University of Minnesota Lab Medicine and Pathology

Clinical Microbiology Rotation

Location: Mayo A205 – Infectious Diseases Diagnostic Laboratory (IDDL)
Duration: Two months
Rotation Director: Patricia Ferrieri, MD, Medical Director – pager: 899-2191
Other Faculty: Sophie Arbefeville, MD, Assistant Medical Director – pager: 899-8125

Goals and Objectives:

The learning objectives below reference the corresponding ACGME core competencies: Patient Care (PC), Medical Knowledge (MK), Professionalism (Prof), Communication Skills (CS), Practice Based Learning and Improvement (PBLI), and Systems-Based Practice (SBP).

Objectives: The general expectations below are expected throughout the rotation. At the end of the rotation, residents are expected to meet/exceed the goals and objectives of each of the subsequent subheadings:

A. A trainee who has satisfactorily completed the rotation is expected to:

1. Be able to perform a high quality Gram's stain and will be able to distinguish between –
   a. Gram-positive and Gram-Negative organisms, and
   b. Rods, cocci, and yeasts
2. Be able to read direct Gram stains on clinical specimens, recording the approximate numbers and types of organisms and white blood cells seen
3. Be able to streak plates and obtain isolated colonies
4. Be able to distinguish colonies of streptococci, staphylococci, and Gram-negative rods on sheep blood agar plates. Be able to recognize colonies which are not streptococci, staphylococci, or Gram-negative rods, such as diphtheroids, Bacillus, Neisseria, yeast, etc. Perform Gram stains of colonies when unable to distinguish them macroscopically
5. Be able to distinguish the various species of Gram-negative bacilli on the commonly used differential media on the basis of their colonial morphology and fermentation reactions
6. Be familiar with the media described in Laboratory Procedures in IDDL. When questioned will –
   a. Give at least the use for each medium
   b. Explain why the medium is used, and
   c. How the medium works:
7. When given a mixture of Gram-positive cocci and Gram-negative rods, be able to separate them in one day, by using proper media and techniques
8. When given a species of a clinically important bacterium be able to identify it, using the reference material at hand (the laboratory or other recommended references)
9. When given any clinical specimen, select the appropriate media necessary for the isolation of clinically important bacteria from that specimen -
   a. Be able to recognize and identify the normal flora which might be found in any given clinical specimen and will be able to list the important pathogens to be found in any specimen;
   b. Be able to state the reason for using each type of medium used for a given clinical specimen
10. Be able to understand and discuss modern blood culture and blood fungus detection systems and other automated equipment for microbial identification, such as the MALDI-TOF mass spec
11. Be able to state the clinical significance of each organism when given actual laboratory reports of respiratory, urine and other miscellaneous cultures
12. Be able to relate the principles upon which antimicrobial dilution and disc diffusion susceptibility testing is based and understand other tests e.g.: E test, modified Hodge test, etc.
13. Be able to outline the methodology for two different antimicrobial assay procedures and describe the appropriate temporal collection of specimens, and, in addition, be able to perform an assay by one of the procedures outlined for defining the antibiotic level in serum. Examples MIC/MBC
14. Be able to outline the methodology and value of the serum bactericidal assay, and be able to perform this procedure.
15. Be able to describe the methods of appropriately obtaining culture specimens from all body areas, and be able to outline proper methods of specimen transport to a laboratory facility.
16. Be able to describe the necessary components of an effective and an efficient quality control program for a microbiology laboratory.
17. Be able to relate the necessary features of a laboratory safety program.
18. Understand the principles of PCR based assays for pathogens – e.g. N gonorrhoeae and Chlamydia; NAAT for Group A Strep; RT PCR assays of C. difficile toxin A, MRSA, Group B Strep, Enterovirus in CSF, etc.
19. Understand enzyme immunoassay principles for detection of microbial products and antibodies, e.g. Giardia antigen; Lyme antibodies.
20. Understand rapid antigen detection systems – e.g. direct specimen tests – CSF, urine and direct bacterial colony tests (examples –latex agglutination for Hib and group B strep, ELISA based assays). Also S. pneumoniae, Legionella, and malaria rapid antigen tests.
21. Understand general principles of anaerobic bacteriology, including collection and processing of specimens.
22. Differentiate and identify common moulds and parasites.
23. Understand epidemiology of mycobacterial infections and general concepts of identification of major species of Mycobacteria, including molecular approaches.
24. Have an understanding of principles of general virology, indications for virus cultures, rapid antigen detection, antibody assays for various viruses, including HIV.
25. Understand the principles of Molecular Microbiology and viral quantitative molecular assays and other molecular assays. (See next on Molecular Microbiology Section).

B. Molecular Microbiology Section Rotation (contained within the regular microbiology rotation)

Upon completing this area of the laboratory rotation, the resident is expected to be able to:
1. Demonstrate an understanding of the technical, interpretive, quality control, and validation aspects as well as the clinical implications of the various tests performed in the microbiology section of IDDL, including:
   a. Viral load tests.
   b. Direct molecular detection of viruses, bacteria and fungi in various body fluids.
   c. Identification of cultured bacteria by sequencing of rRNA genes.
   d. Antimicrobial resistance testing by directed mutation testing, or nucleic acid sequencing.
2. Demonstrate an understanding of the pre-analytical, analytical and post-analytical issues relevant to accurate performance of the tests performed in the laboratory.

C. General Expectations in the IDDL

Patient Care
1. Perform, review, interpret and report tests performed in the IDDL microbiology sections.
2. Understand the clinical implications and limitations of these tests and, when appropriate, communicate these to ordering physicians.
3. When these tests are inadequate to answer relevant clinical questions, help the treating physician identify clinically appropriate tests, laboratories performing such tests, and assist the clinician in interpreting these tests.

Practice Based Learning and Improvement
1. Regularly collect and study the literature relevant to testing performed in microbiology and demonstrate the ability to critically evaluate and compare published material.
2. Evaluate published literature to determine the clinical value of tests performed in the microbiology laboratory and identify future directions in testing to improve the ability of the microbiology laboratory to assist in patient care.

**Interpersonal and Communications Skills**

During the rotation, residents must demonstrate interpersonal and communication skills that result in effective information exchange and teaming with other health care providers, laboratory personnel, patients, and patients' families. Towards this end they shall:

1. Develop effective working relationships with professional and technical staff in the microbiology laboratory, and outside consultants.
2. Demonstrate effective verbal communication skills when communicating results to clinicians, at the appropriate level for the information being transmitted; convey and explain test results clearly, precisely, and concisely to physicians in direct conversations, or at conferences; communicate effectively with technical personnel when troubleshooting assays, or when managing the laboratory.
3. Develop excellent written skills for communication of complicated results when issuing reports, for the development and implementation of new laboratory policies and procedures, and for presentation of scientific research data, as appropriate.
4. Develop presentation skills that include selection of appropriate presentation materials and visual aids, good oral presentation and mannerisms, and the ability to answer questions effectively.

**Professionalism**

Demonstrate habits leading to excellence in professional performance, which includes:

1. Perfect attendance at all laboratory activities; attend daily Lab rounds; CP conference; LMP Grand Rounds; M&M conference;
2. Reliability in each assigned duty;
3. Completeness of work-up of each case;
4. Dedication to patient care;
5. Maintaining appropriate and cordial relationships with laboratory and clerical personnel, with attending-staff and with other fellows and residents.
6. Complete a case report/week (approximately 6-7 per rotation)

**Systems Based Practice**

Residents must demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to call on system resources to provide microbiology services that are of optimal value.

Towards this they shall, where appropriate:

1. Provide guidance to clinicians to ensure that testing in the IDDL is used and integrated into patient care in an appropriate and cost-efficient manner.
2. Demonstrate knowledge of scientific, legal, and ethical issues relating to microbiology testing.
   a. Understand the implications not only to patients, but also to the community at large, of results of microbiology tests.
   b. Understand the ethical basis and the legal requirement for informed consents for HIV related tests.
   c. Monitor the compliance of the laboratory with these requirements in cases that the resident is involved with.
   d. Demonstrate an understanding of the regulatory issues governing the operations of the laboratory, including CLIA regulations, CAP implementation of CLIA regulations, and the various guidelines of the Clinical Laboratory and Standards Institute (CLSI) to help laboratories meet these guidelines and provide optimal testing services to patients.
3. Demonstrate knowledge of the impact of laboratory management and activities on other health care professionals, organizations, and society.
4. Understand financial and economic systems in which the laboratory operates, including billing, the appropriate use of current procedural terminology codes, diagnostic codes, and health insurance and reimbursement issues.
5. Practice cost-effective health care and resource allocation that does not compromise quality of care.
6. Demonstrate an understanding of the impact of nucleic acid based organism identification and typing on infection control activities of the hospital and the mitigation of the spread of infections in the community at large.
7. Be an advocate for quality patient care and contribute to clinician education.
8. Demonstrate the ability to assess, understand, and use the resources, personnel, and health care systems necessary to provide optimal care.

General Reference Books:
- Manual of Clinical Microbiology. 2 volumes ASM Press 11th edition (or earlier or the most recent)

During the rotation, the trainee is expected to join the following Conferences:
- Daily Lab Rounds
- Clinical Pathology Conference: Tues 12:00-1:00 PM (weekly) – Mayo D175
- Resident Didactic Series: Wed 7:00-8:00 AM & 9:15-10:15 AM (weekly) – Mayo D175
- Lab Medicine/Pathology Grand Rounds: Wed 8:00-9:00 AM (weekly) – 450 MCRB
- Morbidity & Mortality Conference: Fri 12:00-1:00 PM (weekly) – Moos 2-690

Assessment methods:
Resident performance on this rotation will be assessed by:
- Global performance assessment completed by Microbiology attending physicians
- Formative feedback will be provided by Microbiology attending physician