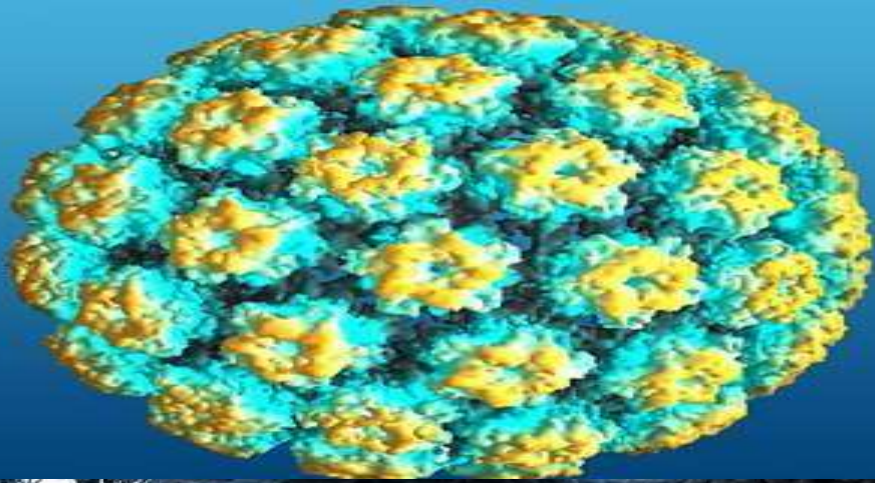


Oncogenic viruses

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Oncog viru

- ❖ HPV
- ❖ EBV
- ❖ CMV

- ❑ **Oncogenesis** -An abnormal growth of tissue resulting from uncontrolled, progressive multiplication of cells and serving no physiological function. Result of genetic changes that alter the expression or function of proteins that play critical roles in the control of cell growth and division.
- ❑ **Proto-oncogenes** - normal gene,present in normal cells, conserved in their genomes, code for proteins which regulate cell growth and differentiation.
- ❑ **Oncogenes** - mutated versions of proto-oncogenes that contribute to cancer development by disrupting a cell's ability to control its own growth.

Oncogenic viruses

TYPES:

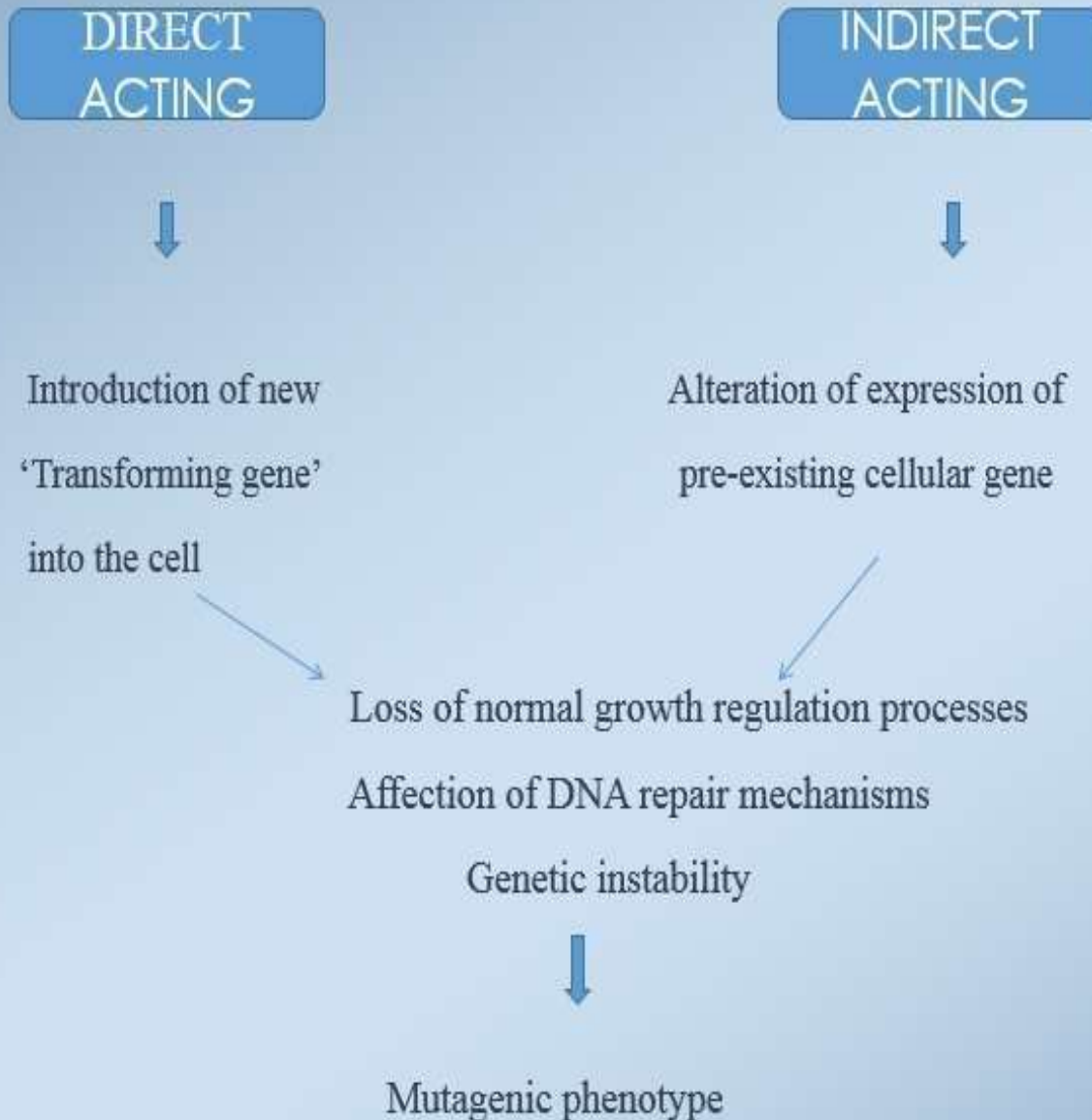
Oncogenic RNA Viruses

Retroviruses are divided into oncoviruses, lentiviruses, and spumaviruses.

Oncogenic DNA Viruses

Oncogenic human DNA viruses include hepatitis B viruses, herpesviruses, and papillomaviruses.

Mechanism of oncogenicity



HPV

- 1- Double strand DNA virus
- 2- Infects human epithelial cells causes (genital warts and cervical dysplasia)
- 3- Considered the most common sexual transmitted infection

Human papillomavirus (HPV)

- Small
- Non-enveloped
- Virion –Icosahedral
- Genome – double stranded ,circular DNA (8000bp)
- 16 genera (5 – human infections)

Epidemiology:

- HPV induced cervical cancer is 2nd most common cancer worldwide
- 16% of all female cancers are linked to HPV
- Papilloma virus is found in 90% of women with cervical cancers

❑ Genital HPV is a very common sexually transmitted infection which usually causes no symptoms and goes away by itself, but can sometimes cause serious illness. HPV is responsible for:

❑ almost all cases of genital warts and cervical cancer

❑ 90 % of anal cancers

❑ 65 % of vaginal cancers

❑ 50 % of vulva cancers

❑ 35 % of penile cancers

❑ 60 % of oropharyngeal cancers (cancers of the back of the throat, including the base of the tongue and tonsils).

HPV infects both men and women.

HPV Symptom

1- Though most HPV infections go away on their own, some HPV infections persist. HPV infections that don't go away can cause changes in the cells in the infected area, which can lead to genital warts or cancer.

2- Genital warts usually appear as a small bump or groups of bumps in the genital area. They can be small or large, raised or flat, or clustered like a small piece of cauliflower.

3- Cervical cancer usually does not have symptoms until it is quite advanced and hard to treat. For this reason, it is important for women to get regular screening for cervical cancer. Screening tests can find early signs of disease so that problems can be treated before they ever turn into cancer.

4- Other cancers caused by HPV might not have signs or symptoms until they are advanced. These include cancers of the vulva, vagina, penis, anus, and cancers of the back of the throat, including the base of the tongue and tonsils (oropharynx)

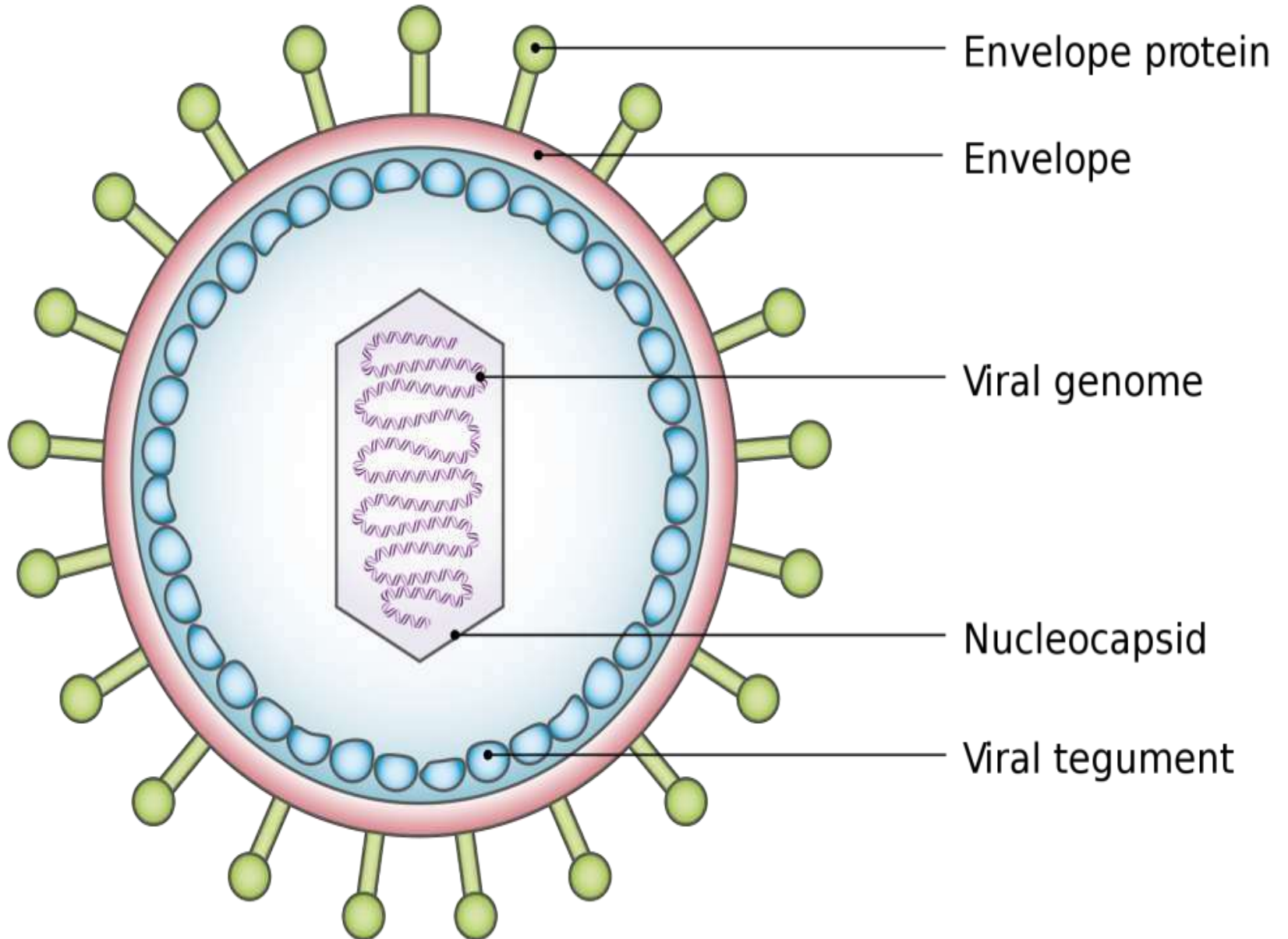
Diagnosis

- ❑ The **Pap test** can find abnormal cells on the cervix so that they can be removed before cancer develops.
- ❑ An **HPV DNA test**, which can find certain HPV types on a woman's cervix, may also be used with a Pap test in certain cases (called co-testing). Even women who were vaccinated when they were younger need regular cervical cancer screening because the vaccines do not protect against all cervical cancers.

Treatment

- ✓ **HPV vaccination** could prevent most cancers and other diseases caused by HPV. There is **no treatment** for the virus itself, but there are treatments for the problems that HPV can cause.
- ✓ For women, having regular **Pap tests** once they become sexually active is the only way to detect abnormal cells on the cervix caused by HPV.
- ✓ **Genital warts** can be treated by doctors or at sexual health clinics.
- ✓ **Recurrent Respiratory Papillomatosis (RRP)**, a rare condition in which warts grow in the throat, can be treated with surgery or medicines.

EBV



- ❑ Infectious mononucleosis
- ❑ Burkitt's lymphoma
- ❑ Epstein-Barr virus (EBV), also known as human herpesvirus 4, is a member of the herpes virus family. It is one of the most common human viruses. EBV is found all over the world.
- ❑ **Epidemiology**
 - Ubiquitous
 - Burkitt's lymphoma
 - Nasopharyngeal carcinoma

Symptoms

Once you're infected with EBV, symptoms can take 4 to 6 weeks to show up. When they do, they're often mild, especially in young children. Kids' symptoms may be more like those of a cold or flu. Teens often have more obvious symptoms of mononucleosis. If you do get symptoms, most likely you'll have:

- Fatigue
- Fever
- Lack of appetite
- Rash
- Sore throat
- Swollen glands in the neck
- Weakness and sore muscles

Symptoms of Burkitt's Lymphoma

- 1- The symptoms depend on the type.
- 2- The endemic (African) variant usually starts as tumors of the jaw or other facial bones. It also can affect the gastrointestinal tract, ovaries, and breasts and can spread to the central nervous system, causing nerve damage, weakness, and paralysis.
- 3- The sporadic and immunodeficiency-associated types usually start in the bowel and form a bulky tumor mass in the abdomen, often with massive involvement of the liver, spleen, and bone marrow. These variants also can start in the ovaries, testes, or other organs, and spread to the brain and spinal fluid.

Infectious Mononucleosis

1- Infectious mononucleosis, also called “mono,” is a contagious disease.

2- EBV is the most common cause of infectious mononucleosis. It is common among teenagers and young adults, especially college students.

3- Typical symptoms of infectious mononucleosis usually appear 4 to 6 weeks after you get infected with EBV.

Symptoms may develop slowly and may not all occur at the same time.

4- Enlarged spleen and a swollen liver are less common symptoms. For some people, their liver or spleen or both may remain enlarged even after their fatigue ends.

5- Most people get better in 2 to 4 weeks; however, some people may feel fatigued for several more weeks.

Diagnosis

- ❑ A person has mononucleosis just by the symptoms. Fever, fatigue, and sore throat could also be signs of other illnesses, like the flu or a cold.
- ❑ Signs of mono, such as an **enlarged spleen**, swollen liver and white patches on your tonsils could be diagnosed.
- ❑ Some **blood tests could also be done**. One test looks for antibodies against EBV.
- ❑ If Burkitt lymphoma is suspected, all or part of an enlarged lymph node or other suspicious disease site will be biopsied. In a **biopsy**, a sample of tissue is examined under a microscope. This will confirm or rule out Burkitt lymphoma.

Treatment

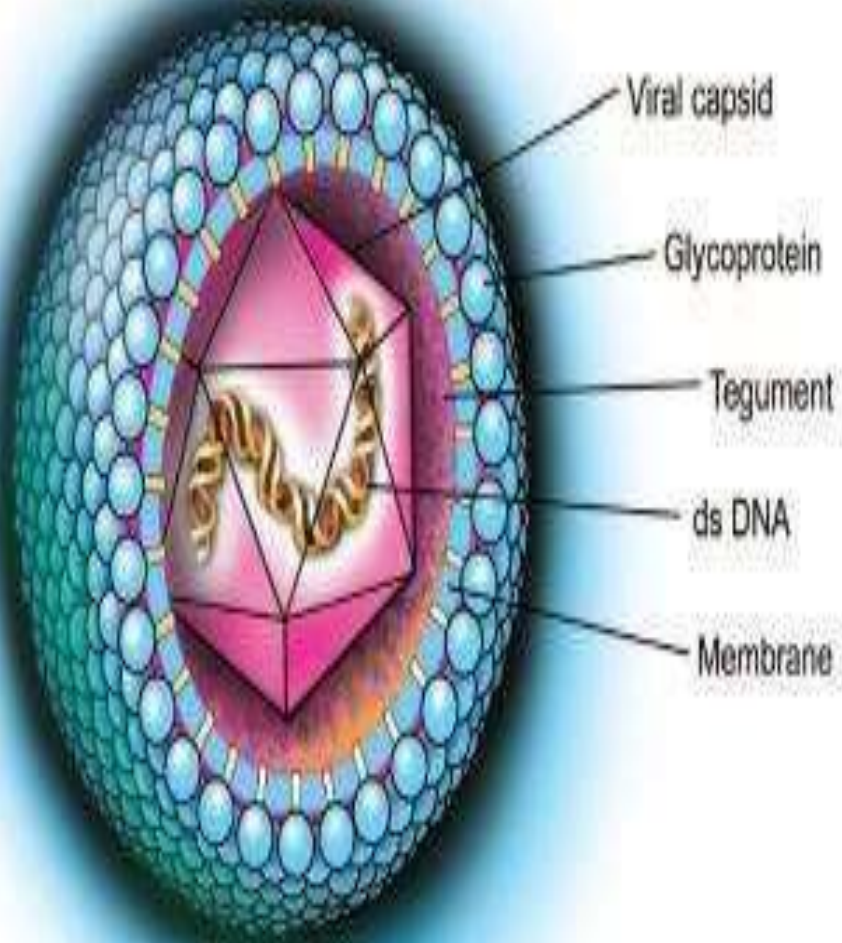
- 1- Epstein-Barr can't be treated with **antibiotics**. Mono should clear up on its own without treatment in a few weeks.
- 2- Take painkillers like **acetaminophen** or **ibuprofen** to bring down fever and relieve body aches.
- 3- Treatment for Burkitt's Lymphoma : Intensive intravenous chemotherapy which usually involves a hospital stay is the preferred treatment for Burkitt lymphoma. Because Burkitt lymphoma can spread to the fluid surrounding the brain and spinal cord, chemotherapy drugs also may be injected directly into the cerebrospinal fluid, a treatment known as **intrathecal chemotherapy**
- 4- Autologous stem cell transplantation, in which the patient's stem cells are removed, stored, and returned to the body

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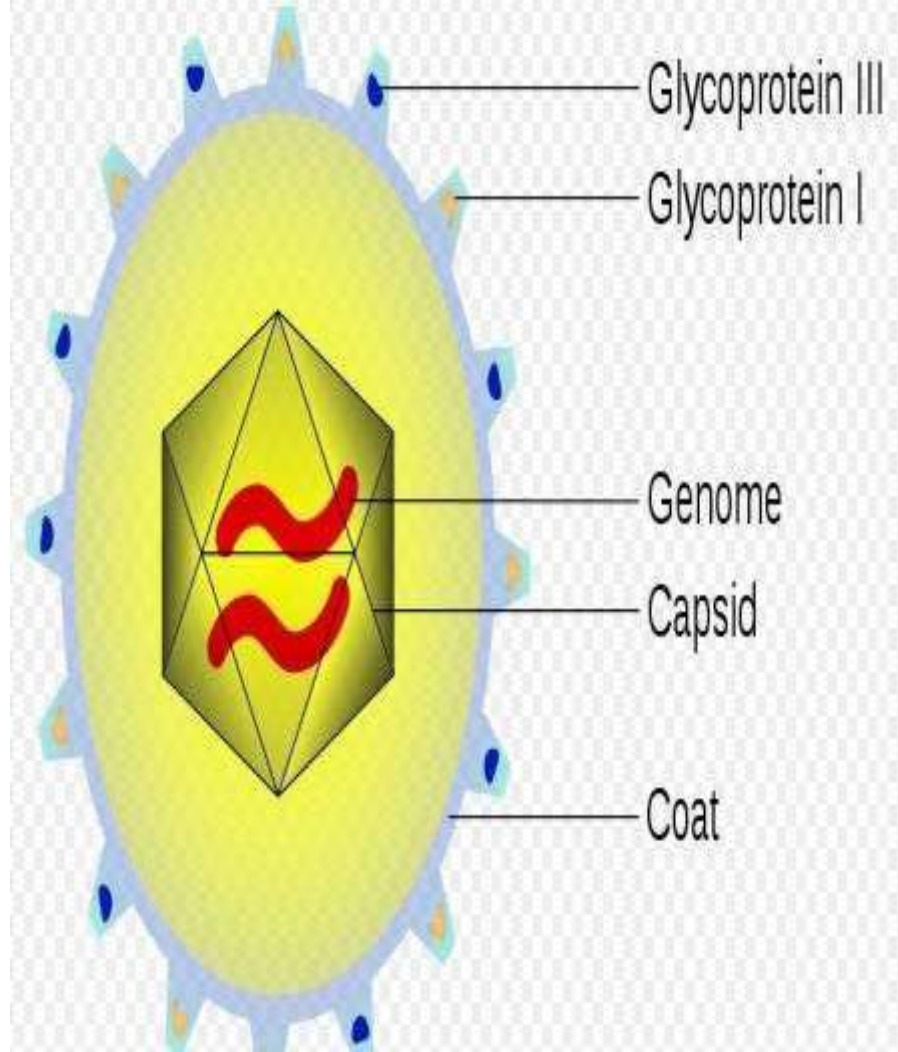
Treatment for Nasopharyngeal Carcinoma

- Radiation Therapy
- Surgery
- Biologic drugs
 - A biologic drug called **Bevacizumab** blocks production of a substance called vascular endothelial growth factor (VEGF).
- Chemotherapy
- Clinical trials

CMV



Scheme of a CMV virus



1- Cytomegalovirus or CMV, is a common virus that infects people of all ages.

2- Most people infected with CMV show no signs or symptoms. That's because a healthy person's immune system usually keeps the virus from causing illness. However, CMV infection can cause serious health problems for people with weakened immune systems, as well as babies infected with the virus before they are born (Congenital CMV).

Signs & Symptoms

1- Most people with CMV infection have no symptoms and aren't aware that they have been infected. In some cases, infection in healthy people can cause mild illness that may include

- Fever,
- Sore throat,
- Fatigue, and
- Swollen glands.
- Occasionally, CMV can cause mononucleosis or hepatitis

2- People with weakened immune systems who get CMV can have more serious symptoms affecting the eyes, lungs, liver, esophagus, stomach, and intestines. Babies born with CMV can have brain, liver, spleen, lung, and growth problems. Hearing loss is the most common health problem in babies born with congenital CMV infection.

Diagnosis

1- **Blood tests** can be used to diagnose CMV infections in people who have symptoms.

2- A person who has been infected with cytomegalovirus (CMV) will develop **antibodies** to the virus that will stay in the body for the rest of that person's life. A blood test for these antibodies can tell whether a person has ever been infected with CMV.

3- If the virus is detected in the blood, saliva, urine or other body tissues, it means that the person has an active infection.

Treatment

1- Healthy people who are infected with CMV usually **do not** require medical treatment.

2- **Medications** are available to treat CMV infection in people who have weakened immune systems and babies who show symptoms of congenital CMV infection.

3- If treatment is needed, it's most often in the form of **antiviral drugs**.

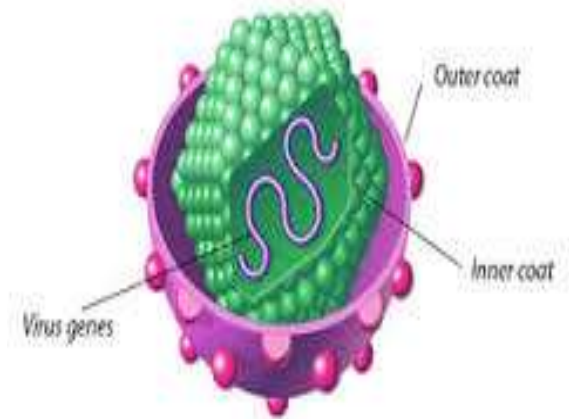
Antiviral drugs slow the virus reproduction, but can't cure it.

The antiviral medications against CMV include the following:

- a. Ganciclovir (Cytovene)
- b. Valganciclovir (Valcyte)
- c. Foscarnet (Foscavir)
- d. Cidofovir (Vistide)

Hepatitis C

- Which cancer?
 - Hepatocellular carcinoma
- How?
 - HCV core protein interferes with p53 (tumor suppressor gene)
- Who?
 - Anyone! (Particularly IV drug users, transplants/transfusions, high risk sex, body piercing/tattoos, babies born to HepC + mothers)



Picture of one Hepatitis C Virus.

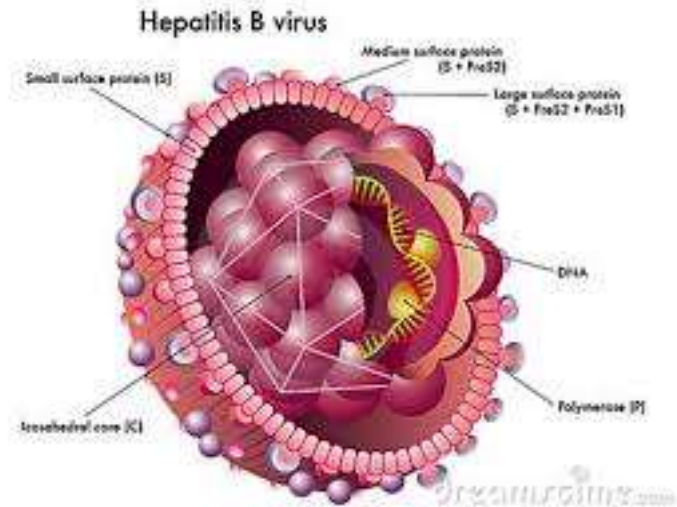
Hepatitis C

- Treatment?
 - Treatment for virus = interferon + ribavirin, other antivirals + ribavirin, liver transplantation (treatment based on genotype)
 - Treatment for HCC = liver resection/transplantation.



Hepatitis B

- Which cancer?
 - Hepatocellular carcinoma
- How?
 - Virus binds to liver cells and is taken inside
 - Viral DNA is reproduced in the liver cell nucleus, which helps create new virus particles which infect surrounding cells

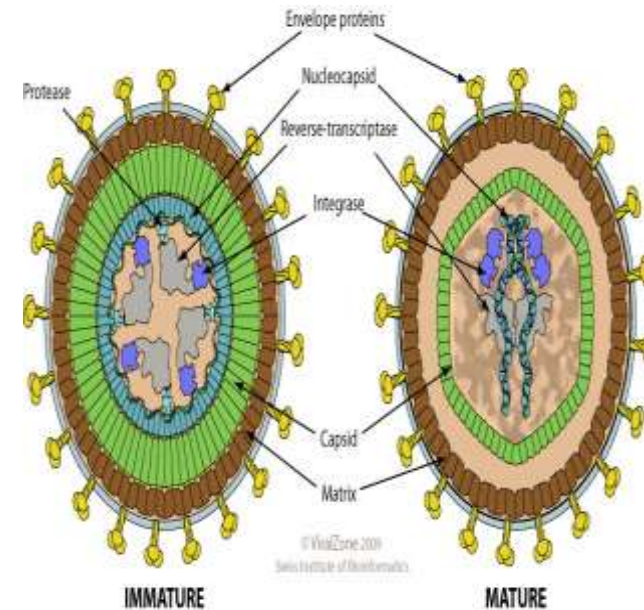


Hepatitis B

- Who?
 - Anyone! Primarily childbirth, person-to-person in early childhood, body piercings/tattoos, toiletries
 - Also sexually transmitted
 - Transmitted via infected blood.
 - Each subtype has a different genome, and each genome is endemic to a different area
- **Treatment?**
 - Vaccine available, 95% effective, 1st against major human cancer
 - Treatment for virus: based on viral genotype, usually includes antivirals and interferon
 - Treatment for cancer: liver resection/transplantation.

Human T-lymphotropic virus (HTLV-1)

- Which cancer?
 - Adult T-cell leukemia and lymphoma (Non-Hodgkin's)
- How?
 - Virus enters T-cell, where its 2 strands of RNA are copied into double-stranded DNA that can integrate into the host cell's genes (much like HIV!)
 - Believed to be sexually transmitted or transmitted via breastfeeding



Kaposi's sarcoma-associated herpesvirus (HHV-8)

- Which cancer?
 - Kaposi's sarcoma
 - Rarely, primary effusion lymphoma
- Who?
 - Can infect anyone
 - Causes disease in immunosuppressed patients; asymptomatic in healthy people
 - HIV/AIDS patients, transplant patients, the elderly, chemo patients
 - While this virus is typically associated with AIDS patients .



Kaposi's sarcoma-associated herpesvirus (HHV-8)

•How?

- Sexually transmitted
- Infects lymphocytes, establishes latency
- Inflammation or some other stimulus ignites the lytic cycle
- Inhibits p53 tumor suppressor protein
- Cell lysis allows virus to escape and infect surrounding cells

•Treatment?

- Prevention = safe sexual practices, condom use
- Cancer treatment = surgery, radiation, and chemotherapy
- Antiviral drug ganciclovir targets HHV-8, but isn't effective once tumor forms
- If the sarcoma is AIDS-related, best course of action is anti-retroviral medication

