

# Types of Laboratory Tests



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## Overview

- Tests:
  - Antigen
  - Antibody
  - Molecular
  - Culture
- What do results mean?

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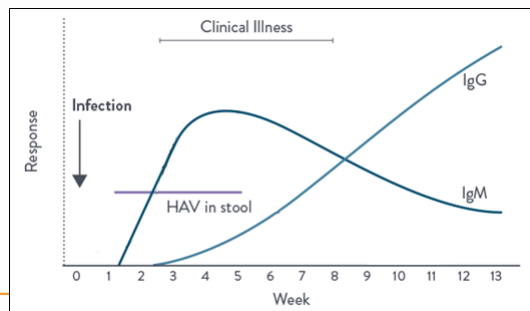
## A quick background

- Antibodies – proteins produced by the body to fight disease
- Antigens – proteins that immune system can detect
- Molecular – looks for the genetic material
- Culture – looks for pathogens

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## Antibody Tests – To Detect Response

- IgM tests
  - Detects IgM antibodies made **earlier** in infection
  - Larger
  - Less specific binding
    - This is why IgM tests sometimes have cross-reactivity!
- IgG tests
  - Detects IgG antibodies made **later** in infection
  - Smaller
  - More specific binding

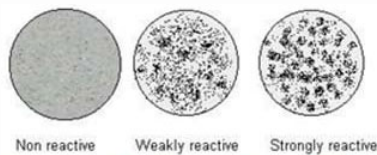


<https://www.corelaboratory.abbott/int/en/offerings/segments/infectious-disease/hepatitis.html#anti-hbc>

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## Antibody Tests – Serology

- Agglutination
  - Patient specimen is combined with antigens.
  - If antibodies are present in the patient specimen, they bind to the antigen, causing “clumping,” or agglutination.
  - Example: Syphilis RPR



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## Antibody Tests – Serology

CMIA (chemiluminescent microparticle immunoassay)

- Patient sample is combined with antigens
- If reactive, patient antibodies bind to antigens. All unbound material is discarded.
- Additional chemicals are added which make antibodies glow
- Specialized equipment looks for light emission



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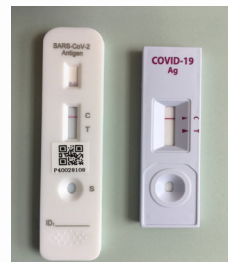
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## Serology Test Takeaway

- One big lesson about serology tests...
  - Sometimes identify **active** infection. (e.g., antigen, some antibody)
  - Sometimes identify **past** infection. (e.g., some antibody)
- Why is this important?
- How do you know?
  - Investigative Guidelines / Lab Test Menu / Lab Results
  - Tune in later!

## Antigen Tests – To Detect Pathogens (Proteins)

- Uses an extraction reagent combined with patient sample to detect proteins (antigens) on the outside of the virus
- Types:
  - Lateral flow – test card with visual color change
  - Immunofluorescence – require an instrument to read the result
- Most useful with reasonable risk of infection (e.g., **symptomatic**, close contact to a case)
- Examples: Rapid tests for HIV, SARS-CoV-2, syphilis



## Molecular Tests – To Detect Pathogens (Genetic Material)

- Nucleic Acid Amplification Test (NAAT) and Polymerase Chain Reaction (PCR)
  - Molecular techniques to amplify and detect specific RNA or DNA targets of pathogen
  - Can detect a virus or bacteria
  - Can detect active/inactive or live/dead genetic material.
  - Examples: Chlamydia, gonorrhea, GeneXpert, SARS-CoV-2, influenza, *B. pertussis*, norovirus



## PCR vs NAAT in Public Health Response

PCR	NAAT
Test kit components put together at the lab	Pre-made kits from manufacturers
Manual processing	Automated platforms
Small instruments	Large instruments
Lower volume throughput	High volume throughput
Highly flexible – one instrument can be modified for different or emerging pathogens	Less flexible – instrument is not easily modified to test for emerging pathogens
First to be deployed for emerging pathogen response	Distributed later in emerging pathogen response

## Culture Tests – To Detect Pathogens

- Culture
  - Grow the organism on selective media
  - Examples: *B. pertussis*, enteric pathogen cultures



## Types of Tests – High Level

General Term	Method	What are you looking for?	Examples
Serology	Fluorescents (EIA; ELISA; IFA; CMIA)	Antibodies	HIV, syphilis FTA, hepatitis
Antigen	Antigen (sometimes rapid)	Proteins on exterior of virus	HIV, SARS-CoV-2
Molecular	NAAT/PCR	Pathogen DNA or RNA target	Chlamydia, SARS-CoV-2, pertussis, norovirus, influenza
Culture	Culture	Growth of a pathogen	Enteric pathogens, pertussis

## Test Results

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## What Can Results Mean?

Example: Enteric Pathogen Culture

- Result: Positive for a certain agent/pathogen
  - Patient's illness was caused by that pathogen
  - Patient is colonized with that pathogen, but their illness isn't caused by it.
  - Specimen was contaminated.
- Result: Negative for a certain agent/pathogen
  - Patient's illness not caused by the pathogen (caused by another pathogen that requires different testing)
  - Specimen was collected too late in illness or after antibiotics were started.
  - Specimen was handled improperly

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## What Can Results Mean?

Example: Chlamydia/Gonorrhea NAAT

- Result: Gonorrhea DETECTED
  - Patient's illness was caused by that pathogen
  - Patient had gonorrhea, was treated, and inactive bacteria was detected
  - Specimen was contaminated
  
- Result: Gonorrhea NOT DETECTED
  - Patient's illness was not caused by that pathogen
  - Insufficient or incorrect sample collected (not enough or no bacteria in specimen collection)
  - Specimen was handled improperly

## Review: Poll Questions