

Chapter 24 – Pathogenic DNA Viruses

NIMESH PATEL | HLSC 2400

NOVEMBER 9, 2017

Announcements

- **Exam dates:**
 - Test 3: December 5 – December 8, 2017
 - Reattempt: Not available
- **30** multiple choice questions and/or true-false questions
- **Duration:** 45 minutes (plus extra 10 *grace* minutes) – 55 minutes total
- **Location:** Testing Centre
- The test will be based on the material presented or discussed in the classroom and textbook chapters that students are required to review independently.
 - This includes students' presentations posted on Moodle

Announcements – Test 2

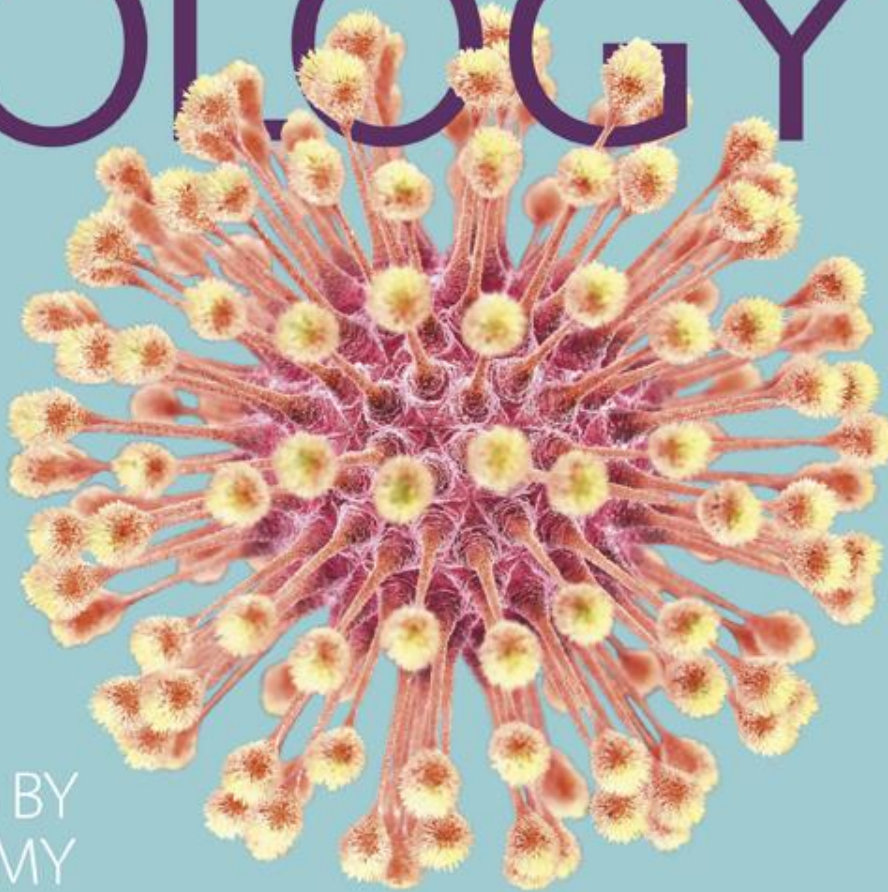
- One bonus mark will be given to all the students who attempted the second test to account for the difficulty level of the test

How to better prepare for the final test

- Study in groups
- Prepare multiple choice questions as a part of your practice for the test
- **Students will receive 1 bonus mark (max 4 bonus marks) for each 10 multiple choice questions they email to TA and Cc your instructor**
 - Means submit 40 MCQs and earn 4 bonus marks!
 - Submit the questions in one PDF file – will be posted on Moodle with your name on it
- Do **NOT** copy questions from online sources or your classmates
- **MCQs must be from the materials to be tested in the final test**
- **Deadline: December 1, 2017 (11:59pm)**

MICROBIOLOGY

5th Edition



WITH
DISEASES BY
TAXONOMY

ROBERT W. BAUMAN

PowerPoint® Lecture
Presentations prepared by
Mindy Miller-Kittrell,
North Carolina State
University

CHAPTER 24

Pathogenic DNA Viruses

Herpesviridae

- ***Human Herpesvirus 3 (Varicella-Zoster Virus)***
Infections
 - In the genus *Varicelovirus*
 - Causes two diseases:
 - **Varicella**
 - Often called **chickenpox**
 - Typically occurs in **children**
 - **Herpes zoster**
 - Also called **shingles**
 - Usually occurs in **adults**

Herpesviridae

- **Human Herpesvirus 3 (Varicella-Zoster Virus) Infections**
 - Epidemiology and Pathogenesis
 - Chickenpox is highly infectious disease
 - Virus enters body through the respiratory tract or eyes
 - Virus travels via the blood from infection site throughout body
 - Causing fever, malaise, and skin lesions
 - Characteristic skin lesions appear 2–3 weeks after infection
 - Progress from macules to papules, to vesicles to crust
 - Viruses are shed through respiratory droplets and the fluid in the lesions
 - **Virus can become latent in sensory nerves**

Herpesviridae

- **Human Herpesvirus 3 (Varicella-Zoster Virus) Infections**
 - Epidemiology and Pathogenesis
 - The disease is usually mild in children
 - Chickenpox in adults is typically more severe
 - Latent virus can reactivate (about 15% of the infected people), producing a rash known as **shingles or herpes zoster**
 - **Painful skin rash near the distal end of the nerve**
 - Lesions occur along band of skin called a dermatome, associated with infected nerve
 - May occur in eye, ear, or elsewhere on the head or torso
 - Some may experience long-term nerve pain
 - Recurrences usually occur only once or twice, typically after age 45

Figure 24.9 Characteristic chickenpox lesions – thin walled, fluid-filled vesicles on red bases.



Figure 24.10 Latency and reactivation of varicella-zoster virus.

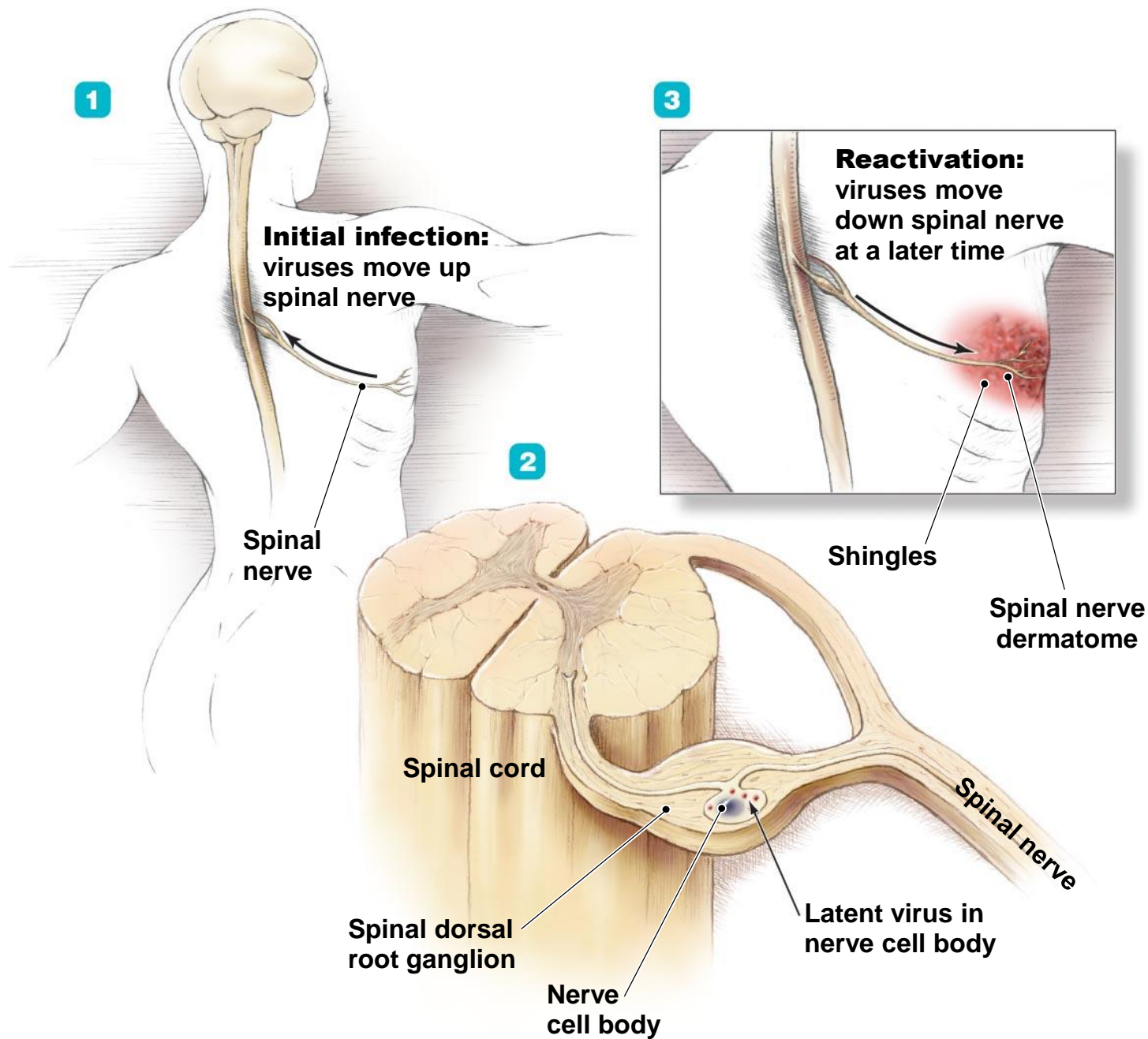


Figure 24.11 Shingles, a rash caused by *Varicellovirus*.



Chickenpox (Varicella)



Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Transmission

Varicella is highly contagious. The virus can be spread from person to person by direct contact, inhalation of aerosols from vesicular fluid of skin lesions of acute varicella or zoster and possibly through infected respiratory secretions that also may be aerosolized. A person with varicella is contagious from 1-2 days before rash onset until the lesions have crusted. It takes from 10-21 days after exposure to the virus for someone to develop varicella. Based on studies of transmission among household members, about 90% of susceptible close contacts will get varicella after exposure to persons with disease.

<https://www.cdc.gov/chickenpox/hcp/clinical-overview.html>

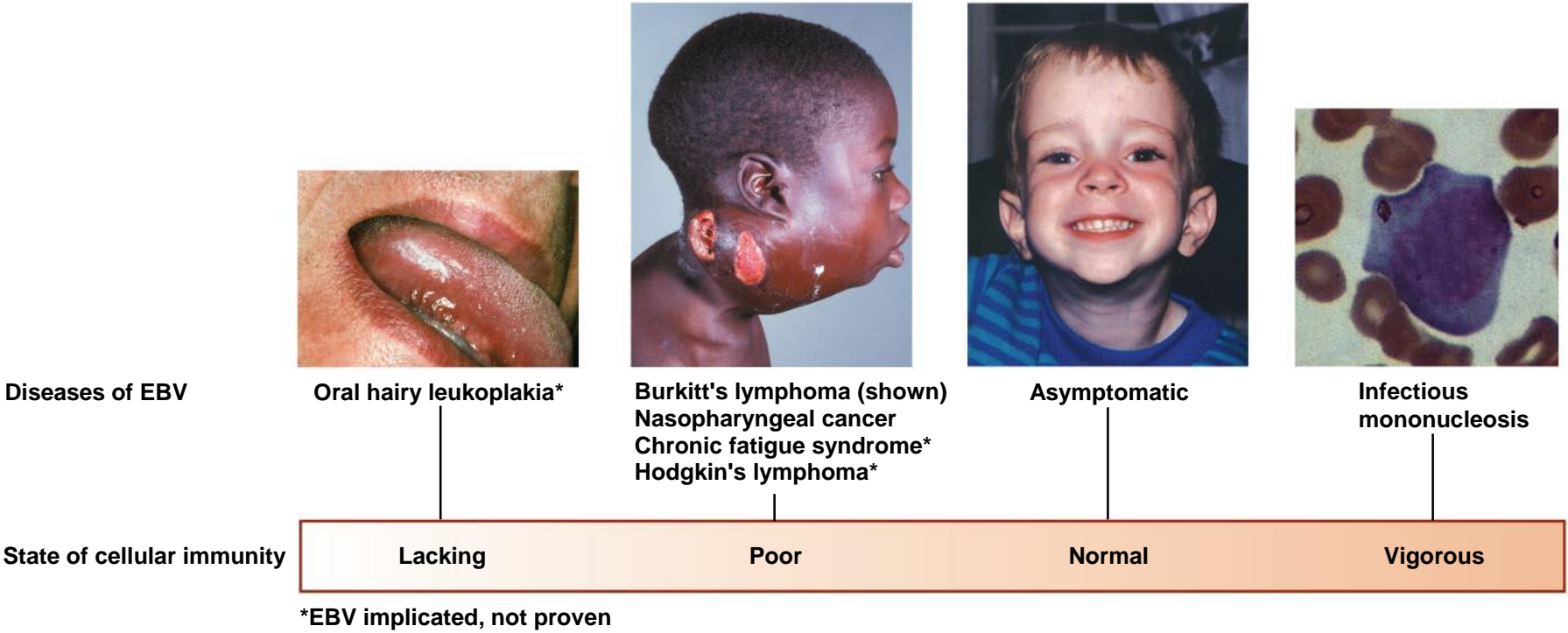
Herpesviridae

- ***Human Herpesvirus 3 (Varicella-Zoster Virus)***
Infections
 - Diagnosis, Treatment, and Prevention
 - Diagnosis
 - Chickenpox is diagnosed from the characteristic lesions
 - Shingles lesions can be more difficult to diagnose
 - Treatment
 - Chickenpox is usually self-limiting
 - Shingles treatment involves management of symptoms
 - Prevention
 - Difficult to prevent exposure, since virus is shed before obvious signs appear
 - Vaccines against chickenpox and shingles are available

Herpesviridae

- ***Human Herpesvirus 4 (Epstein-Barr Virus)***
Infections
 - Also referred to as EBV
 - Can cause a number of different diseases

Figure 24.12 Diseases associated with Epstein-Barr virus.



Herpesviridae

- ***Human Herpesvirus 4 (Epstein-Barr Virus)***
Infections

- Epidemiology and Pathogenesis
 - Transmission usually occurs via saliva
 - Initially infect epithelium of pharynx and parotid salivary glands
 - Virus enters the bloodstream and invades B lymphocytes
 - Becomes latent and suppresses apoptosis of B cells
 - Immune response causes infectious mononucleosis
(kissing disease) symptoms
 - Results from a “civil war” between humoral (antibody) and cellular branches of immunity
 - Cytotoxic T cells kill virus-infected B lymphocytes

Infectious mononucleosis

- Symptoms
 - Fever
 - Sore throat
 - Swollen lymph nodes in your neck and armpits
 - Headache
 - Fatigue
 - Muscle weakness
 - Swollen tonsils
 - Night sweats
- Symptoms look similar like flu – but see your doctor if they don't improve in two weeks
- Think twice before kissing your partner having flu-like symptoms!

Herpesviridae

- ***Human Herpesvirus 4 (Epstein-Barr Virus)***
Infections

- Epidemiology and Pathogenesis
 - Infection in children is usually asymptomatic
 - 70% adults over age 30 have antibodies to EBV
 - Infection in adults produces more serious signs and symptoms
 - Cancer development appears to depend on various cofactors
 - Extreme diseases arise in individuals with T-cell deficiency

Herpesviridae

- ***Human Herpesvirus 4 (Epstein-Barr Virus)***
Infections
 - Diagnosis, Treatment, and Prevention
 - Diagnosis
 - Some diseases diagnosed by their characteristic signs
 - Treatment
 - Burkitt's lymphoma responds well to chemotherapy
 - Hodgkin's lymphoma is treated with radiation and chemotherapy
 - Mono patients are treated to relieve the symptoms
 - Other conditions have no effective treatment
 - Prevention
 - Hard or nearly impossible because virus is widespread and transmitted by saliva

Herpesviridae

- ***Human Herpesvirus 5 (Cytomegalovirus)***
Infections
 - Infected cells become enlarged
 - One of the more common infections of humans
 - 50% of the adult population in the U.S. is infected
 - 100% of the population of some countries test positive for antibodies against Cytomegalovirus (CMV)
 - Like other herpes viruses, CMV becomes latent, with infection lasting for life

Herpesviridae

- ***Human Herpesvirus 5 (Cytomegalovirus)***
Infections
 - Epidemiology and Pathogenesis
 - Transmission occurs through bodily secretions such as saliva, mucus, milk, urine, feces, semen, and cervical secretions, and requires intimate contact
 - Requires close contact and a large exchange of secretion
 - Usually occurs via sexual intercourse
 - Also transmitted by *in utero* exposure, vaginal birth, blood transfusions, and organ transplants

Herpesviridae

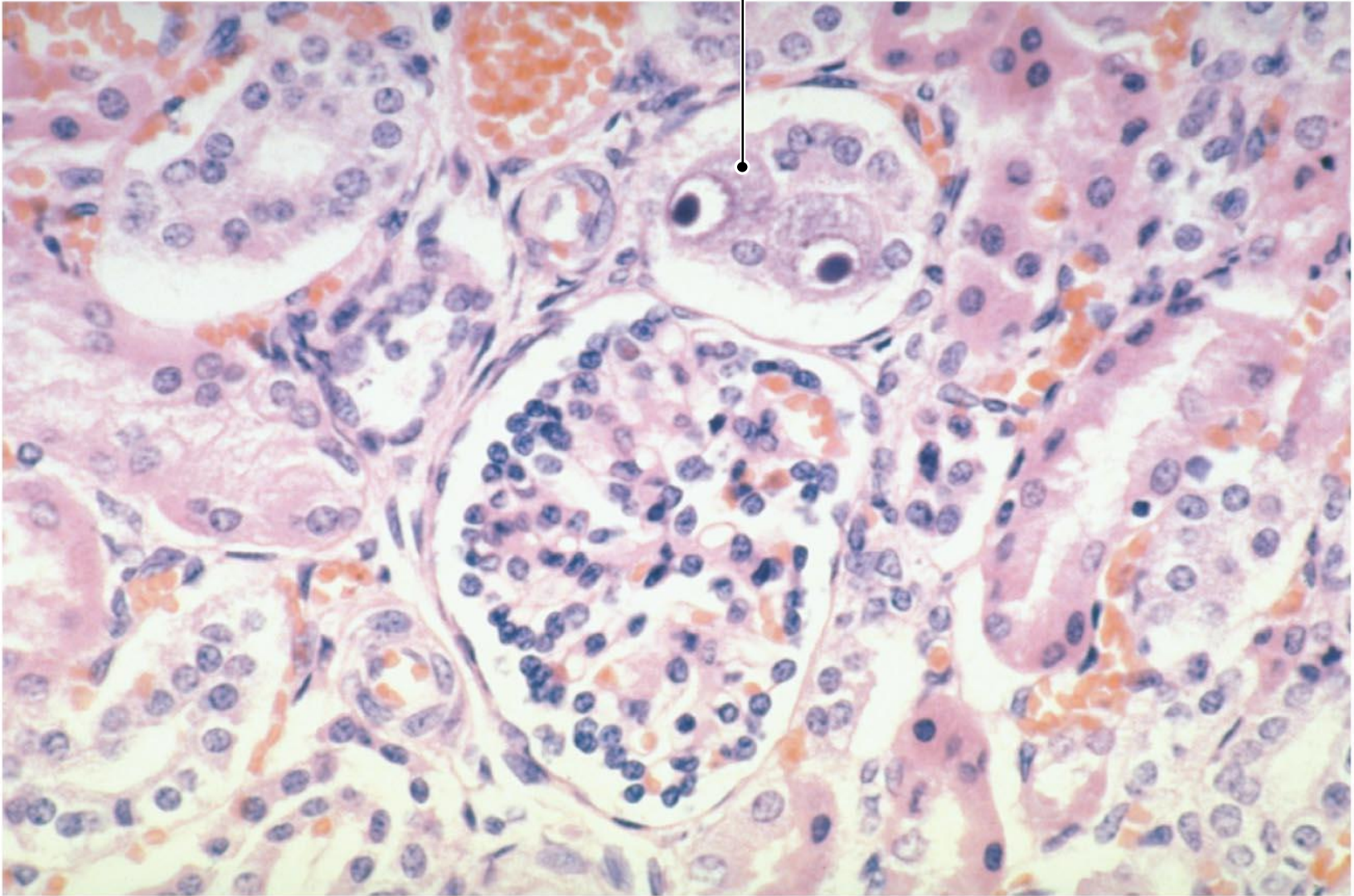
- **Human Herpesvirus 5 (Cytomegalovirus) Infections**
 - Epidemiology and Pathogenesis
 - Most CMV infections are asymptomatic
 - Complications in fetuses, newborns, and immunodeficient patients
 - CMV can be teratogenic, causing birth defects if the virus infects *stem cells* in an embryo or fetus
 - Newborns may develop signs of infection, mental retardation, or hearing and visual damage
 - AIDS patients or immunosuppressed adults may develop pneumonia, blindness, or mononucleosis

Herpesviridae

- ***Human Herpesvirus 5 (Cytomegalovirus) Infections***
 - Diagnosis, Treatment, and Prevention
 - Diagnosis
 - Detection of enlarged cells and cellular inclusions
 - Virus can be detected by enzyme-linked immunosorbent assay (ELISA) tests or DNA probes
 - Treatment
 - Treatment of fetuses and newborns is difficult
 - Damage usually occurs before infection is discovered
 - Fomivirsen is used to treat CMV eye infections
 - Prevention
 - Abstinence, monogamy and safe sex can reduce chance of infection

Figure 24.13 An owl's eyes cell.

"Owl's eyes" cell



LM

100 μ m

Herpesviridae

- **Other Herpesvirus Infections**

- *Human herpesvirus 6 (HHV-6)*
 - In the genus *Roseolovirus*
 - Causes roseola
 - Characterized by pink rash on face, neck, trunk, and thighs
 - May be linked to multiple sclerosis
 - Can cause mononucleosis-like symptoms
 - HHV-6 may make individuals more susceptible to AIDS
- *Human herpesvirus 8 (HHV-8, Rhadinovirus)*
 - Causes Kaposi's sarcoma
 - Cancer often seen in AIDS patients

Herpesviridae

- **Other Herpesvirus Infections**

- *Human herpesvirus 6* (HHV-6)
 - In the genus *Roseolovirus* (**Sixth disease**)
 - Causes roseola
 - Characterized by pink rash on face, neck, trunk, and thighs with fever, sore throat, and enlarged lymph nodes
 - May be linked to multiple sclerosis
 - Can cause mononucleosis-like symptoms
 - HHV-6 may make individuals more susceptible to AIDS
- *Human herpesvirus 8* (HHV-8, *Rhadinovirus*)
 - Causes Kaposi's sarcoma
 - Cancer of the lining of blood vessels often seen in AIDS patients

Figure 24.14 Roseola.



Figure 24.15 Kaposi's sarcoma.



Papillomaviridae and *Polyomaviridae*

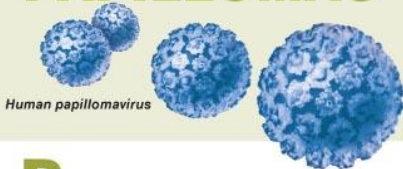
- Double-stranded DNA viruses
- Have small, naked, icosahedral capsid
- Once classified as a single family of viruses

Papillomaviridae and *Polyomaviridae*

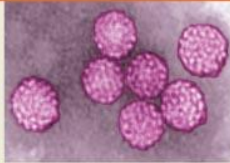
- **Papillomavirus Infections**
 - Cause **papillomas**
 - Commonly known as **warts**
 - Benign growths of the epithelium of skin or mucous membranes
 - Papillomas form on many body surfaces
 - Genital warts associated with an increased risk of cancer

DISEASE
IN DEPTH

PAPILLOMAS



Human papillomavirus



Papillomaviruses shed from a wart
TEM 60 nm

There are more than 100 strains of human papillomaviruses (HPV, family *Papillomaviridae*), each having a single molecule of double-stranded DNA contained in a naked icosahedral capsid. Half of HPVs can permanently integrate into human chromosomes, where they can trigger genital cancer, especially when they infect a patient who is also infected with herpesvirus.

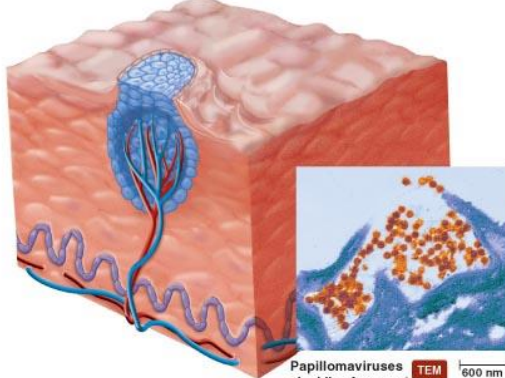
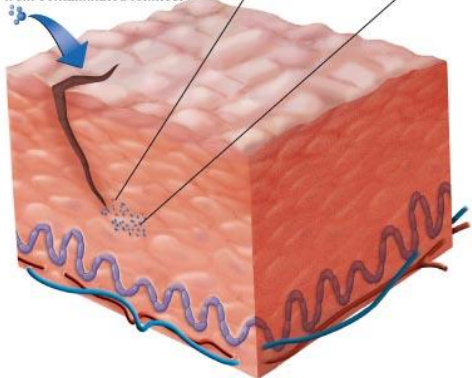
Papillomaviruses cause papillomas, usually benign growths of the epithelium of the skin or mucous membranes commonly known as warts. Papillomas are most often found on fingers or toes (seed warts); deep in soles of feet (*plantar warts*); on the trunk, face, elbows, or knees (*flat warts*); or on the external genitalia, most extremely as *condylomata acuminata*. Certain strains of papillomaviruses can also trigger cancers, such as those of genitalia.



Condylomata acuminata

PATHOGENESIS

- 1 Papillomavirus is transmitted via direct contact or from contaminated fomites.
- 2 Virus multiplies within cells.
- 3 Virus invades adjacent cells.
- 4 Rapid growth of virus-infected cells creates wart.
- 5 Virus is shed when dead skin cells are sloughed off.



Papillomaviruses shedding from wart
TEM 600 nm

INVESTIGATE IT!

Scan this QR code to watch Dr. Bauman's Video Tutor explore papillomas. Then go to MasteringMicrobiology to investigate further and record your research findings on the following question:



How can DNA viruses trigger cancer by inserting into an infected cell's chromosomes?

DIAGNOSIS, TREATMENT, & PREVENTION



Diagnosis of warts is usually a simple matter of observation, though only DNA probes can elucidate the exact strain of *Papillomavirus* involved. Warts usually regress over time as a cell-mediated immune response recognizes and attacks virally infected cells. Cosmetic concerns and pain associated with some warts may necessitate removing infected tissue via surgery, freezing, cauterization (burning), laser, or the use of caustic chemicals. Despite treatment, viruses may remain latent in neighboring tissue and produce new warts at a later time. Prevention is difficult; however, genital warts may be prevented by abstinence, mutual monogamy, or a vaccine against the more common strains associated with genital cancers.

Papillomaviridae and *Polyomaviridae*

- **Papillomavirus Infections**

- Pathogenesis
 - Transmitted via **direct contact** and via fomites
 - Viruses are shed as skin cells slough off
 - Some HPVs can integrate into human chromosomes
 - May trigger **cancer**

HPV – Warts vs. Cancer



What are human papillomaviruses?

Human papillomaviruses (HPVs) are a group of more than 200 related viruses. More than 40 HPV types can be easily spread through direct sexual contact, from the skin and mucous membranes of infected people to the skin and mucous membranes of their partners. They can be spread by vaginal, anal, and oral sex (1). Other HPV types are responsible for non-genital warts, which are not sexually transmitted.

Sexually transmitted HPV types fall into two categories:

- Low-risk HPVs, which do not cause cancer but can cause skin warts (technically known as condylomata acuminata) on or around the genitals and anus. For example, HPV types 6 and 11 cause 90% of all genital warts. HPV types 6 and 11 also cause recurrent respiratory papillomatosis, a less common disease in which benign tumors grow in the air passages leading from the nose and mouth into the lungs.
- High-risk HPVs, which can cause cancer. About a dozen high-risk HPV types have been identified. Two of these, HPV types 16 and 18, are responsible for most HPV-caused cancers (2, 3).

Condylomata acuminata - Genital warts



Photo credit: <https://medicalfoxx.com/condyloma-acuminatum.html>



Photo credit: <https://www.linkedin.com/pulse/unusual-presentation-giant-condylomata-acuminata-case-physiology>

Cervical cancer - Etiology



What causes it and who gets it?

Listed below are some of the known risk factors for this cancer. Not all of the risk factors below may cause this cancer, but they may be contributing factors.

- All women who have ever been sexually active (touching or intercourse) are at risk of cervical cancer.
- Almost all cervical cancers are caused by certain types of the Human papillomavirus (HPV).
 - There are more than 100 types of HPV and about 40 can infect the genital area. About 15 types of genital HPV can cause cervical cancer.
 - HPV is one of the most common sexually transmitted infections (STIs). Most adults have HPV some time in their lives and it usually goes away within 24 months without any problem.
 - In some women, the dysplasia (abnormal cells caused by HPV) does not go away. Over time these abnormal cells in the cervix can change into cervical cancer.

Cervical cancer - Etiology

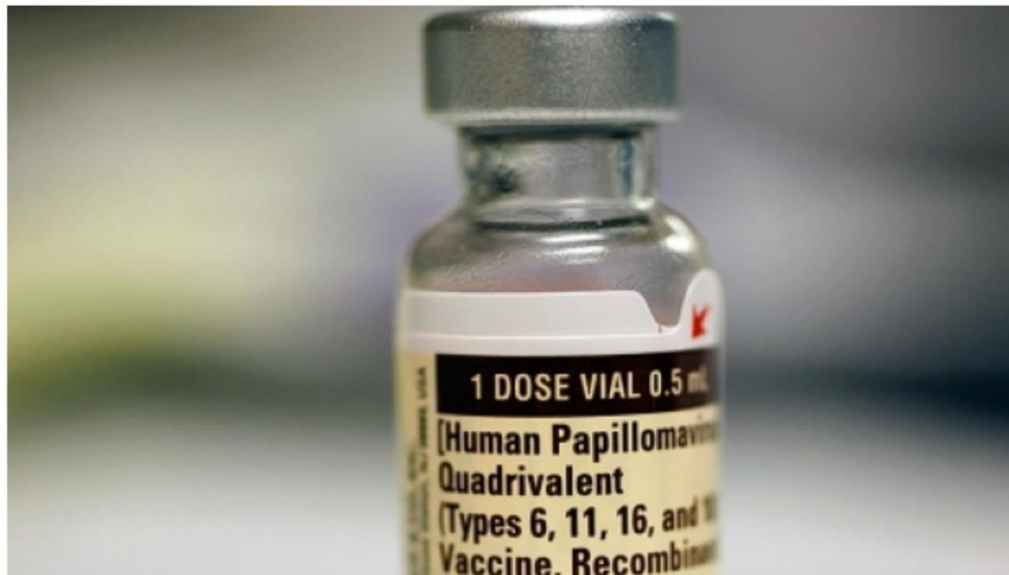


- Risk factors for HPV infection:
 - Starting sexual activity at a young age
 - Multiple sexual partners
 - A sexual partner who has had multiple partners
 - Not using condoms
- Risk factors for HPV progressing to cervical cancer:
 - Weakened immunity, for example because of HIV / AIDS, or drugs taken for an organ transplant
 - Smoking
- Cervical cancer is probably not affected by heredity (family or genetic history).
- Cervical cancer can start to develop at a younger age than many cancers and affects women over a wide age range. Most women diagnosed with cervical cancer are between the ages of 30 and 60.

Cases of HPV-related oral cancers have risen significantly in Canada, study finds

Incidence of HPV-related oral cancers increased by about 50% between 2000 and 2012

The Canadian Press Posted: Aug 14, 2017 1:46 AM ET | Last Updated: Aug 14, 2017 11:42 AM ET



Statistics from a Canadian Cancer Society report last fall showed 1,335 Canadians were diagnosed in 2012 with HPV-related oropharyngeal cancer and 372 died from the disease. (CBC)

6284 shares



The proportion of oral cancers caused by the human papillomavirus has risen significantly in Canada, say researchers, who suggest the infection is now behind an estimated three-quarters of all such malignancies.

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Most cases linked to oral sex

HPV is the most common sexually transmitted infection worldwide. Most people never develop symptoms and the infection resolves on its own within about two years. But in some people, the infection can persist, leading to cervical cancer in women, penile cancer in men and oropharyngeal cancer in both sexes.

Most cases of HPV-related oral cancer are linked to oral sex, said Huang, noting that about 85 per cent of the cases in the CMAJ study were men.

HPV-related tumours respond better to treatment and have a higher survival rate than those linked to tobacco and alcohol use, the other major cause of oral cancer, she said, adding that early identification of a tumour's cause is important to ensure appropriate and effective treatment.

While some centres in Canada routinely test oral tumours to determine their HPV status, such testing is not consistent across the country, the researchers say.

In the past, physicians generally tended to reserve tumour testing for cases most likely to be caused by HPV — among them younger males with no history of smoking and with light alcohol consumption — to prevent an unnecessary burden on pathology labs.

"Only as accumulating data have supported the clinical importance of HPV testing has routine testing been implemented in most (though not all) Canadian centres," the researchers write.

Papillomaviridae and *Polyomaviridae*

- **Papillomavirus Infections**

- Diagnosis, Treatment, and Prevention
 - Diagnosis
 - Diagnosis usually based on observation of the papillomas – **giant cauliflower-like growths**
 - Treatment
 - Some warts can be removed through various methods
 - Prevention
 - Prevention of most types of warts is difficult
 - **Genital warts prevented by abstinence or mutual monogamy**
 - **Vaccine available against some strains associated with cancers**

Cervical Cancer – Screening Guidelines



Canadian Task Force on Preventive Health Care

Recommendations

- For women aged < 20 we recommend not routinely screening for cervical cancer
(Strong recommendation; high quality evidence)
- For women aged 20 to 24 we recommend not routinely screening for cervical cancer.
(Weak recommendation; moderate quality evidence)
- For women aged 25 to 29 we recommend routine screening for cervical cancer every 3 years.
(Weak recommendation; moderate quality evidence)
- For women aged 30 to 69 we recommend routine screening for cervical cancer every 3 years.
(Strong recommendation; high quality evidence)
- For women aged ≥ 70 who have been adequately screened (i.e., 3 successive negative Pap tests in the last 10 years), we recommend that routine screening may cease. For women aged 70 or over who have not been adequately screened we recommend continued screening until 3 negative test results have been obtained.
(Weak recommendation; low quality evidence)

Summary of recommendations for clinicians and policy-makers

Recommendations are presented for screening asymptomatic women who are or have been sexually active. They do not apply to women with symptoms of cervical cancer, previous abnormal screening results (until they have been cleared to resume normal screening), those who do not have a cervix (due to hysterectomy), or who are immunosuppressed.

Papillomaviridae and *Polyomaviridae*

- **Polyomavirus Infections**

- *Poly*=“many”, *Oma*=“tumor”
- Capable of causing tumors in animals and humans
- Can cause other diseases
- BK and JC viruses are endemic worldwide
- Initial infection = affects lymphocytes
- Infection outcome depends on the individual's immune system
 - Normal immune systems tend to prevent latent infections
 - Compromised immune systems allow latent infections to become established in the kidneys where reactivation occurs later

Papillomaviridae and Polyomaviridae

- **Polyomavirus Infections**

- Reactivation events are different between the BK and JC viruses
 - BK virus
 - Potentially severe urinary tract infections can develop
 - JC virus
 - Can cause progressive multifocal leukoencephalopathy
 - Viruses infect and kill the white matter of the CNS
 - Paralysis and death eventually result
- Beta interferon can prevent kidney damage by BK virus
- Diagnosis of JC virus infections often made too late to treat

Adenoviridae

- Contain single, linear dsDNA genome
- Have naked polyhedral capsid with spikes
- **One of many causative agents of the common cold**
- At least 30 respiratory adenoviruses cause the “common cold” and are spread through respiratory droplets
- Spread via respiratory droplets
- Can survive on fomites and in improperly chlorinated water
- Respiratory infections
 - Viruses taken into cells lining the respiratory tract via endocytosis
 - Cause sneezing, sore throat, cough, headache, and malaise
- Infection of the intestinal tract can produce mild diarrhea in children
- Infection of the conjunctiva can result in **pinkeye**
- Treat early stages of infection with gamma interferon
- Attenuated vaccine is available only for military personnel

Catch a cold and catch obesity?

- Human adenovirus 36 (Adv36) began infecting humans in 1980 – beginning of the obesity pandemic the same year
- Directly affects adipocytes (fat cells) in animals and humans – more body fat if infected
- Regulates a gene responsible for fat production
- Also, enhances a cell's ability to take up glucose, which can be metabolized into fat and stored
- Perhaps someday soon, more effective anti-cold remedies may also help you lose weight!

Figure 24.16 Adenovirus.

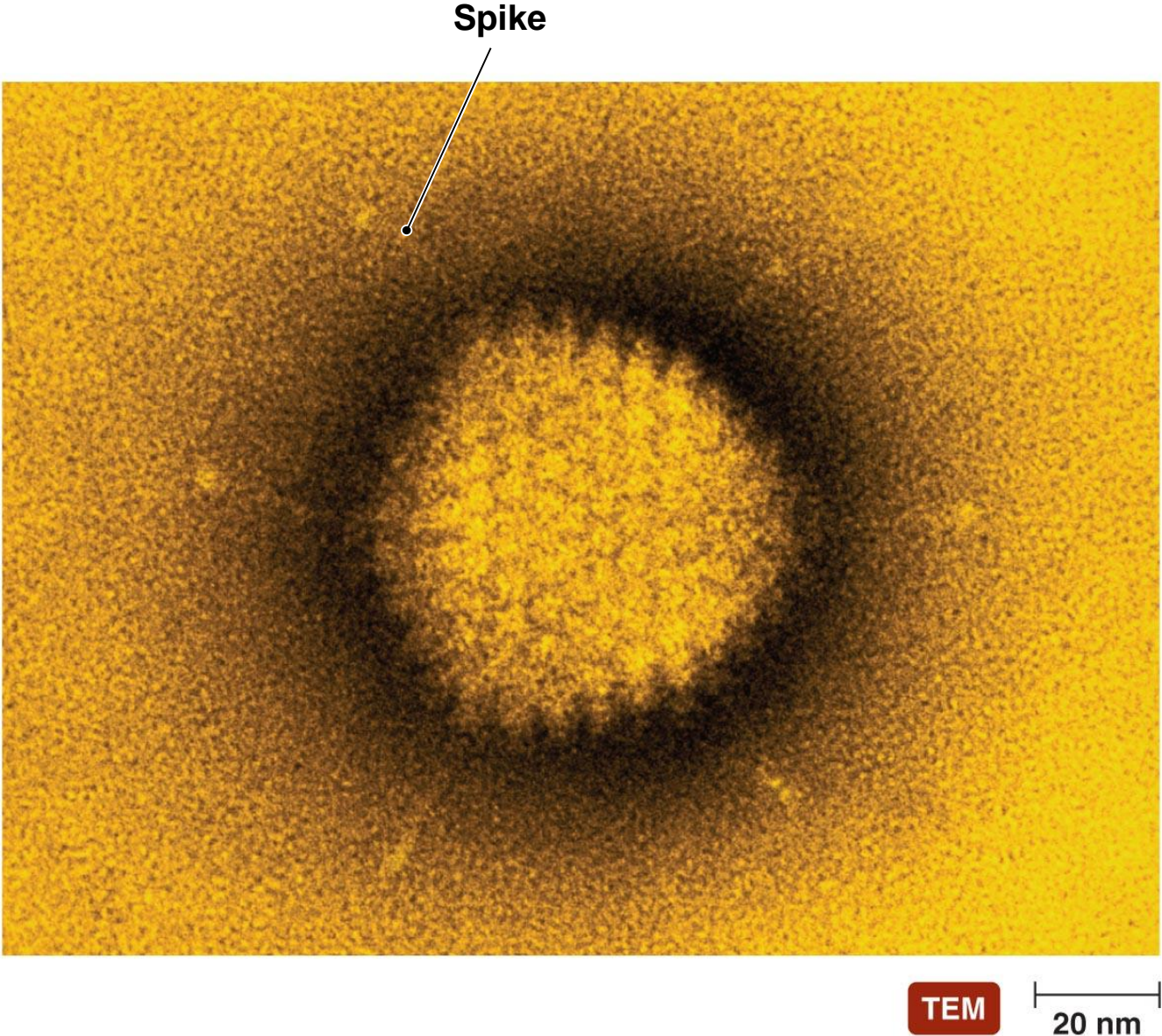


Figure 24.17 Adenoviral conjunctivitis (pinkeye).



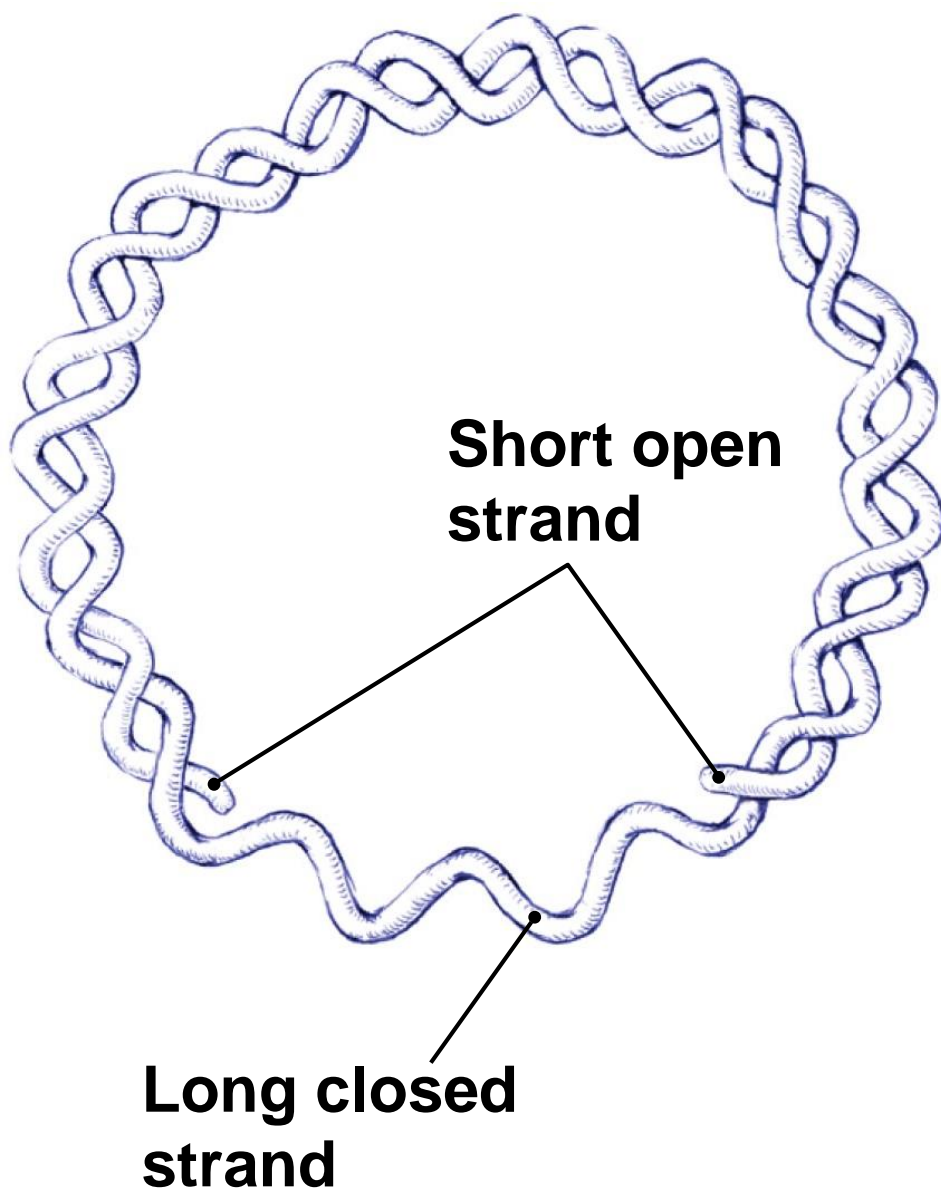
Hepadnaviridae

- Enveloped DNA viruses
- Have icosahedral capsids
- Invade and replicate in liver cells
- The genome includes both double-stranded and single-stranded DNA, with the proportion of ssDNA to dsDNA varying between virions

Hepadnaviridae

- Include hepatitis B virus (HBV), in the genus *Orthohepadnavirus*
- Unique genome is composed of both single- and double-stranded DNA
- HBV replicates through an RNA intermediary
 - Unique among DNA viruses
 - **Reverse transcriptase** transcribes DNA genome into RNA

Figure 24.18 The genome of a hepadnavirus.

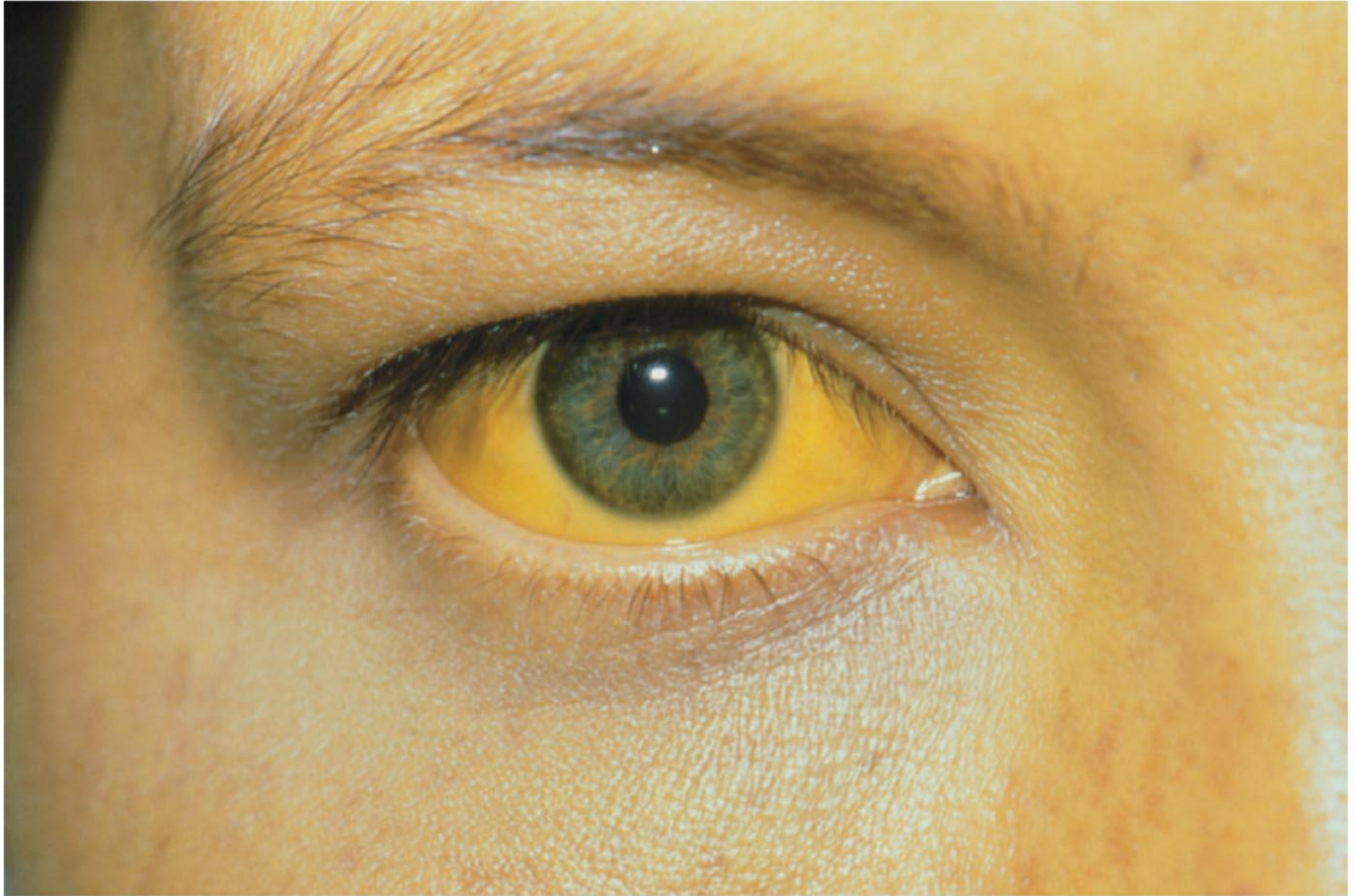


Hepadnaviridae

- **Hepatitis B Infections**

- Cause hepatitis
 - Inflammation of the liver
- **HBV is the only DNA virus that causes hepatitis**
- Viral infection can cause severe liver damage
- Various symptoms
 - Jaundice (a yellowing of the skin and eyes that occurs when *bilirubin* accumulates in the blood), liver enlargement, abdominal distress, and bleeding into the skin and internal organs
- **Co-infection with hepatitis D virus increases risk of permanent liver damage**

Figure 24.19 Jaundice.

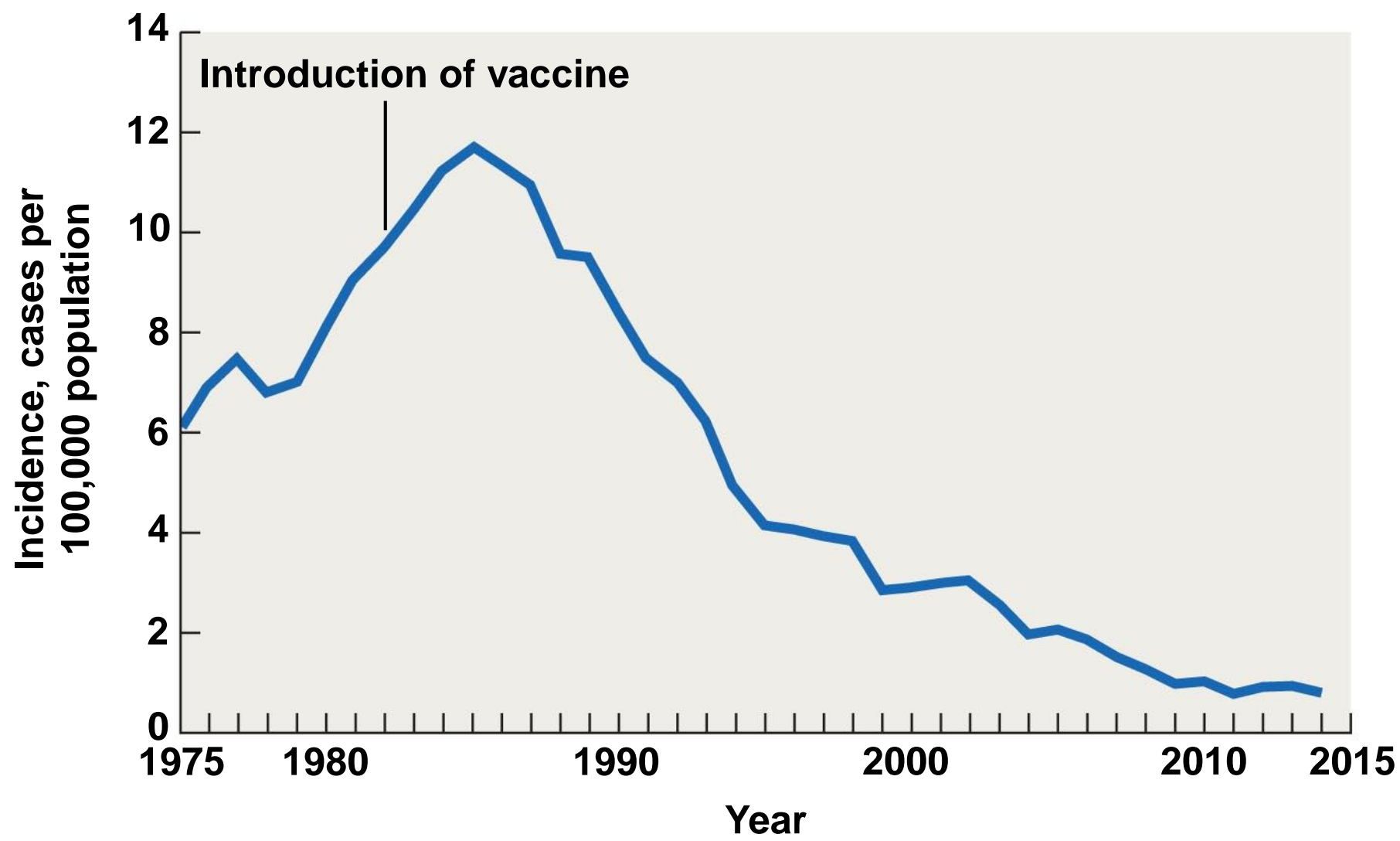


Hepadnaviridae

- **Hepatitis B Infections**

- Epidemiology and Pathogenesis
 - Liver cells continually release virions into the blood (exocytosis)
 - Virions are shed into saliva, semen, blood, and vaginal secretions – requires only a low infective dose
 - Transmitted when infected body fluids contact breaks in the skin or mucous membranes
 - Virus spread through infected needles, sexual intercourse, and passage to babies during childbirth
 - Many individuals are asymptomatic or have mild symptoms
 - Vaccination has reduced the cases of HBV in the U.S.

Figure 24.20 Estimated incidence of acute hepatitis B in the United States.

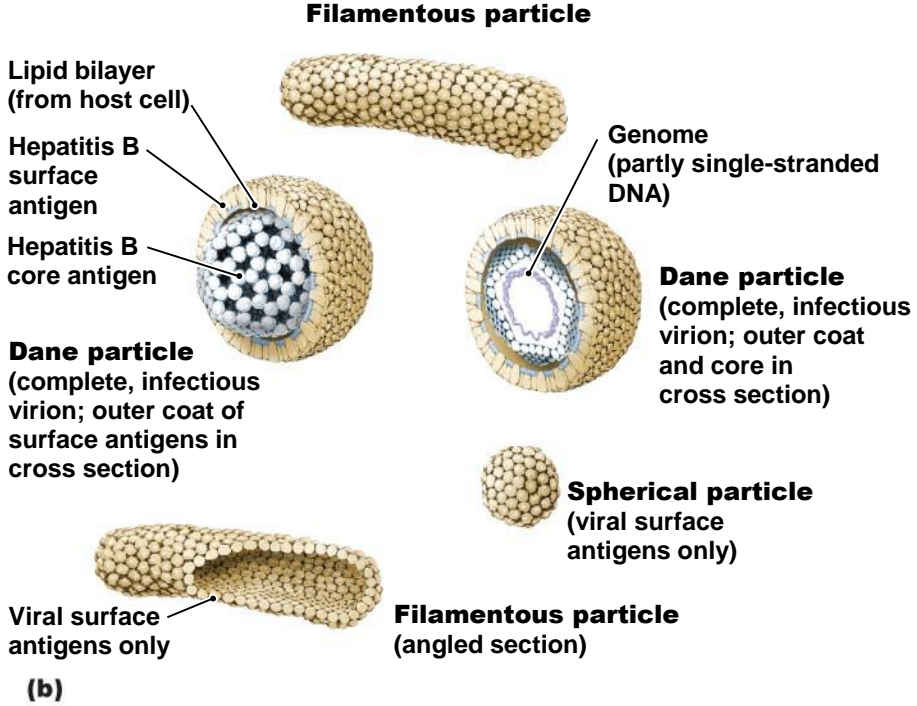
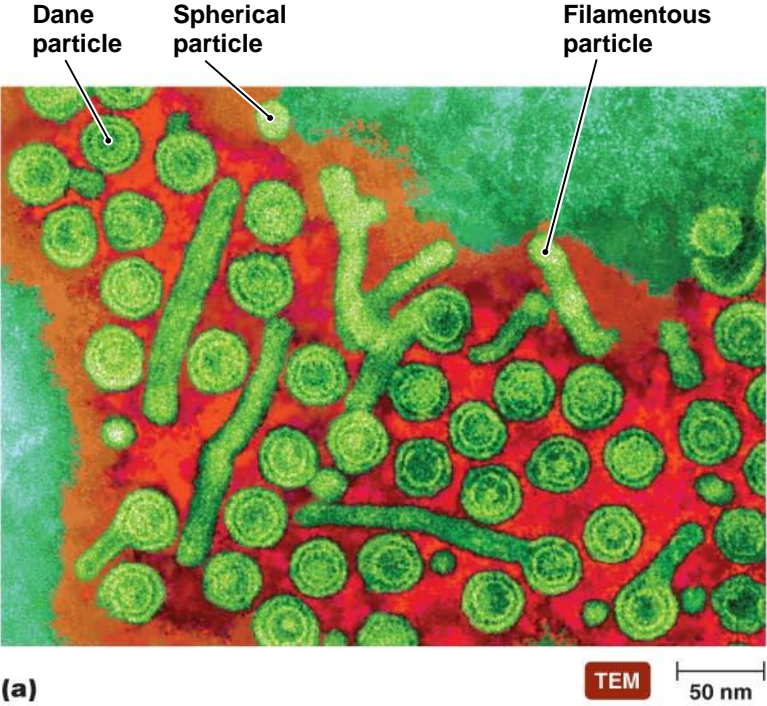


Hepadnaviridae

- **Hepatitis B Infections**

- Diagnosis, Treatment, and Prevention
 - Diagnosis
 - Diagnose by detecting presence of viral antigens
 - Body fluids contain three types of virus particles:
Dane particles, spherical particles, and filamentous particles
 - Treatment
 - No universally effective treatment
 - Prevention
 - Vaccination offers long-term protection against HBV
 - Abstinence and monogamy protect against sexually transmitted infection
 - Care with needles and sharp instruments, disinfection with 10% bleach solutions

Figure 24.21 The three types of viral particles produced by hepatitis B viruses.





14.0 INTERPRETATION OF TESTING RESULTS

Factor to be tested	Term	Use
HBsAg	Hepatitis B surface antigen	Detection of acutely or chronically infected person
Anti-HBs	Antibody to HBsAg	Identification of resolved infection with HBV; determination of immunity after hepatitis B vaccination
Anti-HBc	Antibody to core antigen (HBcAg)	Identification of individuals with prior infection with HBV (not present after immunization).
Anti-HBc IgM	IgM class antibody to HBcAg	Indicates acute or recent infection with HBV; detectable for 4-6 months after infection.
HBeAg	Hepatitis B e Antigen	Identification of infected individuals at increased risk of transmitting HBV.
Anti-HBe	Antibody to HBeAg	Identification of infected individuals at lower risk for transmitting HBV.

Interpretation of test results

HBsAg anti-HBc anti-HBs	negative negative negative	susceptible
HBsAg anti-HBc anti-HBs	negative negative positive (≥ 10 IU/L)	immune due to vaccination
HBsAg anti-HBc anti-HBs	negative positive positive (≥ 10 IU/L)	immune due to natural infection
HBsAg anti-HBc IgM anti-HBs	positive positive negative	acute infection
HBsAg anti-HBc anti-HBs	positive positive negative	chronic infection
HBsAg anti-HBc anti-HBs	negative positive negative	"isolated anti-core positive" four interpretations possible Interpretation unclear; four possibilities: <ol style="list-style-type: none"> 1. Resolved infection (most common) 2. False-positive anti-HBc, thus susceptible 3. "Low level" chronic infection 4. Resolving acute infection

http://www.bccdc.ca/resource-gallery/Documents/Guidelines%20and%20Forms/Guidelines%20and%20Manuals/Epid/CD%20Manual/Chapter%201%20-%20CDC/HepatitisB_Sept_2009.pdf

<https://www.cdc.gov/hepatitis/HBV/PDFs/SerologicChartv8.pdf>

Hepadnaviridae

- **The Role of Hepatitis B Virus in Hepatic Cancer**
 - Evidence shows HBV associated with hepatic cancer
 - Hepatic cancer occurs in areas with high prevalence of HBV
 - HBV genome integrated into hepatic cancer cells
 - Hepatic cancer cells express HBV antigen
 - Chronic HBV carriers more likely to develop hepatic cancer
 - Hepatic cancer may be the first cancer eliminated by vaccination

Parvoviridae

- Only human pathogen with a ssDNA genome
- Have icosahedral capsid
- Smallest of the DNA viruses
- Cause a number of diseases in animals
- B19 virus is the primary parvovirus of humans
 - Causes erythema infectiosum
 - Also called fifth disease
 - Infection results in a reddening of the skin
 - Sunlight aggravates the condition

Figure 24.22 A case of erythema infectiosum (fifth disease).



Table 24.2 Taxonomy and Characteristics of DNA Viruses of Humans

TABLE 24.2 Taxonomy and Characteristics of DNA Viruses of Humans					
Family	Strand Type	Enveloped or Naked	Capsid Symmetry	Size (diameter, nm)	Representative Genera (disease)
Poxviridae	Double	Enveloped	Complex	200–300	Orthopoxvirus (smallpox, cowpox), Molluscipoxvirus (molluscum contagiosum)
Herpesviridae	Double	Enveloped	Icosahedral	150–200	Simplexvirus—type 1 herpes (fever blisters, respiratory infections, encephalitis), type 2 herpes (genital infections), Varicellovirus (chickenpox), Lymphocryptovirus Epstein-Barr virus (infectious mononucleosis, Burkitt's lymphoma), Cytomegalovirus (birth defects), Roseolovirus (roseola)
Papillomaviridae	Double	Naked	Icosahedral	45–55	Papillomavirus (benign tumors, warts, cervical and penile cancers)
Polyomaviridae	Double	Naked	Icosahedral	45–55	Polyomavirus (progressive multifocal leukoencephalopathy)
Adenoviridae	Double	Naked	Icosahedral	60–90	Mastadenovirus (conjunctivitis, respiratory infections)
Hepadnaviridae	Partial single and partial double	Enveloped	Icosahedral	42	Orthohepadnavirus (hepatitis B)
Parvoviridae	Single	Naked	Icosahedral	18–26	Erythrovirus (fifth disease)