of the nerves can lead to muscle weakness and atrophy resulting in deformities, especially of the feet and hands.

Control Priorities in Leprosy

- Implement the WHO-recommended multidrug therapy and reduce disease prevalence.
- Detect cases early and prevent disabilities.
- Strengthen national capacity for control through training of health personnel at all levels.
- Integrate leprosy control within Primary Health Care services.
- Carry out health systems research in leprosy to improve performance of disease control programmes.

Prevention of leprosy by vaccination is another goal. The tuberculosis vaccine, BCG, offers some protection, but more effective vaccines based on killed *M. leprae* together with BCG are now undergoing large-scale field trials in India, Malawi and Venezuela. Genetically engineered vaccines are also under development.

* The 9-banded armadillo can be infected experimentally, and thus provides a vital source of material for research and vaccine preparation.



Research Priorities in Leprosy

Chemotherapy

- to develop new drugs
- to improve treatment schedules with existing drugs (including operational research)
- to develop new methods for screening candidate drugs

Immunology

- to improve diagnostic methods
- to develop vaccines
- to understand how best to use vaccines (including possible immunotherapy)
- to better understand nerve damage in leprosy

Countries and Territories where the target tropical diseases are recorded

WHO African Region	Malaria (excluding imported cases)	Schisto- somi- asias	Filariasis		Trypanosomiasis		Leish- mani- asias	Leprosy (>100 registered cases)
			LF	Oncho	African	Chagas		
Algeria	x	x					x	
Angola	x	x	x	x	x			x
Benin	x	x	x	x	x			x
Botswana	x	x			x			x
Burkina Faso	x	x	x	x	x		x	x
Burundi	x	x	x	x	x			
Cameroon	x	x	x	x	x		x	x
Cape Verde			x					x
Central African Republic	x	x	x	x	x		x	x
Chad	x	x	x	x	x		x	x
Comoros	x		x					
Congo	x	x	x	x	x			x
Côte d'Ivoire	x	x	x	x	x			x
Equatorial Guinea	x	x	x	x	x			
Ethiopia	x	x	x	x	x		x	x
Gabon	x	x	x	x	x			x
Gambia	x	x	x		x		x	x
Ghana	x	x	x	x	x			x
Guinea	x	x	x	x	x			x
Guinea-Bissau	x	x	x	x	x		x	x
Kenya	x	x	x		x		x	x
Lesotho								x
Liberia	x	x	x	x	x			x
Madagascar	x	x	x					x
Malawi	x	x	x	x	x		x	x
Mali	x	x	x	x	x		x	x
Mauritania	x	x					x	x
Mauritius	x	x	x					x
Mozambique	x	x	x		x			x
+ Namibia	x	x	x		x		x	x

+ not a WHO member state

	Malaria (excluding imported cases)	Schisto- somi- asias	Filariasis		Trypanosomiasis		Leish- mani- asias	Leprosy (>100 registered cases)
			LF	Oncho	African	Chagas		
Niger	x	x	x	x	x		x	x
Nigeria	x	x	x	x	x		x	x
Reunion			x					x
Rwanda	x	x	x		x			x
Sao Tome and Principe	x	x	x					x
Senegal	x	x	x	x	x		x	x
Seychelles			x					
Sierra Leone	x	x	x	x	x			x
South Africa	x	x					(x)*	x
Swaziland	x	x			x			x
Togo	x	x	x	x	x		x	x
Uganda	x	x	x	x	x		x	x
United Republic of Tanzania	x	x	x	x	x			x
Zaire	x	x	x	x	x		x	x
Zambia	x	x	x		x		x	x
Zimbabwe	x	x	x		x			x

* no recent human cases

WHO Eastern Mediterranean Region	Malaria (excluding imported cases)	Schisto- somi- asias	Filariasis		Trypanosomiasis		Leish- mani- asias	Leprosy (>100 registered cases)
			LF	Oncho	African	Chagas		
Afghanistan	x						x	x
Bahrain								
Cyprus								x
Democratic Yemen	x	x					x	x
Djibouti	x						x	
Egypt	x	x	x				x	x
Iran (Islamic Rep. of)	x	x					x	x
Iraq	x	x					x	x
Jordan	x	x					x	
Kuwait							x	
Lebanon	x	x					x	
Libyan Arab Jamahiriya	x	x					x	x
Morocco	x	x					x	x
Oman	x	x	x				x	x
Pakistan	x						x	x
Qatar								
Saudi Arabia	x	x					x	
Somalia	x	x	x				x	x
Sudan	x	x	x		x	x	x	x
Syrian Arab Republic	x	x					x	x
Tunisia	x	x					x	x
United Arab Emirates	x						x	
Yemen Arab Republic	x	x			x		x	x

WHO South-East Asian Region	Malaria (excluding imported cases)	Schistosomiasis	Filariasis		Trypanosomiasis		Leishmaniasis	Leprosy ($\times 100$ registered cases)
			LF	Oncho	African	Chagas		
Bangladesh	x		x				x	x
Bhutan	x							x
Union of Myanmar	x		x					x
Dem. People's Rep. of Korea								
India	x	x	x				x	x
Indonesia	x	x	x					x
Maldives			x					x
Mongolia								
Nepal	x		x				x	x
Sri Lanka	x		x					x
Thailand	x	x	x					x

WHO Western Pacific Region	Malaria (excluding imported cases)	Schistosomiasis	Filariasis		Trypanosomiasis		Leishmaniasis	Leprosy (>100 registered cases)
			LF	Oncho	African	Chagas		
American Samoa			x					x
Australia								x
Brunei Darussalam	x							
China	x	x	x				x	x
Cook Islands			x					
Dem. Kampuchea	x	x						x
Federal States Micronesia								x
Fiji			x					x
French Polynesia			x					
Guam								
Hongkong								x
Japan		(x) *						x
Kiribati								
Lao People's Dem. Rep.	x	x						x
Macao								
Malaysia	x	x	x					x
Nauru								
New Caledonia								x
New Zealand								x
Papua New Guinea	x		x					x
Philippines	x	x	x					x
Republic of Korea			x					x
Samoa			x					x
Singapore								x
Solomon Islands	x		x					x
+Taiwan							x	x
Tonga			x					
Tuvalu								
Vanuatu	x		x					x
Viet Nam	x		x					x

* no recent human cases

+ not a WHO member state

WHO Region of the Americas	Malaria (excluding imported cases)	Schistosomiasis	Filariasis		Trypanosomiasis		Leishmaniasis	Leprosy (>100 registered cases)
			LF	Oncho	African	Chagas		
Anguilla								
Antigua and Barbuda		x						
Argentina	x					x	x	x
Bahamas								
Barbados								
Belize	x						x	
Bermuda								
Bolivia	x					x	x	x
Brazil	x	x	x	x		x	x	x
Canada								x
Cayman Islands								
Chile						x		
Colombia	x			x		x	x	x
Costa Rica	x		x			x	x	x
Cuba						x		x
Dominica								
Dominican Republic	x	x	x				x	x
Ecuador	x			x		x	x	x
El Salvador	x					x	x	
French Guiana	x		x				x	
Grenada								
Guadeloupe		x						x
Guatemala	x			x		x	x	x
Guyana	x		x			x	x	x
Haiti	x		x					x
Honduras	x					x	x	x
Jamaica								x
Martinique		x						x
Mexico	x			x		x	x	x
+Montserrat		x						

+ not a WHO member state

WHO European Region	Malaria (excluding imported cases)	Schisto- somiasis	Filariasis		Trypanosomiasis		Leish- maniasis	Leprosy (>100 registered cases)
			LF	Oncho	African	Chagas		
Albania							(x)*	
Andorra								
Austria								
Belgium								
Bulgaria							(x)*	
Czechoslovakia								
Denmark								
Finland								
France							x	x
German Democratic Republic								
Germany, Federal Republic of								
Greece							x	x
+Holy See								
Hungary								
Iceland								
Ireland								
Israel							x	x
Italy							x	x
Lichtenstein								
Luxembourg								
Malta							x	
Monaco								
Netherlands								
Norway								
Poland								
Portugal							x	x
Romania							x	
San Marino								
Spain							x	x

* no recent human cases

+ not a WHO member state

	<i>Malaria</i> (excluding imported cases)	<i>Schisto-</i> <i>somiasis</i>	<i>Filariasis</i>		<i>Trypanosomiasis</i>		<i>Leish-</i> <i>maniasis</i>	<i>Leprosy</i> (>100 registered cases)
			LF	Oncho	African	Chagas		
Sweden								
Switzerland								
Turkey	x	x	x				x	x
USSR	x						x	x
United Kingdom of Great Britain and Northern Ireland								x
Yugoslavia							x	
