Virology for 2nd Year MD Students

(02) Virus Classification, Replication & Pathogenesis

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Virus Classification

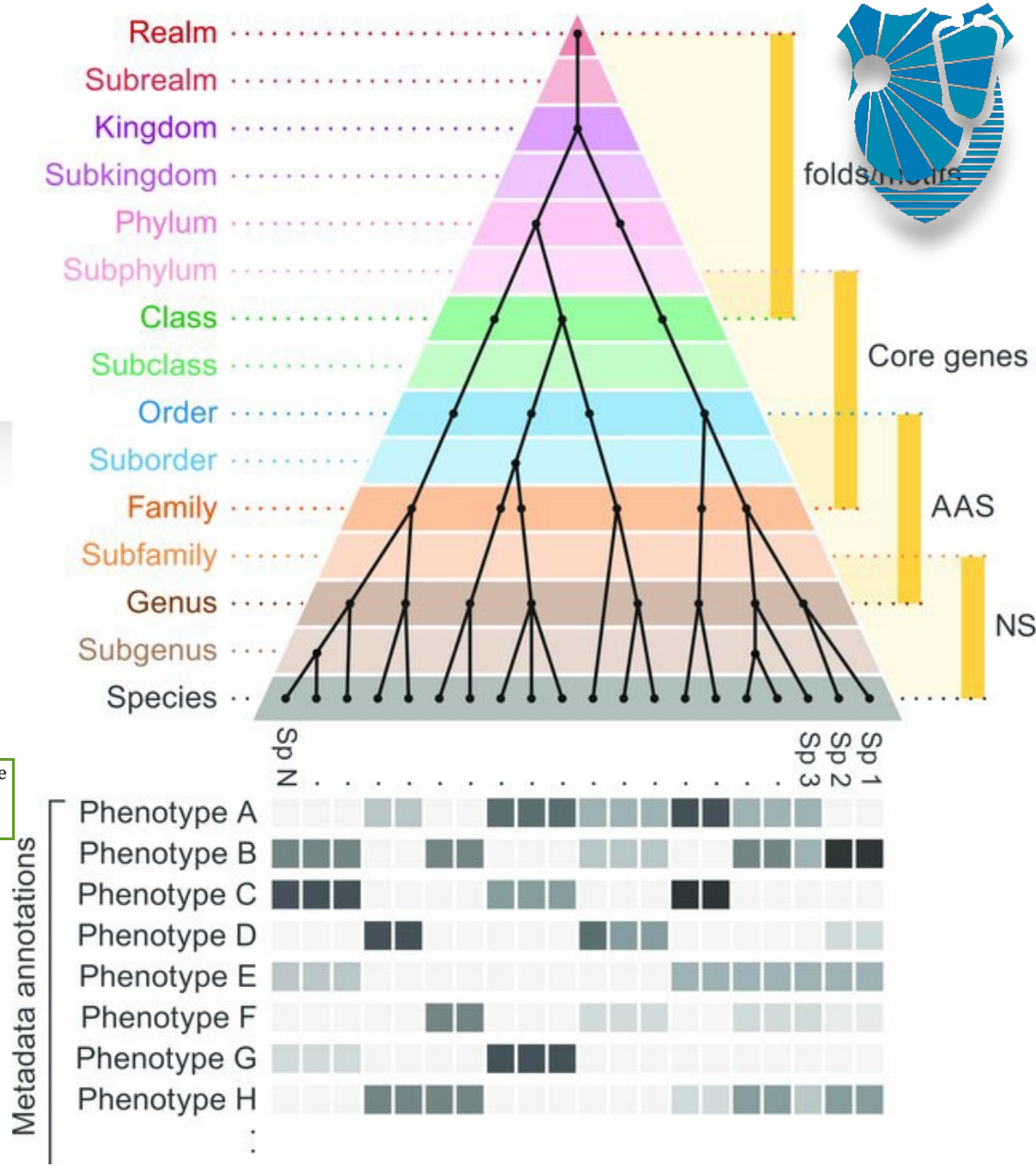
- **Classification of viruses can be based on shared features:**

14. The suffix -*viridae* is specific to virus sub-families, distinguishing them from genera. **FALSE**

1. Virus family (the name ends in *viridae*). Example: Coronaviruses are classified in the family *Coronaviridae*.

19. Because SARS-CoV-2 is in the *Orthocoronavirinae* sub-family, it must share more genomic and structural features with MERS-CoV than with an unrelated RNA virus in another sub-family. **TRUE**

2. Virus sub-family (the name ends in *viniae*). Example: SARS coronavirus 2 is classified in the subfamily *Orthocoronavirinae*.
3. Virus genus (the name ends in *virus*). Example: monkeypox virus is classified in the *Orthopoxvirus* genus.



Source: Simmonds P, Adriaenssens EM, Zerbini FM, Abrescia NGA, Aiewsakun P, et al. (2023) Four principles to establish a universal virus taxonomy. PLOS Biology 21(2): e3001922. https://doi.org/10.1371/journal.pbio.3001922

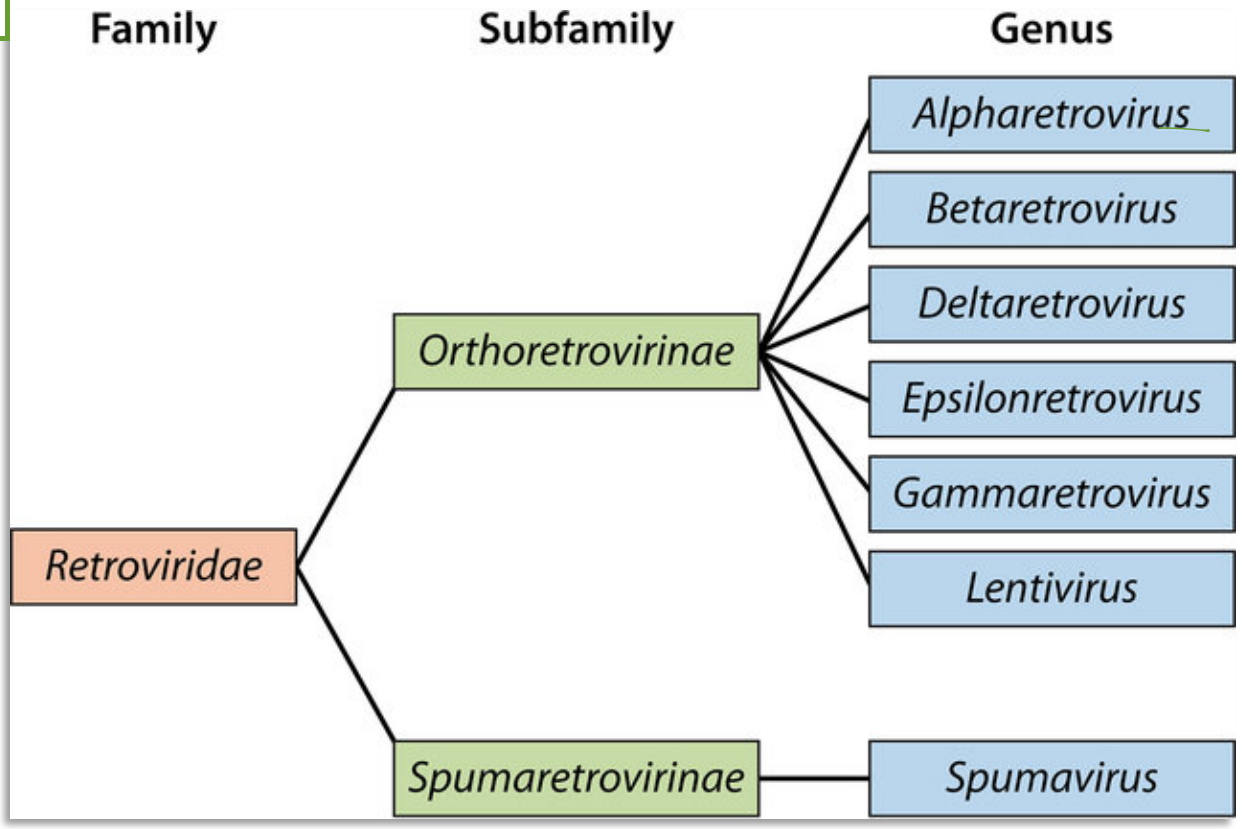
Virus Classification

3. If two viruses belong to the same genus, they share more phenotypic similarities than two viruses belonging only to the same family. **TRUE**

4. A virus in the *Orthopoxvirus* genus can differ from another *Orthopoxvirus* member in replication strategy but not in genome type. **FALSE**

12. The hierarchical increase in similarity from family to sub-family to genus implies that evolutionary divergence decreases correspondingly. **TRUE**

- There are shared features among the members of the same family.
- Similarities increase among the members of the same subfamily.
- The features become very similar among the members of the same genus.



Source: Greenwood AD, Ishida Y, O'Brien SP, Roca AL, Eiden MV. 2018. Transmission, Evolution, and Endogenization: Lessons Learned from Recent Retroviral Invasions. Microbiol Mol Biol Rev 82:10.1128/mmbr.00044-17. https://doi.org/10.1128/mmbr.00044-17

Virus Replication

Attachment: The virus recognizes a cell receptor and binds it.

Penetration: The virus enters the cell.

Uncoating: The virus genome is exposed.

Early transcription and early translation: Production of the early mRNA and its translation into early virus proteins involved in virus replication.

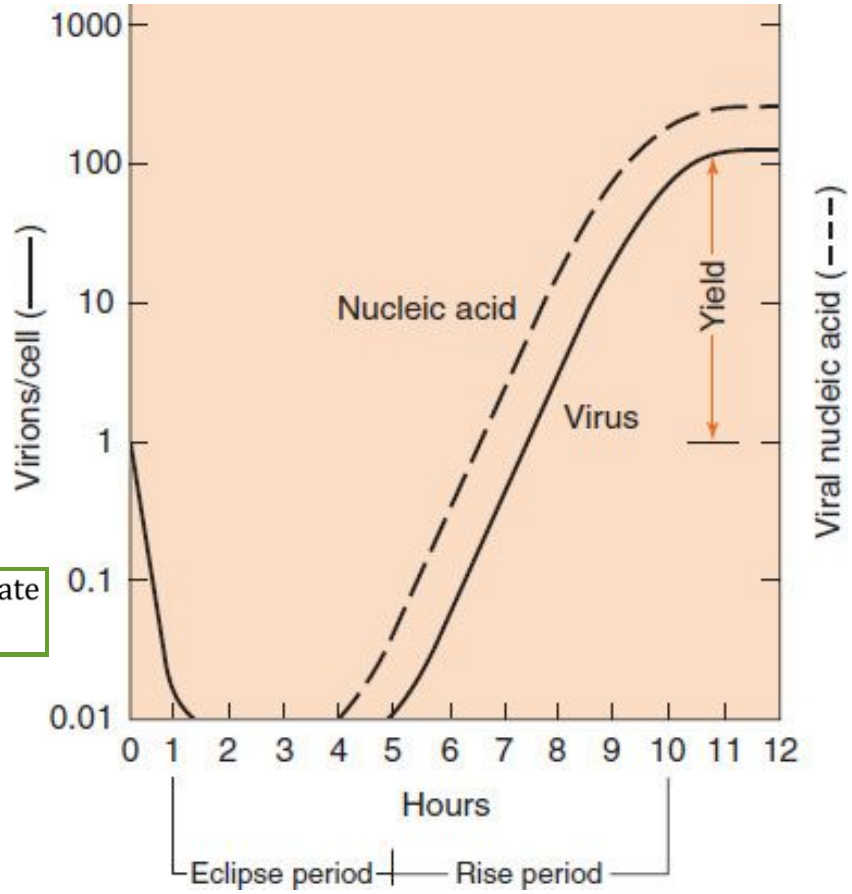
Virus genome synthesis.

18. Early viral proteins are primarily structural, while late proteins regulate genome replication. **FALSE**

Late transcription and late translation: Production of the late mRNA and its translation into late virus proteins involved in virus structure.

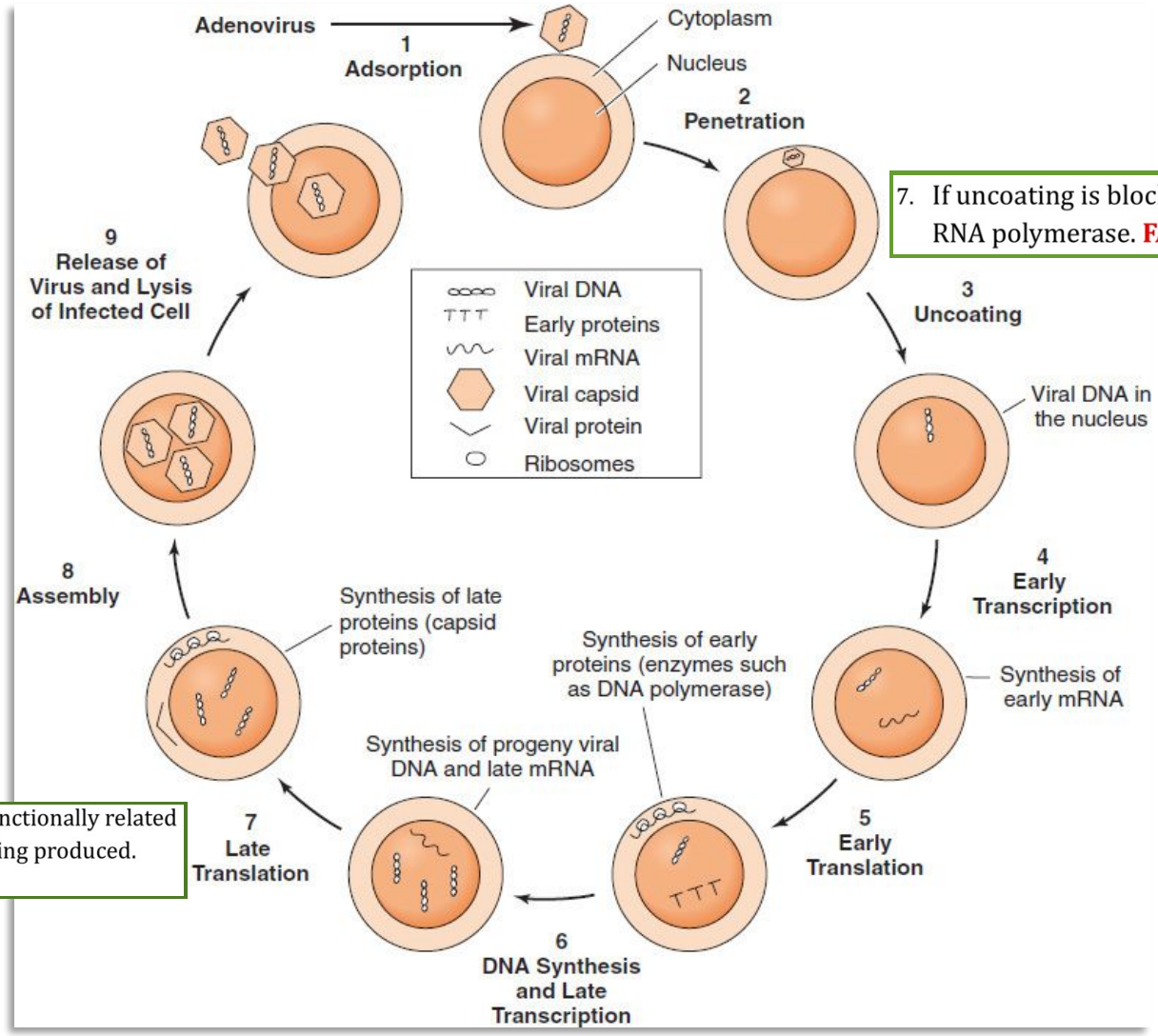
Virus assembly: The virus genome and capsid come together.

Virus release from the infected cell.



Source: Joklik WK et al. Zinsser Microbiology. 20th ed.

Virus Replication



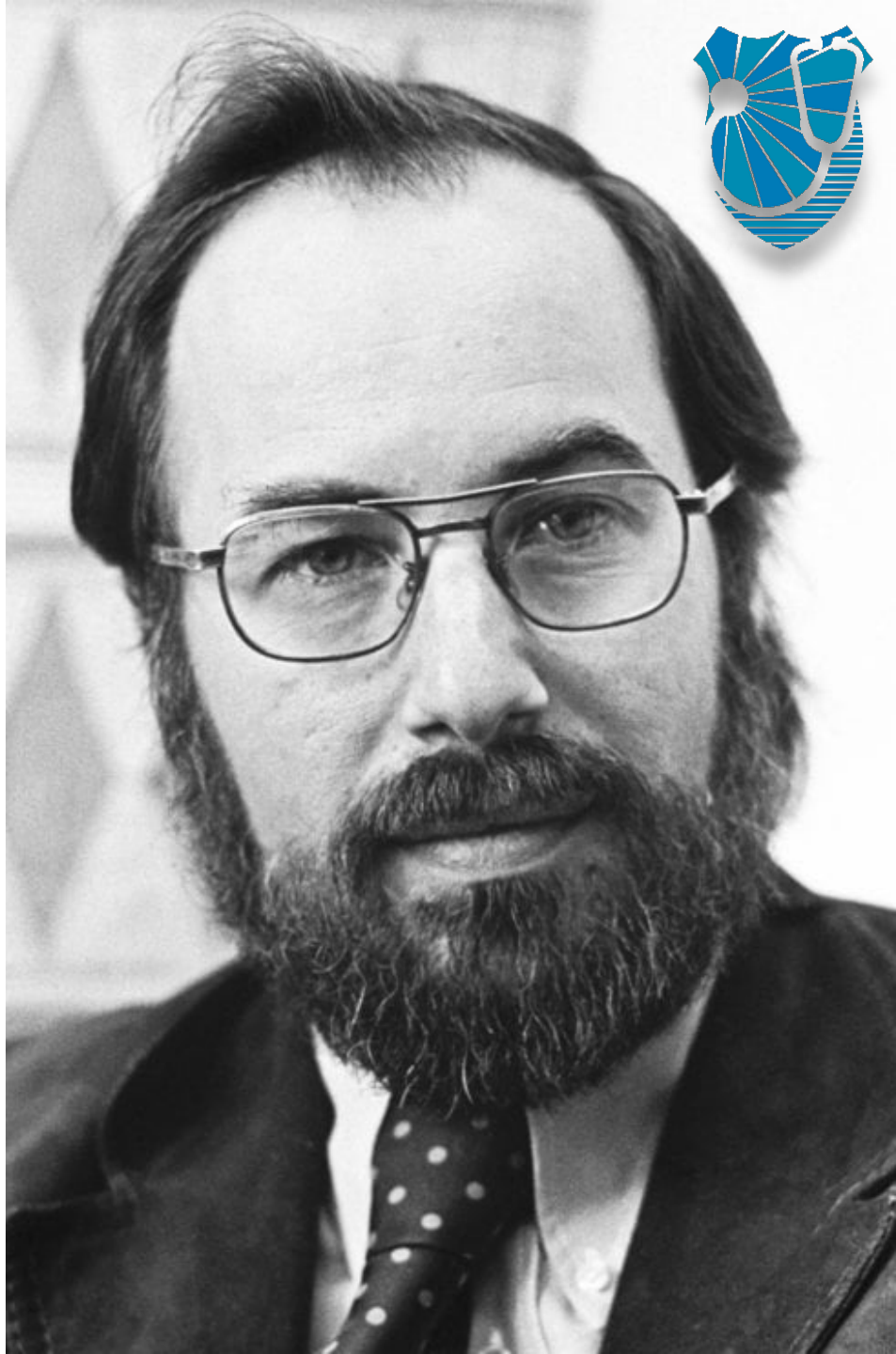
7. If uncoating is blocked, viral genome synthesis can still proceed via host RNA polymerase. **FALSE**

15. The distinction between early and late transcription is functionally related to whether the viral replication or capsid proteins are being produced. **TRUE**

Source: Jawetz E, Melnick JL, Adelberg EA. Review of Medical Microbiology. 16th ed. Originally published by Appleton & Lange. Copyright 1984 by McGraw-Hill.)

Baltimore Classification

- Baltimore classification of viruses depends on genome type:
- A) DNA vs. RNA
- B) double stranded vs. single stranded
- C) reverse transcription
- Note: transcription is the conversion of DNA into RNA. So, reverse transcription is the conversion of RNA into DNA.



Baltimore classification system

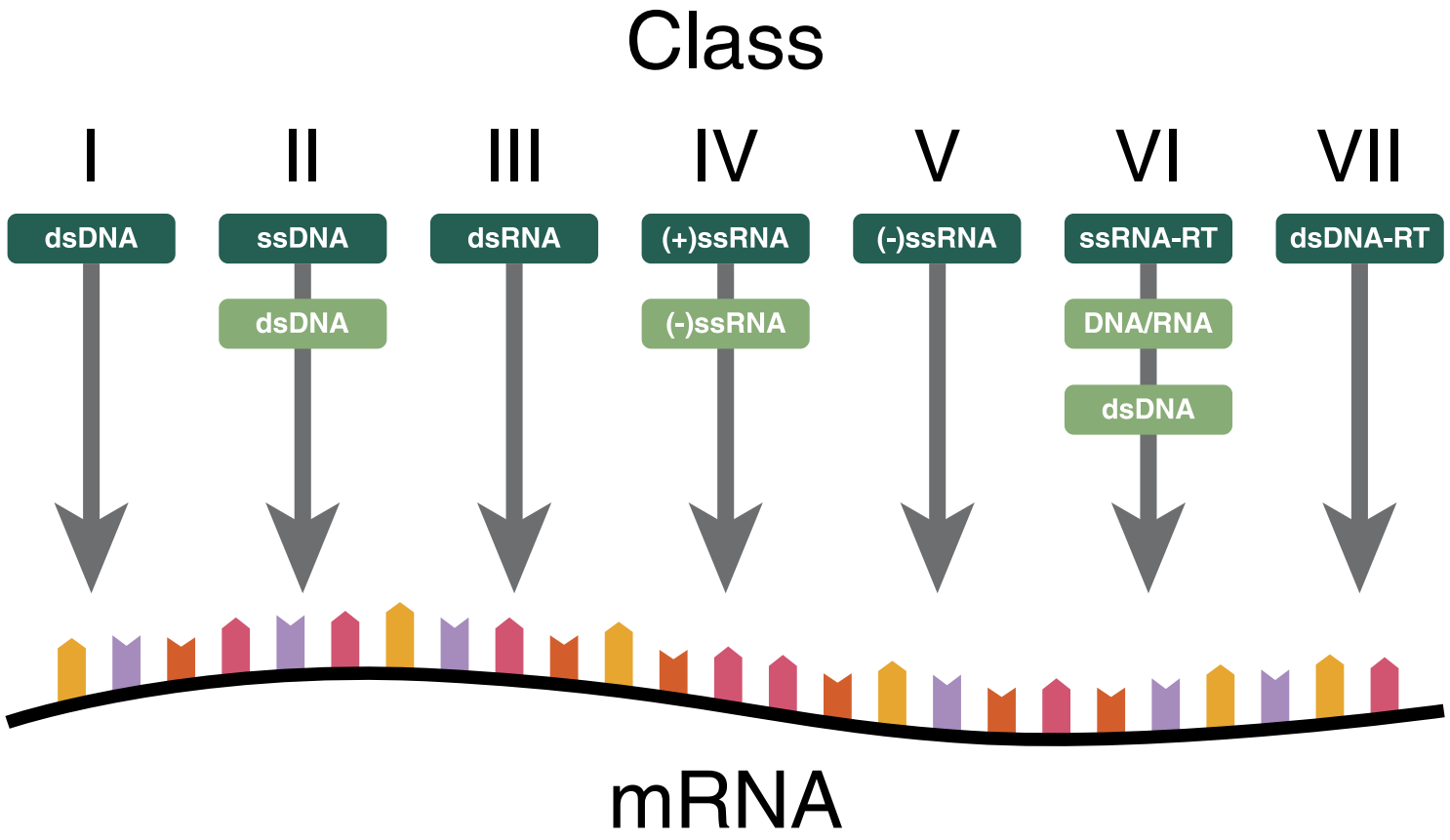
Group	Description
1	Double-stranded DNA
2	Single-stranded DNA
3	Double-stranded RNA
4	Positive-sense single-stranded RNA
5	Negative-sense single-stranded RNA
6	Positive-sense single-stranded RNA with reverse transcription
7	Double-stranded DNA with reverse transcription

9. Groups VI and VII in the Baltimore system differ only in the polarity of their RNA strands. **FALSE**

11. Reverse transcription can occur in viruses that start with either RNA or DNA genomes. **TRUE**

13. Group IV and Group VI viruses both contain positive-sense RNA genomes, yet only one group requires a DNA intermediate in replication. **TRUE**

Baltimore classification system



Pathogenesis of virus infections

Pathogenesis of virus infections involves the processes including direct virus effect and host responses.

Pathogenic viruses cause disease. So, non-pathogenic viruses do not cause disease.

20. The presence of a virus in the body means symptomatic disease if attachment and entry occur successfully. **FALSE**

Virulent viruses cause more severe disease.

1. Every virulent virus is pathogenic, but not every pathogenic virus is virulent. **TRUE**

What are the possible outcomes of exposure to viruses?

16. An asymptomatic infection implies absence of both viral replication and host immune response. **FALSE**

1. Exposure without virus attachment and without infection.
2. Virus infection but without obvious damage: Asymptomatic infection
3. Infection with cell damage or cell transformation Symptomatic disease. Sometimes this can lead to fatality

So, the possible clinical outcomes of acute virus infection can be:

A. Acute infection with complete virus clearance.

B. Acute infection followed by chronic infection.

5. Chronic infection can result from incomplete virus clearance after an acute phase. **TRUE**

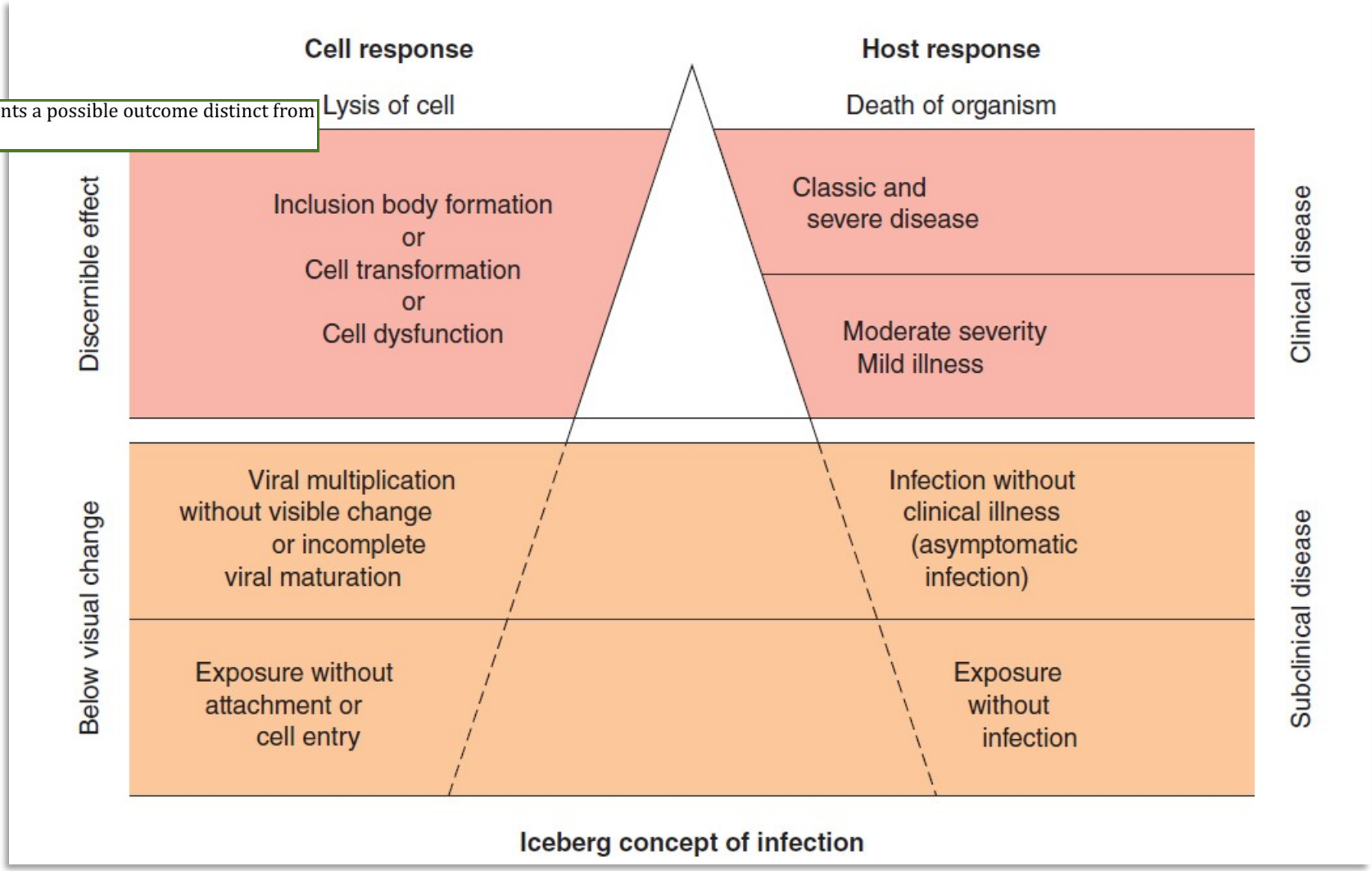
C. Acute infection followed by silent persistence and periodic reactivation.

2. Latent persistence with periodic reactivation implies the presence of inactive viral genomes within host cells. **TRUE**

D. Acute infection followed by death.

What are the possible outcomes of exposure to viruses?

17. Viral transformation of cells represents a possible outcome distinct from cytolytic destruction. **TRUE**



How can viruses enter the body?

A. Direct: Skin contact. Respiratory aerosols or droplets. Blood. Genital secretions. Saliva.

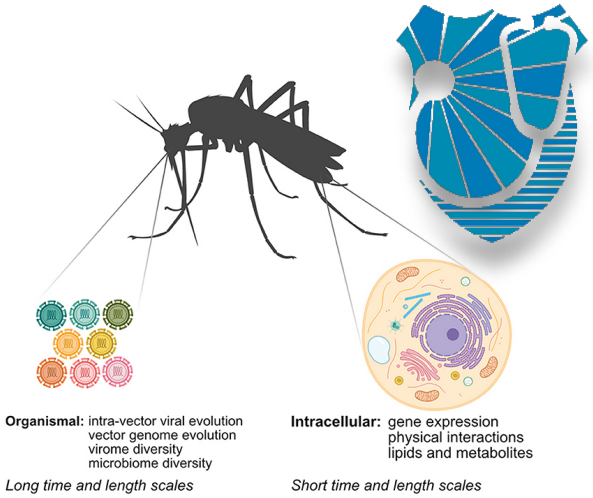
6. Virus transmission through contaminated surgical instruments constitutes indirect transmission via fomites. **TRUE**

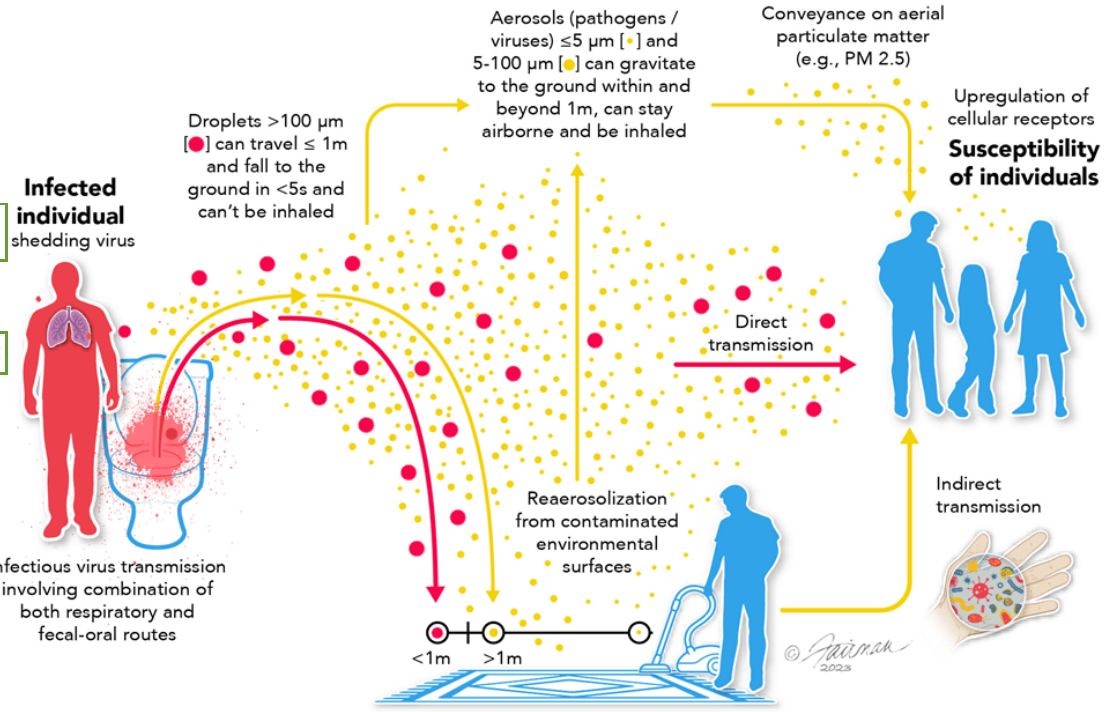
B. Indirect: Fomites (non-living object) or Vector (e.g. insects).

8. Infection via fomites is an example of direct viral entry into the body. **FALSE**

Viruses are foreign entities. Upon entry into the body, the immune system will react. The immune response to virus infection can contribute to the disease process.

10. The immune response to viruses is always protective and never contributes to disease pathology. **FALSE**





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Virology for 2nd Year MD Students

(03) Principles of Diagnosis of Virus Infections

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How to diagnose virus infections?

1. Virus culture

The gold-standard, reference method.

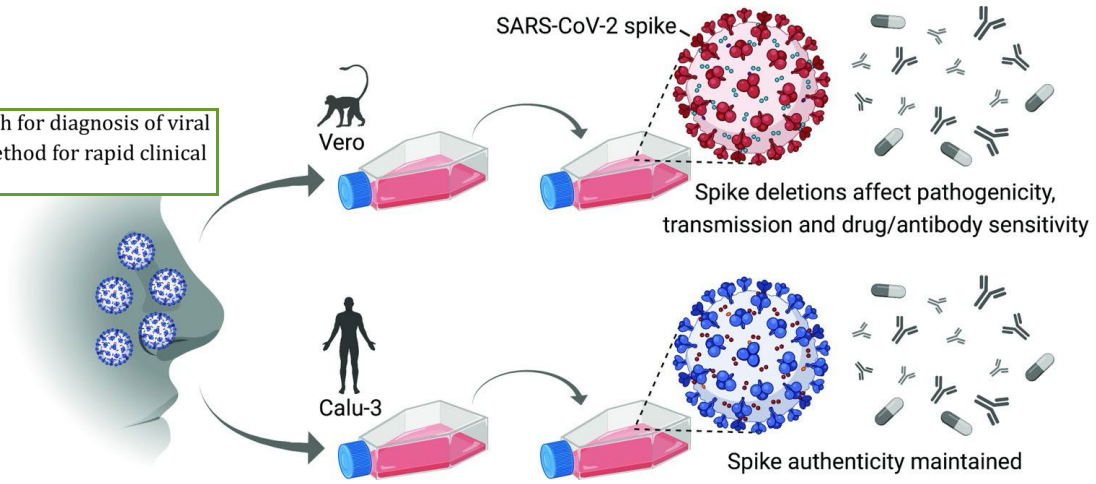
However, it is not used routinely in clinical practice because:

1. Since virus culture is the gold standard approach for diagnosis of viral infections, it remains the primary diagnostic method for rapid clinical identification of acute viral infections. **False**

A. Many viruses are difficult to grow in culture.

B. Virus culture is often difficult and complex process.

C. Slow.

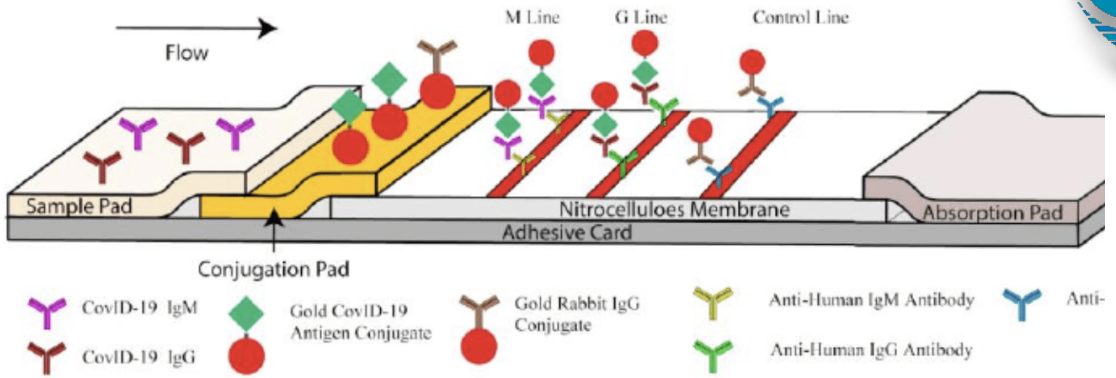


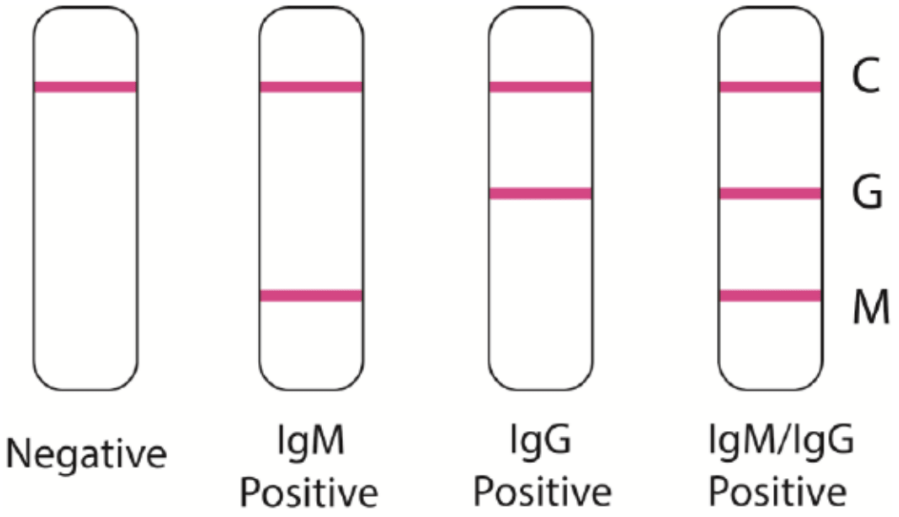
How to diagnose virus infections?

2. Serology

The study of serum that contains **antibodies**. Blood is two parts (cells + fluid that have proteins). The fluid part is called serum. Antibodies are part of these serum proteins. Antibody is also called immunoglobulin.

Specific virus infections will cause specific antibody production. So, if these specific antibodies are present, it means that the infection by that specific virus occurred.

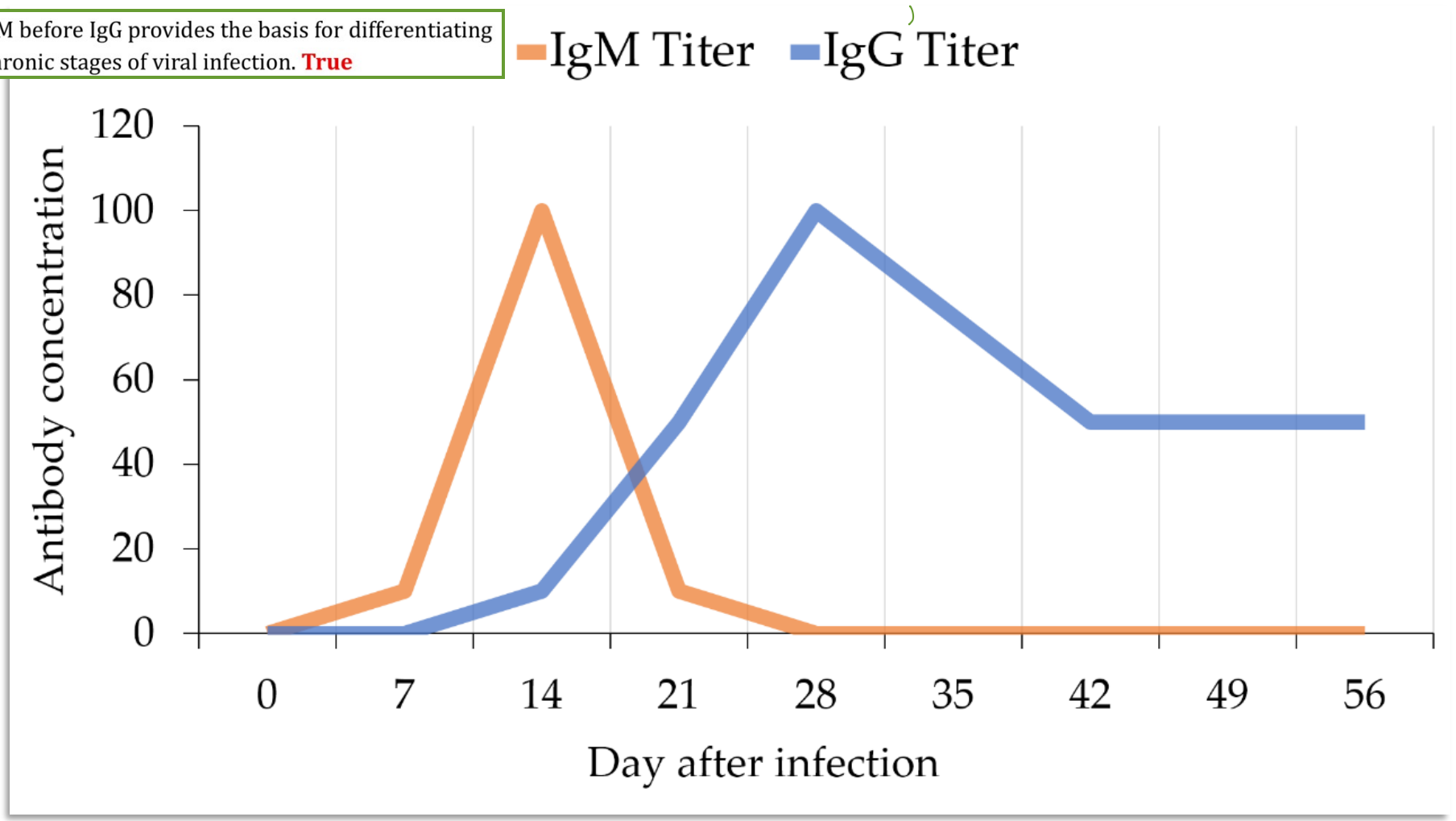




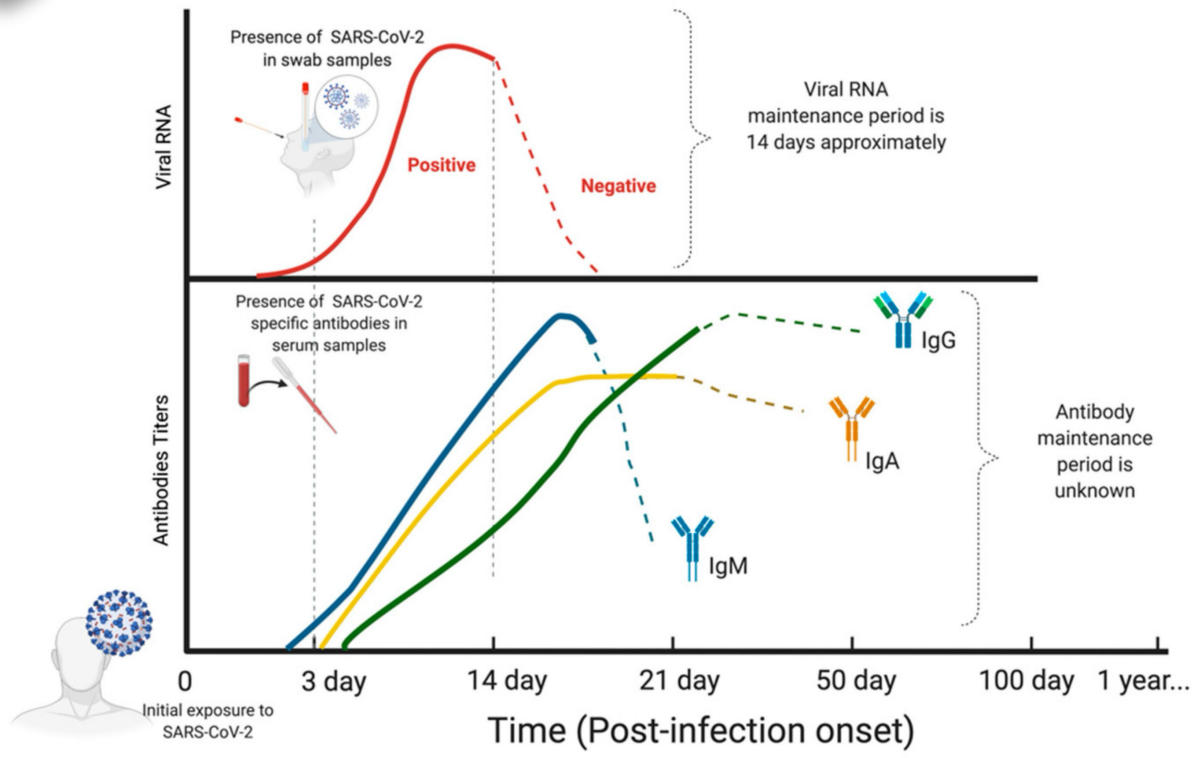
4. The basis of serologic diagnosis of virus infections is similar to a specific key for a specific lock where each virus elicits a unique antibody that can be traced back to its specific antigenic stimulus; hence, helping to reach an accurate diagnosis of that specific virus infection. **True**

How to diagnose virus infections?

2. The appearance of IgM before IgG provides the basis for differentiating between acute and chronic stages of viral infection. **True**



How to diagnose virus infections?



Source: Guevara-Hoyer K, Fuentes-Antrás J, De la Fuente-Muñoz E, Rodríguez de la Peña A, Viñuela M, Cabello-Clotet N, Estrada V, Culebras E, Delgado-Iribarren A, Martínez-Novillo M, et al. Serological Tests in the Detection of SARS-CoV-2 Antibodies. Diagnostics. 2021; 11(4):678. https://doi.org/10.3390/diagnostics11040678

- Antibodies are produced in the following order: immunoglobulin M (IgM) in the first 1-2 weeks. Immunoglobulin G (IgG) in the first two months. IgM will disappear in a few weeks. IgG will stay in the blood for long time. So, IgM=recent infection and IgG=past infection
- Disadvantage of serology: the body will take 1-2 weeks for antibody production. So, serology is not helpful for very early diagnosis.

3. In a patient tested within 48 hours of symptoms of acute virus infection, serologic diagnosis is the most valuable diagnostic tool. **False**

How to diagnose virus infections?

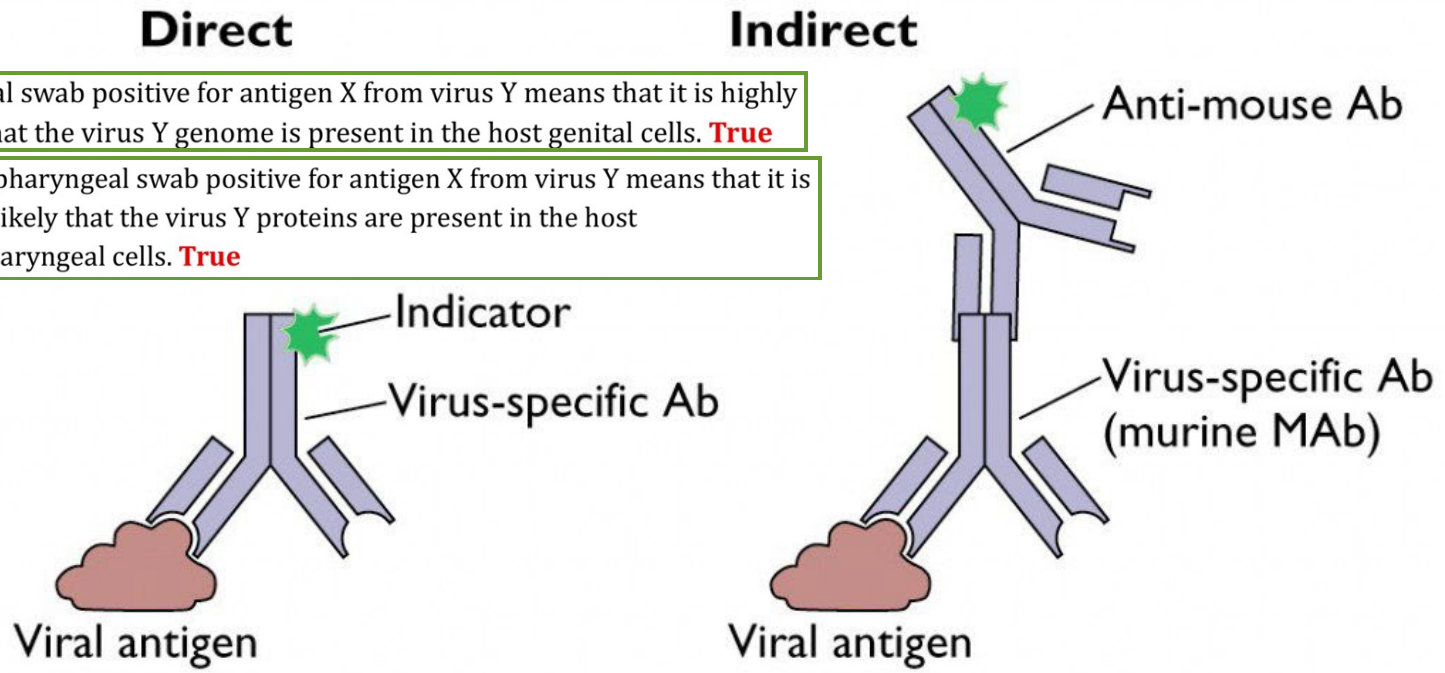
3. Antigen detection

We look for the specific virus proteins.

For example, virus A have antigen A, virus B have antigen B and virus C have antigen C.

Let's assume that viruses A, B, and C cause influenza-like disease (fever, cough, fatigue). We want to reach a specific diagnosis. We take a sample through the nose or throat. We test the sample for antigens. We find antigen C. Then, we can reach a specific diagnosis. VIRUS C caused this influenza-like disease.

6. In the diagnosis of virus infections, antigen detection depends on identifying viral proteins directly in patient samples, which helps to reach diagnosis before antibody production begins. **True**



7. A genital swab positive for antigen X from virus Y means that it is highly likely that the virus Y genome is present in the host genital cells. **True**

8. A nasopharyngeal swab positive for antigen X from virus Y means that it is highly likely that the virus Y proteins are present in the host nasopharyngeal cells. **True**

5. Cross-reactivity between viral antigens increases the specificity of serologic diagnosis. **False**

9. Antigen detection and serologic diagnosis both assess host immune responses rather than direct viral components. **False**

How to diagnose virus infections?

13. In general, molecular and antigen detections methods help for early diagnosis of virus infections while serology helps for retrospective confirmation of these infections. **True**

14. If PCR and antigen detection are both negative for a virus X while IgM for the same virus is positive, the most likely explanation is that the virus X was cleared before sampling, but the immune system still reflects recent exposure. **True**

15. Negativity of PCR, antigens, and antibodies for virus Z definitively rules out virus Z infection as a cause of an underlying illness. **False**

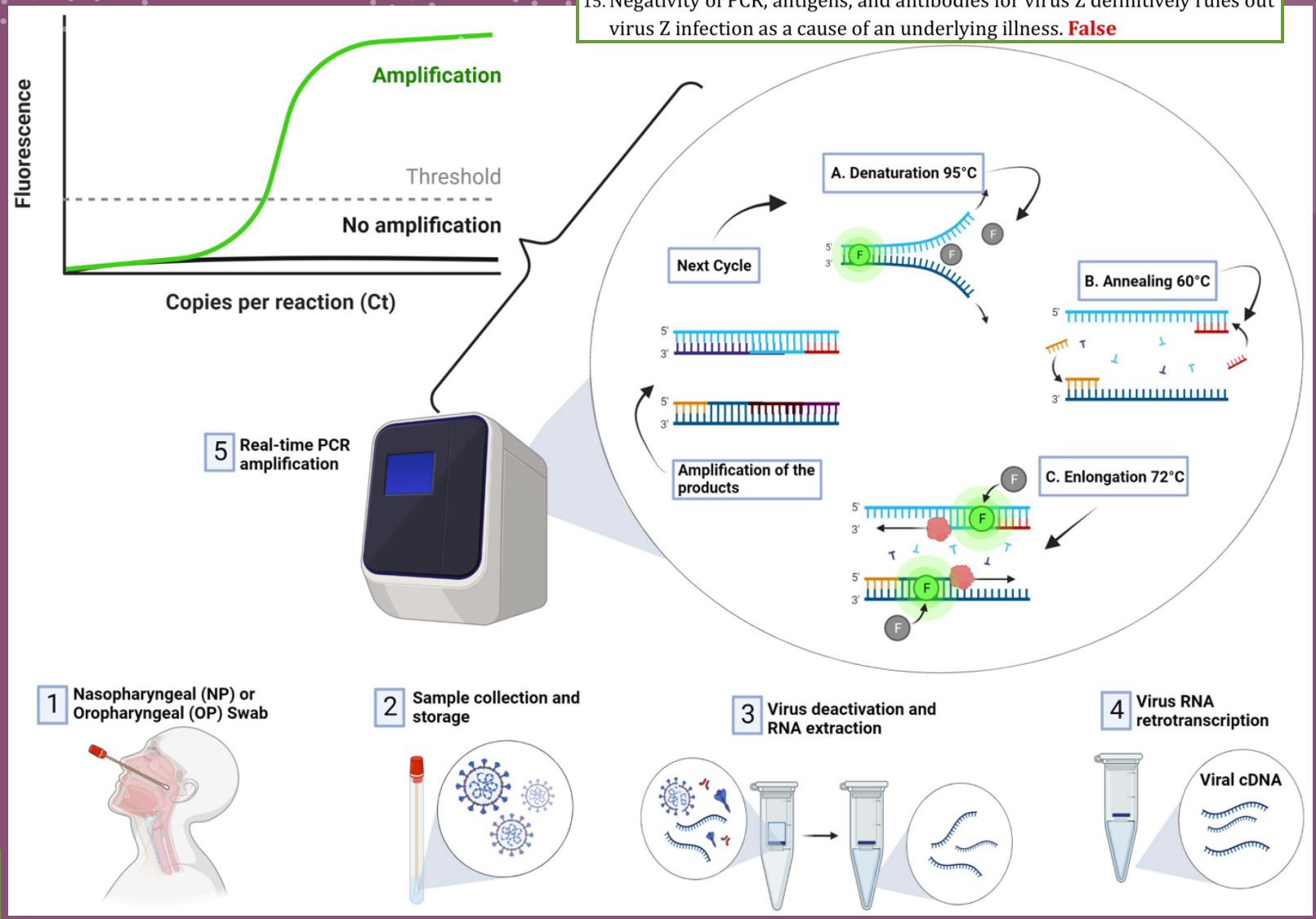
10. In the diagnosis of virus infections, molecular detection is used to amplify any DNA sequence present in the sample, regardless of its virus origin. **False**

4. Molecular detection

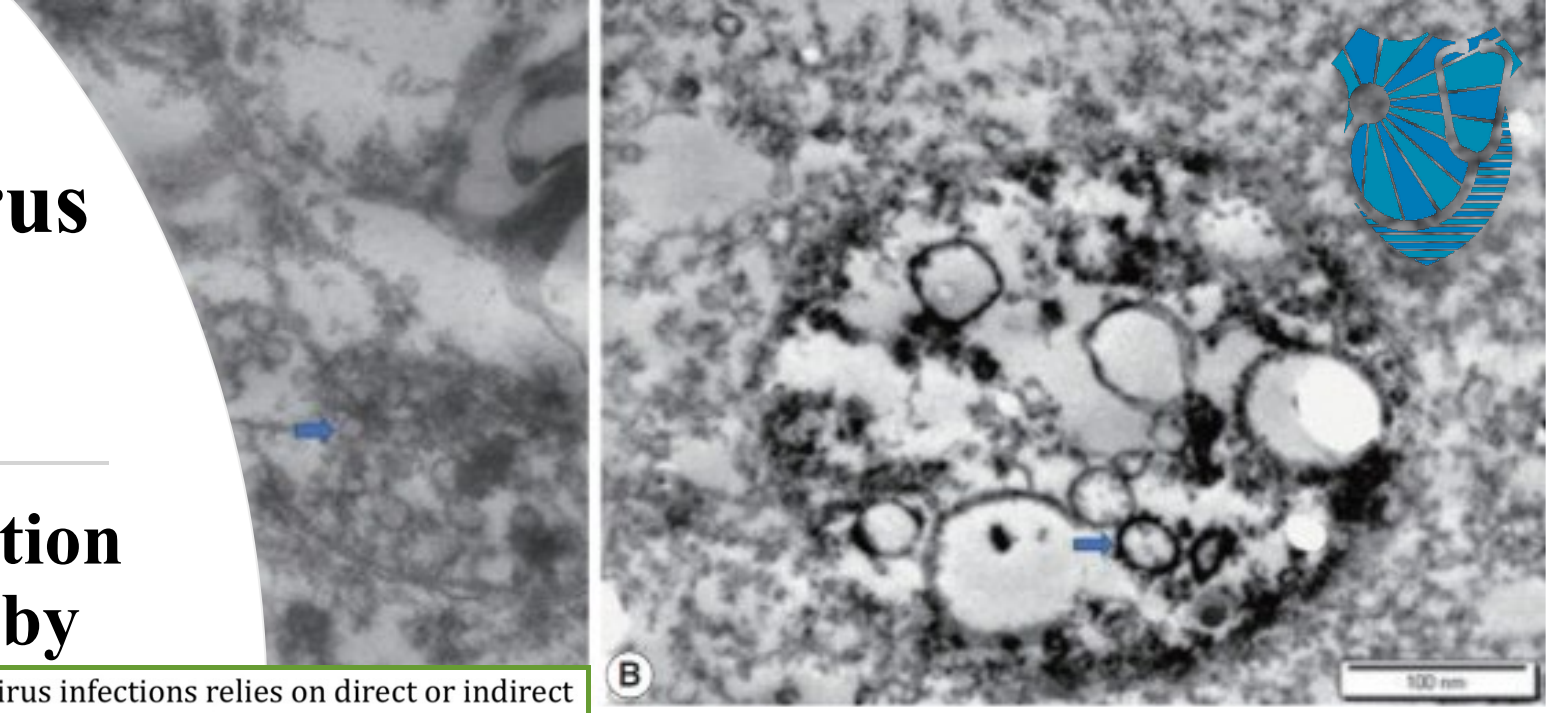
We look for specific DNA or RNA sequence in the virus genome. This can be done using different methods.

The most common method used for molecular detection is Polymerase Chain Reaction (PCR).

16. A patient with positive PCR, positive antigen, and rising IgM to virus M but absent IgG to virus M is most likely in the decline of virus M replication. **False**



How to diagnose virus infections?

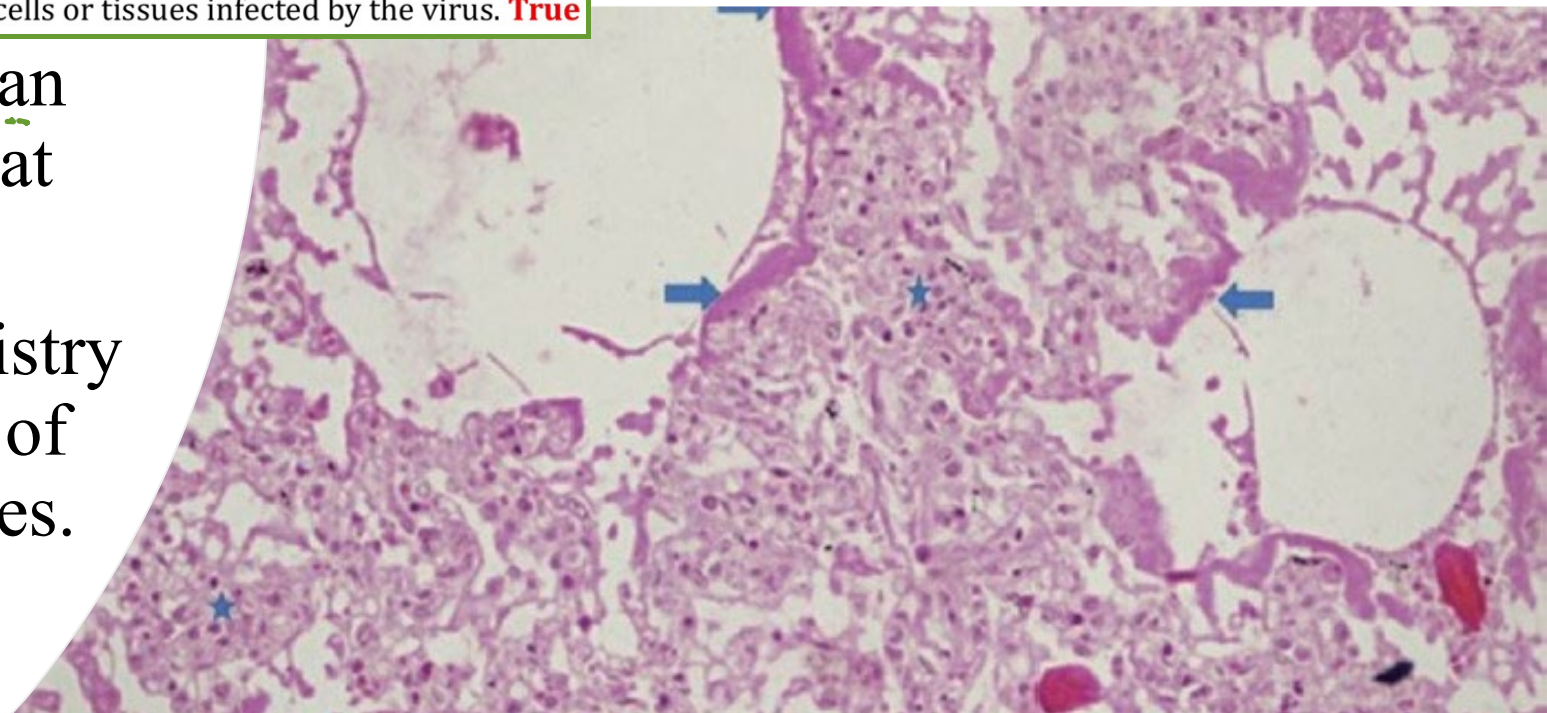


5. Histopathologic examination of cells or tissue infected by the virus.

11. Histopathologic diagnosis of virus infections relies on direct or indirect viral genome detection in the cells or tissues infected by the virus. **True**

Specific changes in the cells can give an idea about the virus that caused the infection.

The use of immunohistochemistry can also confirm the presence of viral antigens in infected tissues.

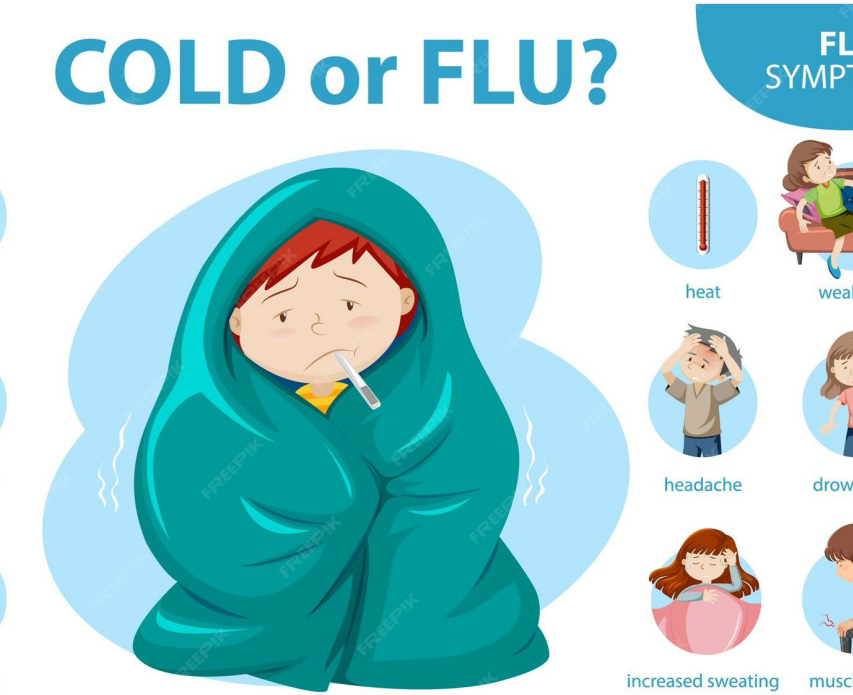


How to diagnose virus infections?

6. Clinical diagnosis

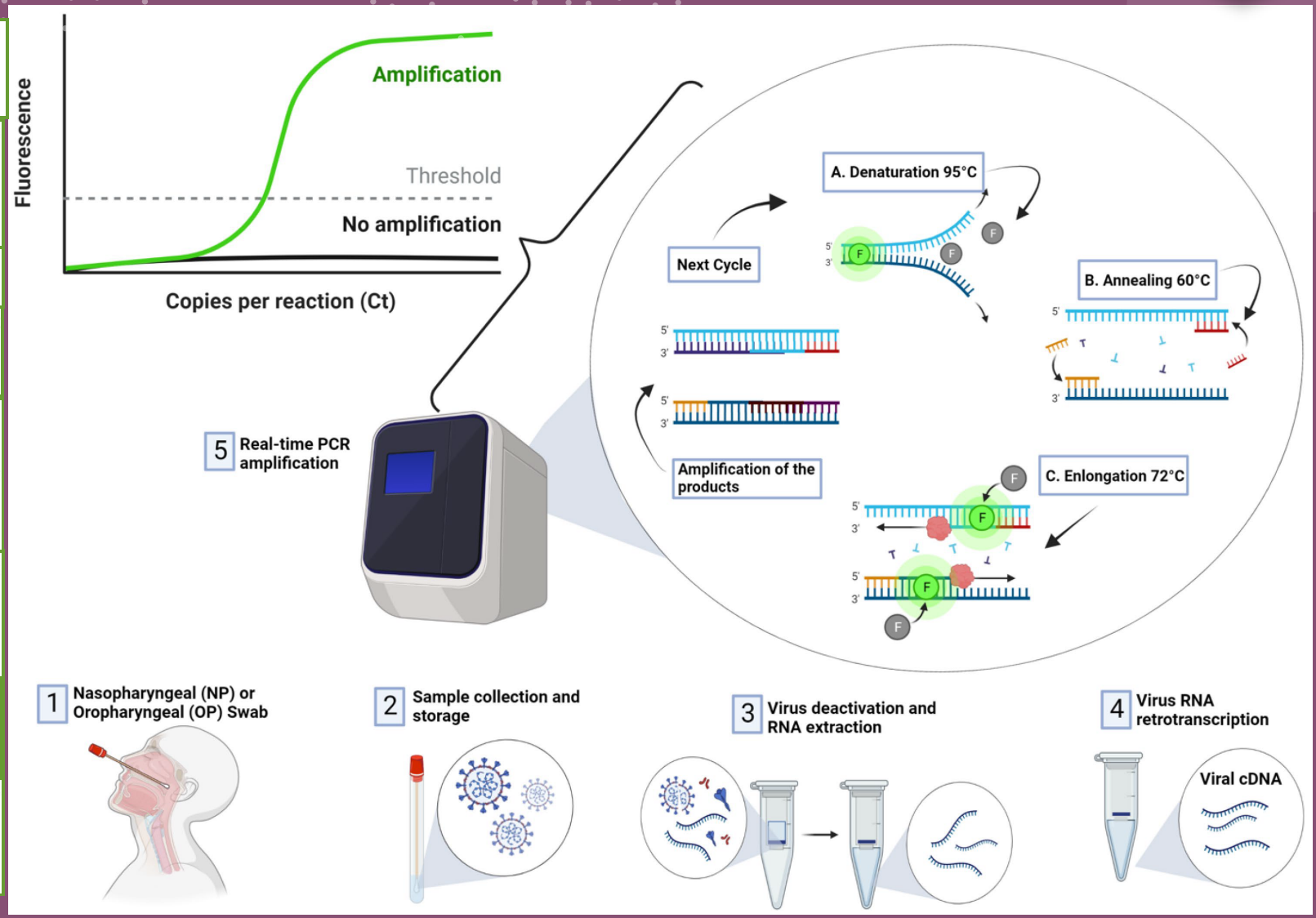
Sometimes, certain signs and symptoms can help to reach the diagnosis of virus infection.

12. The presence of typical clinical signs and symptoms can help in the diagnosis of virus infections without laboratory or radiologic confirmation.
True



The following questions are cases inluding more than one diagnostic test:

13. In general, molecular and antigen detections methods help for early diagnosis of virus infections while serology helps for retrospective confirmation of these infections. **True**
14. If PCR and antigen detection are both negative for a virus X while IgM for the same virus is positive, the most likely explanation is that the virus X was cleared before sampling, but the immune system still reflects recent exposure. **True**
15. Negativity of PCR, antigens, and antibodies for virus Z definitively rules out virus Z infection as a cause of an underlying illness. **False**
16. A patient with positive PCR, positive antigen, and rising IgM to virus M but absent IgG to virus M is most likely in the decline of virus M replication. **False**
17. Lung biopsy from a patient recovering from viral pneumonia caused by virus A showed typical cytopathic inclusions. PCR and antigen tests for virus A were negative. The morphologic changes seen in histopathology likely represent residual structural damage rather than active virus A replication. **True**
18. A healthcare worker with IgG positivity for a respiratory virus Y presents with new respiratory symptoms. Laboratory tests showed PCR positive, IgM negative, IgG positive for virus Y. The most likely diagnosis is a reinfection rather than primary infection. **True**
19. A cell culture grew virus I, but both antigen and PCR tests for virus I were negative. The only explanation of this discrepancy is contamination by virus I in the laboratory. **False**
20. A patient was tested by PCR for a DNA virus and the result was positive, but repeated testing after two days by PCR yielded a negative result. The explanation for this discrepancy is that the first result was a false positive because viruses cannot be cleared from the body very quickly. **False**



Thank You…
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(04) Principles of Treatment & Prevention of Virus Infections

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How to treat virus infections?

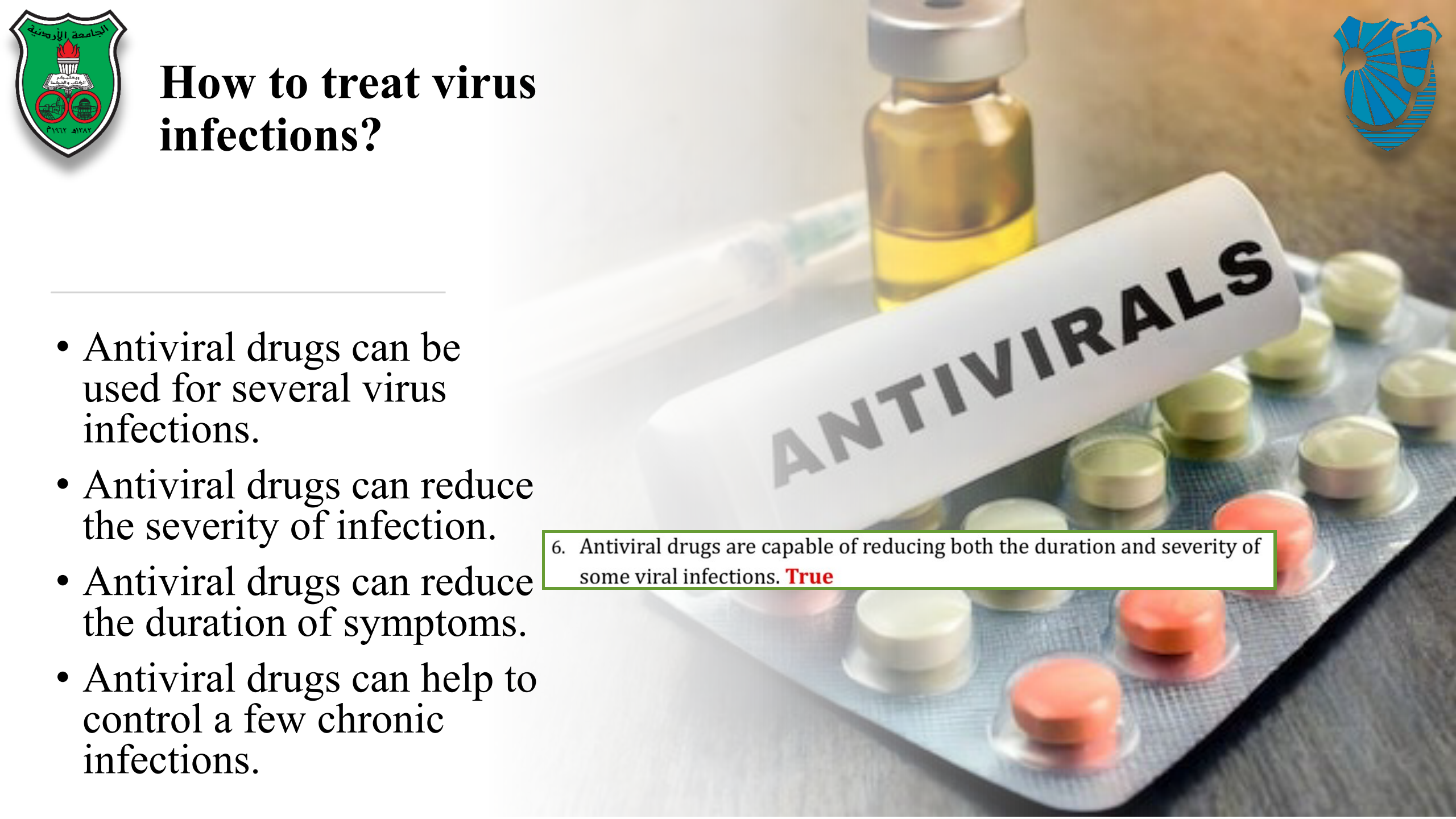
18. If a treatment for a virus infection reduces symptoms but does not alter the virus itself, it is considered symptomatic treatment. **True**

- Usually **supportive care** (treat the symptoms)
- Fever → antipyretic.
- Pain → analgesic.
- Dehydration → fluids.
- Cough → antitussive.
- Fluids
- Bed rest

5. A patient with dehydration from a viral infection should primarily receive antiviral drugs rather than fluids. **False**

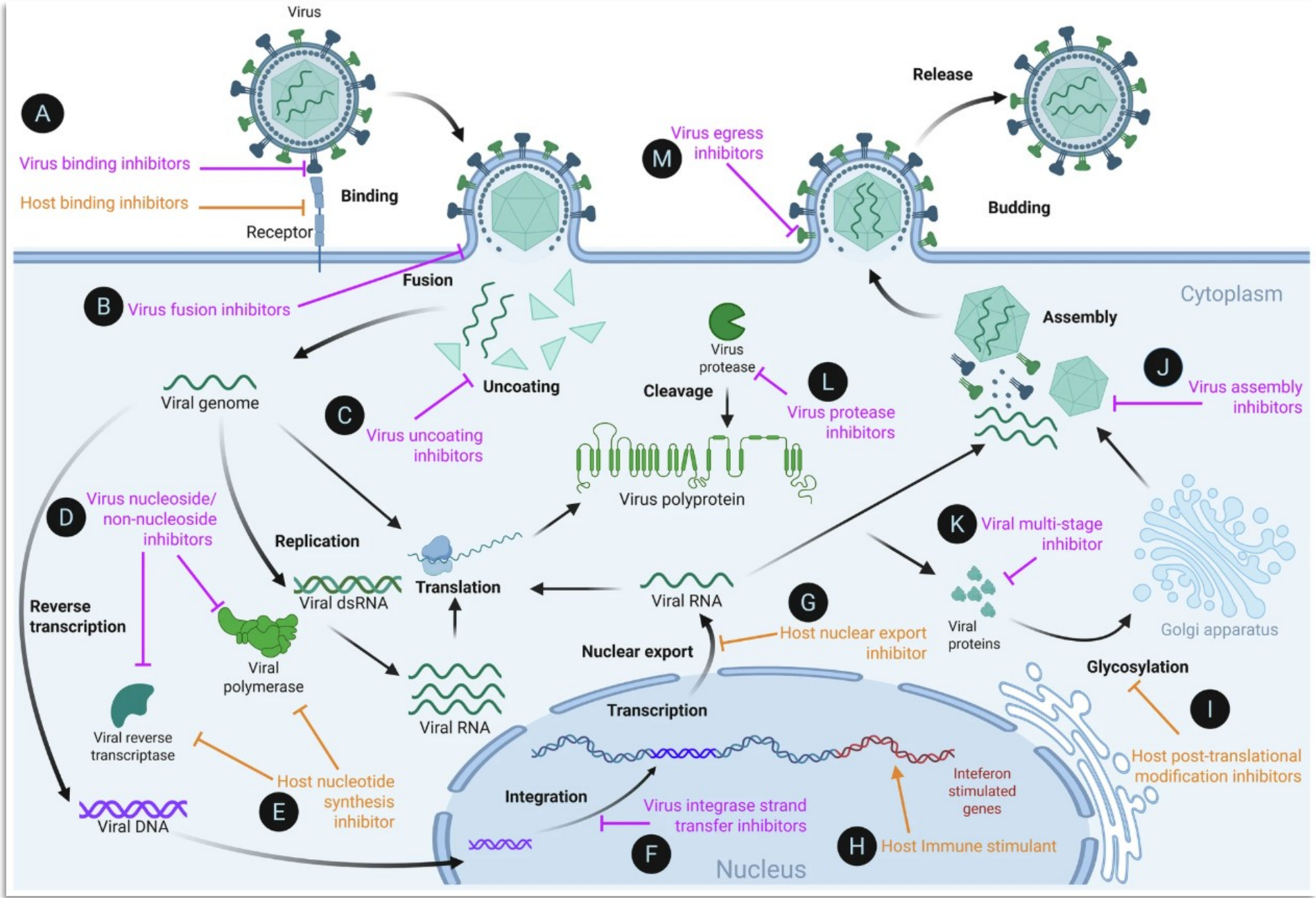
How to treat virus infections?

- Antiviral drugs can be used for several virus infections.
- Antiviral drugs can reduce the severity of infection.
- Antiviral drugs can reduce the duration of symptoms.
- Antiviral drugs can help to control a few chronic infections.



6. Antiviral drugs are capable of reducing both the duration and severity of some viral infections. **True**

How to treat virus infections? Antivirals



Source: Aw, D.Z.H., Zhang, D.X. & Vignuzzi, M. Strategies and efforts in circumventing the emergence of antiviral resistance against conventional antivirals. npj Antimicrob Resist 3, 54 (2025). https://doi.org/10.1038/s44259-025-00125-z

How to treat virus infections?

1. A patient with chronic hepatitis C begins a course of direct-acting antivirals. Complete clearance of hepatitis C virus is an achievable endpoint. **True**

Antiviral drugs can help to cure hepatitis C chronic infection.

Antiviral drugs can help to manage HIV infection.

7. High cost, resistance, and side effects are considered major limitations to the widespread use of antiviral drugs. **True**

Development of resistance, high cost and side effects are the major problems of antiviral drugs.

20. Interferons have non-specific broad-spectrum antiviral activity and can be used to treat a wide range of virus infections. **True**

Interferons have non-specific broad-spectrum antiviral activity and can be used. Adverse effects (flu-like symptoms, hematological toxicity, elevated transaminases, nausea, fatigue, and psychiatric sequelae).

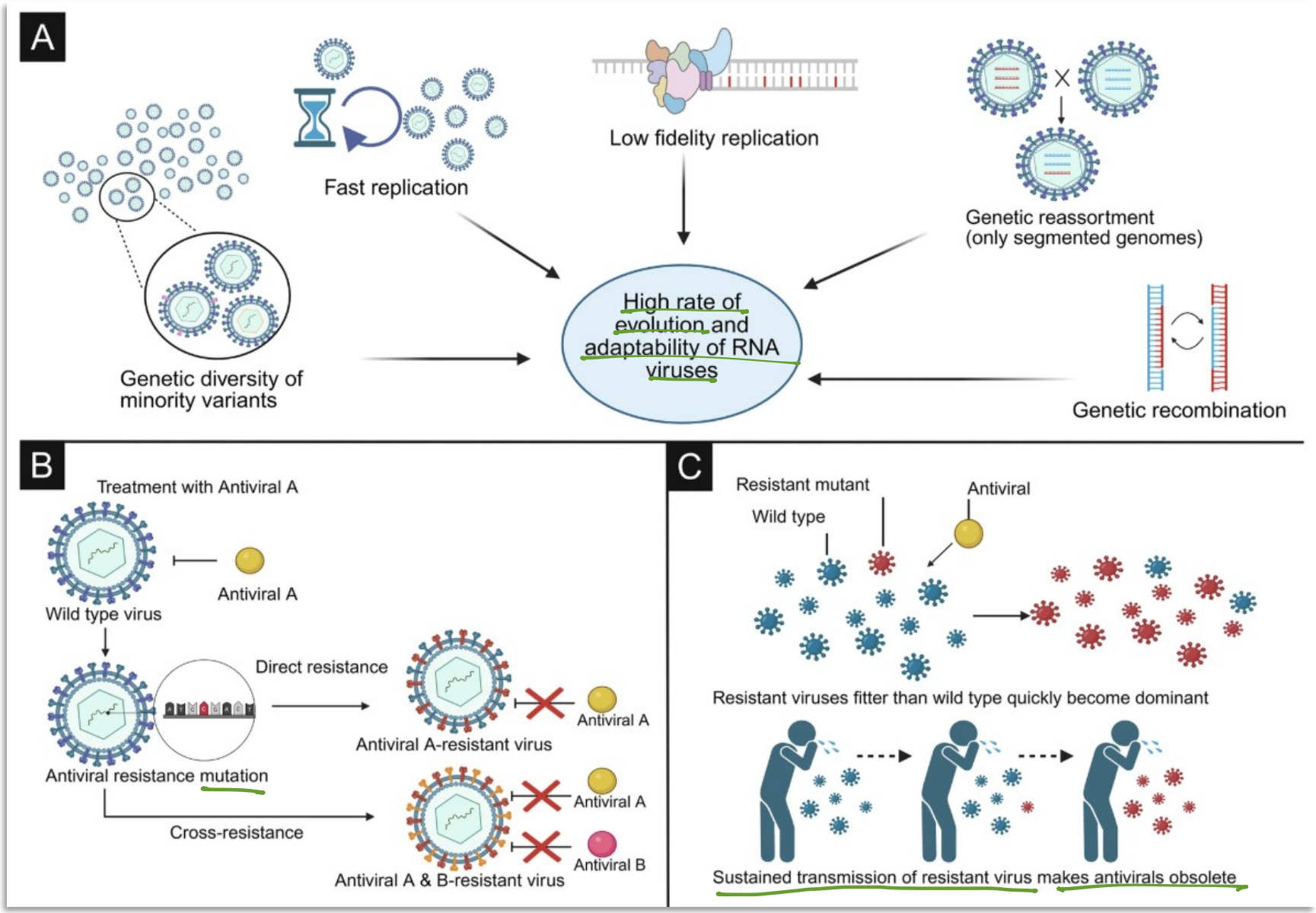
Antibiotics can NOT help to treat virus infections

4. You are a resident doctor working at a night shift in the emergency room. A patient with mild viral illness insisted on receiving antibiotics. Giving antibiotics can shorten symptom duration and is justified despite its cost. **False**

19. Since antibiotics are ineffective against viruses, using antibiotics in viral infections increases the therapeutic value without any associated harm. **False**

Antibodies CAN help to treat virus infections.

Antiviral resistance



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8. Passive immunization protects individuals by providing externally generated antibodies rather than stimulating their own immune response. **True**

How to prevent virus infections?

12. Antibodies transferred from the mother to the newborn via breast milk are examples of active immunization. **False**

15. Passive immunization is unsuitable for generating short-term protection from virus infections. **False**

1. Passive immunization

Mother to child through the placenta.

Mother to child through breast milk.

Specific antibodies taken from persons immune to the disease and given to a person at risk of infection.

2. Vaccination to prevent virus infections stimulates the immune system, and it provides faster protection compared to passive immunization. **False**

9. The use of specific antibodies from immune individuals exemplifies active immunization. **False**

14. Natural immunity is less effective compared to active immunization. **False**

How to prevent virus infections?

2. Active immunization (Vaccination)

The gold standard prevention method.

13. Vaccination to prevent virus infections is considered as the gold standard approach since it provides the most reliable form of long-term protection from these infections. **True**

11. Live attenuated, inactivated, mRNA, and subunit vaccines differ in biological composition but not in their classification as active immunization to prevent viral infections. **True**

- Several types:

A. Inactivated vaccines
B. Live-attenuated vaccines
C. Messenger RNA (mRNA) vaccines
D. Subunit, recombinant, polysaccharide, and conjugate vaccines
E. Viral vector vaccines

Vaccine safety? Vaccine efficacy?

Unvaccinated % – Vaccinated % ÷ Unvaccinated %

17. Since vaccination is the gold standard, behavioral interventions are unnecessary for effective prevention of virus infections. **False**

How to prevent virus infections?

16. Behavioral interventions to prevent virus infections reduce infection risk but do not contribute to immune memory. **True**

3. Behavioral and non-pharmaceutical interventions (NPIs).

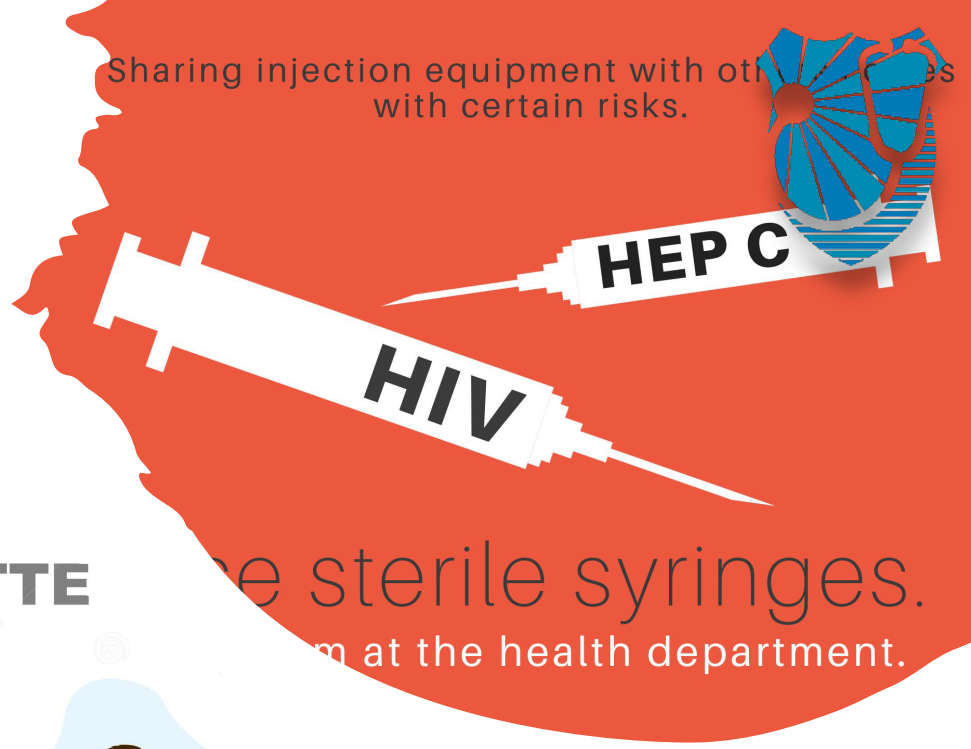
- Examples:
  - Hand hygiene
  - Clean needles/syringes
  - Face masks

10. Personal protective equipment such as masks is considered a pharmaceutical method of preventing viral infections. **False**

  - Respiratory etiquette
  - Infection control measures in hospitals

3. Infection control measures in hospitals fall under the category of non-pharmaceutical intervention strategies for the prevention of virus infections. **True**

  - Quarantine



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Virology for 2nd Year MD Students

(05) DNA viruses:

Poxviridae

Parvoviridae

Adenoviridae

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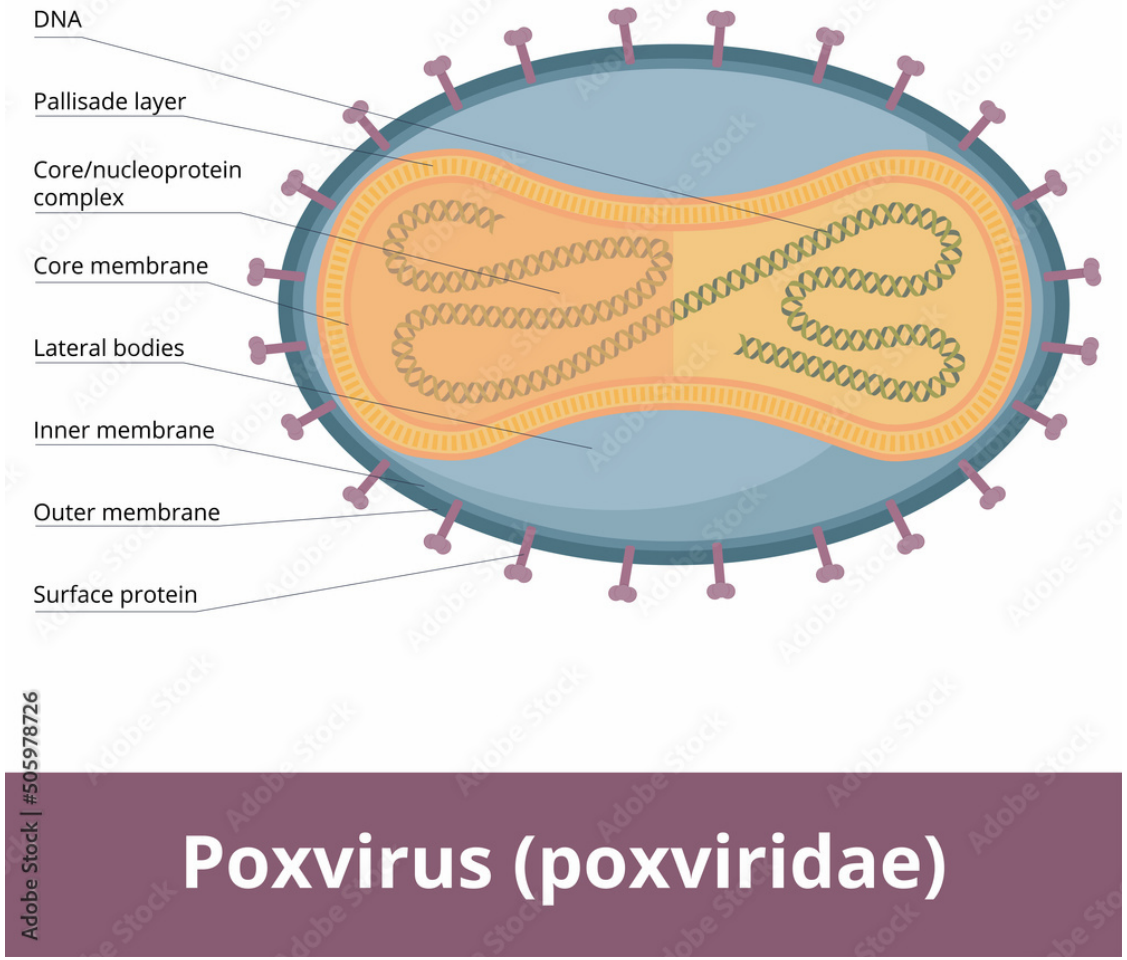
7. A virus the belongs to the *Poxviridae* family would be a double stranded DNA, enveloped virus of icosahedral symmetry that is large and replicate in the cytoplasm. FALSE

Poxviridae

dsDNA, enveloped viruses of **complex symmetry** that are large and **replicate in the cytoplasm**.

Medically important members:

1. Variola virus (the cause of smallpox)
2. Monkeypox virus
3. Molluscum contagiosum virus



Smallpox transmission, pathogenesis, and clinical manifestations

8. Variola virus is transmitted by respiratory droplets or direct contact with lesions or contaminated fomites. TRUE

Transmission: Respiratory droplets or direct contact with lesions or contaminated fomites

Pathogenesis: Viral entry via respiratory tract → lymphatic spread → viremia. Then, secondary viremia seeds skin → rash.

Clinical manifestations: High fever, malaise, back pain followed by centrifugal rash (vesicles/pustules all in same stage of development). Lesions prominent on face/extremities; possible scarring.

Why is it fatal (about 30%)?

9. Variola major fatality rate is about 30% as a result of shock, multi-organ failure, and secondary bacterial infections such as pneumonia and sepsis. TRUE

Shock, multi-organ failure, secondary bacterial infections such as pneumonia, sepsis

Smallpox diagnosis, treatment, and prevention

Diagnosis:

Clinical pattern + PCR

EM or culture in reference labs

Treatment:

Supportive care

Antivirals

Prevention:

Vaccination with live vaccinia.

Isolation of cases; contact tracing.

Variola (smallpox) was eradicated from the human population in late 1970s…
Why the eradication campaign was successful?

29. Variola virus is a DNA virus that is stable antigenically. TRUE

- Variola virus is a DNA virus that is stable antigenically.
- The live-attenuated vaccine was effective and gave long-term immunity.

16. The smallpox subunit vaccine was effective and gave long-term immunity which helped in the successful eradication of smallpox from the human population. FALSE

- The disease affected humans only with animal reservoir.

10. Smallpox affected humans and monkeys as the only animal reservoir for variola virus. FALSE

17. Smallpox was eradicated from the human population in late 1970s but remained in cows as cowpox caused by variola virus. FALSE

- All cases were symptomatic with no subclinical infections or carrier states.

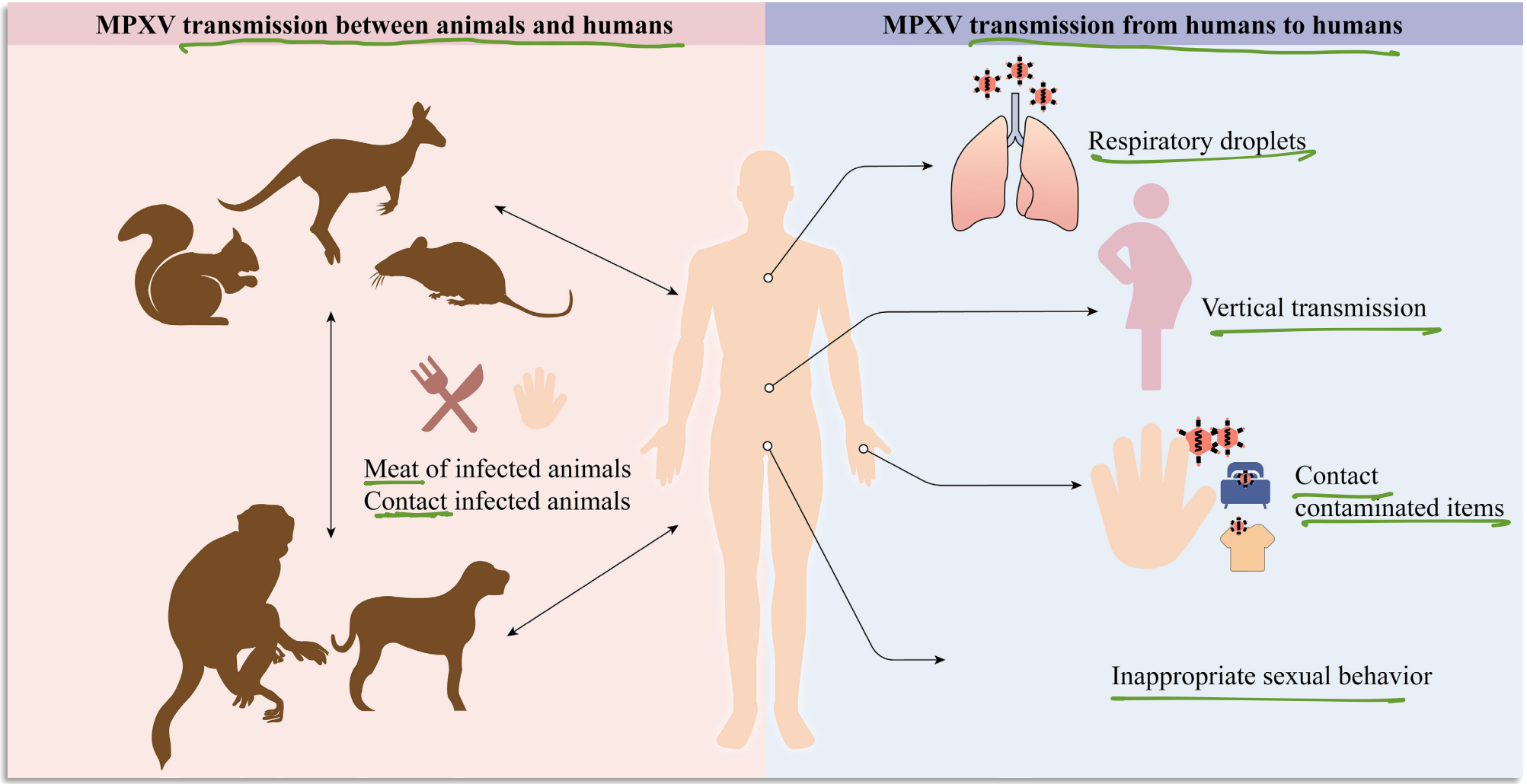
11. All smallpox cases were symptomatic without subclinical infections or carrier states which helped in the successful eradication of smallpox from the human population. TRUE

- The disease had high mortality rate and for those who survived infection, permanent scars remained causing emotional damage. So, people collaborated in the vaccination efforts.

2. Variola major had a high mortality rate and for those who survived infection, permanent scars remained causing emotional damage; therefore, people collaborated in the vaccination efforts. TRUE

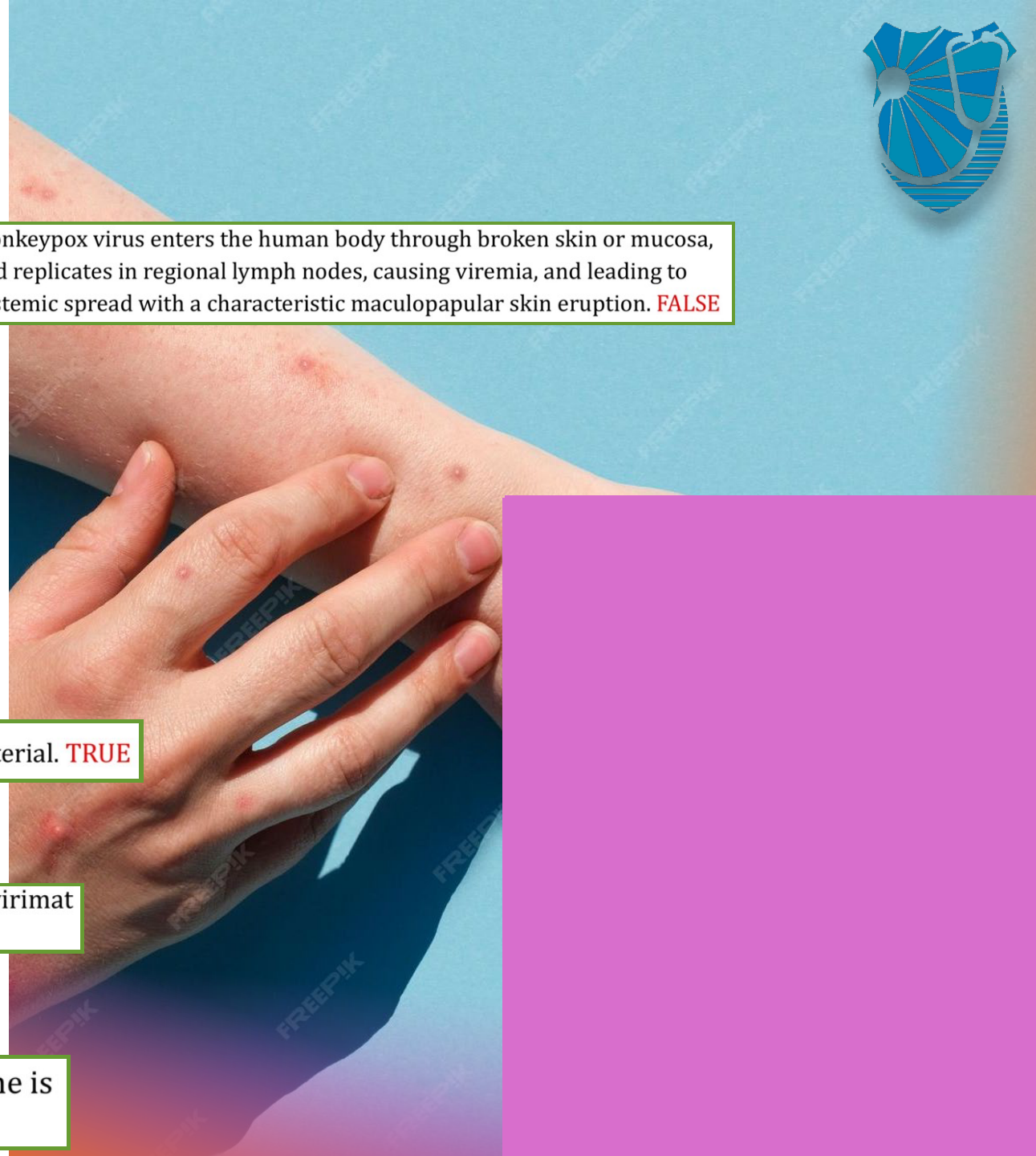
poxviridae
species 2:

Monkeypox (mpox)



Monkeypox (mpox)

- Mpox virus enters through broken skin or mucosa, replicates in regional lymph nodes, causes viremia, and leads to systemic spread with a characteristic vesiculopustular eruption.
- Patients develop fever, lymphadenopathy, malaise, followed by a centrifugal rash.
- Diagnosis is made by PCR testing of lesion material
- Supportive care is necessary, while antivirals such as tecovirimat can be used in severe cases.
- Vaccination with live Modified Vaccinia vaccine is recommended for high-risk groups.



12. Monkeypox virus enters the human body through broken skin or mucosa, and replicates in regional lymph nodes, causing viremia, and leading to systemic spread with a characteristic maculopapular skin eruption. FALSE

13. The diagnosis of mpox is made by PCR testing of the lesion material. TRUE

14. Supportive care is necessary in mpox , while antivirals such as tecovirimat can be used in severe cases. TRUE

15. Vaccination to prevent mpox with live Modified Vaccinia vaccine is recommended for the general population. FALSE

Molluscum Contagiosum

18. Molluscum contagiosum virus infects keratinocytes causing localized proliferation and formation of characteristic umbilicated papules following primary viremia. FALSE

- MCV infects keratinocytes causing localized proliferation and formation of characteristic **umbilicated papules** without systemic spread.
- Transmission by direct skin-to-skin contact, fomites, and autoinoculation from scratching; it can also be sexually transmitted in adults.
- Diagnosis is clinical. Many cases resolve spontaneously. Treatment include curettage, cryotherapy, or topical antivirals.

23. Molluscum contagiosum transmission occurs by direct skin-to-skin contact, fomites, and autoinoculation from scratching. TRUE

19. Molluscum contagiosum is commonly transmitted sexually in adults through direct skin-to-skin contact, especially if papules appear in the genital, groin, or thigh area. TRUE

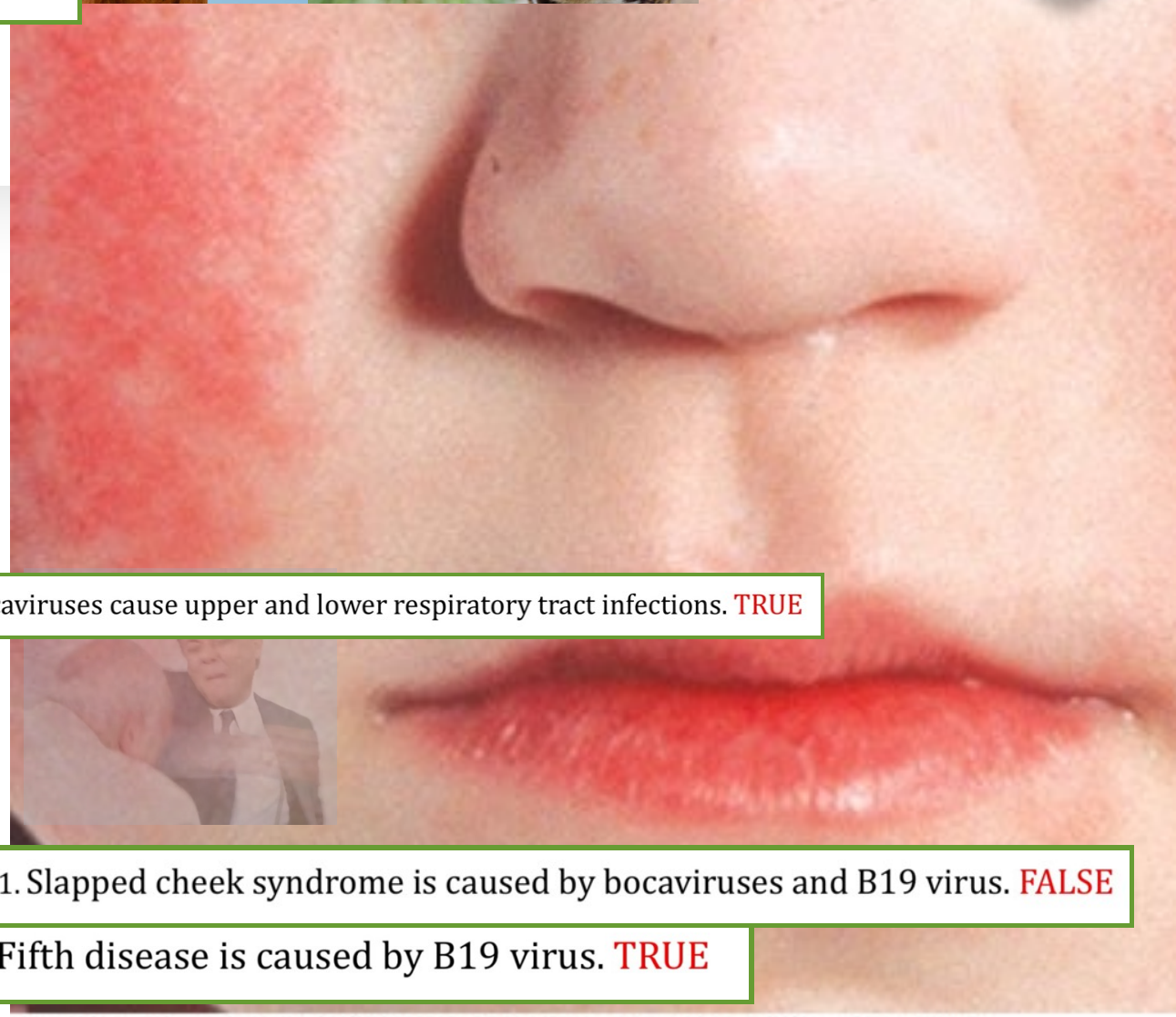
4. The diagnosis of molluscum contagiosum is by electron microscopy and many cases resolve spontaneously; however, treatment options include curettage, cryotherapy, or topical antivirals. FALSE

Parvoviridae

20. Tropism for parvovirus include the erythroid progenitors for bocaviruses and the respiratory cells for B19 virus. FALSE

- ssDNA, non-enveloped viruses.
- **Parvovirus B19 and bocaparvoviruses**
- Transmission: respiratory secretions, mother-to-child
- Tropism: erythroid progenitors for B19 virus. Respiratory cells for bocaviruses.
- Clinical features: For bocavirus: upper and lower respiratory tract infections.
- B19 in children, it causes fever and rash which is called erythema infectious (fifth disease or **slapped cheek syndrome**). In adults, primary infection can cause arthritis.

1. Bocaviruses cause upper and lower respiratory tract infections. TRUE



21. Slapped cheek syndrome is caused by bocaviruses and B19 virus. FALSE

5. Fifth disease is caused by B19 virus. TRUE

33. Erythema infectiosum is caused by bocavirus. FALSE

Parvoviridae

Other parvovirus B19 disease in special groups of patients:

A. Immunosuppressed patients: **Pure red cell aplasia** (chronic anemia)

22. Pure red cell aplasia occurs as a result of B19 virus infection affecting immunocompetent individuals. FALSE

B. Underlying chronic anemia: **Transient aplastic crisis** (severe acute anemia)

34. Transient aplastic crisis occurs as a result of bocavirus infection of individuals with underlying chronic anemias. FALSE

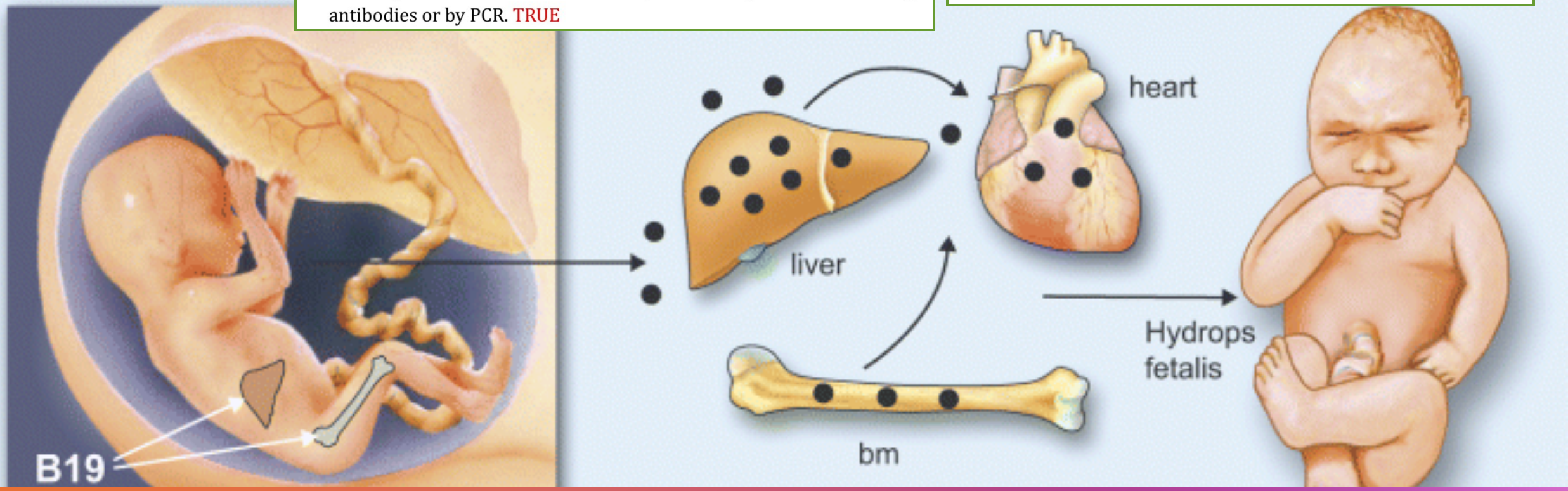
C. Congenital infection: **Hydrops fetalis** (anemia that could be fatal)

27. Hydrops fetalis is a congenital infection by bocaviruses. FALSE

Diagnosis: Clinical, PCR, Serology. **Treatment:** Supportive.

24. The diagnosis of fifth disease is usually achieved by the detection of IgM antibodies or by PCR. TRUE

32. The treatment of slapped cheek syndrome is supportive care. TRUE



Adenoviridae

25. Adenoviruses are single-stranded non-enveloped DNA viruses that replicate in the nucleus with many serotypes. FALSE

dsDNA, naked viruses that replicate in the nucleus. The virus has many serotypes (>60).

Transmission: respiratory secretions, fecal-oral, direct contact.

26. Transmission of adenoviruses occurs by exposure to respiratory secretions, fecal-oral route, or direct contact. TRUE

Tropism: epithelial cells of the respiratory tract, eyes, GI tract and urinary tract.

Clinical features:

28. Adenoviruses tropism are mainly the epithelial cells of the respiratory tract, eyes, GI tract and urinary tract. TRUE

A. Upper and lower respiratory tract infections (**adenoviruses are the most common causes of pharyngitis**).

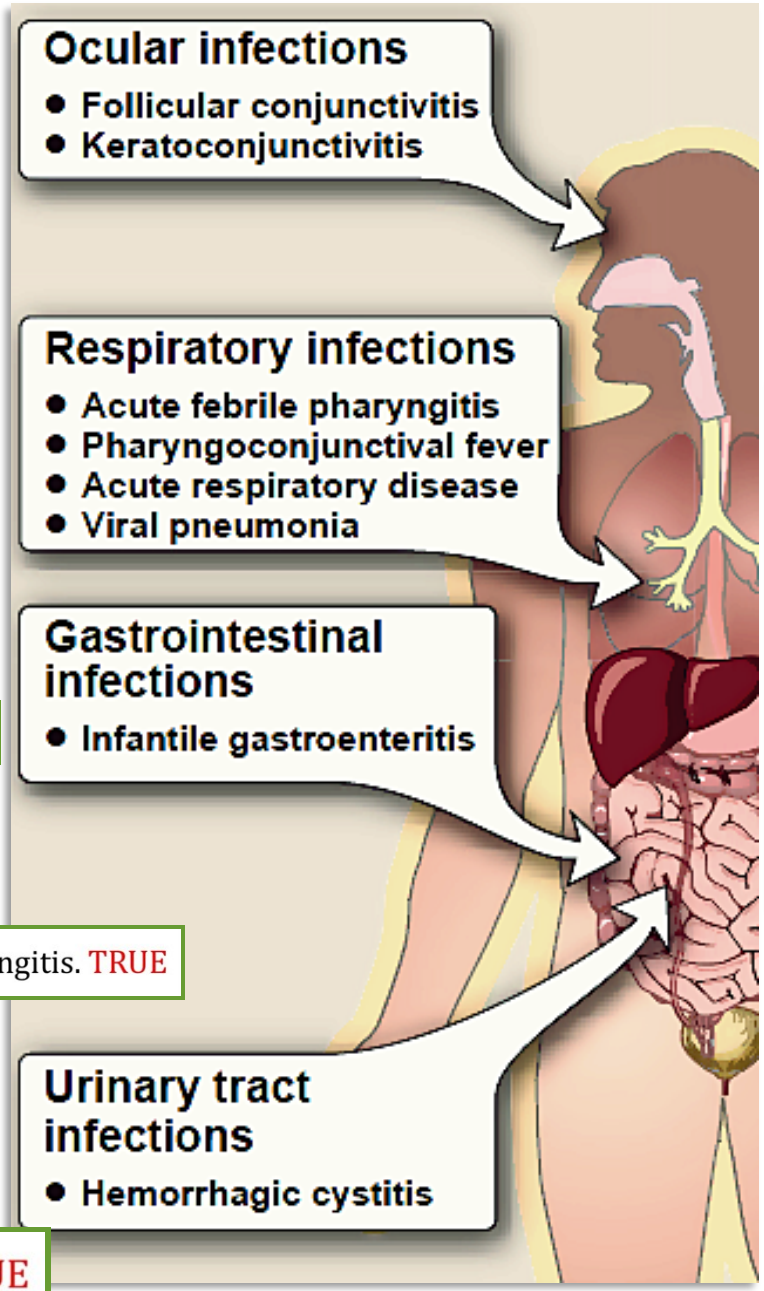
30. Adenoviruses are the most common causes of pharyngitis. TRUE

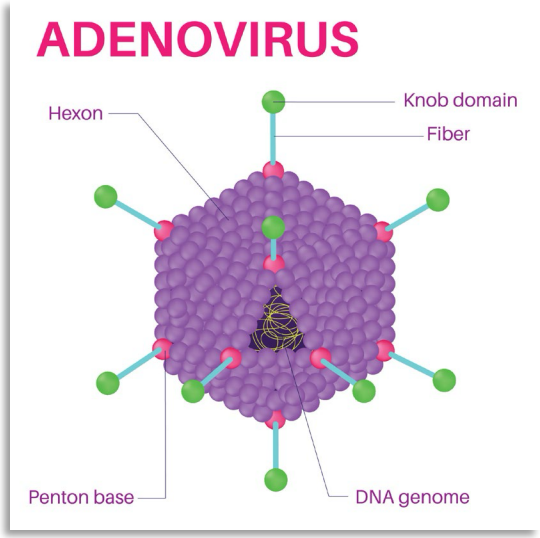
B. Gastroenteritis.

C. Conjunctivitis.

D. Cystitis

6. Adenoviruses cause gastroenteritis, conjunctivitis, and cystitis. TRUE





Adenoviridae

Diagnosis:

Antigen detection.

PCR.

31. The diagnosis of adenovirus infection is usually done by antigen detection of PCR. TRUE

Treatment: Supportive.

Prevention: Live attenuated vaccine is available for a few serotypes that can cause pneumonia.

3. Live attenuated adenovirus vaccine is available for a few serotypes that can cause gastroenteritis. FALSE

Epidemiology: Infection can occur year around without seasonality.

35. Adenovirus infection occurs mainly in winter months. FALSE

Thank You…
Wishing you all the best!

#Microbiology

Virology for 2nd Year MD Students

(06) DNA viruses:
Papillomaviridae
Polyomaviridae

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School of Medicine

Department of Pathology, Microbiology and Forensic Medicine

Papillomaviridae

22. Human papillomaviruses are double-stranded enveloped DNA viruses that replicate in the nucleus with more than 200 types. FALSE

Human papillomavirus (HPV)

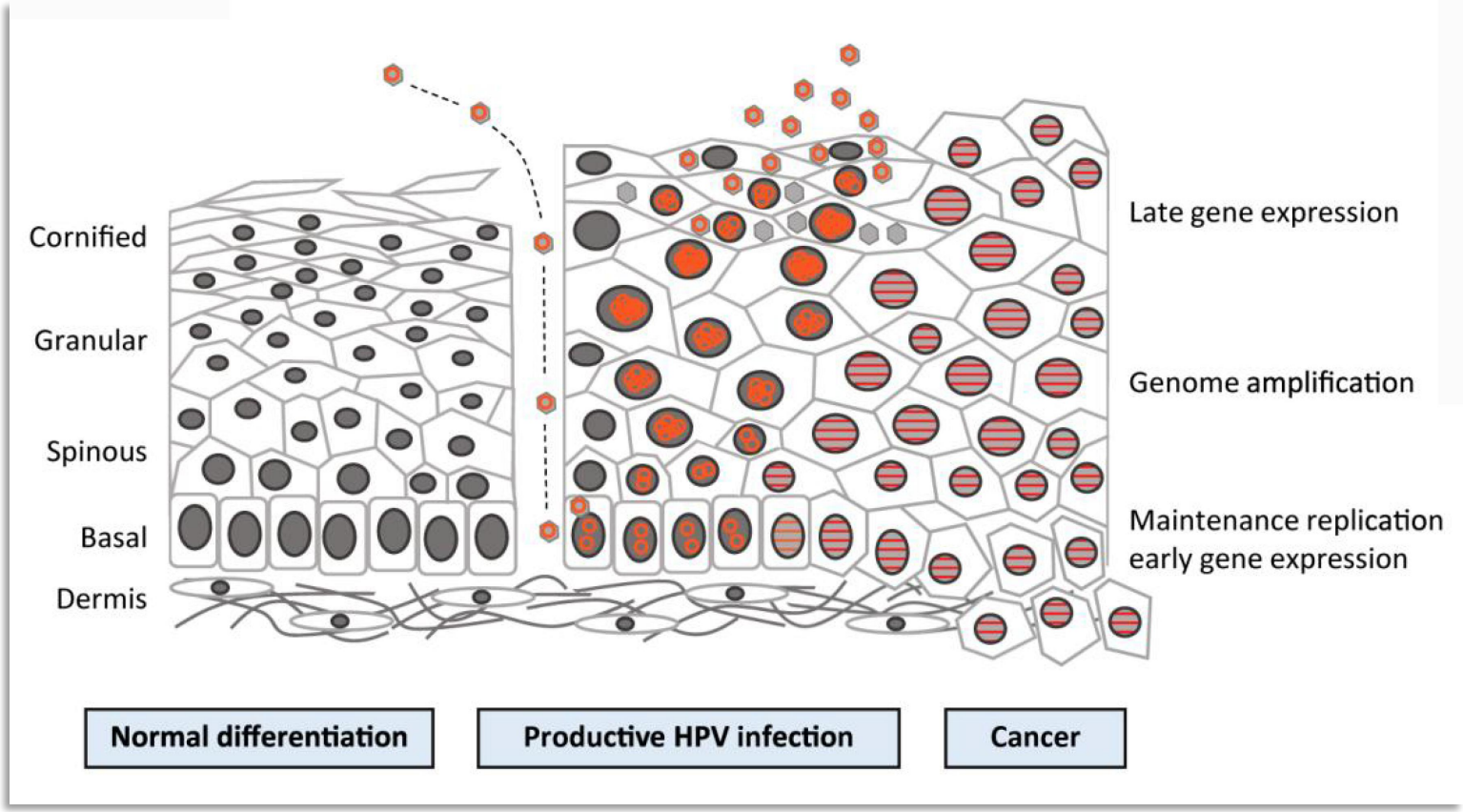
dsDNA, non-enveloped viruses that replicate in the nucleus. The virus has many types (>200).

Transmission: direct contact, sexual.

25. Skin-to-skin contact is a main route for human papillomavirus transmission. TRUE

Tropism: epithelial cells of the skin and mucous membranes.

10. Human papillomavirus has a tropism preference for epithelial cells of the skin and mucous membranes, infecting the basal layer and using the host cell differentiation for completing its life cycle. TRUE



HPV Important features

9. Human papillomavirus is the most common sexually transmitted infection. TRUE

1. HPV is the most common cause of sexually transmitted infections worldwide.
2. Most HPV infections resolve spontaneously within 2-3 years.
3. Many infections are totally asymptomatic, so the patient can have HPV without knowing
4. Some HPV types are benign, some have low-risk of causing cancer and some are high-risk types that can cause the following cancers: cervical, penile, anal, oropharyngeal, and vulvar cancers.
5. High-risk HPV types have transforming proteins that are related to cancer development.

7. The vast majority of human papillomavirus infections are permanent and would not resolve spontaneously despite the body immune system response. FALSE

2. Most HPV infections are symptomatic. FALSE

1. Most HPV-infected people carry and transmit the virus without knowing it, making it very common and difficult to track. TRUE

13. High-risk HPV types have transforming proteins that are related to cancer development. TRUE

HPV Clinical Features

14. Warts are benign lesions that occur in the mucosa and skin and caused by the benign types of the human papillomavirus. TRUE

8. Warts caused by high-risk HPV types can turn into cancers. FALSE

15. Condyloma acuminata also known as genital warts, are caused by low-risk HPV types 16 and 18 resulting in benign, flesh-colored growths found in the genital and anal areas, spread through skin-to-skin contact during sexual activity. FALSE

Common warts

Condyloma acuminata (genital warts) caused mainly by HPV-6 and HPV-11

Laryngeal papilloma.

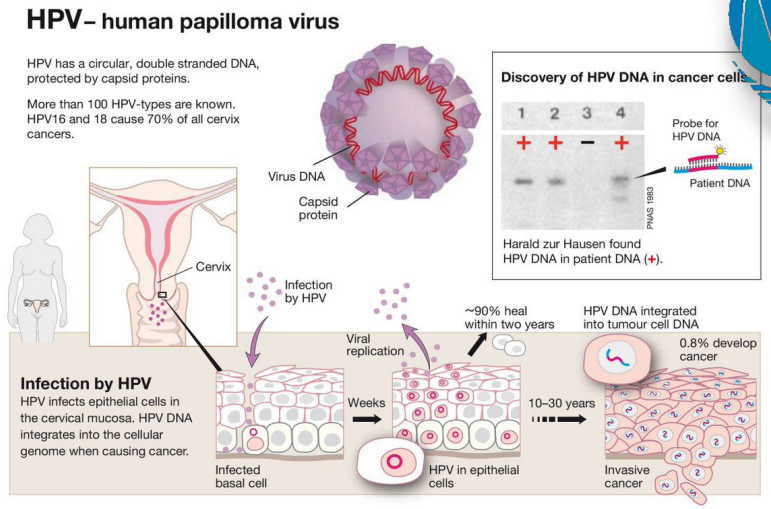
17. Laryngeal papilloma involves benign wart-like growths on the vocal cords and larynx, caused by HPV types 6 and 11 leading to hoarseness, voice changes, and potential breathing obstruction. TRUE

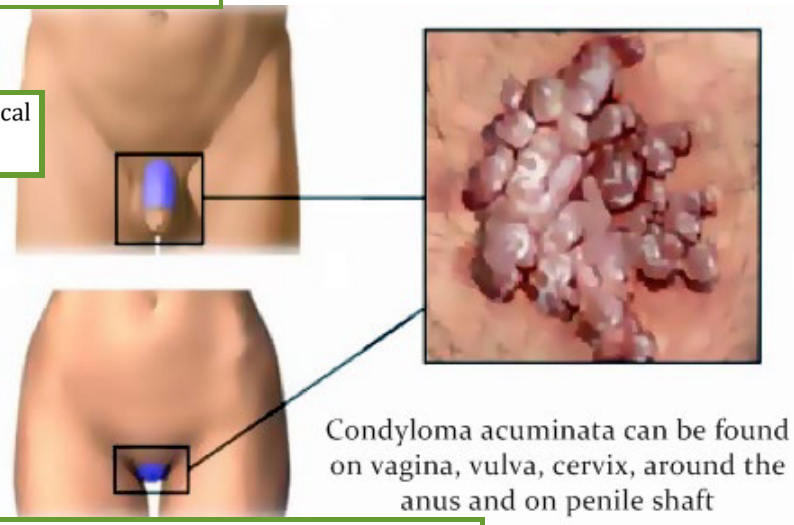
Cervical cancer caused mainly by HPV-16 and HPV-18

18. HPV types 6 and 11 are known to be responsible of the majority of cervical cancers and precancerous cervical lesions. FALSE

Other cancers: **penile, anal, oropharyngeal, and vulvar cancers**. Caused by high-risk HPV types (e.g., HPV-16 and HPV-18)

11. High-risk HPV types are definitive causes of cervical, penile, anal, oropharyngeal, breast and vulvar cancers. FALSE





Condyloma acuminata can be found on vagina, vulva, cervix, around the anus and on penile shaft

HPV Clinical Features






HPV diagnosis and management

Diagnosis:

A. Clinical.

19. Human papillomavirus infection is typically a clinical diagnosis in cases where visible lesions are present. TRUE

B. Pap smear (Papanicolaou smear is a cytology method of cervical screening to look for precancerous lesions in the cervix).

20. Papanicolaou test is a cervical screening method that detects abnormal cells, including precancerous ones, before they can develop into cervical cancers. TRUE

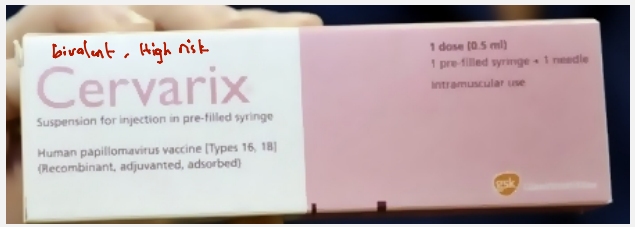
C. PCR.

Treatment: Most do not require treatment. Other methods: surgical excision, laser therapy, chemical agents (e.g., podophyllotoxin and podophyllin, imiquimod).

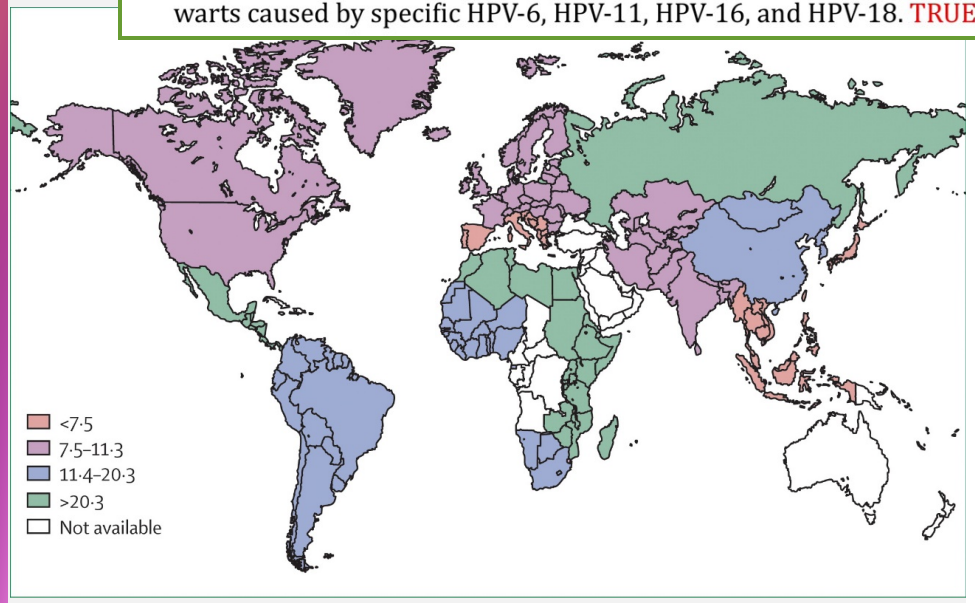
5. Podophyllotoxin, podophyllin, and imiquimod are common chemical and immune-modifying agents used in the topical treatment of external anogenital warts caused by HPV. TRUE

21. Treatments for HPV lesions such as surgical excision, laser therapy, and chemical agents are all effective options, with varying clearance rates, recovery times, and recurrence rates. TRUE

HPV epidemiology and prevention



23. Gardasil is a quadrivalent HPV vaccine that prevents cancers and genital warts caused by specific HPV-6, HPV-11, HPV-16, and HPV-18. TRUE



Prevention: Subunit vaccines:

1. Cervarix (bivalent vaccine for HPV-16 and 18).

6. Cervarix is a bivalent HPV vaccine preventing infection by types 6 and 11 used to prevent cervical cancer and pre-cancers caused by these high-risk HPV types in young females. FALSE

2. Gardasil (quadrivalent vaccine for HPV-6, HPV-11, HPV-16, and HPV-18).
3. Nonavalent vaccine (for the following types: 6, 11, 16, 18, 31, 33, 45, 52, 58).

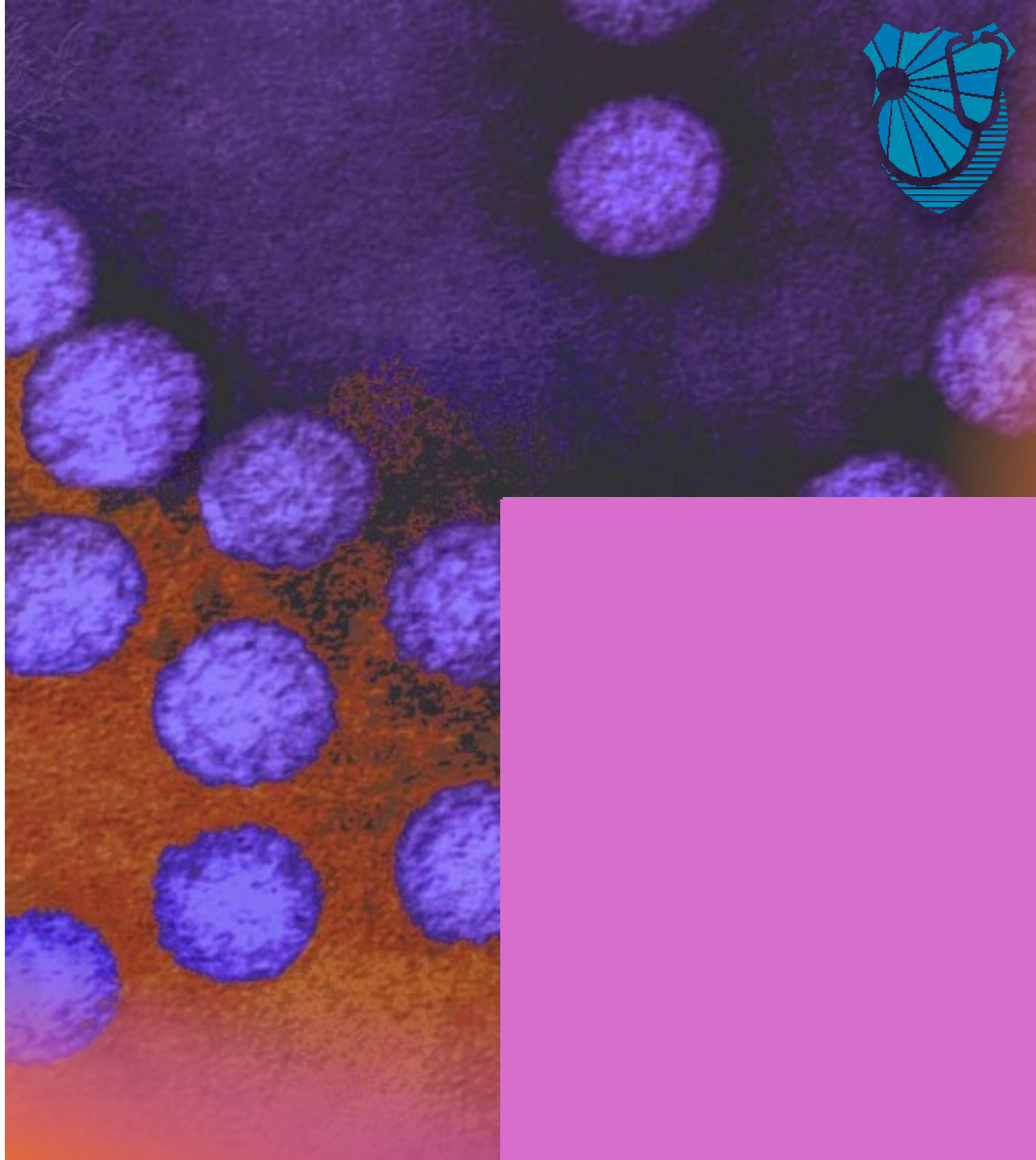
3. The nonavalent HPV vaccine protects against nine types of HPV: types 6, 11, 16, 18, 31, 33, 45, 52, and 58. TRUE

Epidemiology: The global HPV prevalence is about 10%.

Polyomaviridae

- Double-stranded DNA, non-enveloped viruses that replicate in the nucleus
- **JC virus, BK virus and Merkel cell polyomavirus**
- **Most of these infection remain latent in the body without symptoms.**
- **Transmission:** not established

16. The JC virus, BK virus, and Merkel cell polyomavirus are common, usually harmless papillomaviruses that establish persistent infections, but can reactivate and cause severe disease in immunocompromised individuals.
TRUE



Polyomaviridae

Clinical features:

24. JC virus causes severe, painful hemorrhagic cystitis in bone marrow transplant patients due to immune suppression. FALSE

A. BK virus: cystitis in bone marrow transplant patients

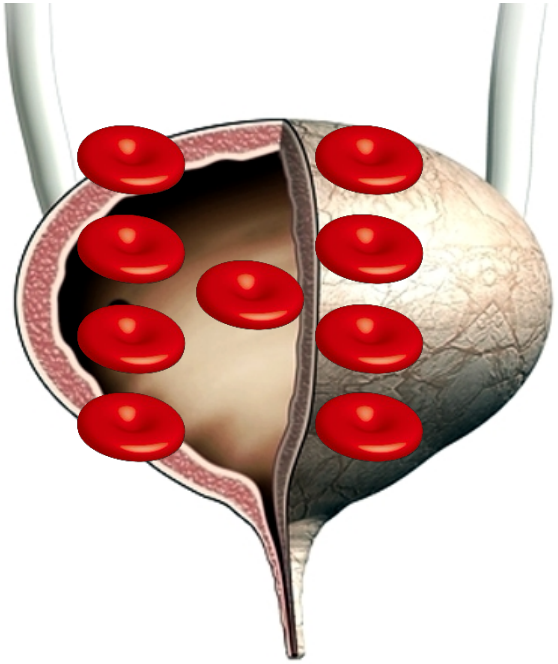
B. JC virus: progressive multifocal leukoencephalopathy (PML) in AIDS patients.

12. BK virus causes progressive multifocal leukoencephalopathy (PML) in AIDS patients, which is a severe brain infection leading to demyelination and neurological damage, and is often fatal. FALSE

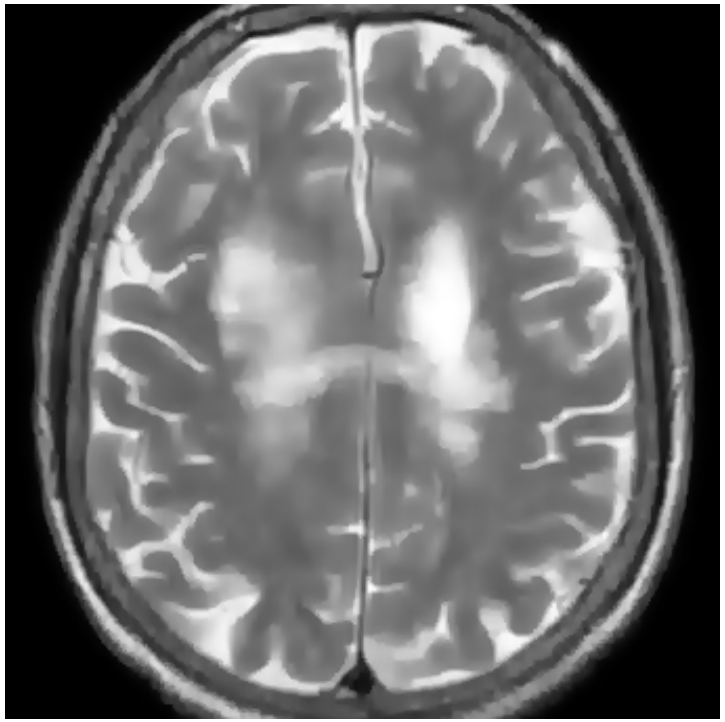
C. Merkel cell polyomavirus: Merkel cell carcinoma (rare skin cancer). So, Merkel cell polyomavirus is an oncovirus

26. Merkel cell polyomavirus is an oncovirus that is well recognized as the major etiological agent of Merkel cell carcinoma which is a rare but rapidly metastasizing skin neoplasm. TRUE

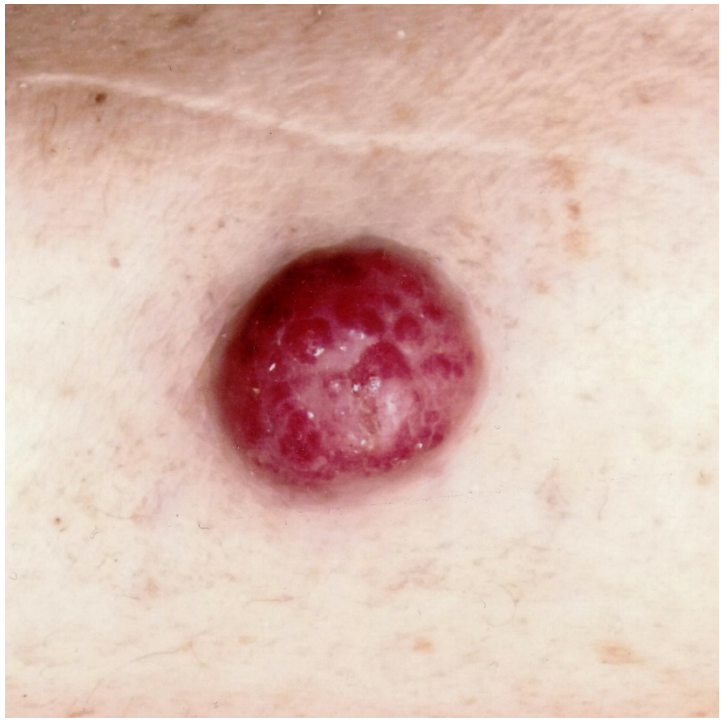
Polyomaviridae



BK virus: Hemorrhagic cystitis



JC virus: Progressive multifical leukoencephalopathy (PML)



MCPyV: Merkel cell carcinoma

Polyomaviridae

Diagnosis:

A.PCR

B.Radiology

C.Histopathologic examination

Treatment: No specific treatment.

Prevention: Vaccines have not been approved for prevention so far.

Epidemiology: Widely spread. A majority of humans have the infection by BK and JC viruses.

4. BK and JC polyomaviruses are widespread, with a majority of the human population being exposed to and infected by these viruses, typically during childhood. TRUE

Thank You…
Wishing you all the best!