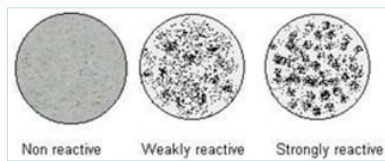


# Laboratory Tests



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## Questions to Explore

- What do we want to know from lab tests?
- Which lab tests can give us that information?
- What do the test results really mean?

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## Why Test?

- Infection status
- Immune status
- History of infection
- Linkages between cases
- Population level data

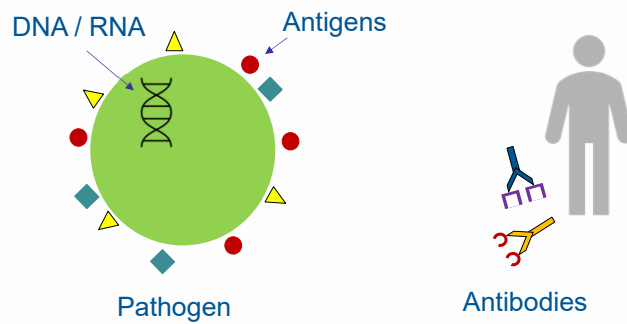
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## What are we testing?



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## Antibody Tests

What does it test for	<ul style="list-style-type: none"> <li>• Presence of antibodies in a patient sample</li> <li>• Has the patient been exposed to this pathogen?</li> </ul>
When would you use this test	<ul style="list-style-type: none"> <li>• May be actively infected</li> <li>• May have been infected in the past</li> <li>• Check for immunity</li> </ul>
Examples	<ul style="list-style-type: none"> <li>• Hepatitis</li> <li>• HIV</li> </ul>



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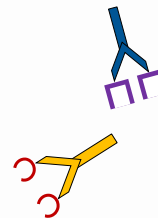
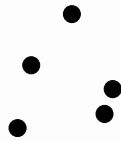
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## Antibody Tests

● Synthetic antigens

 Patient sample containing antibodies



Synthetic antigens are introduced with the patient sample. If the antibody is present, they bind. How we see this binding varies based on testing methodology.

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## Antibody Tests – More to Consider

- IgM tests
  - Detects IgM antibodies made **earlier** in infection
  - General defense
  - Less specific binding
  - Shorter term protection
- IgG tests
  - Detects IgG antibodies made **later** in infection
  - Specific defense
  - More specific binding
  - Longer term protection



Want to learn more? Check the OHA Investigative Guidelines!

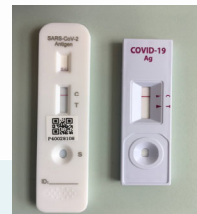
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## Antigen Tests



What does it test for	<ul style="list-style-type: none"> <li>• Presence of antigens in a patient sample or isolate</li> </ul>
When would you use this test	<ul style="list-style-type: none"> <li>• Patient may be actively infected (symptomatic, close contact with a case)</li> </ul>
Examples	<ul style="list-style-type: none"> <li>• Rapid HIV</li> <li>• Rapid SARS-CoV-2</li> <li>• Salmonella serotyping</li> </ul>

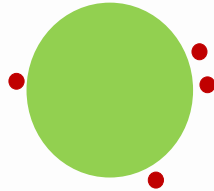
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## Antigen Tests



● Patient sample containing antigens

⌘ Synthetic antibodies



Synthetic antibodies for the pathogen being tested are introduced with the sample. If the antigen is present, they bind. How we see this binding varies based on testing methodology.



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## Culture Tests



What does it test for	<ul style="list-style-type: none"> <li>• Viable pathogen growth and isolation/identification of pathogen</li> </ul>
When would you use this test	<ul style="list-style-type: none"> <li>• Pathogen hasn't been identified yet</li> <li>• Want to study it further (subtyping)</li> <li>• Need to know if it is an active infection</li> </ul>
Examples	<ul style="list-style-type: none"> <li>• B. pertussis</li> <li>• Enteric pathogen cultures</li> <li>• Tuberculosis</li> </ul>

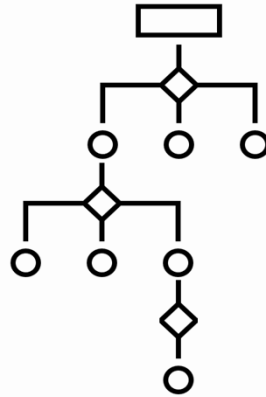
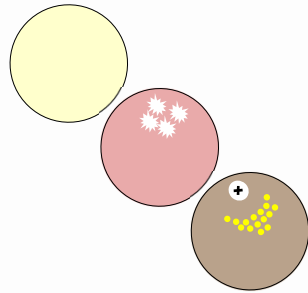
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## Culture Tests



A sample is placed in environments which promote/inhibit growth, depending on what is being tested. Growth characteristics are observed (speed, color, etc), and compared to known pathogen.



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## Molecular Tests

What does it test for	<ul style="list-style-type: none"> <li>• Presence of genetic material in a patient sample</li> <li>• Bacterial or viral</li> <li>• Active/live or inactive/dead</li> </ul>
When would you use this test	<ul style="list-style-type: none"> <li>• Test for something specific</li> <li>• High levels of sensitivity</li> <li>• Need a faster result than culture</li> </ul>
Examples	<ul style="list-style-type: none"> <li>• Norovirus</li> <li>• Influenza</li> <li>• Pertussis</li> <li>• Chlamydia</li> </ul>



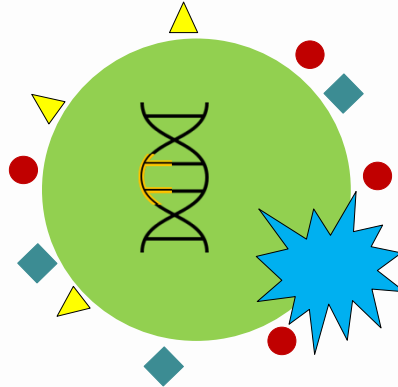
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## Molecular Tests



Known genetic sequences of a pathogen are introduced to a sample. If the sample contains the matching sequence, they pair up, replicate, and are detected by the instrument.

## PCR vs NAAT in Public Health Response



PCR	Automated NAAT
Individual components measured and mixed together at the lab	Pre-made kits from manufacturers
Manual processing	Automated platforms
Lower volume throughput	High volume throughput
Highly flexible – test/instrument can be modified	Less flexible – test/instrument is not easily modified
First to be deployed for emerging pathogen response	Distributed later in emerging pathogen response

## Testing Takeaways

- Some tests tell you about active infections:
  - Antigen, some antibody, culture, molecular
- Some tests tell you about past infections:
  - Some antibody
- How do you know?
  - Check the lab results
  - Look at the Lab Test Menu
  - Visit the Investigative Guidelines

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## Test Reports and Results

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## How to Read Reports

**Patient Info** → Patient name: TEST, SARS COV2 POS (U)      Proficiency Testing 00000  
 Chart Number: 11/11/1911  
 Date of Birth: 11/11/1911  
 County of Residence: Unknown

**Submitter Info** → Date Collected: 5/11/2020  
 Date Received: 5/11/2020      Clinician: QA, Test  
 PHL ID Number:      Report Date: 5/11/2020

**Test Performed** → Aptima SARS-CoV-2, NAAT  
 Specimen Source: Nasopharyngeal Swab

**Result** → SARS-CoV-2      DETECTED

**Reference Range** → Reference Range: Normal Result = Not detected

**Testing Lab Info** → Lab Director: John L. Fontana, PhD, (HCLD) ABB      END OF REPORT (Final) 5/11/2020      TEST, SARS COV2 POS  
 CLIA: 38D0656824      CAP: 2442701      Page: 1      PHL ID:

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## What Can Results Mean?

### Example: Enteric Pathogen Culture

#### Shigella Culture

##### Final Report

Specimen Source  
Stool

RESULT  
Shigella flexneri serotype 3b

- 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.

#### Campylobacter Identification

##### Final Report

Specimen Source  
Stool

Submitted Media  
Solid Media

Campylobacter Final Result  
Campylobacter spp. not identified

- Patient's illness not caused by that pathogen
- 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

Gonorrhea Screen Final

Positive for rRNA

Reference Range: Normal Result = Negative for rRNA

- Patient's illness was caused by that pathogen
- Patient had gonorrhea, was treated, and inactive bacteria was detected
- Specimen was contaminated

Gonorrhea Screen Final

Negative for rRNA

Reference Range: Normal Result = Negative for rRNA

- 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





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# Recap

What Are We Testing?	Also Known As	Pros	Cons
Antibodies 	Serology	<ul style="list-style-type: none"> <li>• Can give info about current, chronic, past, and immune status</li> </ul>	<ul style="list-style-type: none"> <li>• Check what antibody was tested – all mean different things</li> </ul>
Antigens 	Serology	<ul style="list-style-type: none"> <li>• Tests for presence of pathogen</li> </ul>	<ul style="list-style-type: none"> <li>• Applicable use varies based on test – read the instructions!</li> </ul>
Molecular 	PCR, NAAT	<ul style="list-style-type: none"> <li>• Very specific</li> <li>• Flexible/adaptable technology</li> </ul>	<ul style="list-style-type: none"> <li>• Can detect “dead” material</li> </ul>
Pathogen 	Culture	<ul style="list-style-type: none"> <li>• Detects “live” material</li> </ul>	<ul style="list-style-type: none"> <li>• Can be fragile – make sure you handle specimens carefully</li> </ul>

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# Questions?

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