Viral diseases of the Lymphoid and Blood Vascular Systems

- Two important examples are HIV, cause of AIDS, and cytomegalovirus, which causes lymph node enlargement.
- Infectious mononucleosis has similar symptoms.
- Yellow fever mainly involves the circulatory system.

Kissing disease (Infectious Mononucleosis, Mono)

- High incidence among people between the age of 15-24 years (students).
- Lymphocytes and monocytes are collectively called peripheral blood **mononuclear cells**.
- This disease is characterized by increased mononuclear cells in the peripheral blood.

Causative agent:

- Epstein-Barr virus (EBV) named after its discoverers. It is a double-stranded DNA virus of the herpesvirus family.
- EBV can immortalize immature B cells, and can result in **Burkitt's Lymphoma**.

Infectious mononucleosis

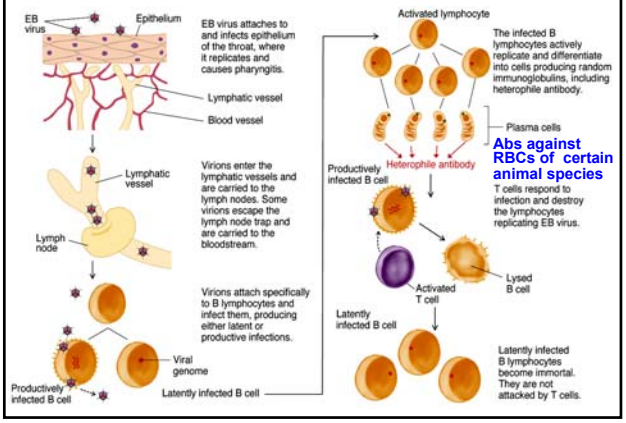
Incubation period: 1 to 2 months

Symptoms

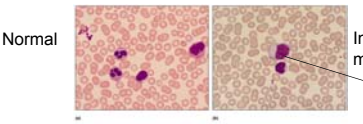
- Flu-like symptoms, including fever, sore throat covered with pus, fatigue, enlargement of spleen and lymph nodes.
- In most cases, the fever and sore throat are gone in about 2 weeks, and enlarged lymph node in 3.
- Persons may return to school or work after 4 weeks but fatigue may persist for several months.
- But in some cases, severe exhaustion and difficulty in concentrating which prohibit from normal activities for months.

Pathogenesis The proliferating lymphocytes are responsible for the large # of mononuclear cells and thus its name	Productive infection of epithelial cells of throat and salivary ducts; latent infection of B lymphocytes; activation of B and T lymphocytes; hemorrhage from enlarged spleen is a rare but serious complication

Pathogenesis of infectious mononucleosis



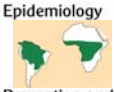
Infectious mononucleosis



Epidemiology 'Mouth-to-mouth kissing is an important mode of transmission in young adults, giving it the name kissing disease.	Spread by saliva; lifelong recurrent shedding of virus into saliva of asymptomatic, latently infected individuals **No animal reservoir.**
Prevention and treatment	Avoid sharing of articles such as toothbrushes and drinking glasses, which may be contaminated with the virus from saliva. Treatment: usually none needed; acyclovir of benefit in rare cases

Table 28.7 Yellow Fever

- In Euthopia, 100,000 cases and 30,000 deaths in 1960.
- No outbreaks in US since 1905.

Symptoms Mortality may reach up to 50% or more.	Often only headache and fever. Severe cases characterized by high fever, jaundice, black vomit, and hemorrhages into the skin hence is the name yellow fever
Incubation period	Usually 3 to 6 days
Causative agent	Yellow fever virus, an enveloped, single-stranded RNA virus of the flavivirus family
Virus multiplies in the species of mosquitoes Pathogenesis	Virus multiplies locally at site of introduction by an infected mosquito; spreads to the liver and throughout the body by the bloodstream. Virus destroys liver cells, causing jaundice and decreased production of blood-clotting proteins. Hemorrhages and decreased strength of the heart result in circulatory failure and kidney failure
Epidemiology 	Virus persists in forest primates and the mosquitoes that feed on them, in Africa and Central and South America; human epidemics occur when the virus infects household mosquitoes that feed on humans
Prevention and treatment	There is a highly effective attenuated viral vaccine. No proven antiviral therapy is available

Protozoan diseases

- Millions of people worldwide are infected with blood protozoan.

Examples of human protozoan diseases:

- African sleeping sickness: caused by *Trypanosoma brucei*
- American trypanosomiasis (chagas disease): caused by *Trypanosoma cruzi* and manifest as chronic heart infection.
- Visceral leishmaniasis: caused by *Leishmania sp*.
- Characterized by huge enlargement of spleen and was a problem for American troops during 1990 Middle east war.
- Malaria: more widespread and is leading cause of morbidity and mortality worldwide.
- ~300 to 500 million people suffer with malaria each year, with a child dying of the malaria every 40 seconds.

Malaria

- It is an ancient scourge, described in early Chinese and Hindu writings.
- The Italians gave the disease its name, malaria, meaning 'bad air'.
- In 1902, Ronald Ross was given a Nobel Prize for describing the life cycle of the protozoan cause of malaria.
- Malaria is the most common serious infectious disease worldwide.
- In 1955, the WHO began a program for the worldwide elimination of malaria using
  - DDT against the mosquito vector,
  - detecting infected patients by obtaining blood smears and
  - providing treatment to infected individuals.

Malaria

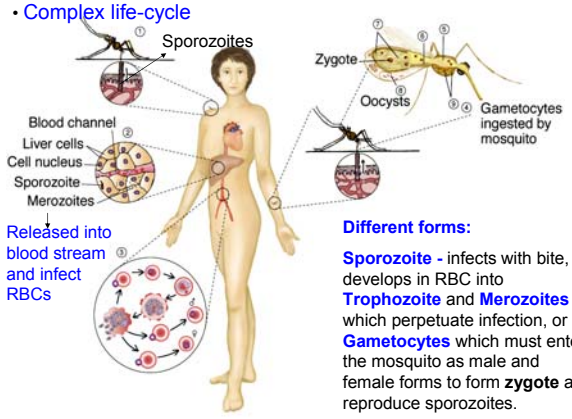
- Initially good success but later insecticides resistant strains of *Anopheles* mosquitoes began to appear
- Malaria made a rapid resurgence and in 1976, WHO declared eradication program a failure.
- Actually more people (~ 3 million every year) are dying of malaria than when the eradication program first began.

Causative agent

- Human malaria is caused by protozoa of the genus *Plasmodium*.
- Four different species are - *P. vivax, P. falciparum, P. malariae*, and *P. ovale*.
- These species differ in microscopic appearance and in some cases, in life cycle, type of disease produced, severity and treatment.
- In U.S. majority of patients have been infected with *P. vivax* and *P. falciparum* (more dangerous).

Life cycle of Plasmodium vivax

- Complex life-cycle



Different forms:

Sporozoite - infects with bite, develops in RBC into **Trophozoite** and **Merozoites** which perpetuate infection, or **Gametocytes** which must enter the mosquito as male and female forms to form **zygote** and reproduce sporozoites.

Symptoms of malaria

- Initially flu-like symptoms, with fever, headache, and pain in the joints and muscles.
- These symptoms usually start about 2 weeks or more (6 to 37 days) after an infected mosquito bite.
- After 2-3 weeks of these symptoms, pattern changes and symptoms usually fall into 3 phases and are highly suggestive of malaria.
  - The patient suddenly feels cold and develops shaking chills which may last for as much as an hour (cold phase)
  - Following chills, temp begins to rise steeply, often reaching 40°C (104°F) or more (hot phase)
  - After few hours of fever, the temperature falls, and drenching sweating occurs (wet phase).
- Other than fatigue, the patient feels well for sometime.
- About 24-48 hours later, depending upon the causative species, the pattern of symptoms repeats.

Malaria

- For *P. malariae*, the growth cycle takes 72 hrs, so fever recurs every third day. However, for other species, fever generally occur every other day.
- Infections by *P. falciparum* are more severe compared to other species.

Epidemiology

Anapheles ← Transmitted from person to person by bite of infected anopheline mosquito. Some individuals genetically resistant to infection → People of black African heritage lack receptors for the parasite on their RBCs and hence are resistant.

- Endemic malaria was eliminated from US in the late 1940s
- May be transmitted by blood transfusions or sharing of syringes among drug users.

Distribution of malaria in 1996

Malaria

Pathogenesis

Involvement of the brain, or cerebral malaria is particularly devastating.

Cell rupture, release of protozoa cause fever; infected red blood cells adhere to each other and to walls of capillaries; vessels plug up, depriving tissue of oxygen; spleen enlarges in response to removing large amount of foreign material and many abnormal blood cells from the circulation *P. falciparum* causes anemia

Prevention and treatment

In 1998, a new initiative called 'Roll Back Malaria' was started. Goal is to halve malaria deaths by the year 2010 and halve deaths again by 2015.

Weekly doses of chloroquine while in malarial areas; after leaving, primaquine is given; other medicines for resistant strains; eradication of mosquito vectors; mosquito netting impregnated with insecticide; vaccines under development. Same medicines used in treatment; additional choices available for resistant strains