

Lesson/Week 9

Other Infectious Diseases of Global Significance

- ✓ Dengue Fever and Dengue Hemorrhagic Fever (DHF)
- ✓ Yellow fever
- ✓ Schistosomiasis (Bilharziasis)
- ✓ Leishmaniasis
- ✓ African Trypanosomiasis and Chagas Disease
- ✓ Onchocerciasis
- ✓ Lymphatic Elephantiasis
- ✓ Hepatitis
- ✓ Diarrheal diseases
- ✓ Sexually transmitted diseases (other than HIV/AIDS)

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US A vectored diseases: the case of WNV

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- ✓ Protein energy malnutrition and micronutrient deficiency

Dengue fever and dengue hemorrhagic fever DHF

Dengue Fever Agent virus, vector aedes aegypti (mosquito)

- ✓ One-third to two-fifths of the world's population at risk.
- ✓ Dengue infection is a leading cause of illness and death in many countries.
- ✓ As many as **50 million** people are **infected yearly**.
- ✓ Dengue is caused by any one of **four related viruses (1,2,3 and 4)** transmitted by mosquitoes.
- ✓ There are no vaccines to prevent DENV and DHF infections.
- ✓ When infected, early recognition and prompt supportive treatment can substantially lower the risk of developing severe disease.
- ✓ Dengue has emerged as a worldwide problem **only since the 1950s**.

<http://www.cdc.gov/dengue/> and www.WHO.org

Denguecontd...

Interactive map <http://www.healthmap.org/dengue/index.php>

“In rare cases dengue can be transmitted in **organ transplants** or **blood transfusions** from infected donors, and there is evidence of transmission from an infected pregnant **mother to her fetus**. But in the vast majority of infections, a mosquito bite is responsible.” <http://www.cdc.gov/dengue>

✓ During **epidemics** of dengue, infection rates among those who have not been previously exposed to the virus are often **40% to 50%**, but can reach **80% to 90%**.

✓ An estimated **500 000** people with **DHF** require hospitalization each year, a very large proportion of whom are children.

✓ About **2.5%** of those affected die. Without proper treatment, **DHF** fatality rates can exceed **20%**.

“Dengue haemorrhagic fever (**DHF**) is a potentially deadly complication that is characterized by high fever, often with enlargement of the liver, and in severe cases circulatory failure” **WHO**

Yellow fever

Yellow Fever:

Key facts <http://www.who.int/mediacentre/factsheets/fs100/en/>

- ✓ Yellow fever is an acute **viral** haemorrhagic disease transmitted by infected mosquitoes. The "yellow" in the name refers to the **jaundice** that affects some patients.
- ✓ Up to 50% of severely affected persons without treatment will die from yellow fever.
- ✓ There are an estimated 200 000 cases of yellow fever, causing **30 000 deaths**, worldwide each year.
- ✓ The virus is endemic in tropical areas of Africa and Latin America, with a combined **population of over 900 million people**.
- ✓ The number of yellow fever cases has increased over the past two decades due to declining population immunity to infection, deforestation, urbanization, population movements and climate change.
- ✓ There is **no cure** for yellow fever. Treatment is symptomatic, aimed at reducing the symptoms for the comfort of the patient.
- ✓ **Vaccination** is the most important preventive measure against yellow fever. The vaccine is safe, affordable and highly effective, and appears to provide protection for 30–35 years or more. The vaccine provides effective immunity within one week for 95% of persons vaccinated.

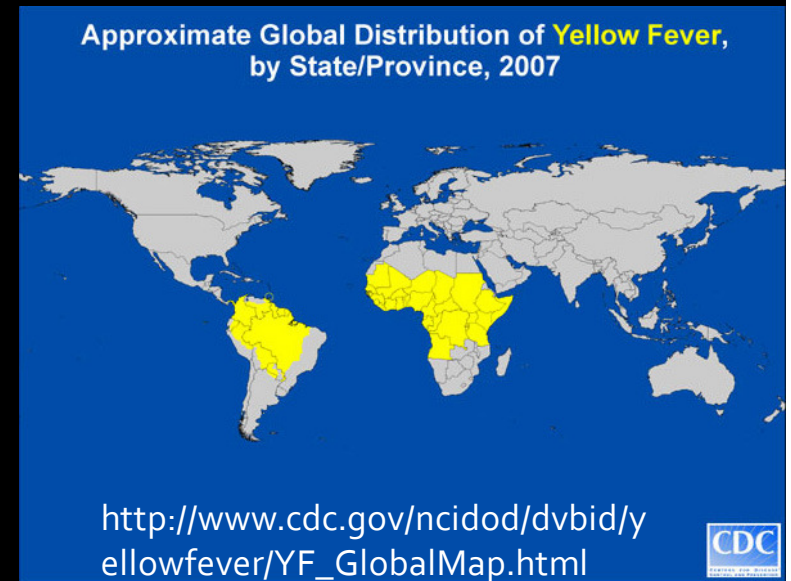
Yellow fevercontd

Transmission

- ✓ The agent is a virus - an **arbovirus** of the **flavivirus** genus, and the mosquito is the primary vector. It carries the virus from one host to another, primarily **between monkeys**, from **monkeys to humans**, and from **person to person**.
- ✓ Several different species of the *Aedes* and *Haemogogus* mosquitoes transmit the virus.
- ✓ There are three types of transmission cycles.
- ✓ **1. Sylvatic (or jungle) yellow fever**: In tropical rainforests, yellow fever occurs in monkeys that are infected by wild mosquitoes. The infected monkeys then pass the virus to other mosquitoes that feed on them. The infected mosquitoes bite humans entering the forest, resulting in occasional cases of yellow fever.
- ✓ **2. Intermediate yellow fever**: Semi-domestic mosquitoes (that breed in the wild and around households) infect both monkeys and humans.
- ✓ **3. Urban yellow fever**: Virus introduced into densely populated areas with a high number of non-immune people and *Aedes* mosquitoes.

Countries where Yellow Fever is present.

Angola
Argentina
Benin
Bolivia
Brazil
Burkina Faso
Burundi
Cameroon
Central African Republic
Chad
Congo
Congo, DRC
Colombia
Cote d'Ivoire (Ivory Coast)
Ecuador
Equatorial Guinea
Ethiopia
French Guiana
The Gambia
Gabon
Ghana
Guinea
Guinea-Bissau
Guyana
Kenya
Liberia
Mali
Mauritania
Niger
Nigeria
Panama
Paraguay
Peru
Rwanda
Sao Tome & Principe
Senegal
Sierra Leone
Somalia
Sudan
Suriname
Tanzania
Trinidad & Tobago
Togo
Uganda
Venezuela



Schistosomiasis



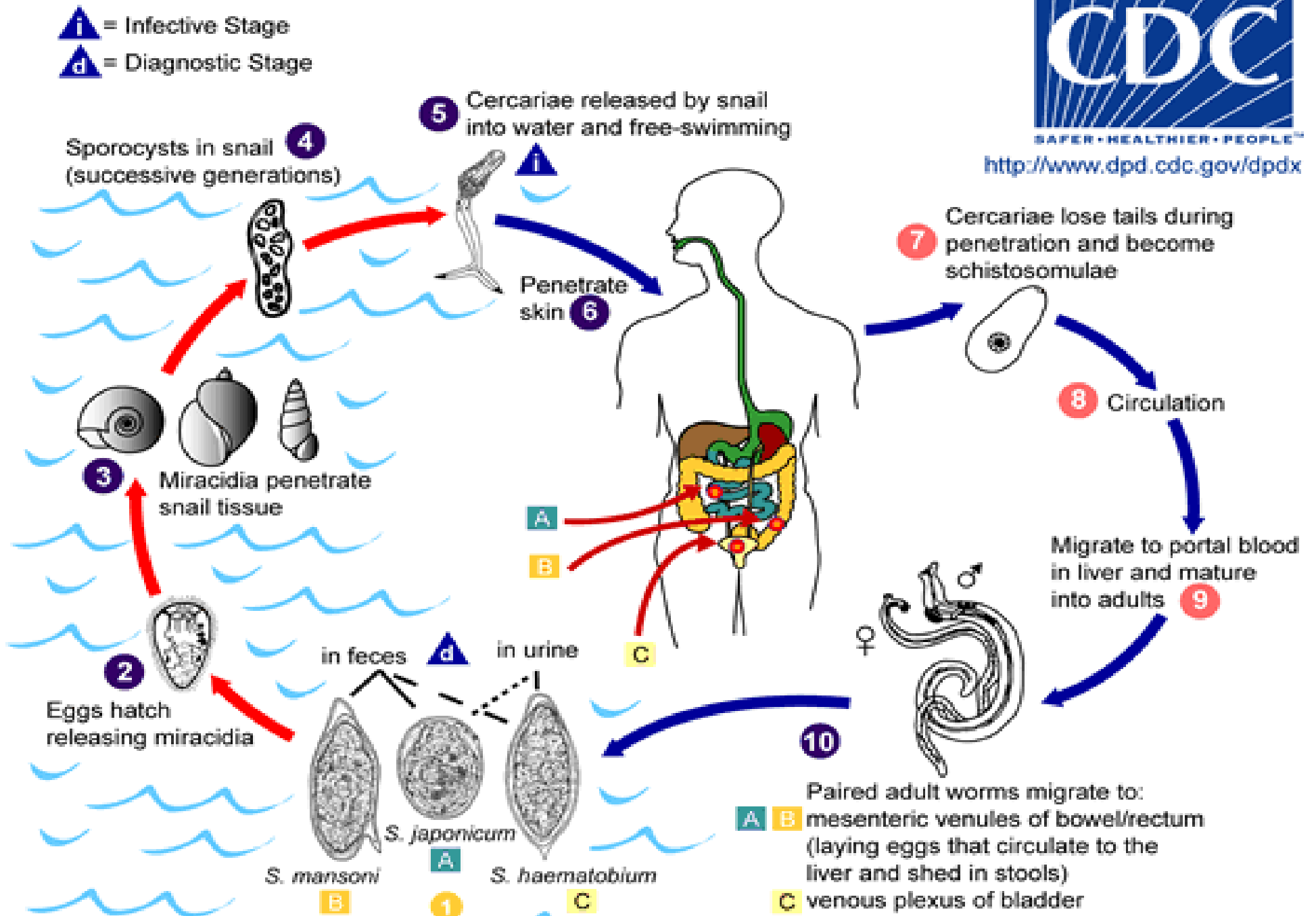
Animation

http://www.wellcome.ac.uk/en/labnotes5/animation_popups/schisto.html

Schistosomiasis

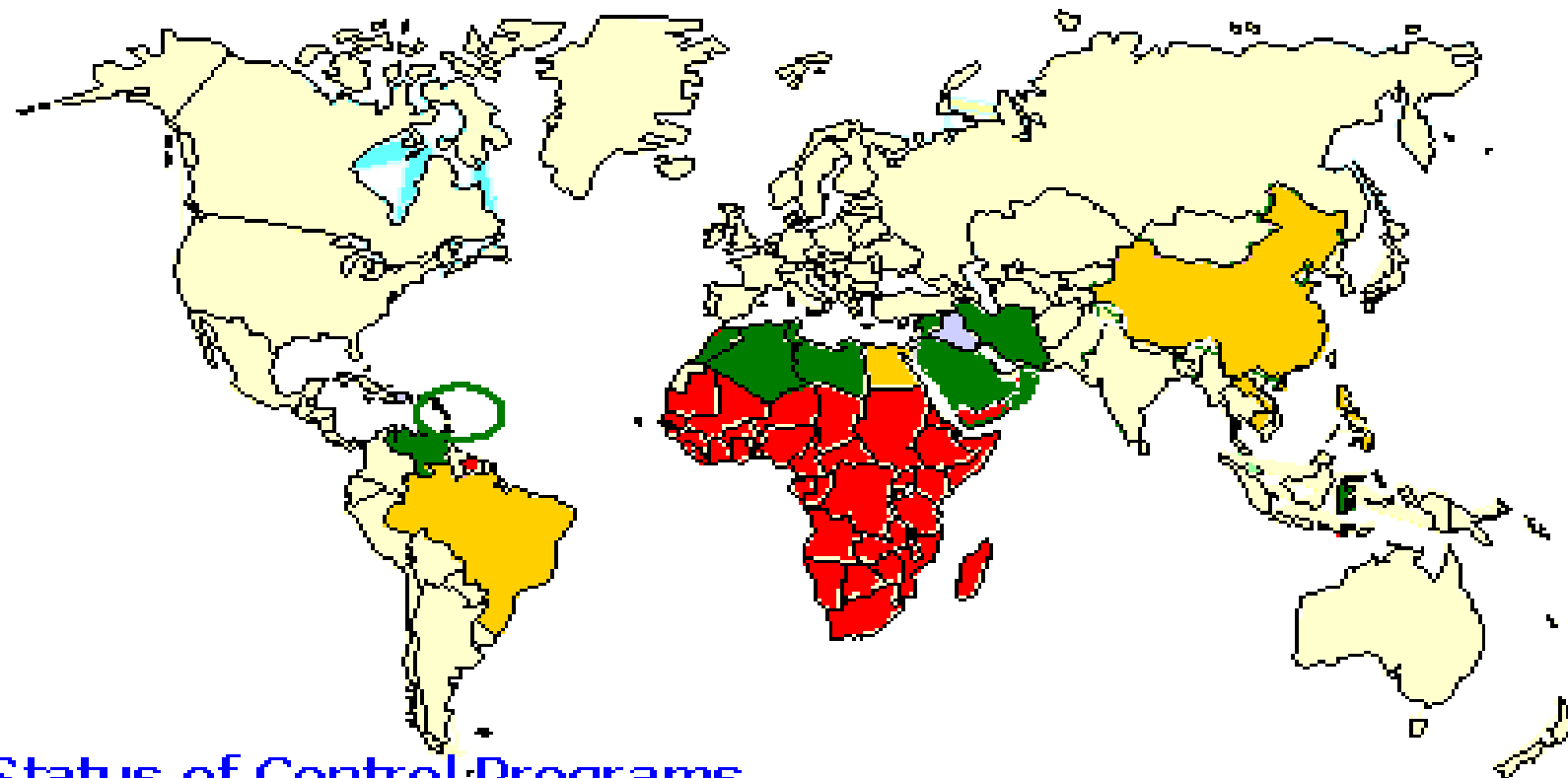
<http://www.who.int/mediacentre/factsheets/fs100/en/>

- ✓ Schistosomiasis, or bilharzia, is a parasitic disease caused by trematode **flatworms** of the genus *Schistosoma*.
- ✓ Larval forms of the parasites, which are released by freshwater **snails**, **penetrate the skin** of people in the water.
- ✓ In the body, the larvae develop into adult schistosomes, which live in the blood vessels.
- ✓ The females release eggs, some of which are passed out of the body in the urine or faeces. Others are trapped in body tissues, causing an immune reaction.
- ✓ In urinary schistosomiasis, there is progressive damage to the bladder, ureters and kidneys. In intestinal schistosomiasis, there is progressive enlargement of the liver and spleen, intestinal damage, and hypertension of the abdominal blood vessels.
- ✓ Control of schistosomiasis is based on drug treatment, snail control, improved sanitation and health education.

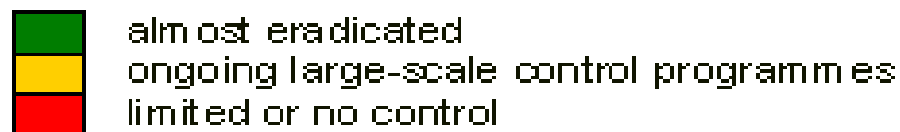


- ✓ An estimated 200 million people worldwide infected.
 - ✓ It is estimated that 200,000 annual deaths are attributable to schistosomiasis.
- <http://www.cwru.edu>

Global Distribution of Schistosomiasis

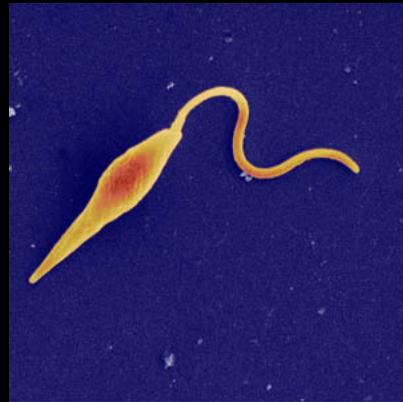


Status of Control Programs



Source: WHO

Leishmaniasis



Leishmaniasis

<http://www.who.int/leishmaniasis/en/>



Leishmaniasis is caused by **protozoan parasites** belonging to the genus *Leishmania*. The parasites are transmitted by the bite of a tiny – only 2–3 mm long – **insect vector**, the *phlebotomine sandfly*.

There are some 500 known phlebotomine species, but only about **30** have been found to **transmit leishmaniasis**. Only the **female** sandfly transmits the parasites. Female sandflies need blood for their eggs to develop, and become infected with the *Leishmania* parasites when they suck blood from an infected person or animal. Over a period of between 4 and 25 days, the parasites develop in the sandfly. When the infectious female sandfly then feeds on a fresh source of blood, it inoculates the person or animal with the parasite, and the transmission cycle is completed.

Leshmaniasis ...contd

Global disease burden

Two types: **Visceral**

✓ **Cutaneous**

Every year Leishmaniasis causes **57,000 deaths** .

✓ *WHO* estimates that 1.5 million people become infected with the *Leishmania* species that cause Cutaneous, Mucocutaneous and Diffuse cutaneous leishmaniasis each year.

✓ An additional 500,000 people become infected with Visceral Leishmaniasis (**Kala-azar**) on an annual basis.

<http://www.stanford.edu>



<http://en.wikipedia.org>

Leshmaniasis ...contd

Most *Leishmania* species cause cutaneous leishmaniasis in people.

With the exception of Antarctica, *Leishmania spp.* have been reported on every continent.

Person-to-person transmission including vertical (congenital) transmission, venereal transmission, and transmission by blood transfusion has been reported. Newborns can be infected whether or not the mother was symptomatic.

Humans and domesticated animals are **accidental hosts** for many *Leishmania spp.*, which are maintained in cycles between wild animals and sandflies.

Treatment :

Visceral or cutaneous leishmaniasis can usually be cured in immunocompetent individuals.

<http://www.cfsph.iastate.edu/Factsheets/pdfs/leishmaniasis.pdf>

African Trypanosomiasis (sleeping sickness) and American Trypanosomiasis (Chagas Disease)

Definition of African Trypanosomiasis

- ✓ Human African trypanosomiasis, also known as sleeping sickness, is a vector-borne parasitic disease.
- ✓ The parasites concerned are **protozoa** belonging to the *Trypanosoma* genus.
- ✓ They are transmitted to humans by tsetse fly (*Glossina* genus) bites which have acquired their infection from human beings or from animals harbouring the human pathogenic parasites." <http://www.who.int>



tsetse fly (Genus *Glossina*)



Image of sleeping sickness parasite (*Trypanosoma*) in blood x3,700
Colour enhanced scanning electron micrograph

The Disease

✓ In advanced stages, the disease attacks the central nervous system, causing changes in personality, alteration of the biological clock (the circadian rhythm), confusion, slurred speech, seizures, and difficulty walking and talking.

✓ These problems can develop over many years in the T. Gambiense form and some months in the T. Rhodesiense form (these are the two main types of trypanosoma); if not treated, the person will die.

Video: <http://www.rockhopper.tv/programmes/150/>

✓ Almost 45,000 cases of African sleeping sickness were reported to the World Health Organization (WHO) in 1999, but the WHO believes the real number of cases is between 300,000 and 500,000 cases. In specific villages of many provinces of Angola, the Democratic Republic of Congo and southern Sudan, the prevalence of the disease is 20% to 50%. Sleeping sickness has become the second greatest cause of death, ahead of HIV/AIDS, in those areas.

American Trypanosomiasis (Chagas Disease)

- ✓ Chagas disease is named after the Brazilian physician Carlos Chagas, who discovered the disease in 1909.
- ✓ It is caused by the parasite *Trypanosoma cruzi*, which is transmitted to animals and people by insect vectors that are found only in the Americas (mainly, in rural areas of Latin America where poverty is widespread). Chagas disease (*T. cruzi* infection) is also referred to as American trypanosomiasis.
- ✓ The vector is the *Triatomine* bug



Triatomine bugs

<http://www.cdc.gov/parasites/chagas/>

Mode of Transmission

Infection occurs—

- ✓ Through **vector-borne** transmission in endemic counties via the feces of the triatomine insect (reduviid bug), which may be inadvertently inoculated into the skin, the mucosa of eye, nose, or mouth when the insect's bite is scratched and rubbed
- ✓ Through **transfusion** or organ **transplantation**
- ✓ From **mother to infant**
- ✓ By **ingestion** of contaminated **food or drink**
- ✓ Through occupational exposure in research workers

Occurrence

"Approximately 7.6 million people are infected with Chagas disease, according to the most recent estimates. The disease is endemic in Mexico, Central and South America. Rare cases of Chagas disease attributed to local vector-borne transmission have been reported in the United States" <http://wwwnc.cdc.gov>

Onchocerciasis (river-blindness)



✓ **Onchocerciasis** is a parasitic disease caused by the filarial **worm** *Onchocerca volvulus*.

✓ It is transmitted through the bites of infected **blackflies** (of *Simulium* species, which carry immature larval forms of the parasite from human to human.

“In the human body, the larvae form nodules in the subcutaneous tissue, where they mature to adult worms.”

“After mating, the female adult worm can release up to 1000 microfilariae a day. These move through the body, and when they die they cause a variety of conditions, including blindness, skin rashes, lesions, intense itching and skin depigmentation.”

<http://www.who.int/topics/onchocerciasis/en/>

Onchocerciasis is the world's second leading infectious cause of blindness.

Rarely life-threatening, the disease causes chronic suffering and severe disability.

In Africa, it constitutes a serious **obstacle to socio-economic development**.

It is often called river blindness because the blackflies that transmit the disease abound in riverside areas, where they breed in oxygen-rich **fast-flowing** waters.

Fertile riverine areas are frequently abandoned for fear of the disease.

78 million people are estimated to be at risk
300 000 people are blind



Lymphatic Filariasis

✓ **Lymphatic filariasis**, commonly known as elephantiasis, is a neglected tropical disease. Infection occurs when filarial parasites are transmitted to humans through mosquitoes.

✓ When a mosquito with infective stage larvae bites a person, the parasites are deposited on the person's skin from where they enter the body.

✓ The larvae then migrate to the lymphatic vessels where they develop into adult worms forming 'nests' in the human lymphatic system.

✓ Infection is usually acquired in childhood, but the painful and profoundly disfiguring visible manifestations of the disease occur later in life. Whereas acute episodes of the disease cause temporary disability, lymphatic filariasis leads to permanent disability. <http://www.who.int>

- ✓ More than **1.3 billion people** in 81 countries worldwide are **threatened** by lymphatic filariasis, commonly known as elephantiasis.
- ✓ **Over 120 million people are currently infected**, with about **40 million disfigured** and **incapacitated** by the disease.
- ✓ Lymphatic filariasis can result in an altered lymphatic system and the abnormal enlargement of body parts, causing pain and severe disability.
- ✓ Acute episodes of local inflammation involving the skin, lymph nodes and lymphatic vessels often accompany chronic lymphoedema.
- ✓ Lymphatic filariasis afflicts over 25 million men with genital disease and over 15 million people with lymphoedema.



Hepatitis

Hepatitis

“Hepatitis means ‘inflammation of the liver’, and the most common cause is infection with one of 5 viruses, called hepatitis **A, B, C, D**, and **E**. All of these viruses can cause an acute disease with symptoms lasting several weeks including yellowing of the skin and eyes (jaundice); dark urine; extreme fatigue; nausea; vomiting and abdominal pain.” www.who.int

Hepatitis B

Key facts <http://www.who.int>

- ✓ Hepatitis B is a viral infection that attacks the liver and can cause both acute and chronic disease.
- ✓ The virus is transmitted through contact with the blood or other body fluids of an infected person - not through casual contact.
- ✓ About **2 billion people worldwide have been infected** with the virus and about **350 million live with chronic infection**. An estimated **600 000 persons die each year** due to the acute or chronic consequences of hepatitis B.
- ✓ About **25%** of adults who become chronically infected during childhood later die from **liver cancer** or cirrhosis (scarring of the liver) caused by the chronic infection.
- ✓ The hepatitis B virus is **50 to 100 times more infectious than HIV**.
- ✓ Hepatitis B virus is an important occupational hazard for health workers.
- ✓ Hepatitis B is preventable with a safe and effective vaccine.

Diarrheal diseases

Key facts

<http://www.who.int>

- ✓ Diarrhoeal disease is the second leading cause of death in children under five years old. It is both preventable and treatable.
- ✓ Diarrhoeal disease kills 1.5 million children every year.
- ✓ Globally, there are about two billion cases of diarrhoeal disease every year.
- ✓ Diarrhoeal disease mainly affects children under two years old.
- ✓ Diarrhoea is a leading cause of malnutrition in children under five years old.

Causes

“Infection: Diarrhoea is a symptom of infections caused by a host of bacterial, viral and parasitic organisms, most of which are spread by faeces-contaminated water. Infection is more common when there is a shortage of clean water for drinking, cooking and cleaning. **Rotavirus and Escherichia coli (E coli)** are the two most common causes of diarrhoea in developing countries.”

“Malnutrition: Children who die from diarrhoea often suffer from underlying malnutrition, which makes them more vulnerable to diarrhoea. Each diarrhoeal episode, in turn, makes their malnutrition even worse. Diarrhoea is a leading cause of malnutrition in children under five years old.”

Protein energy malnutrition and micronutrient deficiency



Nutrition Basics

Six Classes of Nutrients

- Carbohydrates
- Protein
- Fat
- Vitamins
- Minerals
- Water



healthymeals.nal.usda.gov

Carbohydrates

- Glucose and glycogen
- Simple carbohydrates
- Complex carbohydrates

“Carbohydrates are the **foundation** of our diets and are found primarily in grains, fruits, vegetables, and milk. During digestion, carbohydrates are broken down into **glucose**, the fuel for our bodies. Glucose is burned in all body cells and is the primary source of energy If glucose is not immediately used for fuel, the body stores glucose as **glycogen**.”



“There are two types of carbohydrates- **simple** (fruit sugars-fructose, milk sugar-lactose, and table sugar-sucrose), and **complex** (also called starchesinclude potatoes, beans, cereal, rice, pasta, bread, corn, peas, etc.).

Protein

- Building and repairing tissues
- Source of energy



Building and **repairing** the body tissues is a primary function of protein. It forms enzymes, hormones, and hemoglobin, which is the oxygen carrying part of the red blood cell. It will be used as a source of energy, but only in the cases of injury, starvation, and malnutrition. Protein is found in grains, milk, eggs, dried beans, peas and lentils, meat poultry and fish.

Fat

- Saturated fat, *unsaturated* fat, and cholesterol



Fat contributes to healthy skin, proper growth and health cell membranes. It is an insulator and protector of organs. Fat also provides transport for the fat soluble vitamins (A, D, E, K).

Saturated fats are solid at room temperature (butter, meat fat, coconut oil).

Unsaturated fats and oils are liquid at room temperature.

Vitamins

- Maintain healthy body cells and protect against cancer (antioxidants)
- Water soluble
- Fat soluble

Water soluble vitamins are the C and the B-complex vitamins.

Vitamin C is primarily found in citrus fruits, strawberries, and peppers.

B-complex vitamins include thiamin, riboflavin, niacin, B12, folic acid, etc.

Fat soluble vitamins A, E, D, K are stored in body's fat

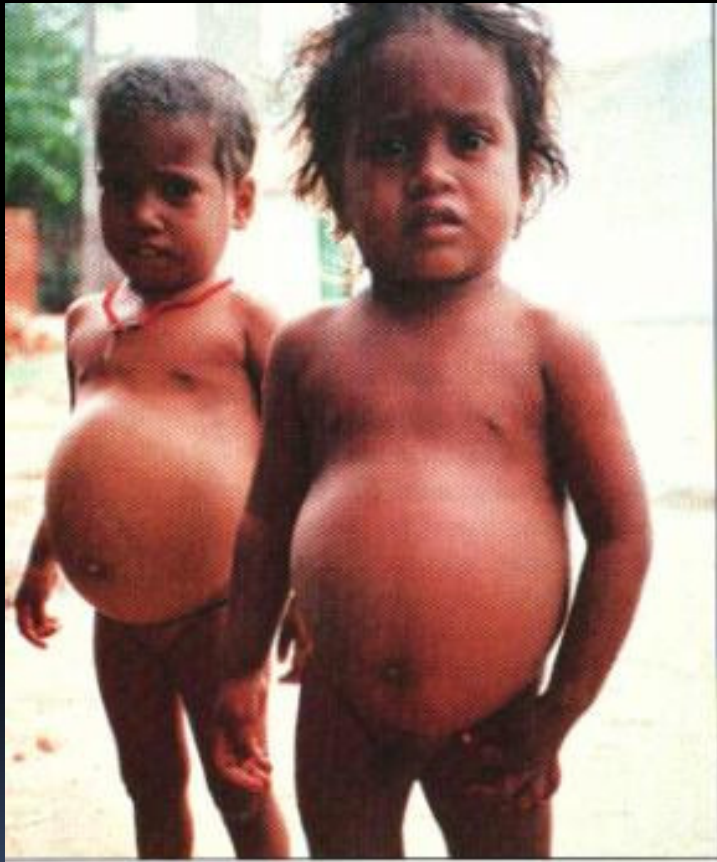
Minerals

- Create healthy bodies, bones, teeth and skin
- Nervous and cardiovascular systems
- Enzymes



- ✓ Minerals, like vitamins, create healthy bodies by growing strong bones, teeth, skin and bodies.
- ✓ They play a role in regulating our nervous and cardiovascular systems and act as enzymes in chemical reactions in our normal body processes.
- ✓ Most common deficiencies include **iron** and **calcium** deficiencies

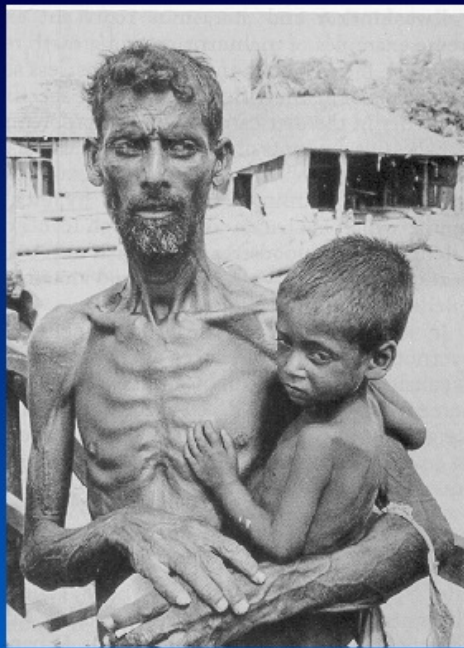
Protein Energy Malnutrition (PEM)



Kwashiorkor

- Underconsumption of calories or protein
- **Most important form of malnutrition**
- Associated with poverty
 - Not enough food
 - Poor quality food
- Kwashiorkor
 - Extreme protein deficiency
- Marasmus
 - Extreme calorie deficiency

Marasmus



Marasmus



- Calorie deficiency
 - Lack of food
 - Poorest populations
 - Neglected
 - Infants
 - children
- Protein used for energy
- Results in wasting
 - Deterioration of tissues
- Brain development impaired

Vitamin A Deficiency

- 500,000 children become blind each year
 - xerophthalmia
- Half of these will die within a year of becoming blind
- Rice diet lacking green vegetables
 - Vitamin supplements help: cost \$3/year
 - Golden Rice could help



Rickets (Vitamin D deficiency)



www.public.iastate.edu

Rickets is also known as osteomalacia.

It is among the most frequent childhood diseases in developing countries.

The predominant cause is a vitamin D deficiency in the body, but lack of calcium in the diet may also lead to rickets.

This disease involves softening and weakening of bones.

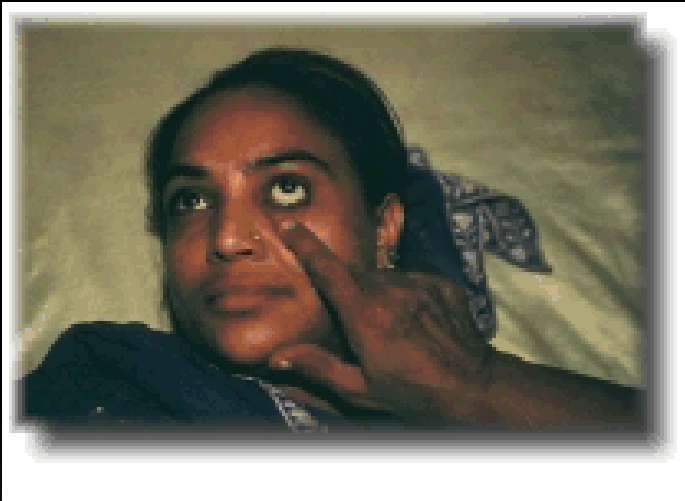
Rickets occurs mostly during periods of rapid growth when the body demands high levels of calcium and phosphate.

Iodine Deficiency



- Iodine deficiency
 - affects 740 million people worldwide
 - single greatest cause of preventable **brain damage** in babies
 - Goiter
 - Stillbirth
 - Miscarriages
 - Mental Retardation
- Prevented by iodized salt
- Best sources of natural iodine
 - Sea weed
 - Sea food

Iron Deficiency Anemia



- **Affects 2 billion people,**
- **90% live in developing countries**
 - 39% of preschool children
 - 52% of pregnant women
- **Reduced**
 - physical activity
 - mental activity
- **Increased**
 - birth mortality
 - Worms
 - Malaria
 - HIV
- **High iron rice could help**

Other Deficiencies



- **Vitamin C**
 - Causes Scurvy (spots on the skin, spongy gums): **problem in refugee camps**
- **Niacin (B complexo - B₃)**
 - Causes Pellagra (delusions, diarrhea), dermatitis, diarrhea, dementia
 - Due to diet high in
- **Thiamin (B complex – B₁)**
 - Causes Beriberi (difficulty walking; loss of feeling (sensation) in hands and feet)
 - Due to diet high in polished rice
- **Folic acid (B complex B₉)**
 - Birth defects

Sexually transmitted diseases

Global Burden

- Approximately 340 million new cases of curable STIs occur annually
- Prevalence is generally highest in the developing world
- STIs rank in the top 5 disease categories for which adults in developing countries seek health care services (nearly as common as malaria)

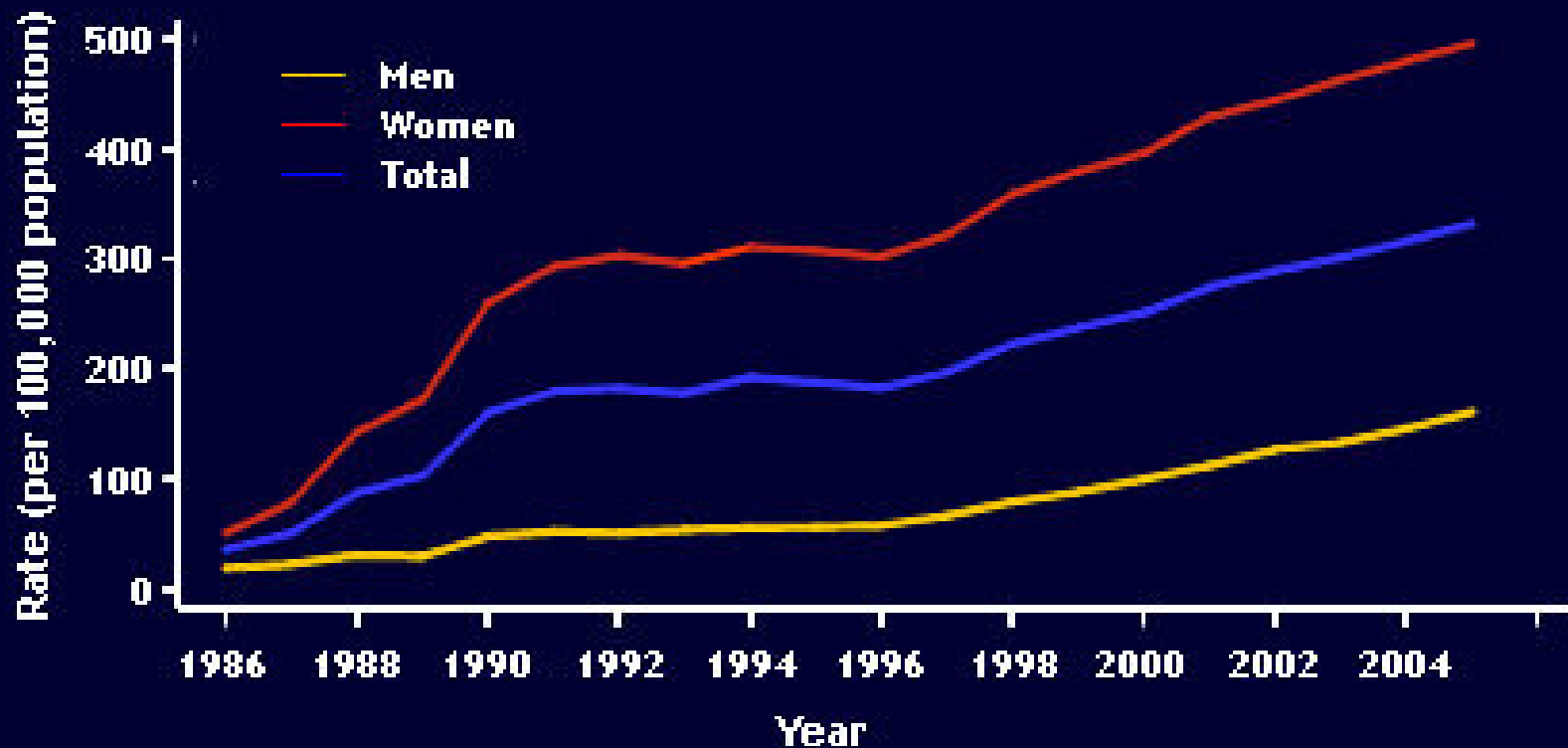
Global Burden (cont'd)

- For women aged 15-44 years, the morbidity and mortality associated with STIs, excluding HIV, are second only to maternal causes
- The cost of diagnostics can exceed the per capita national health care budgets of many low-income countries

STIs in the US: Estimated Incidence

Human papillomavirus	6,200,000
Trichomonas vaginalis	5,000,000
Chlamydia trachomatis	3,000,000
Herpes simplex virus	1,000,000
Neisseria gonorrhoea	650,000
Hepatitis B virus	77,000
Treponema pallidum	70,000
Human immunodeficiency virus	20,000
	<hr/>
	16,017,000

Chlamydia Rates in the United States



As of January 2000, all 50 states and the District of Columbia had regulations requiring the reporting of chlamydia cases.

CDC. STD Surveillance 2005.

USA West Nile Encephalitis

Vector: Mosquito

Agent: Flavivirus

Symptoms

Usually 3-15 days after bite of infected mosquito.
Most people infected with WNV have no symptoms
Or - may have mild flu-like illness (West Nile Fever)
fever, headache, and body aches
completely recover (few days).

Or - serious illness with inflammation of brain
(WN Encephalitis)

particularly at risk are the elderly (> 50 yrs old)
high fever, severe headache, nausea, stiff neck,
confusion, muscle weakness, paralysis,
disorientation, convulsions, coma, and rarely,
death.

< 1% of humans infected with WNV will develop
serious illness.



Amplifying hosts
Birds



Vectors

Culex sp., Aedes sp., Ochlerotatus sp.

Incidental hosts

Humans, horses, and
other animals



History

1937: West Nile District, Uganda

1950: Egypt

Ecology studied

Disease varies

Israel

1951-54

1957

1962, 2000: France

1973-74: South Africa

1996: Romania

1998: Italy

1999

Russia

United States, New York

US history of WNV

WNV 1st recognized in Western Hemisphere **summer 1999**

outbreak occurred in New York City area

62 people diagnosed with WNV

7 deaths.

2000:

District of Columbia and 12 states (CT, DE, MD, MA, NH, NJ, NY, NC, PA, RI, VT, and VA)

21 human cases WN encephalitis (NY, NJ, and CT) with 2 deaths

October 2001:

WNV present in 27 states and Canada

“The continued expansion of West Nile virus in the United States indicates that it is permanently established in the Western Hemisphere” www.uaex.edu

West Nile Virus in the United States, 1999 - 2002

