

# TRAVEL-RELATED INFECTIONS

## LEARNING OUTCOMES

1. Apply the infection model to a patient presenting with an infection linked to travel
2. To expand the description of pathogen/person/practice/place as it applies to travel related infections
3. Understand the importance of a travel history
4. Describe Malaria and its pathogenesis
5. Describe Enteric Fever, including its assessment and management
6. Describe Brucellosis and its pathogenesis
7. To understand where and how to look up information on travel related infections
8. Describe *Influenza* virus and its transmission
9. Describe *Legionella pneumophila* and an example of its clinical importance

**DR . SUNDUS AL- HUCHAIMI**

**Travel-related disease:** A disease specifically because of travel.

- ✘ Result from exposure to many bacterial, viral, parasitic, and fungal infections . some diseases that are rarely or never seen in the part are common in other parts of the world.

Some travel-related infections are spread through

- ✘ The bites of insects, such as malaria, leishmaniasis trypanosomiasis.
- ✘ Swimming, wading, or bathing in contaminated water....  
[schistosomiasis](#)
- ✘ Eating or drinking contaminated food or water ...Giardiasis ; Ameobasis

## **Important elements of a medical history in an ill returned traveler**

- Severity of illness and duration of travel
- Timing of onset of illness in relation to international travel
- Past medical history and medications
- Travel immunizations and adherence to malaria chemoprophylaxis
- Individual exposures

## **Key Factors determining medical risk for travelers**

- **Destination**
- **Duration of visit and purpose of visit**
- **Standard of accommodation and food hygiene**
- **Health and behavior of the traveler**

# • Why is the travel history important?

- Imported diseases (rare/unknown )
- Different strains of pathogen
- Antigenically different
- Impacts on protection & detection
- Antibiotic resistance
- Infection prevention On the ward and in the laboratory

**There are scores of travel-related diseases. they include, but are not by any means limited to the following diseases**

Malaria; salmonellosis (Salmonella infection); influenza (flu); leishmaniasis (Leishmania infection) cholera; dengue fever; E. coli (infection with Escherichia coli); giardiasis (Giardia infection); scabies; schistosomiasis; hepatitis; sexually transmitted diseases (STDs).

**Malaria** : A vector-borne infectious disease caused by protozoan parasites. It is widespread in tropical and subtropical regions.

A bite from an infective female Anopheles mosquito.

Anopheles must be infected through a previous blood meal taken on an infected person to transmit malaria

There are four species that are typically parasitic to humans:

*P. falciparum*

*P. vivax*

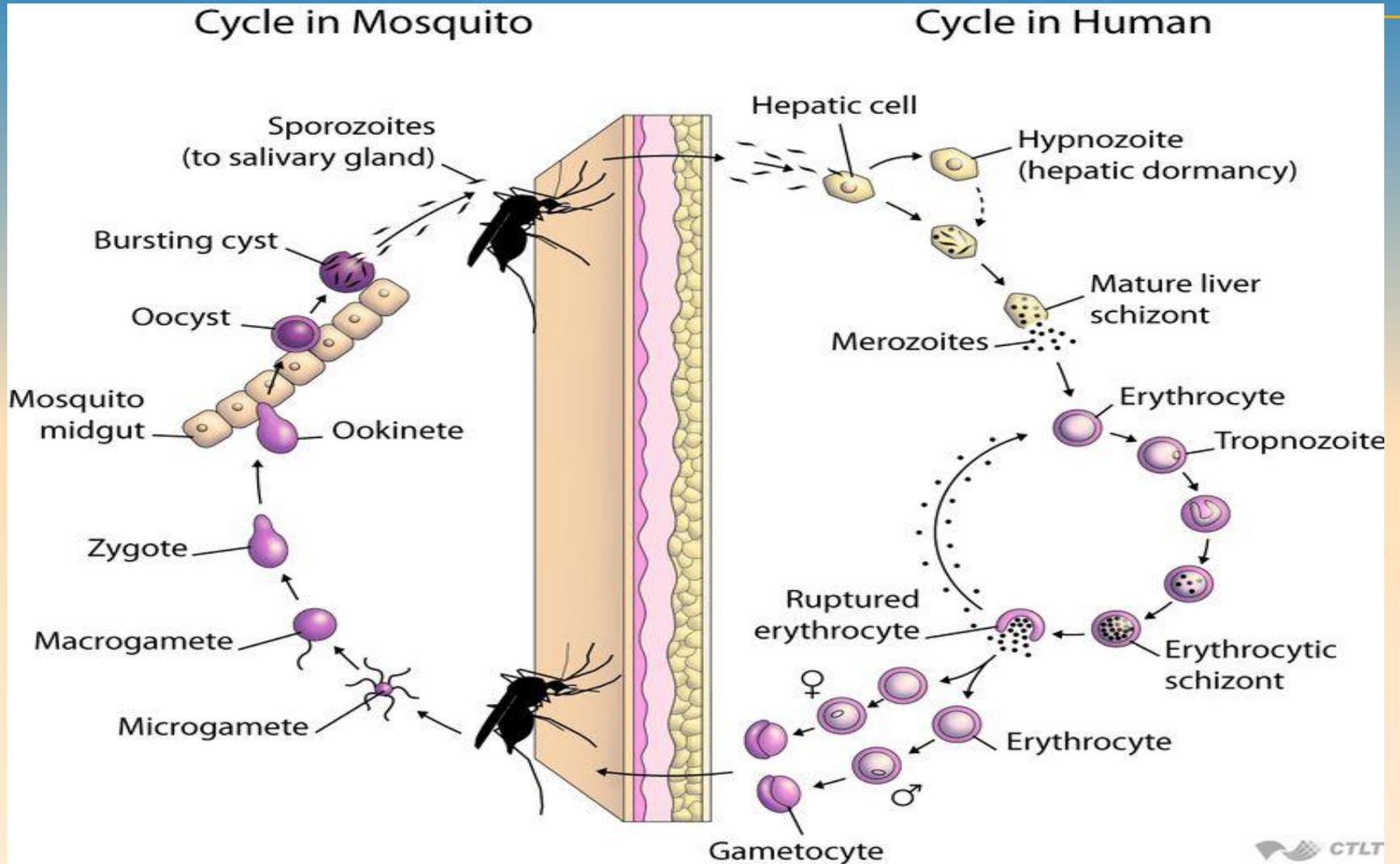
*P. malaria*

*P. ovale*

☞ *Plasmodium* requires two types of host, Vertebrate and Invertebrate.

☞ Definitive host is the invertebrate, Sexual reproduction occurs (*Anopheles* spp.)

☞ Intermediate host is the vertebrate, Asexual reproduction occurs (Humans)



# *P. FALCIPARUM*

- ❖ Is the most dangerous of the malaria parasites
  - 👉 Accounts for 50 % of all malaria cases, Causes malignant tertian malaria
  - 👉 Symptoms appear 9 to 14 days after initial infection
  - 👉 Parasitemia levels are extremely high ,Up to 65% of erythrocytes infected
  - 👉 Schizonts grow in liver cells, releasing 30,000 merozoites
  - 👉 Infected RBCs can attach to uninfected RBCs, forming rosettes
  - 👉 Falciparum trophozoites secrete proteins that cause deformations of erythrocytes

# SYMPTOMS

- 👉 **Common symptoms:** Fever, Chills, Headache, Sweats, Fatigue, Nausea and vomiting.
- 👉 **P.falciparum:** Mild jaundice, Enlarged liver, Increased respiratory rate, Pulmonary edema.
- 👉 **Pathogenesis:** Clinical signs of malaria can be attributed to two factors
  - 👉 **Host inflammatory response**
    - 👉 Produces chills and fever
    - 👉 Correlated with maturation of merozoites, rupture of RBCs
    - 👉 Toxins released from RBCs can stimulate secretion of TNF by macrophages
    - 👉 TNF overproduction and toxicity can cause most or all of malaria symptoms
  - 👉 **Anemia**
    - 👉 Caused by destruction of RBCs

# CLINICAL PRESENTATION

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**Varies in severity and course**

## × **Parasite factors**

- + **Species and strain of parasite**
- + **Geographic origin of parasite**
- + **Size of inculcum of parasite**

## × **Host factors**

- + **Age**
- + **Immune status**
- + **General health condition and nutritional status**
- + **Chemoprophylaxis or chemotherapy use**

## × **Mode of transmission**

- + **Mosquito**
- + **Blood borne, no hepatic phase (transplacental , needle stick , transfusion, organ donation/transplant)**

## DIAGNOSIS:

diagnosis of malaria can be difficult, because many symptoms are general

- ✘ **Blood examination: Thick and thin blood film**
- ✘ **Dipstick test - not as effective when parasite levels are below 100 parasites/mL of blood**

**Fluorescent dye staining, DNA probe specific for *P.falciparum***

**PCR, ELISA detection of *P.falciparum* antigen**

👉 **Treatment:** Treatment of malaria focuses on eradication of the blood parasites

👉 Several drugs can be administered, such as

👉 Chloroquine, Quinine, Doxycycline

👉 Treatment is dependent on type of malaria and drug-resistance

- ✘ Cerebral malaria, Anaemia, Renal disease, Black water fever, Dysenteric malaria, Algid malaria
- ✘ **Prevention of malaria**
  - + \*Assess risk – knowledge of at risk areas  
Regular/returning travelers .
  - + \*Bite prevention , adequate clothing, nets .
  - + \*Chemoprophylaxis before travel .
  - + Must include regular/returning travelers
  - + \*Diagnosis and treatment.

**Typhoid fever** is a bacterial infection due to *salmonella typhi* that causes symptoms. typhoid fever is a type of enteric fever along with paratyphoid fever, typhi, growing in the intestines and blood .

**Symptoms** may vary from mild to severe and usually begin six to thirty days after exposure often there is a gradual onset of a high fever over several days. weakness, abdominal pain, constipation, and headaches also commonly occur.

Diarrhea is uncommon and vomiting is not usually severe. some people develop a skin rash with rose colored spots. in severe cases there may be confusion. without treatment, symptoms may last weeks or months. Typhus is a different disease. **Risk factors** :include poor sanitation and poor hygiene. Those who travel to the developing world are also at risk and only humans can be infected.

**Diagnosis** is by either culturing the bacteria or detecting the bacterium's DNA in the blood, stool, or bone marrow. Culturing the bacterium can be difficult. Bone marrow testing is the most accurate .

**Treatment** of disease is with antibiotics such as azithromycin , fluoroquinolones or third generation cephalosporins Resistance to these antibiotics has been developing, which has made treatment of the disease more difficult.

**Prevention:**1.A typhoid vaccine can prevent about 30% to 70% of cases during the first two years.- The vaccine may have some effect for up to seven years.- It is recommended for those at high risk or people traveling to areas where the disease is common.

2. providing clean drinking water, better sanitation, and better hand washing.

*Brucella* is an aerobic, small, Gram-negative coccobacillus or short rod that can persist in the environment invariably depending on temperature, pH, and humidity. *Brucella* spp. can persist indefinitely if frozen or protected in aborted fetuses or placentas. It is a facultative, intracellular pathogen and thus requires prolonged treatment with clinically effective antibiotics. brucellosis has many different names involving Malta fever, undulant fever, Mediterranean fever, gastric fever.

- ✘ **Transmission to Humans:** Conjunctiva or broken skin contacting infected tissues.
  - + Blood, urine, vaginal discharges, aborted fetuses, placentas
- ✘ **Ingestion**
  - + Raw milk & unpasteurized dairy products
  - + Rarely through undercooked meat
  - + Inhalation of infectious aerosols

### **Who is at Risk?**

- ✘ **Occupational Disease**(Cattle ranchers/dairy farmers, Veterinarians, Abattoir workers, Meat inspectors, Lab workers, Hunters, Travelers)
- ✘ **Consumers of unpasteurized dairy products**

- × **Human Disease:**
- × Can affect any organ or organ system
- × All patients have a cyclical fever
- × Variability in clinical signs
  - + Headache, weakness, arthralgia, depression, weight loss, fatigue, liver dysfunction
- × 20-60% of cases
  - + Osteoarticular complications
    - × Arthritis, spondylitis, osteomyelitis
- × Hepatomegaly may occur
- × Gastrointestinal complications
- × 2-20% of cases
  - + Genitourinary involvement
    - × Orchitis and epididymitis most common

# HUMAN DISEASE

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- × **Neurological**
  - + **Depression, mental fatigue**
- × **Cardiovascular**
  - + **Endocarditis resulting in death**
- × **Chronic brucellosis is hard to define**
  - + **Length, type and response to treatment variable**
  - + **Localized infection**
- × **Blood donations of infected persons should not be accepted**
- × **Congenitally infected infants**
  - + **Low birth weight**
  - + **Failure to thrive**
  - + **Jaundice**
  - + **Hepatomegaly**
  - + **Splenomegaly**
  - + **Respiratory difficulty**
  - + **General signs of sepsis (fever, vomiting)**
  - + **Asymptomatic**

# DIAGNOSIS IN HUMANS

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- × Isolation of organism
  - + Blood, bone marrow, other tissues
- × Serum agglutination test
- × Immunofluorescence
- × PCR
- × **Treatment:** Combination therapy has the best efficacy
  - + Doxycycline for six weeks in combination with streptomycin for 2-3 weeks or rifampin for 6 weeks
- × CNS cases treat 6-9 months
  - + Same for endocarditis cases plus surgical replacement of valves
- × **Prevention and Control:**
- × Education about risk of transmission
- × Wear proper attire if dealing with infected animals/ tissues
- × Avoid consumption of raw dairy products
- × Immunize in areas of high prevalence
- × Eradicate reservoir

**NOVEL virus:** refers to a virus not seen before. it can be a virus that is isolated from its reservoir or isolated as the result of spread to an animal or human host where the virus had not been identified before. it can be an emergent virus, one that represents a new strain, but it can also be an extant virus not previously identified.

✘ Emerging diseases – novel viruses

- + Influenza pandemics 1918-19 ‘Spanish’ 1957 ‘Asian’ 1968 ‘Hong Kong’
- + H5N1 (‘avian flu’) in 2005
- + H1N1 (‘swine flu’) in 2009
- + H7N9 in 2013 – another avian strain
- + Novel coronaviruses SARS-CoV in 2003 Severe Acute Respiratory Syndrome
- + MERS-CoV in 2012 Middle East Respiratory Syndrome

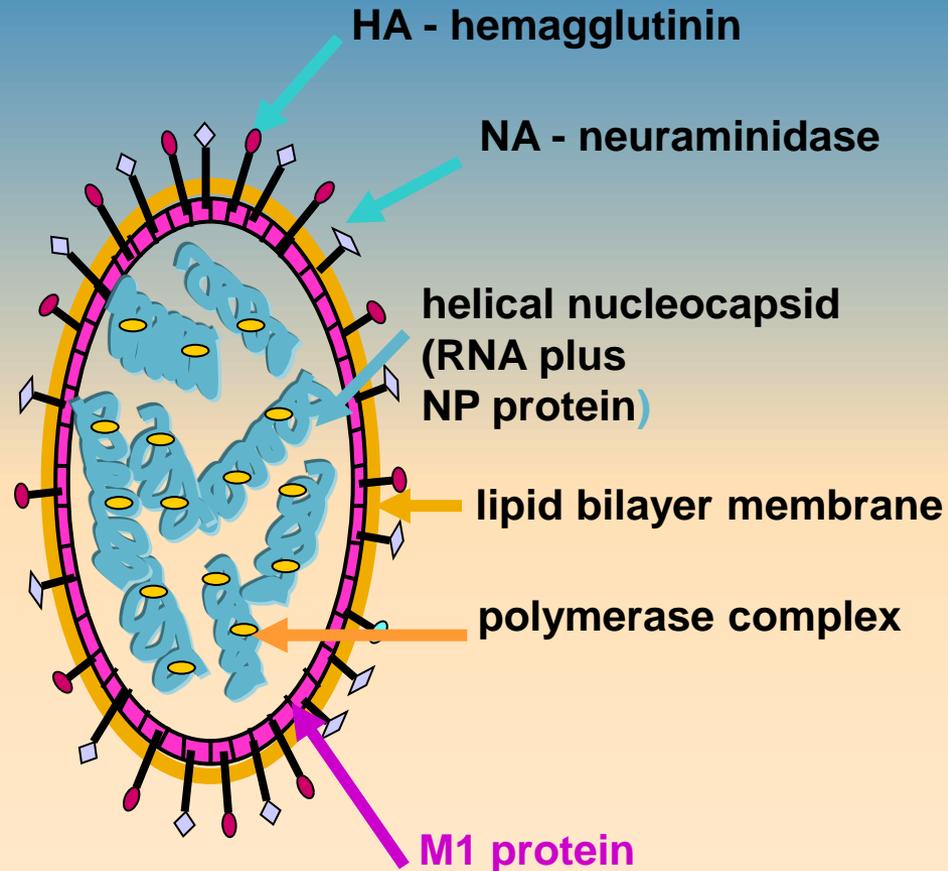
# influenza virus

- True influenza
  - influenza virus A or influenza virus B (or influenza virus C infections - much milder)
- Febrile respiratory disease with systemic symptoms caused by a variety of other organisms often called 'flu'

# ORTHOMYXOVIRUSES

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Influenza viruses are spherical, enveloped, polymorphic particles. Two types of spikes project from the surface: hemagglutinin (H protein) and neuraminidase (N protein). The M (matrix) proteins underlie the viral lipid membrane. The RNA genome is located in a helical nucleocapsid composed of 8 segments of RNA.



type A, B, C : NP, M1 protein  
sub-types: HA or NA protein

- ✘ Influenza viruses are classified as type A,B and C depending on their inner protein(M,NP protein).
- ✘ The classification into subtypes depends on antigens associated with the outer viral proteins,H and N.
- ✘ 16 H and 9N subtype have been described.

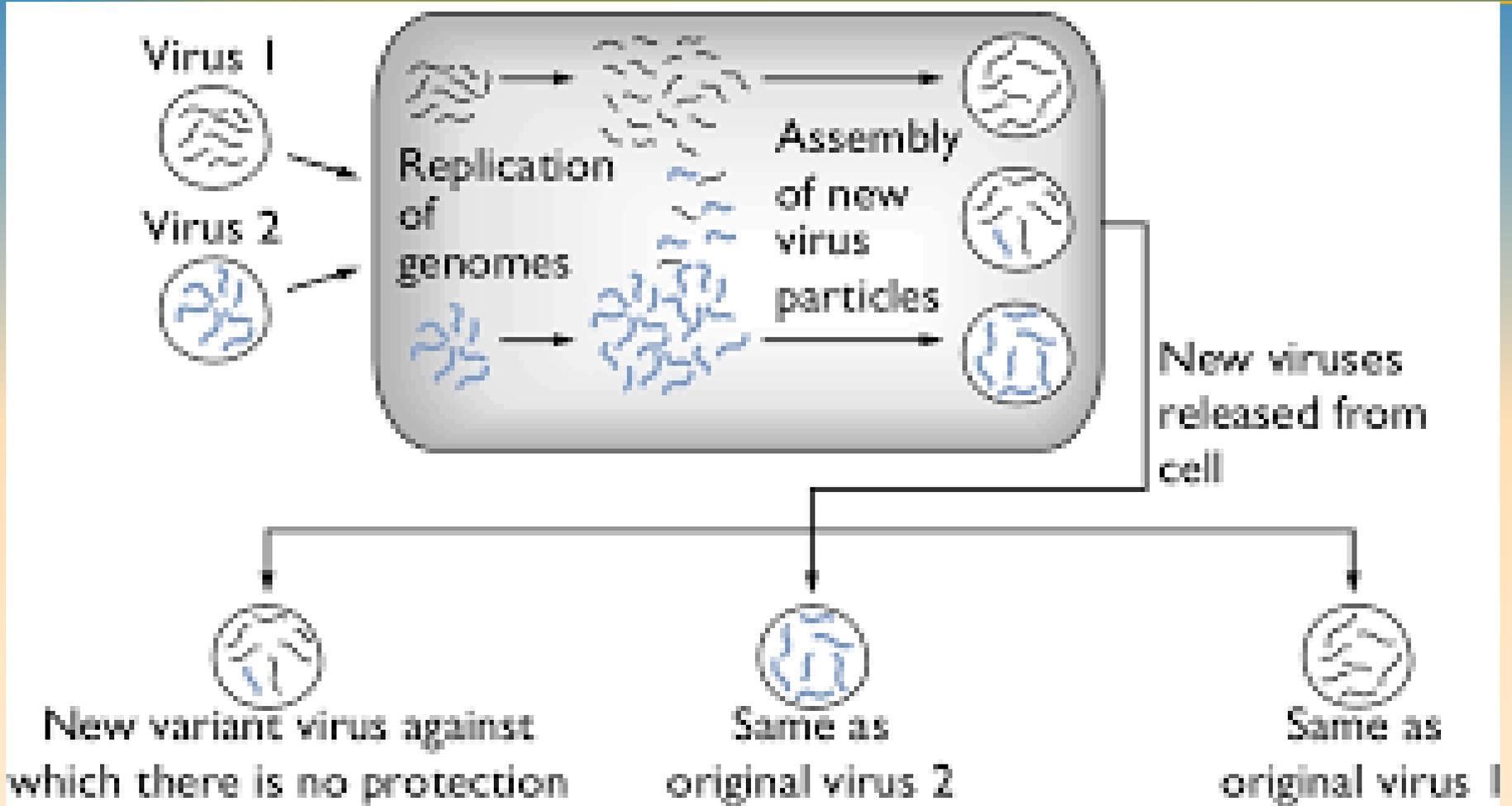
- **Antigenic drift**

- Occurs with influenza A, B, and C
- Small number of slowly occurring changes (mutations)
  - Error-prone viral RNA polymerase
- HA changes most prominent, but can occur in any viral gene
- Partially responsible for yearly vaccine changes
- *MAY* result in breach of species barrier and pandemic

# Antigenic Shift

When more than one type of influenza virus infects a single cell the separation of viral genome into eight separated segments allows mixing or reassortment of new viral RNAs that induces new strains of influenza virus. This process called antigenic-shift. It occurs only in influenza Type A.

- caused by exchange of genetic materials (RNA)
- new strains generate
- results in pandemics
- eg. Asian flu by H2N2 subtype in 1958-1959.
- only in influenza type A



# Pathology and Clinical Significance

- ✘ Influenza is spread by respiratory droplets.
- ✘ Influenza has an acute onset characterized by chills, high fever, muscle pain and extreme drowsiness.
- ✘ **Severity:** very young, elderly, immuno-compromised, heart or lung disease.
- ✘ **Reye syndrom is rare and serious complication in children ,especialy in those who have chickenpox or influenza B**

**Diagnosis:** Isolation: nose, throat swab, tissue culture

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Serology: ~~Rapid tests (viral Ag in respiratory tract secretion)~~  
provisional - clinical picture + outbreak

✘ **TREATMENT:** Rimantadine and Amantadine

✘ (inhibition of viral M2 membrane protein stop  
viral uncoating).

✘ type A only, needs to be given early

✘ **ZANAMIVIR and OSELTAMIVIR** (inhibition of  
viral neuraminidase stop viral releasing).

✘ types A and B, needs to be given early

# TRAVELER'S DIARRHEA

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- ✘ **Traveler's diarrhea (TD)** is a stomach and intestinal infection. TD is defined as the passage of unformed stool three or more while traveling.
- ✘ It may be accompanied by abdominal cramps, nausea, fever, and bloating. Occasionally bloody diarrhea may occur.

**Causes:** E. coli, enterotoxigenic(20–75%), E. coli, enteroaggregative(0–20%),

E. coli, enteroinvasive(0–6%), Shigella spp.(2–30%),

- ✘ Salmonella spp(0–33%), Campylobacter jejuni(3–17%), Vibrio parahemolyticus(0–31%), Aeromonas hydrophila(0–30%) Giardia lamblia(0–20%), Entamoeba histolytica(0–5%), Cryptosporidium spp.(0–20%) Rotavirus(0–36%), Norwalk virus(0–10%).

## ✘ Risk factors

- ✘ traveler's destination, young adults, immunosuppressed persons, persons with inflammatory bowel disease or diabetes, and those taking H2 blockers or antacids

# PREVENTION

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- ✘ Sanitation
- ✘ Water
- ✘ Medications(Bismuth subsalicylate)
- ✘ Vaccination(oral cholera vaccine)

## Treatment

- ✘ Rehydration therapy
- ✘ Antibiotics(the fluoroquinolone antibiotics are the drugs of choice)
- ✘ Antimotility agents(loperamide and diphenoxylate)

# LEGIONNAIRES' DISEASE

- ✘ **Legionnaires' disease**, is a form of atypical pneumonia caused by any type of *Legionella* bacteria.
- ✘ *Legionella pneumophila* is a thin, aerobic, pleomorphic, flagellated, non-spore forming, Gram-negative bacterium and produces beta-lactamase.
- ✘ **Signs and symptoms** include cough, shortness of breath, high fever, muscles pains, and headaches. Nausea, vomiting, and diarrhea may also occur. This often begins two to ten days after being exposed.

- × The bacterium is found naturally in freshwater. It can contaminate hot water tanks, hot tubs, and cooling towers of large air conditioners.
- × **Spread** is usually by breathing in mist that contains the bacteria and when contaminated water is aspirated.
- × **Risk factors** for infection include older age, history of smoking, chronic lung disease, and poor immune function.
- × **Diagnosis** is by a urinary antigen test and sputum culture.
- × **Prevention** depends on good maintenance of water systems.
- × There is no vaccine.
- × **Treatment** with fluoroquinolones, azithromycin, or doxycyclin. Hospitalization is often required.