



Lab 2: Orientation to Microbiology II

Laboratory diagnosis of microbiological diseases plays a crucial role in identifying infectious agents, guiding appropriate treatment, and preventing the spread of infections. This process involves detecting and characterizing microorganisms such as bacteria, viruses, fungi, and parasites using various diagnostic techniques.

The significance of laboratory diagnosis extends beyond individual patient care. It helps in monitoring antimicrobial resistance patterns, guiding infection control measures, and supporting public health interventions. For example, rapid detection of multidrug-resistant organisms enables healthcare providers to implement appropriate isolation and treatment strategies, reducing the risk of outbreaks. Additionally, laboratory-based surveillance of emerging and re-emerging infectious diseases, such as COVID-19 and tuberculosis, is vital for early detection and containment efforts. Moreover, **laboratory diagnosis plays a key role in ensuring the rational use of antibiotics, minimizing the risk of antimicrobial resistance.**

Microbiological diagnostic methods are broadly classified into direct and indirect techniques.

Direct methods include microscopy, culture, antigen detection, and molecular assays such as polymerase chain reaction (PCR). These techniques allow for the identification and characterization of pathogens from clinical specimens, aiding in targeted antimicrobial therapy.

Indirect methods, such as serology, detect host immune responses to infections and are useful for diagnosing chronic or past infections.



Process of laboratory diagnosis

1. Specimen Collection

General Guidelines:

- Use **sterile containers** and appropriate collection tools (e.g., swabs, syringes, tubes).
- Collect specimens **before** administering antibiotics whenever possible.
- Minimize contamination by following **aseptic techniques**.
- Label specimens properly with **patient details, date, and time** of collection.

Specific Specimen Types & Collection Methods:

Specimen Type	Collection Method
Blood	Collected via venipuncture in blood culture bottles (aerobic & anaerobic).
Urine	Midstream clean-catch, catheterization, or suprapubic aspiration.
Sputum	Early morning deep cough specimen in a sterile container.
Throat Swab	Sterile swab from the tonsillar area, avoiding saliva.
Wound/Pus	Sterile swab or aspirated pus in a syringe.
Stool	Fresh sample in a sterile container; transport quickly for parasite detection.
CSF (Cerebrospinal Fluid)	Lumbar puncture into a sterile tube.



2. Storage of Specimens

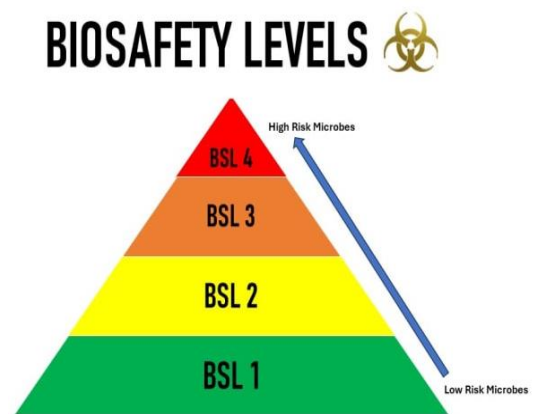
- **Room Temperature (15-25°C):** Blood cultures, CSF (if immediate processing is possible).
- **Refrigeration (2-8°C):** Urine, sputum, stool (if delayed processing).
- **Frozen (-20 to -70°C):** Some viral and molecular specimens if not processed immediately.
- **Avoid Freezing:** CSF, blood, and other specimens for bacterial culture.

3. Guidelines in microbial handling

Biosafety Levels (BSL):

Biosafety level (BSL) is a set of containment principles and protocols that define the level of safety precautions required when working with various biological agents in a laboratory setting. The Biosafety levels range from BSL-1 to BSL-4, each representing an increasing level of containment and safety measures.

- BSL-1 is the lowest level and is suitable for working with well-characterized agents that pose minimal risk to laboratory workers and the environment.
- BSL-2 involves moderate containment measures and is used for handling agents that pose a moderate hazard to personnel, but can be effectively contained with standard laboratory practices.
- BSL-3 requires additional safety precautions and is designed for work involving indigenous or exotic agents that can cause serious diseases through inhalation.
- BSL-4 is the highest level of containment and is reserved for handling the most dangerous and exotic agents that pose a high risk of transmission and severe or fatal diseases with no known treatments or vaccines.



CDC 24/7 **4 BIOSAFETY LAB LEVELS**

BSL 1

- BSL 1
- 1 controlled access
- 2 hand washing sink
- 3 sharp hazards warning policy
- 4 personal protective equipment
- 5 laboratory bench
- 6 autoclave

BSL 2

- BSL 2
- 1 controlled access
- 2 hand washing sink
- 3 sharp hazards warning policy
- 4 physical containment device
- 5 personal protective equipment
- 6 laboratory bench
- 7 autoclave

BSL 3 (WITH RISK-BASED ENHANCEMENTS)

AIR TIGHT (WHEN DISINFECTING)

- BSL 3
- 1 self-closing double-door access
- 2 controlled access
- 3 shower out
- 4 sharp hazards warning policy
- 5 hand washing sink
- 6 sealed penetrations
- 7 physical containment device
- 8 powered air purifying respirator
- 9 laboratory bench
- 10 autoclave
- 11 exhaust HEPA filter
- 12 effluent decontamination system

AIR TIGHT (WHEN DISINFECTING)

BSL 4

AIR TIGHT

- BSL 4
- 1 self-closing double-door access
- 2 controlled access
- 3 sharp hazards warning policy
- 4 hand washing sink
- 5 sealed penetrations
- 6 physical containment device
- 7 positive pressure protective suit
- 8 laboratory bench
- 9 autoclave
- 10 chemical shower out
- 11 personal shower out
- 12 supply and exhaust HEPA filters
- 13 effluent decontamination system

AIR TIGHT

Legend: ● Required safety equipment ● Risk-based enhancements

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