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

very specific, confirms live virus

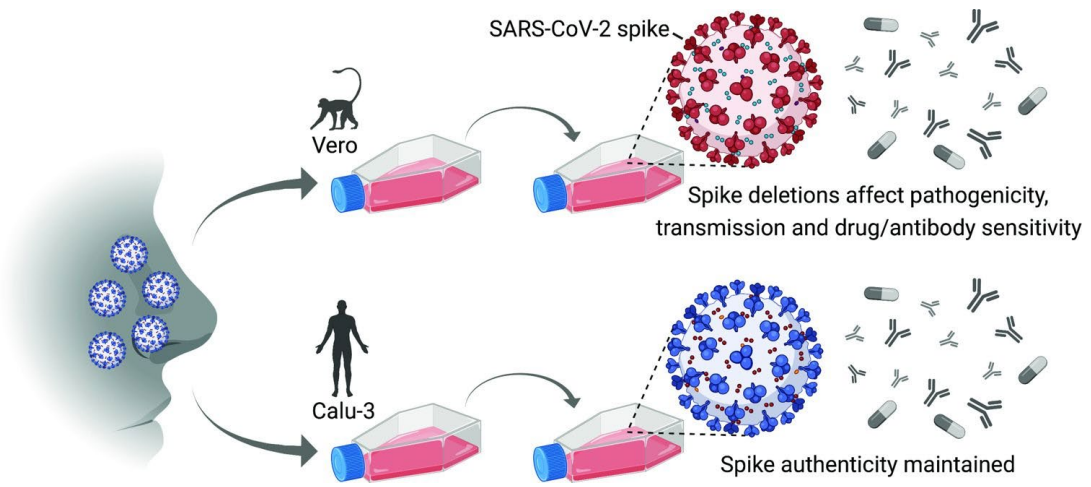
The gold-standard, reference method.

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

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?

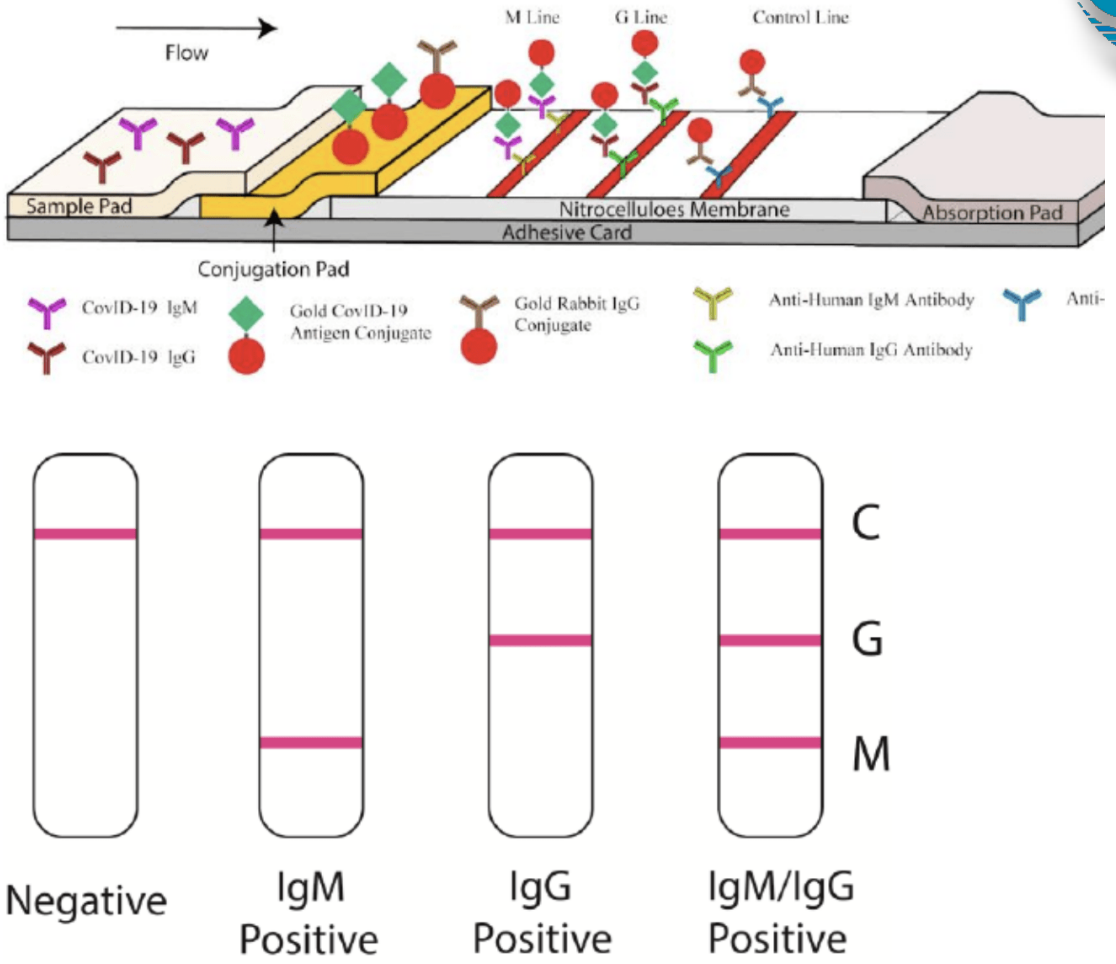
Not useful for very early diagnosis

2. Serology (Serum) الفحوصات المصلية

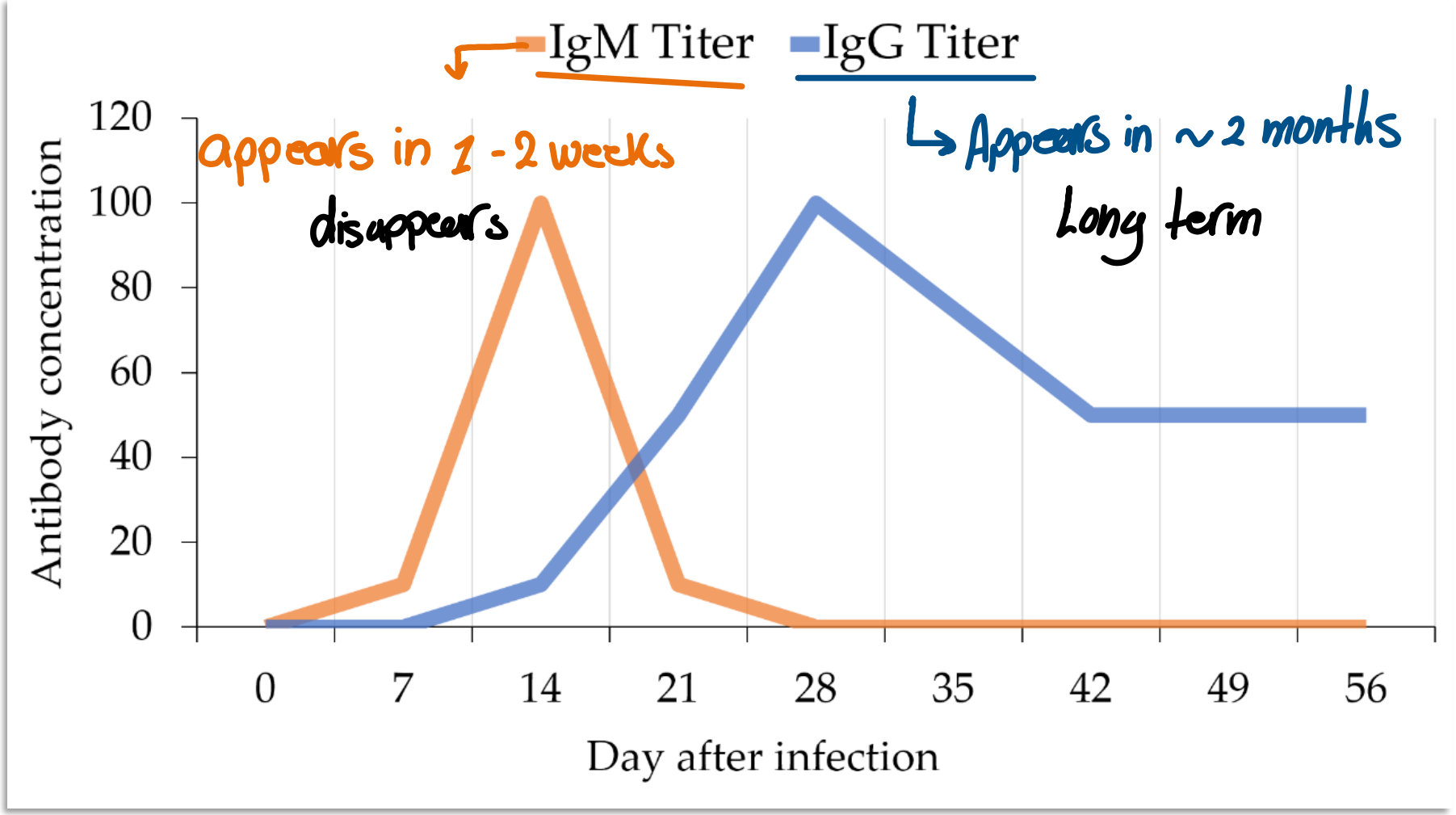
↳ Antibodies

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.

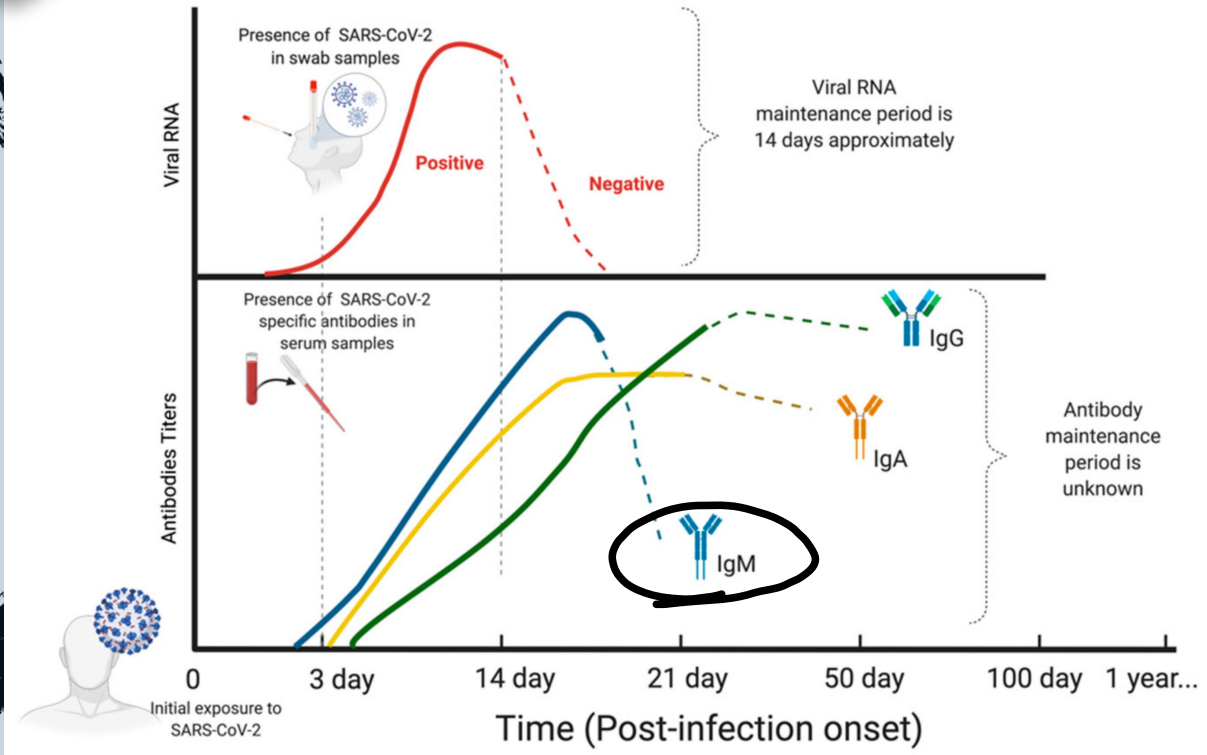
Specific virus infections will cause specific antibody production. So, if these specific antibodies are present, it means that the infection by that specific virus occurred.



How to diagnose virus infections?



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.

يعني مريض مارلي يومين عنده الاعراض في هذا الفحص رح يكون (Negative)

How to diagnose virus infections?

3. Antigen detection

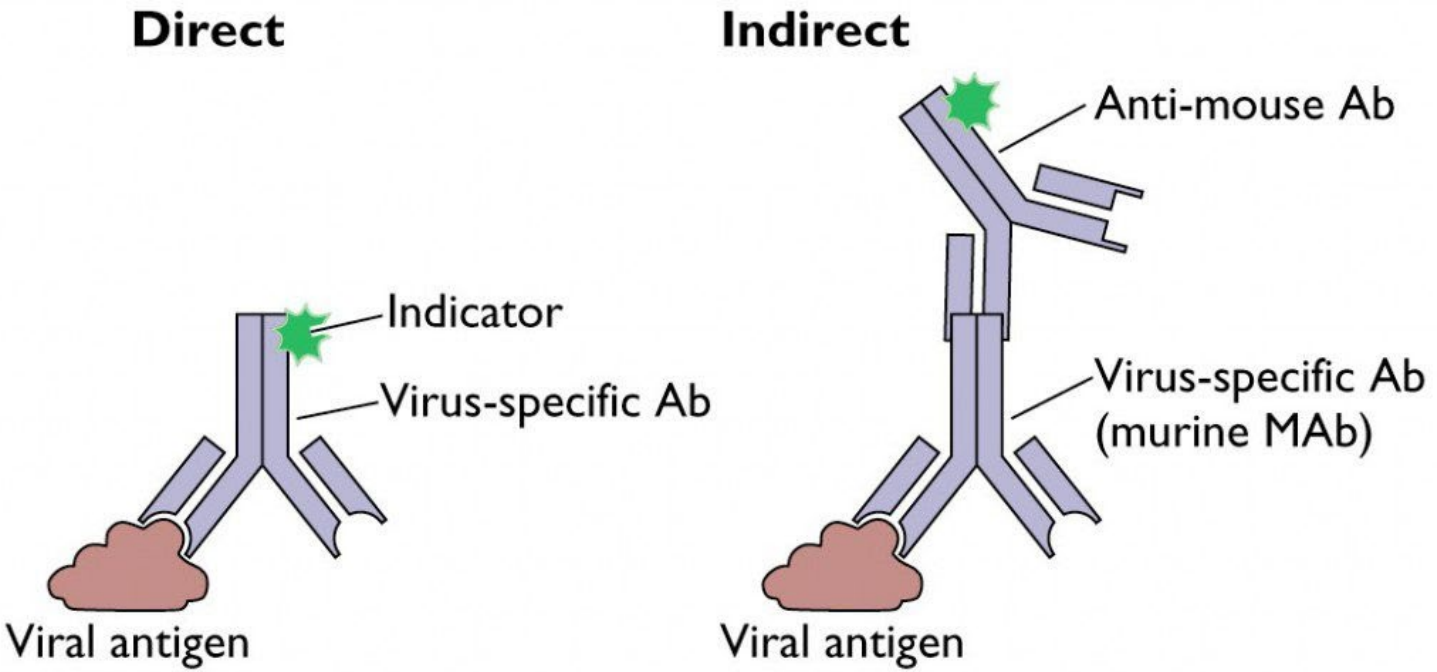
مستضدات الفايروس

We look for the specific virus proteins. (Antigens) ← Foreign bodies

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.

يعني بناءً على الفحص
بحدد نوع الـ Virus



Faster than culture

More specific than symptoms alone

How to diagnose virus infections?

هذا محتوى الدكتور

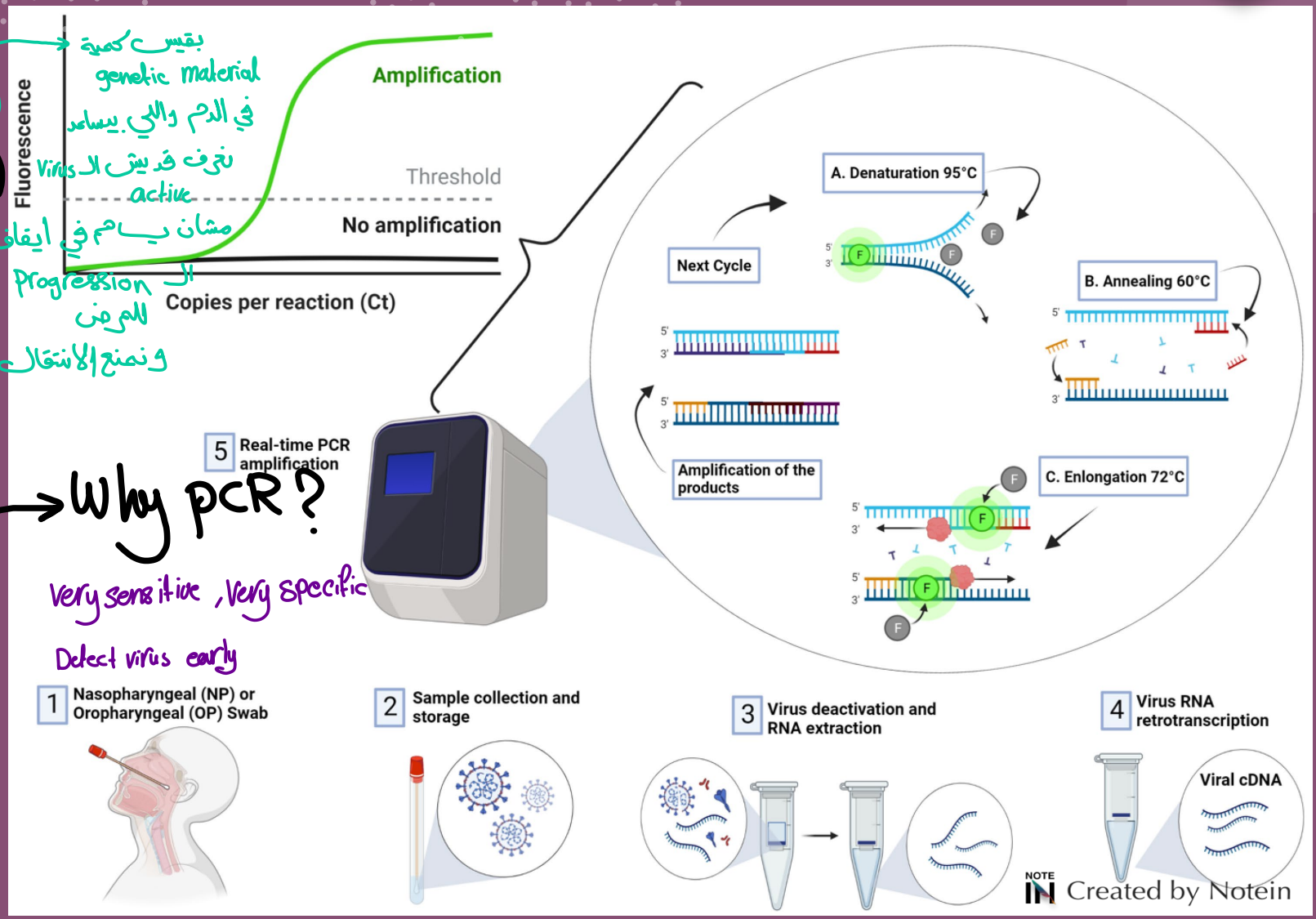
Clinical relevance:

1) COVID-19
2) CMV
3) HSV
4) HIV viral load

4. Molecular detection (PCR)

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).



How to diagnose virus infections?

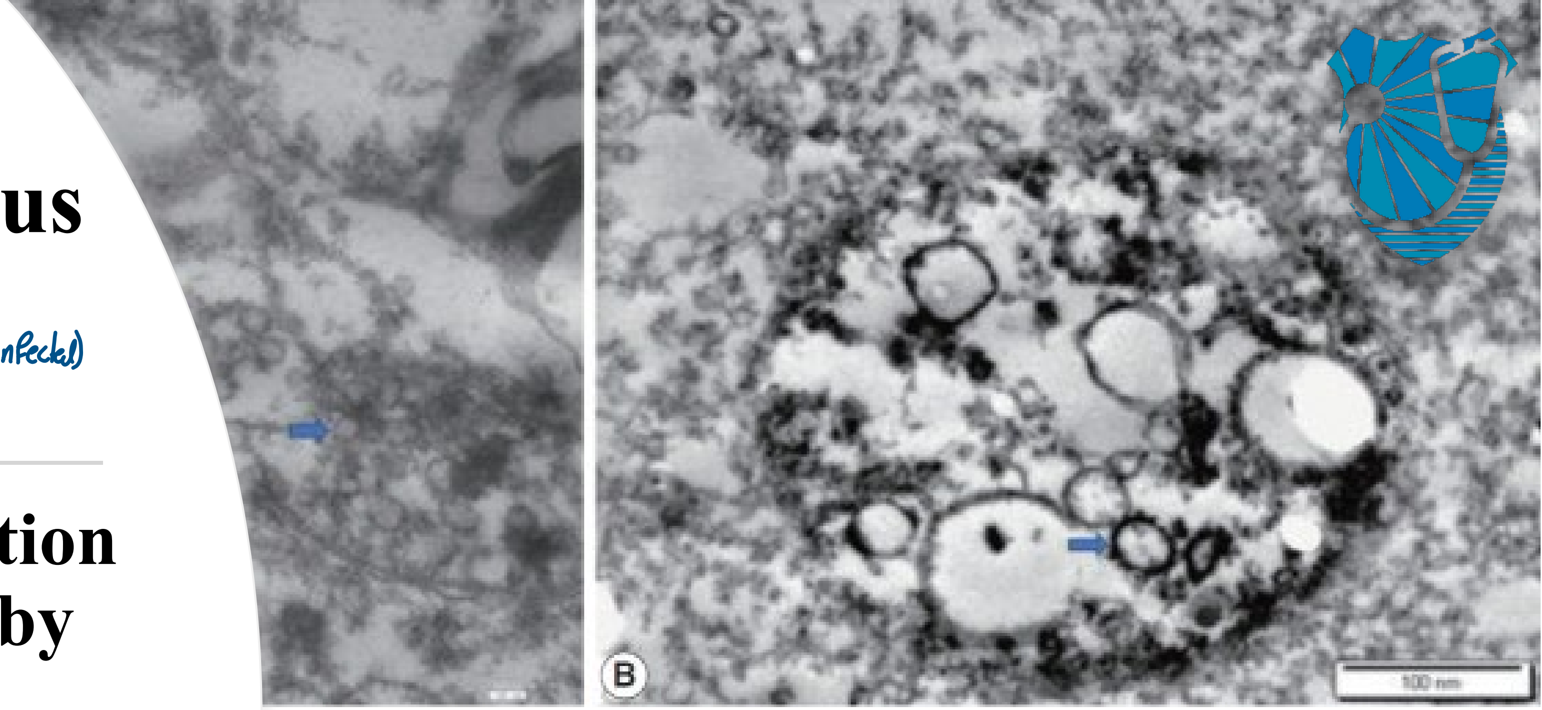
Detect cells/tissues (infected)

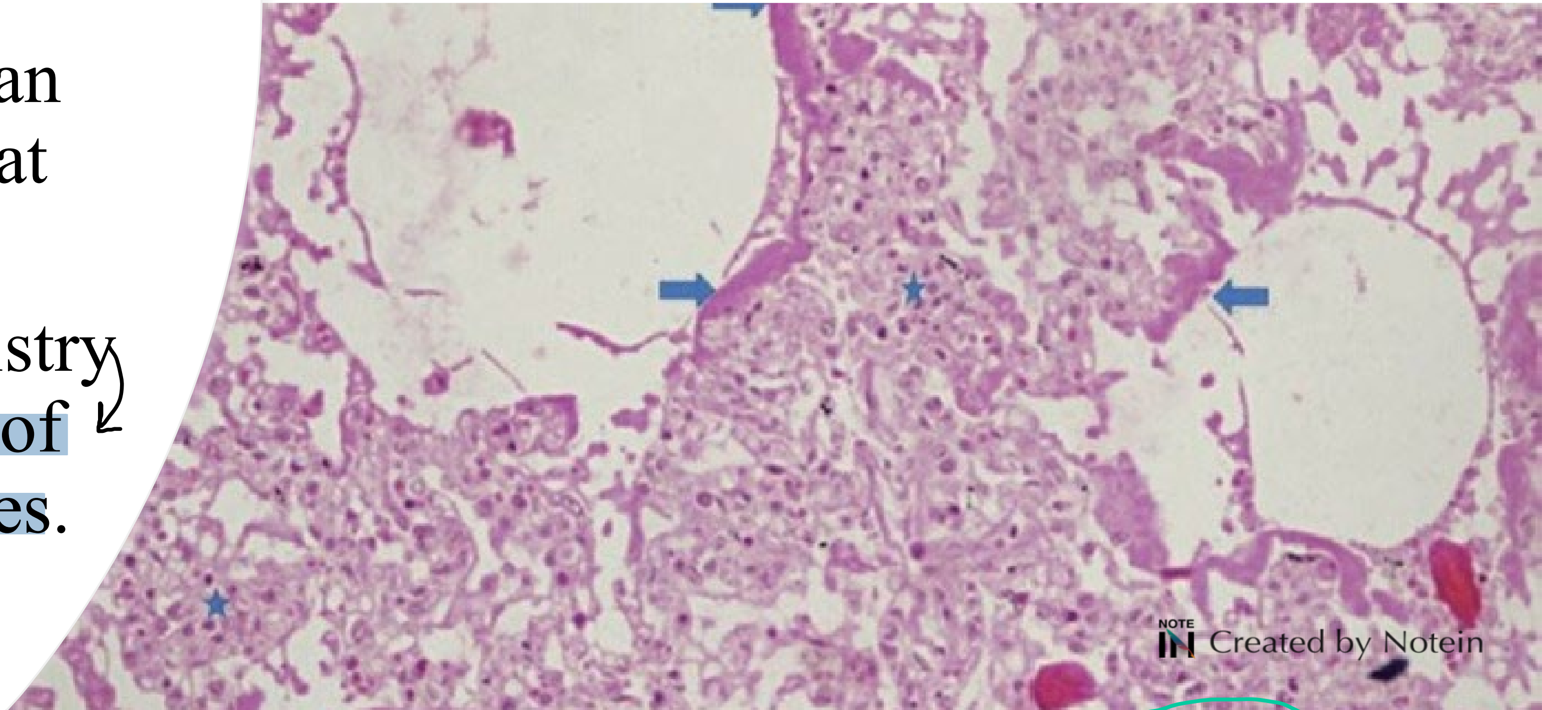
على شو بيحث تحديداً؟
① cellular charcterstics تغير في
② Inclusion bodies [Viral proteins تجمعات or viral N.A. في النواة السيتوبلازم] → كل virus have its special Place & structure
③ Giant cells

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

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.



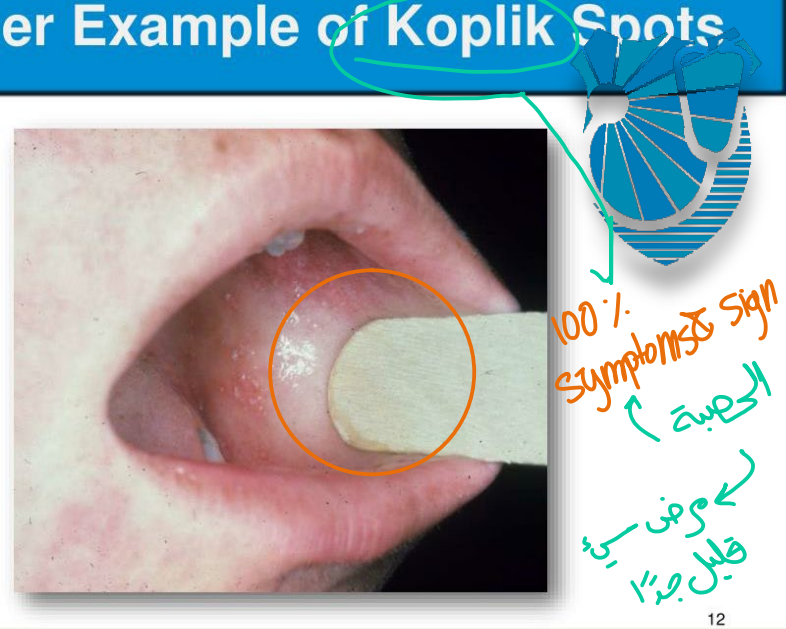


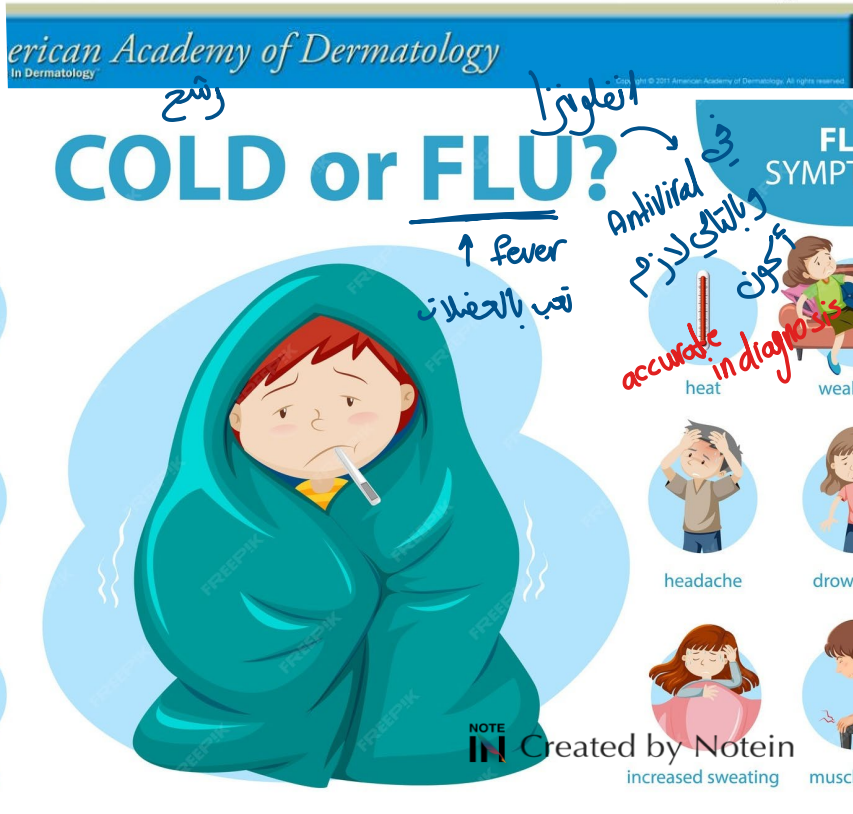
How to diagnose virus infections?

6. Clinical diagnosis

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

fast, cheap, but Not always accurate





The 6 Diagnostic Methods

Method	Detects	Key Point
Virus culture	Live virus	Gold standard, slow
Serology	IgM / IgG	Past vs recent infection
Antigen detection	Viral proteins	Fast & specific
PCR	Viral DNA/RNA	Early & sensitive
Histopathology	Cell changes	Tissue diagnosis
Clinical	Symptoms	Pattern recognition

If question asks:
Early diagnosis? ↠ PCR
Recent vs past infection? ↠ IgM vs IgG
Gold standard? ↠ Virus culture
Fast bedside test? ↠ Antigen detection
Biopsy finding? ↠ Histopathology
Classic rash? ↠ Clinical diagnosis

Thank You…
Wishing you all the best!