

# ADVANCED LABORATORY TECHNIQUES

## IMMUNOCHROMATOGRAPHY



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قسم تقنيات المختبرات الطبية

. third Stage

المرحلة الثالثة

محاضرة رقم 3

Lecture No. 3

الجانب النظري

Theoretical

تدريسي المادة : م.م طيبة شاكر

## (INTRODUCTION)

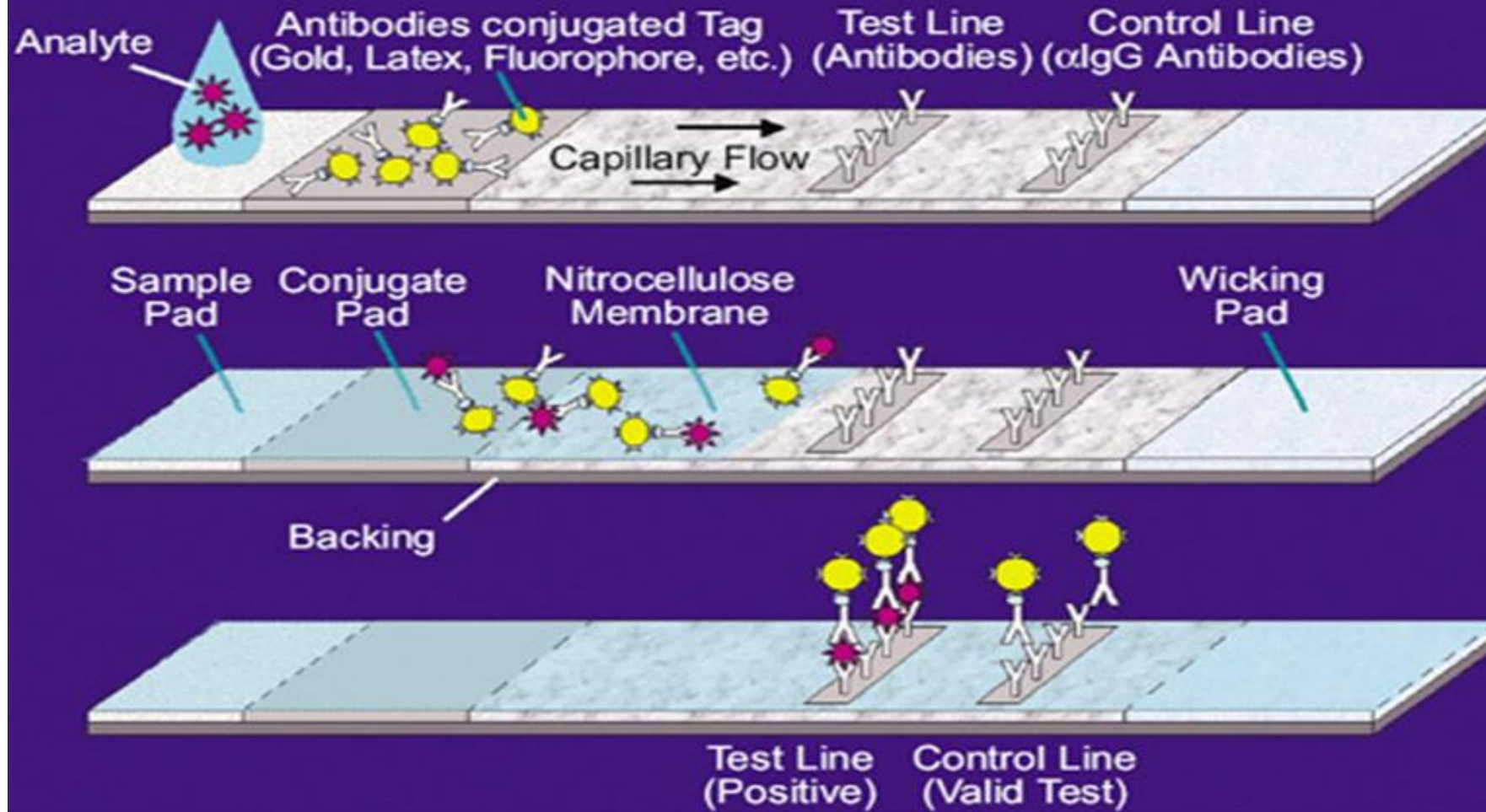
- Immunochromatography, also known as **lateral flow immunoassay (LFIA)**, is a **rapid, simple, and cost-effective** diagnostic tool. It is widely used for the **qualitative detection of antigens or antibodies in biological samples such as serum, plasma, urine, or whole blood.**
- This technique is most familiar to the public as the **basis of pregnancy tests** and many rapid diagnostic kits for **infectious diseases like HIV, Hepatitis B, and malaria**

# Principles:

The Test Is Based On

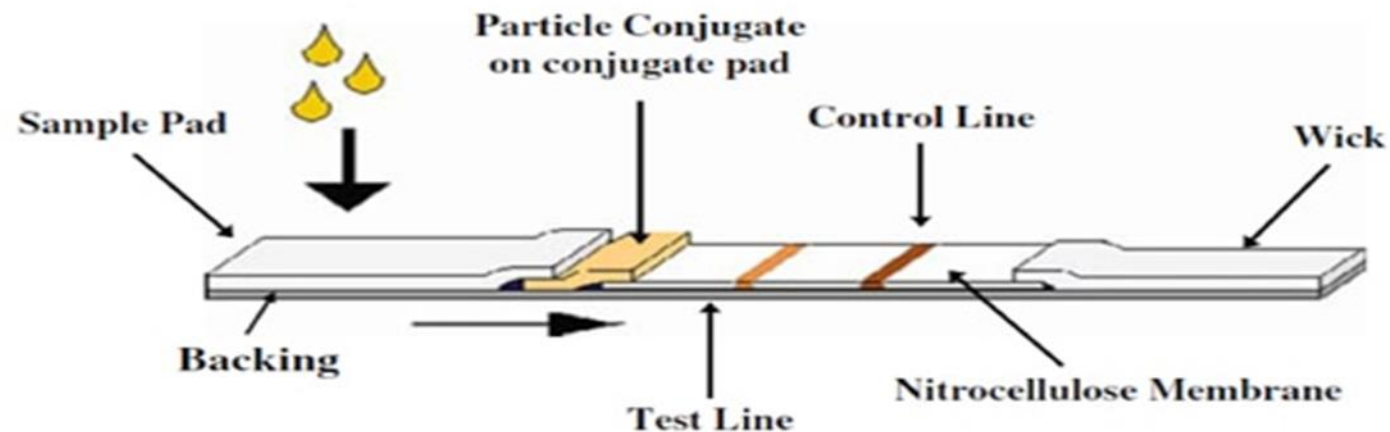
- **Capillary action:** the sample migrates across A porous membrane strip (usually nitrocellulose). If the target analyte (antigen/antibody) is present, it forms A complex with labeled antibodies (conjugated with colloidal gold or colored latex). This complex is captured on A test line coated with specific antibodies, producing A visible colored band. A control line always appears to indicate the test is valid.

## Lateral Flow Assay Architecture



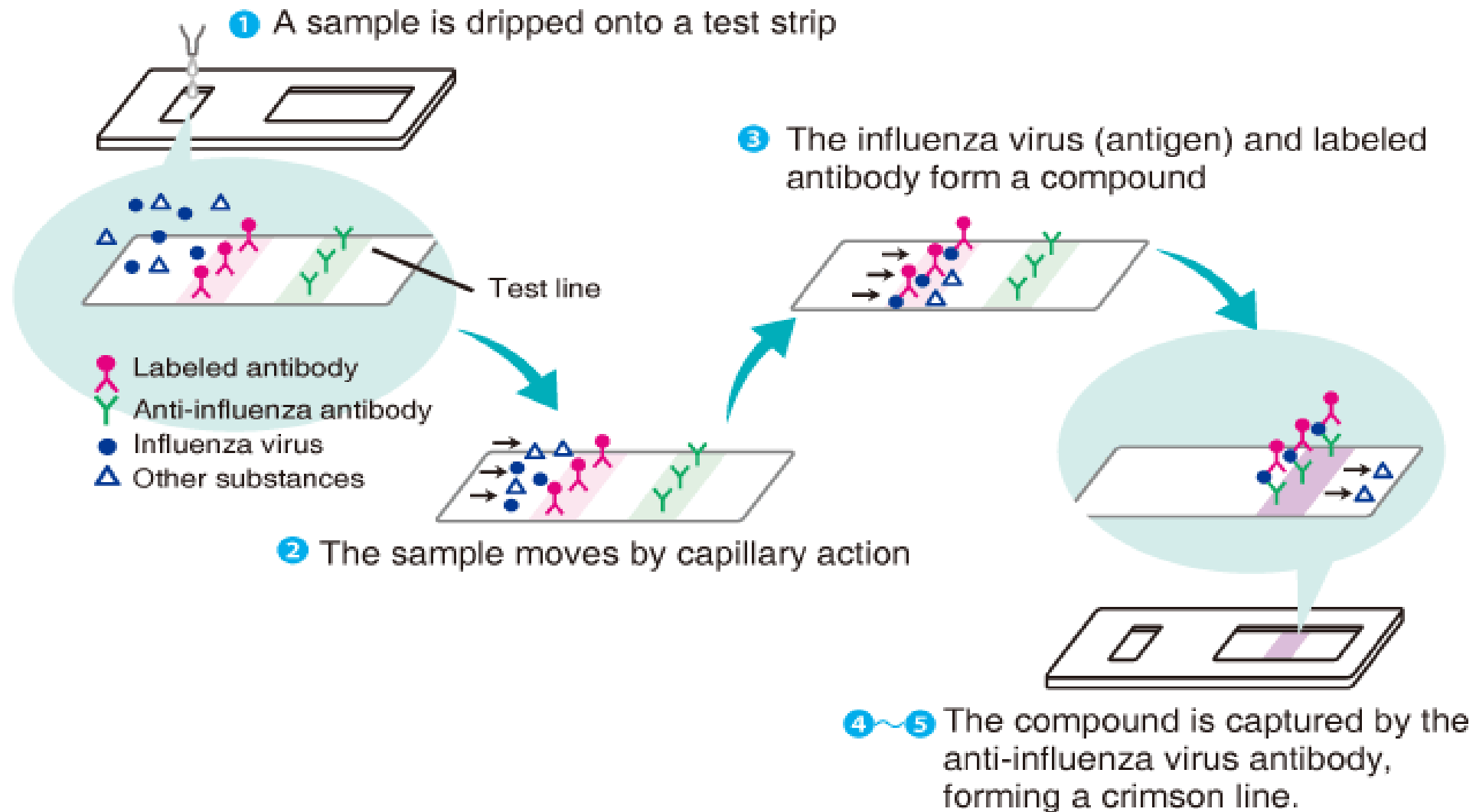
## Components of the lateral flow device

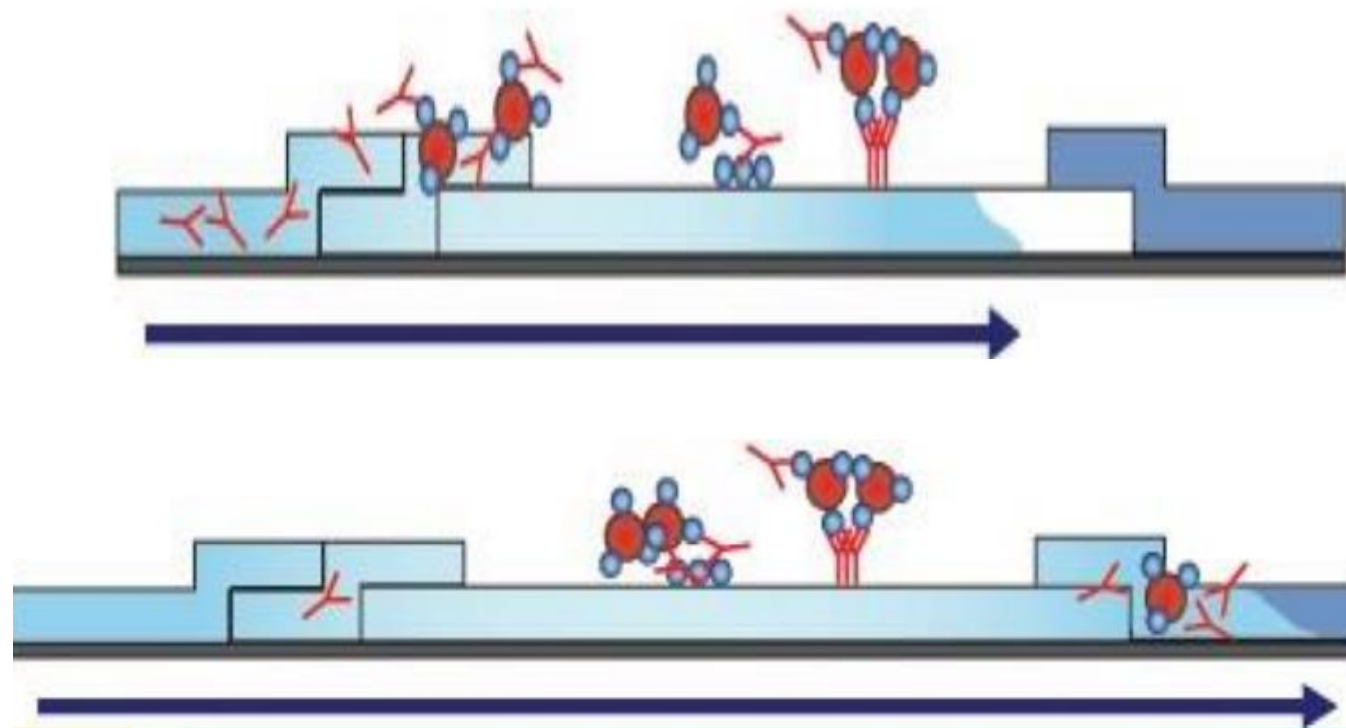
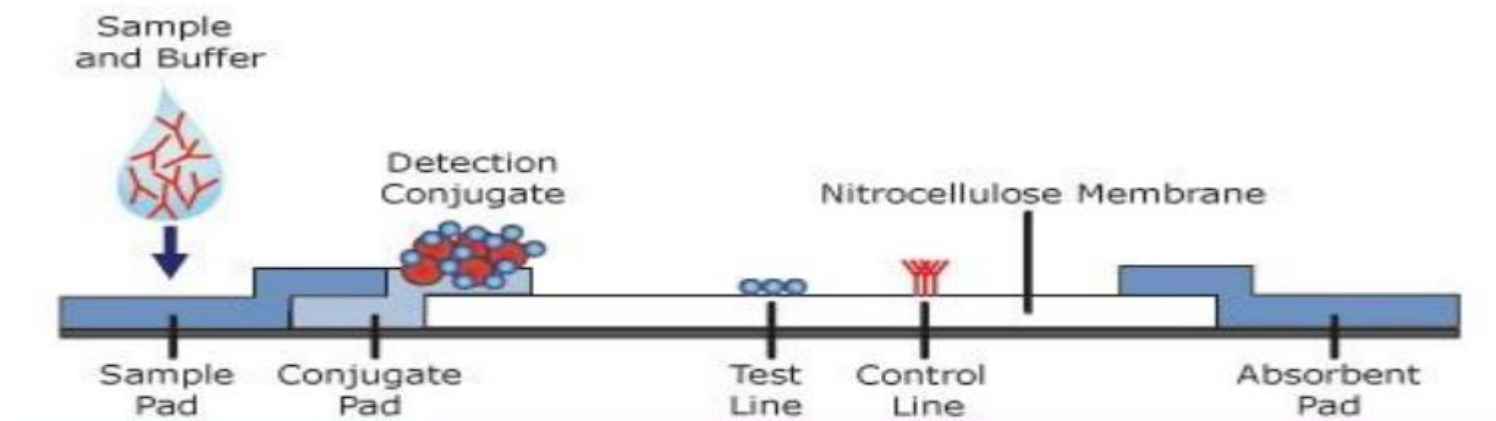
1. **Sample pad** – where the specimen is applied.
2. **Conjugate pad** – contains antibodies labeled with colored particles (e.G., Gold nanoparticles).
3. **Nitrocellulose membrane** – contains two lines:
  1. **Test line (T)**: coated with specific antibodies.
  2. **Control line (c)**: coated with anti-ig antibodies that bind labeled conjugates regardless of the target.
4. **Absorbent pad** – draws the liquid across the membrane and prevents backflow.

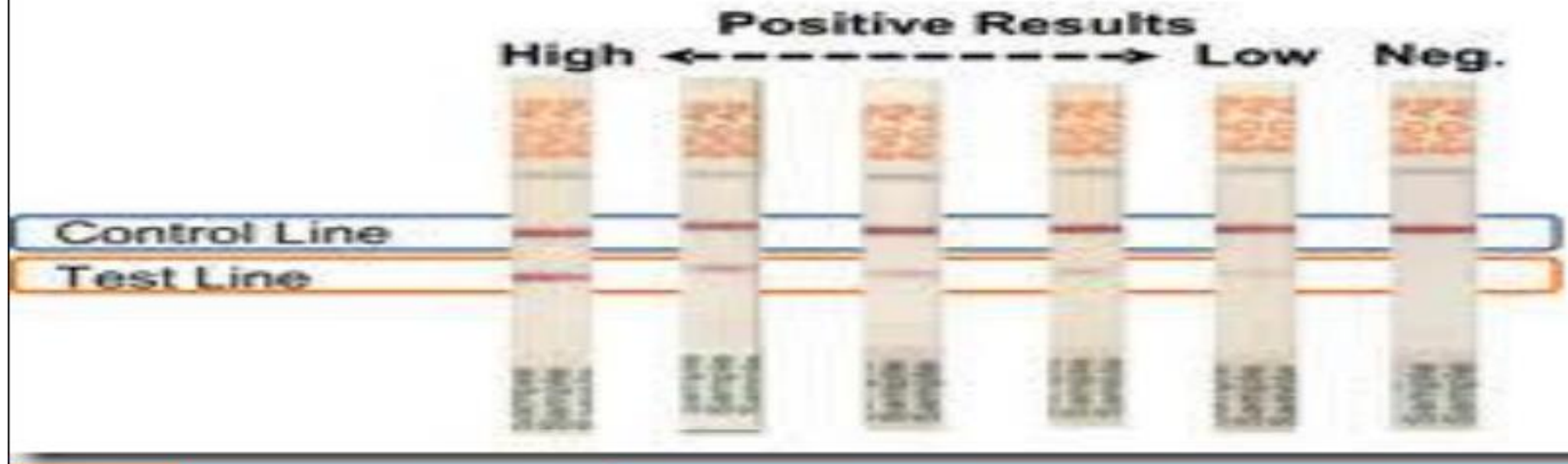
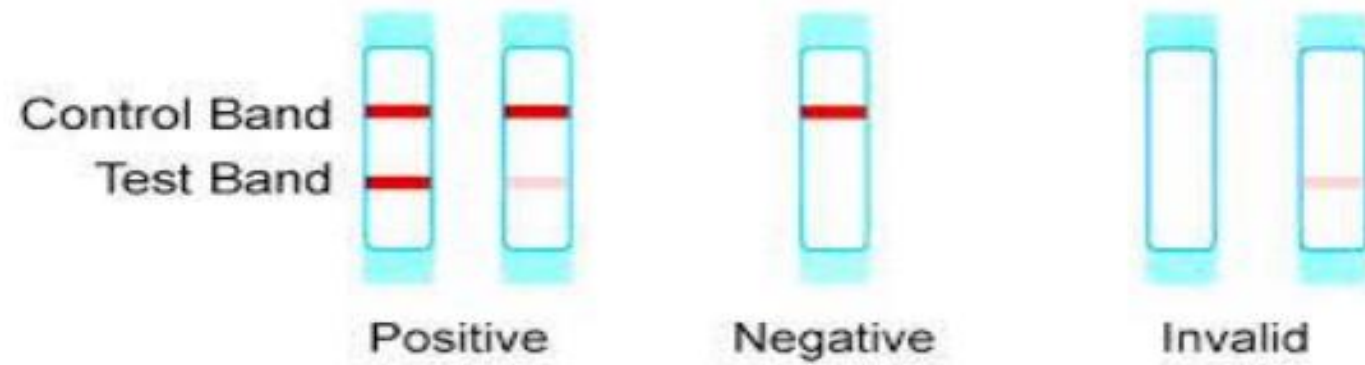


## Procedure:

- Add a drop of specimen (serum, plasma, urine, or blood) to the sample pad .
- The fluid migrates along the strip by capillary action.
- If the target antigen/antibody is present, it binds to labeled antibodies in the conjugate pad.
- The immune complexes are captured at the test line, forming a colored band.
- The conjugate (whether bound or unbound) continues to the control line, where it is trapped to confirm test validity.
- Results are interpreted after 5–20 minutes: **Positive:** both test line and control line visible.  
**Negative:** only control line visible. **Invalid:** control line absent.







# Application:

- HIV antibody detection (dipstick test)
- Hepatitis B surface antigen (HBsAg) detectionMalaria antigen detection (Plasmodium falciparum)
- Pregnancy tests (detection of hCG hormone)
- COVID-19 rapid antigen/antibody tests

## Advantages:

- ✓ Rapid results (minutes).
- ✓ Easy to use, no need for sophisticated equipment.
- ✓ Portable and suitable for field/point-of-care testing.
- ✓ Requires small sample volume.

## Limitations:

- Mostly qualitative (yes/no result).
- Lower sensitivity compared to ELISA or PCR.
- False positives/negatives possible (need confirmation by other tests).

# QUIZ

H.W:

imagine you are working in a field laboratory located in a remote area with limited resources, where advanced techniques such as ELISA or PCR are not available. The only diagnostic tools you have are immunochromatographic test strips for detecting a rapidly spreading infectious disease (e.g., malaria or Hepatitis B)

.Discuss:

How would you evaluate the usefulness of immunochromatography as the primary diagnostic method in such conditions?

What practical steps could you suggest to minimize the risk of false positive or false negative results when relying on this technique?

**Any questions?**

*Thank  
You*