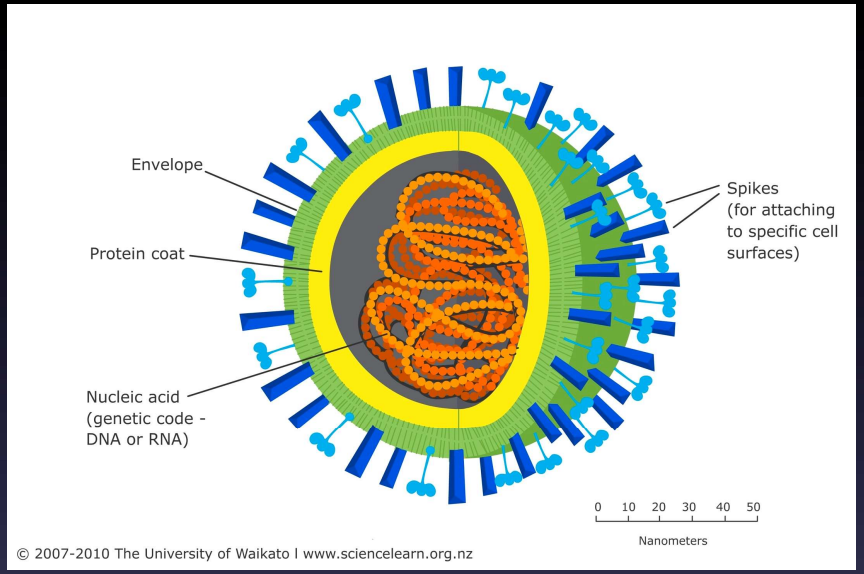
Oncoviruses

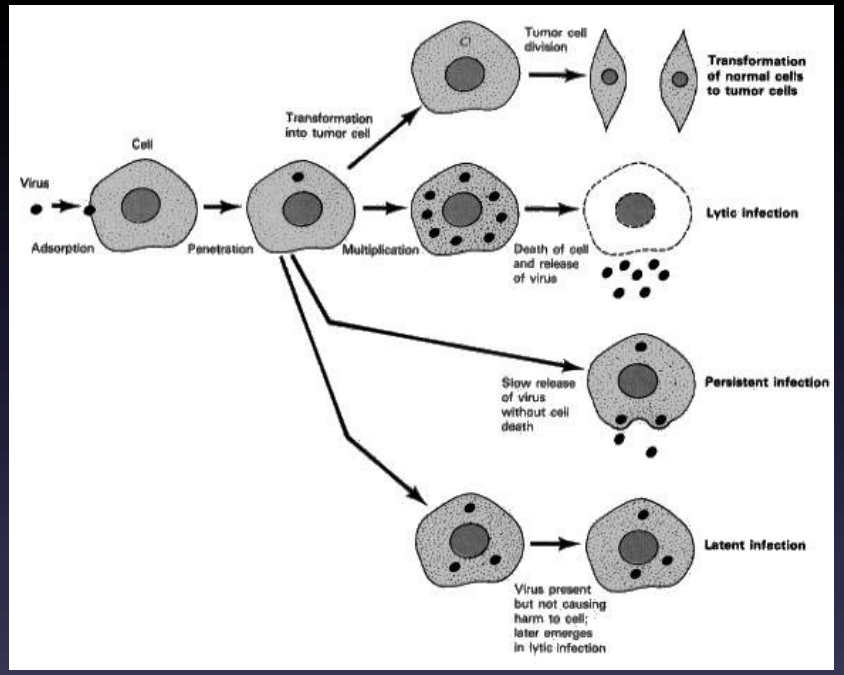
First of all…what is a virus?

- Infectious
- Non-living
- Composed of:
  - Capsid
  - Genome
  - (sometimes) Envelope
  - “Obligate intracellular parasite”



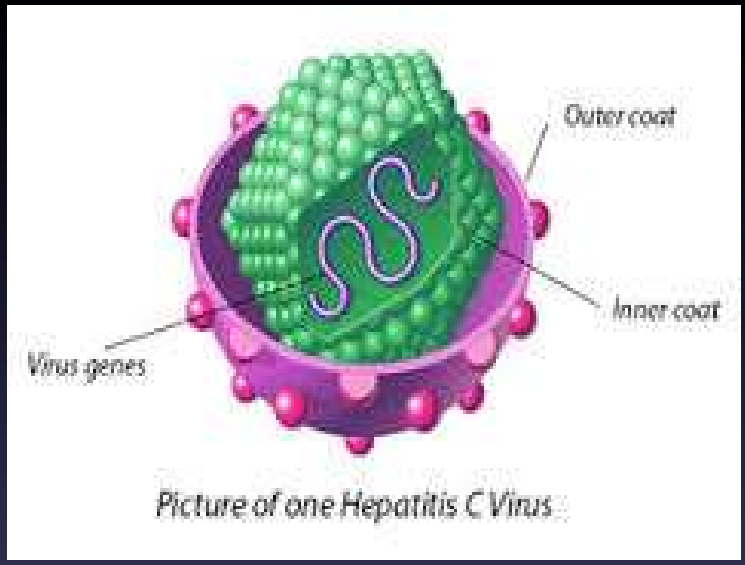
So what is an oncovirus?

- Virus that causes cancer
- Known oncoviruses are:
  - Hepatitis C
  - Hepatitis B
  - HTLV-1
  - HPV
  - HHV-8 (KSHV)
  - Merkel Cell Polyomavirus
  - EBV



Hepatitis C

- **Which cancer?**
  - **Hepatocellular carcinoma**
- **How?**
  - **HCV core protein interferes with p53 (tumor suppressor gene)**
- **Who?**
  - **Anyone! (Particularly IV drug users, transplants/transfusions before 1990, high risk sex, body piercing/tattoos, babies born to HepC + mothers)**



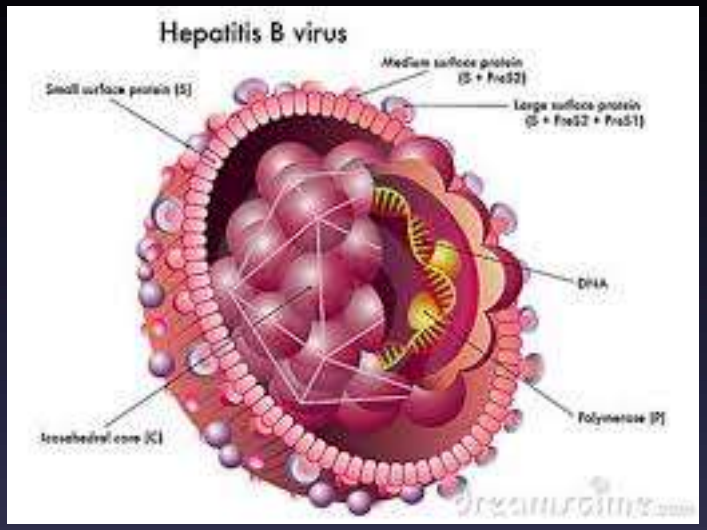
Picture of one Hepatitis C Virus

Hepatitis C

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

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, wet or dried

  -Each subtype has a different genome, and each genome is endemic to a different area

- Treatment?

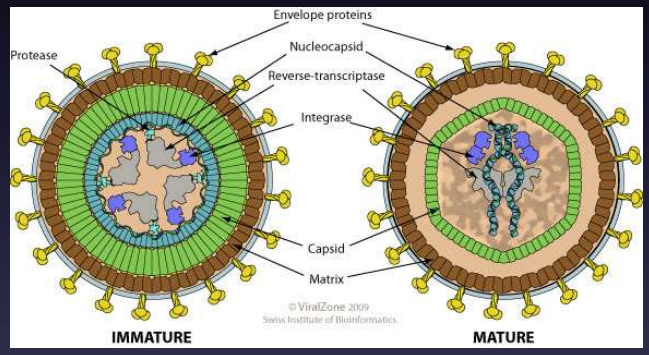
  -Vaccine available since 1982, 95% effective, 1st against major human cancer

  -Treatment for virus: based on viral genotype, usually includes antivirals and interferon

  -Treatment for cancer: liver resection/transplantation, adjuvant chemo, XRT

Human T-lymphotropic virus (HTLV-1)

- Which cancer?
  - -Adult T-cell leukemia and lymphoma (Non-Hodgkin's)
  - --Most patients die within a year of diagnosis
- 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



Human T-lymphotropic virus (HTLV-1)

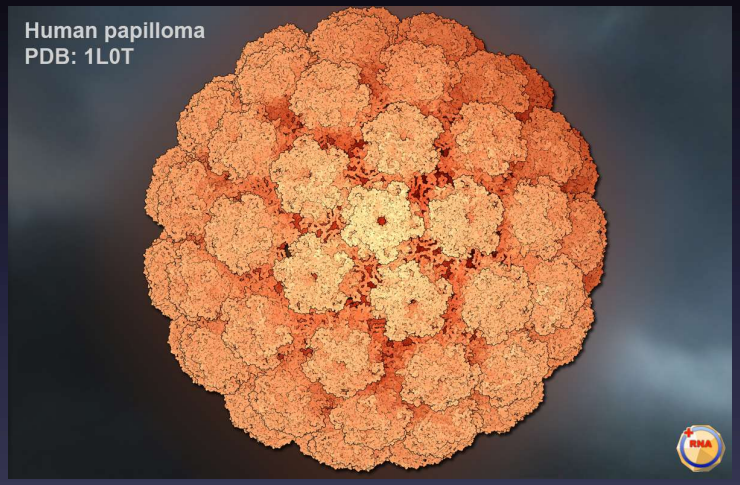
- Treatment
  - -Treatment for virus: prosultiamine, azacytidine, TDF (reverse-transcriptase inhibitor),
  - -Treatment for cancer: treatment usually includes purine analog chemo and immunotherapy, splenectomy, bone marrow transplant

- Who?
  - -Anyone! Rare in U.S., where highest prevalence is in southeastern African-Americans
  - -Endemic to southern Japan, the Caribbean, South American, and Africa
  - -Transmitted via infected blood

Human Papillomavirus (HPV)

- Which cancer?
  - -Cervical cancer…also associated with oropharyngeal cancers, as well as anal and genital cancers

- Who?
  - -Anyone!
  - -Cervical cancer is the second most common in women (can take 15-20 years)
  - -Risk factors for persistent HPV leading to cancer include multiple sexual partners, tobacco use, and immune suppression



Human Papillomavirus (HPV)

- How?
  - -Transmitted via sexual contact, skin-to-skin contact; can be transmitted (rarely) during childbirth
  - -Many different subtypes- types 16 and 18 are responsible for cancers and recurrent respiratory papillomatosis (RRP)
  - -Types 6 and 11 are associated with genital warts
  - -Nearly all cervical cancers and all cases of genital warts are caused by HPV

- Treatment?
  - -Vaccine for virus (Gardasil and Cervarix)
  - -Cautery or cryotherapy for warts/cancer
  - -Condom, circumcision encouraged

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

- Which cancer?
  - -Kaposi's sarcoma

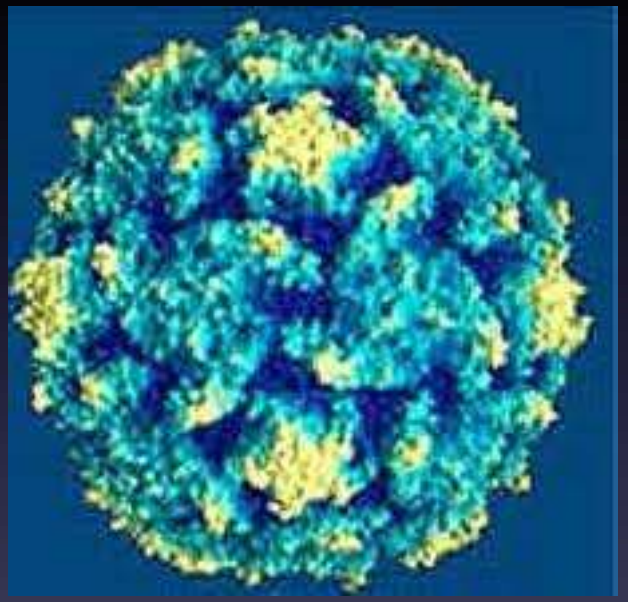
- Who?
  - -Can infect anyone
  - -Causes disease in immunosuppressed patients; asymptomatic in healthy people
  - -HIV/AIDS patients, transplant patients, the elderly, chemo patients
  - -While this virus is typically associated with AIDS patients in the U.S., infection is widespread in sub-Saharan Africa and there are more cases of KS there

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

- How?
  - -Sexually transmitted
  - -Infects lymphocytes, establishes latency
  - -Inflammation or some other stimulus the lytic cycle
  - -Inhibits p53 tumor suppressor protein
  - -Cell lysis allows virus to escape and infect surrounding cells
- Treatment?
  - -Prevention = safe sexual
  - -Cancer treatment = surgery, radiation, and chemotherapy
  - -Antiviral drug ganciclovir targets HHV-8, but isn't effective once tumor forms medication

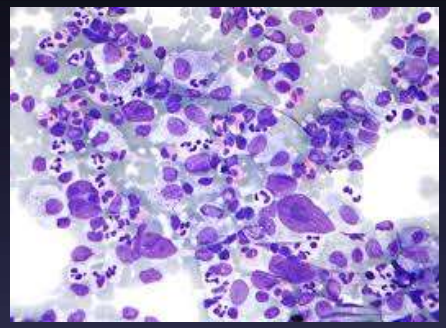
Epstein-Barr Virus (EBV)

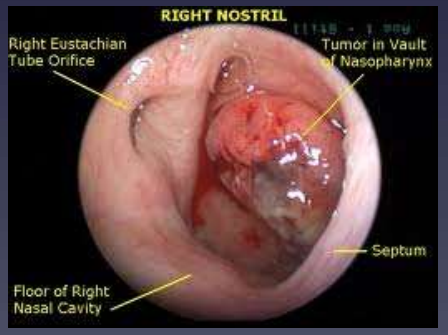
- Which cancer?
  - -Hodgkin's lymphoma, Burkitt's lymphoma, nasopharyngeal carcinoma
  - -In HIV patients, infection associated with CNS lymphomas and hairy leukoplakia
- Who?
  - -90-95% of people are infected in childhood, with no symptoms
  - -Causes infectious mononucleosis in adolescents
  - -Causes cancer in certain geographical locations, and in immunocompromised patients



Epstein-Barr Virus (EBV)

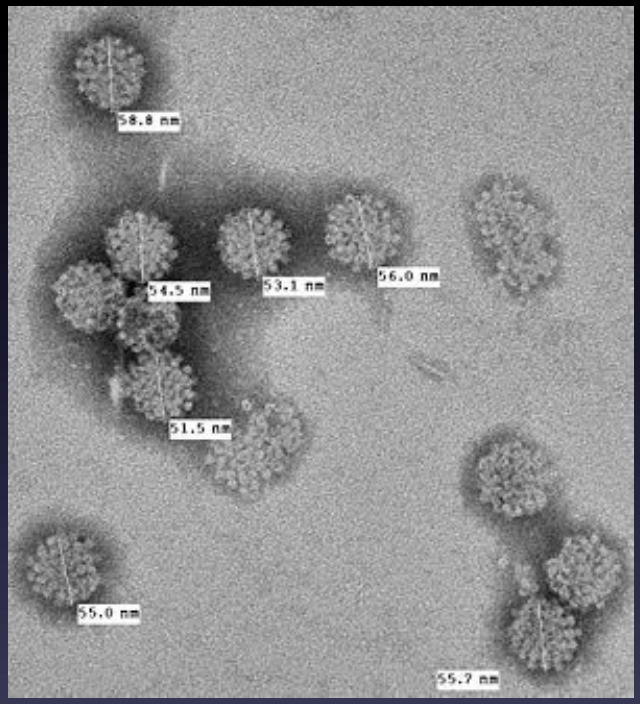
- How?
  - -Transmitted by transfer of saliva/genital secretions
  - -Same genus as HHV-8
  - -Infects B cells and epithelial cells
  - -Can establish latency
- Treatment?
  - -Vaccine is currently in clinical trials
  - -For Burkitt's lymphoma: chemotherapy, immunotherapy, bone marrow transplant, stem cell transplant, surgery, radiation
  - -For Hodgkin's: early stage = chemo/radiation, late stage = chemo only





Merkel cell polyomavirus

- Which cancer?
  - -Merkel cell carcinoma (rare, aggressive neuroendocrine skin cancer)
  - -Merkel cells help make up the barrier between dermis/epidermis
  - -Can occur anywhere you have skin, most commonly face
- Who?
  - -Chronically immunosuppressed (HIV/AIDS, transplant, chronic lymphocytic leukemia)
  - -More common in Caucasians, males
  - -Median age is 65 years old
  - -UV radiation may increase risk of cancer formation
  - -rare---around 1500 new cases each year



Merkel cell polyomavirus

- How?
  - -The exact mechanism of cancer formation is not known yet…the virus was first described in 2008!
- Treatment?
  - -No vaccine or treatment for virus
  - -For MCC: surgery and adjuvant radiation
  - -Chemo can be used palliatively or to shrink a tumor if needed