CLINICAL MICROBIOLOGY ROTATION

SAINT LOUIS UNIVERSITY HOSPITAL
AND VA MEDICAL CENTER

I. GOALS AND OBJECTIVES

The goal of the microbiology rotation is to help you acquire basic knowledge and skills in this subject, which may be applied to your chosen specialty of Pathology. We hope to prepare you also for the microbiology portion of the pathology boards. The majority of the microbiology training occurs in the microbiology lab at the University Hospital. Additional training occurs at the VA (see separate rotation objectives).

At the completion of your microbiology experience's you should be able to:

1. Understand the collection and processing as well as appropriate culture set-up for clinical specimens.
2. Evaluate sputum gram stains for adequacy of sample and for preliminary diagnosis.
3. Evaluate direct smears and tissue sections for fungal and acid fast organisms and provide a preliminary diagnosis based on staining and microscopic exam.
4. Formulate a differential diagnosis of agents based on clinical history, lab data and microbiological data.
5. Identify the commonly seen aerobic and anaerobic microorganisms seen in the lab by colonial morphology on different media and by knowing key biochemical reactions important in their identification.
6. Have a working knowledge of the commonly encountered/clinically important mycobacteria, yeasts and fungi including lab diagnosis and tissue diagnosis.
7. Be knowledgeable about the mechanism of action of major antibiotic groups, the mechanisms of resistance, and in vitro methods to detect resistance.
8. Be knowledgeable in the various automated instrumentation systems used in clinical microbiology for identification and antibiotic susceptibility testing of organisms, including interpretation of test results.
9. Be knowledgeable about the various manual susceptibility tests.
10. Be knowledgeable in appropriate antibiotics for treatment of different species of bacteria especially strategies for treatment of resistant organisms.
11. Be knowledgeable in alternative instrumentation and processes for identification of infectious organisms such as ligase chain reaction and DNA probe.
12. Provide consultation to requesting clinicians as well as medical technologists.
13. Understand basic microbiology administrative functions and participate in management of the laboratory.
14. Evaluate specimen slides for infectious diseases to include histology, gram stains, and special stains. Be able to identify bacteria, yeasts, fungi, and tissue and blood parasites.
II. DURATION OF THE EXPERIENCE

The rotation in clinical microbiology (including two-week virology) will last three months. Usually this involves a two-month rotation early in your residency training and a second one-month rotation later.

The first month of microbiology is always at the University Hospital for a very important reason; the first month is basic "hands-on" bench experience and demonstrations. This foundation is essential if you are to progress in subsequent months by building on this foundation. The first month of microbiology, therefore, is dedicated to bench techniques.

III. DUTIES AND RESPONSIBILITIES OF THE RESIDENT

During the Microbiology rotation, the resident is expected to find interesting cases/isolates for the Monday plate rounds with Infectious Diseases (11:00 A.M). Also the resident is expected to present a clinical microbiology case at weekly lab medicine rounds during the rotation. (See below). The resident is expected to attend the weekly Infectious Diseases Conference (Thursday noon) and during the second month of the microbiology rotation, the Directors Meeting at the University Hospital (Wednesday 9:15 am).

MONTH 1

Upon beginning this first month of microbiology you will be given a prepared schedule of bench rotations. These rotations are completed during this month allowing an overview of the various specimen work-ups and interpretations. The following basic bench tasks are included for this first month:

1. SPECIMEN PROCESSING AND DIRECT STAINS (2 days)

   A. Observe what occurs in the processing area. The reasoning for this exercise is:

      • It will help you to deal with clinicians, on site FNA, frozen section situations where you may be required to inform clinicians how to collect, store and order various microbiology tests.

      • You will verify what constitutes bad/good, acceptable/ unacceptable specimens.

   B. Look at as many gram stains as possible; match your observations with those of the technologists. Review any acid-fast stains, calcofluor white stains and smears for malarial parasites.
2. URINE CULTURES (2 days)

This is a good bench to see reactions of gram-negative rods on MacConkey agar. You will need to know how the lactose fermenters appear, how the nonlactose fermenters and oxidative rods react. Set up urine unknowns. Determine the type of media to use and perform quantitative cultures.

3. BLOOD CULTURES (3 days)

Observe blood culture bench. Prepare and read any gram stains from suspected positive bottles. Observe identification of isolates. A blood culture unknown will be provided. The bottles should be loaded in the Bactec instrument, incubated, subcultured and isolates should be identified and appropriate susceptibility testing should be performed.

4. RESPIRATORY CULTURES (2 - 3 days)

Distinguish normal flora from pathogens. Observe oxidase, catalase, coagulase tests. Know how the CAMP test is performed and why it is done. Observe “E test” and Kirby Bauer susceptibility testing. Work up unknowns.

5. MISCELLANEOUS CULTURES (1 week and cryptococcal antigen)

Note any positive CSF, pleural fluid or other normally sterile sites that produce positive cultures. Work up unknowns.

6. ANAEROBIC SPECIMENS (4 days and C. difficile toxin assay)

Learn how the anaerobic glove box works. Also read about the various anaerobic jars and know the principles of each. Ask the technologists to show you gram stains of the more common anaerobes. Observe the C. difficile toxin assay by enzyme-immunoassay.

7. MYCOLOGY (1 week)

Observe the techniques for identifying yeasts and molds. Become familiar with the media used. Know what is involved in preparing a microculture and a stained lactophenol cotton blue mount for review. Review permanent mounts of fungi. Read all calcofluor white smears and compare your results with those of the technologist.

8. MYCOBACTERIA (1 week)

Observe how we process pulmonary samples for growth and identification of mycobacteria (watch entire processing of sputum samples from receipt into the lab, specimen concentration and staining, set-up on media). Observe positives on LJ media. Observe identification procedures, i.e. biochemical testing and DNA hybridization. Perform auramine-rhodamine and Kinyoun stains and read acid-fast smears. Read the case histories provided and answer the study questions.
OTHER EXERCISES DURING MONTH ONE
Observe performance of LCX test for detection of Chlamydia and Neisseria gonorrhoeae.

MONTH TWO

1. Unless otherwise informed, the second month includes a two-week virology rotation with Dr. Swierkosz at Cardinal Glennon Hospital. (See separate sheet for Virology Objectives.) The resident is to make arrangements with Dr. Swierkosz for the scheduled virology rotation. It is strongly suggested that the resident do so within 2 weeks of starting the microbiology rotation.

2. Resident education in medical microbiology includes interaction with house staff for results of clinical significance. Residents interface with house staff to gain clinical information, review bench results of significant cultures and present these cases at clinical laboratory conferences. Where applicable, presentations are made in microbiology, plate rounds infectious disease conference, and to laboratory technical staff. The residents interact with the medical director and laboratory supervisor in reviewing bench procedures, CAP results and responses, verification of culture results, quality control and quality assurance.

3. Other administrative activities include participation in infection control committee once per month and attendance at the weekly Director’s meeting. The residents will continue to attend all weekly infectious disease conferences and when requested by I.D. fellows, present pathologic correlation to the cases. The residents present cases on Mondays to the I.D. fellows and rotating medical students and medicine residents at plate rounds.

4. Evaluate peripheral blood for malarial parasites. Know principle of thick and thin preparation.

5. Review antibiotics and antibiotic susceptibility testing.

6. Perform a concentration procedure on stool specimens submitted for ova and parasite examination. Identify common protozoans and ova present in stool specimens by iodine preparations of stool concentrate and in trichrome stained specimens.

7. Review slides and prepare iodine preps of CAP proficiency samples containing intestinal parasites.

8. Review of resident in-service examinations.

MONTH THREE - VA Rotation

During this rotation, the resident will function more independently.
1. During this rotation, you will be given trays of various unknown slides to be reviewed as a pretest. The results of your observation will be reviewed with you prior to the end of the month with Dr. Gibson.

2. Review of parasitology slides and specimens.

3. An open book test on parasitology covering clinical aspects as well as parasite identification. This is an open book test and minimum test score is 80%. Continuation of parasitology via series of review lectures (Dr. Gibson).

4. Additional lectures include (but not limited to):
   - Mycology Kodachrome lecture
   - Bacteriology Kodachrome review lecture

5. Special projects (as available) in microbiology and virology.

A. MANDATORY CONFERENCES/ROUNDS

**Infectious Disease Conference:** Thursday 12:00 noon. The second, third and fourth week Thursday conferences are held in the 8th floor Conference Room of the University Hospital. The First Thursday of the month, the conference is held at the VA Hospital meeting rooms located in the basement. This conference is excellent and is much better than attempting to attend rounds because the cases presented are the best that have been seen at Deaconess, Cardinal Glennon Children's Hospital, VA Hospital or University Hospital. Here you will have the opportunity to listen to clinical histories and formulate a differential diagnosis for the cases. A side benefit from this conference is that you will become familiar with which antibiotics are being used to treat various infections.

**Tuesday Noon Lab Medicine Rounds:** You already will be attending this conference and it is the Residency Director's policy that you will present a problem oriented presentation at this conference each week. This presentation should primarily emphasize microbiologic work-up of the case, but also include a thorough chart review of the patient. In the event of no available patient material, lab identification of microorganisms or review questions may be presented.

**Plate Rounds:** Monday at 11:00 am. These are presentations where the resident is able to present interesting findings to the ID team.

**Directors Meeting:** Wednesday, 9:15 a.m., Pinkerton Room (Month 2 only).

B. CONTINUING EDUCATION PRESENTATION
During each one month rotation at the University Hospital the resident will pick a topic of interest to them on clinical microbiology and discuss it (15 minutes maximum) with the medical technologists.

IV. TEACHING STAFF

Dr. Gretchen Johns, Dr. Sandra Gibson, and Dr. Ella Swierkosz will be the primary individuals responsible for the resident educational experience.

We are fortunate at the University Hospital to have highly qualified medical technologists and you are urged to take advantage of their experience and knowledge. Your bench rotation schedule will be posted for each week. Please contact the technologist you will be working with and let them know your schedule and when you plan to be there. If something comes up, please be sure and let the technologist know you will not be there, so that they will not wait for you and hold up their workday.

V. SUPERVISION AND EVALUATION

The resident is evaluated as to how they work with the medical technologists, infectious disease staff, their overall work ethic and their responsibility to the handling of patient problems.

Drs. Johns, Swierkosz, and Gibson both welcome the resident's input on how the rotation can be improved. We would also like you to honestly evaluate how you think the rotation prepared you for the board exam. Outcome assessment methods (below) are used in the resident overall evaluations, which are summarized on the standard resident evaluation form.

VI. OUTCOME ASSESSMENT METHODS

1. Each resident prepares and examines Gram stains, calcofluor white stains, and acid-fast stains of patient specimens, which are reviewed by a technologist. Interpretation of each type of smear must be correct for minimum competency.

2. Blood, urine, respiratory, CSF, and stool “unknowns” are provided. The resident must determine the appropriate media to inoculate, must differentiate pathogens from normal flora, performs identification procedures, and performs antibiotic susceptibility testing when appropriate. Identification of all pathogens and appropriate susceptibility testing and interpretation are required for minimum competency.

3. A set of study questions on bacteriology, mycology, and mycobacteriology is provided and discussed with the resident. Because this is an “open book” examination, the resident should correctly answer a minimum of 80% of the questions correctly.
4. Case histories and study questions are provided for acid-fast organisms. A minimum of 80% correct answers is considered acceptable.

5. A slide set of blood and intestinal parasites from CAP parasitology proficiency surveys is maintained for resident review. These are provided as unknowns to the resident and are subsequently reviewed by the resident. Likewise, formalin-fixed stool concentrates are provided as unknowns to the resident. Acceptable performance is identification of 80% of blood and intestinal parasites using reference books and atlases for identification.

6. In virology, specimen “unknowns” are provided for viral culture, antigen detection, and PCR. Study questions are also provided and discussed with the resident. Acceptable performance if recognition and identification of all viral pathogens.

7. Near the end of the microbiology rotation, ASCP resident in-service examination questions are reviewed with each resident. The most recent few years of exams are reviewed. A minimum of 70% correct answers is considered acceptable.

8. A written examination encompassing all topics addressed during the first two months is also provided. A minimum score of 70% is considered acceptable.

Rev. 2/2003

Microbiology Objectives
Pathology Resident Unknowns-Microbiology
Items Expected of Resident during Bench Training in Microbiology

1. **Bacteriology.** Specimens will be given to the resident for Gram stain (if appropriate), inoculation of plates, identification of relevant isolates, and appropriate antibiotic susceptibility testing. Results will be compared with those obtained by the microbiology technologist.

2. **Gram stain.** Five smears should be Gram stained and examined by the resident and results will be compared with duplicate smears prepared and read by a microbiology technologist.

3. **AFB.** 8 AFB smears will be read by the resident and results compared with those of the microbiology technologist. Also, the resident will answer a written exam of 40 questions and results will be reviewed with the technical supervisor.

4. **Calcofluor white stain.** 8 calcofluor smears will be stained and read by the resident and results compared with those of the microbiology technologist. Also, the resident will answer a written exam of 8 questions on mycology and results will be reviewed with the technical supervisor.
Teaching Resources
Resident Rotation in Microbiology

1. The residents rotate through each position in the microbiology (at SLU) and virology laboratories (at CGH) so that they observe all aspects of each lab. The residents are also given unknowns in both laboratories. They are expected to inoculate the appropriate media or cell cultures, read Gram stains or other appropriate stain, identify organisms, and perform antibiotic susceptibility testing appropriately. In virology, they also learn how to perform PCR and gel electrophoresis.

2. Detailed syllabus with reading list and assignments for each laboratory station prepared by Drs. Swierkosz and Johns.

3. An extensive collection of glass slides and questions covering bacteriology, mycology, and parasitology compiled by Dr. Gibson.

4. Lectures by Dr. Johns.

5. Ten AFB case histories with questions prepared by Margie Carey.

6. Three trays of lactophenol cotton blue permanent mounts of fungi prepared by Margie Carey.

7. Dr. Johns reviews previous RISE exams with the residents.

8. Trichrome and Giemsa stained slides from CAP parasitology surveys. Also stool concentrates from CAP survey for iodine mounts for detection of ova, cysts and larvae.
SAINT LOUIS UNIVERSITY DEPARTMENT OF PATHOLOGY
Microbiology and Virology Rotation

**Goals and Objectives**
During the rotation in Microbiology and Virology, the Resident will master the following skills:

- **Patient Care**
  Prepare weekly rounds presentation for the Infectious Disease Staff.

  Attend weekly Infectious Disease Conference

- **Medical Knowledge**
  Understand the principles of media selection, plating and culture examination for identification of bacterial, mycobacterial, fungal, and viral cultures.

  Understand the principles of antimicrobial susceptibility testing of bacteria, mycobacteria and fungi.

  Understand the preparation and interpretation of Gram, acid fast, and fluorescent stains for microscopic examination of specimens of bacteria, mycobacteria or fungi.

  Gain experience in the microscopic identification of ova and parasites.

  Understand the principles of PCR and RT-PCR and their application to clinical diagnostic microbiology and virology.

- **Practice-Based Learning and Improvement**
  Prepare and review Gram stains. Correlate with previous Gram stain results (if available) and culture results.

  Isolate and identify significant isolates from “unknowns”, e.g., urine, sputum, blood.

  Perform appropriate susceptibility testing.

- **Interpersonal and Communication Skills**
  Learn proper procedures for communicating culture results to clinicians, infection control committees and government agencies that monitor reportable diseases.
• **Systems-Based Practice**

Understand the principles of specimen collection, transport and processing for aerobic and anaerobic bacterial, fungal, mycobacterial, and viral samples from a variety of sources.

Understand the principles of automated equipment for monitoring of aerobic and anaerobic blood cultures for growth.

Know the algorithms for reporting culture results, including standard incubation times, culture identification and antimicrobial susceptibility.

Learn proper methods for specimen collection, transport and processing of specimens for identification of ova and parasites.

**Duration**

The Microbiology/Virology rotation is three months in length.

**Duties and Responsibilities of Residents**

Resident training in Microbiology is taught at two times. The first rotation is two months long; the second rotation is one month long. During the 3 months rotation each Resident is expected to perform the following activities:

Rotate through all bench areas in bacteriology, virology and parasitology.

Prepare weekly laboratory rounds to the Infectious Disease Staff.

Attend weekly Infectious Disease Conference.

Attend and present at the weekly clinical pathology conference. This entails preparing a written synopsis of a case encountered in the laboratory during rotation which includes a description of the case, the microorganism involved, the diagnostic testing required, the appropriate antibiotic susceptibility testing and interpretation, and therapy and literature references.

Review all Gram stains and correlate with culture results and share findings with technologist.
Participate in problem solving sessions said with supervisors/medical director and technologists.

Complete “unknowns” which consist of patient samples, smears, case studies. Specimens are incubated, pathogens are identified, and appropriate susceptibility testing and interpretation is performed.

During the third month of the microbiology rotation, which is at the John Cochran VA Medical Center, histopathologic diagnosis of infectious diseases is stressed. Other areas covered are parasitology, viral load testing for HIV, and serologic diagnosis of infectious diseases.

Participate in teaching sessions and review of cultures with supervisors/medical director.

Participate in completion of CAP proficiency surveys.

Confer with medical staff/surgical pathology, etc. regarding culture results, service needs, etc.

For the two week experience in virology see the Virology rotation objectives.

**Teaching Staff**

Ella M. Swierkosz, Ph.D. - Director of Microbiology, Saint Louis University Hospital

Sandra Gibson, M.D. – Director of Microbiology, John Cochran VA Medical Center

**Supervision and Evaluation**

Residents meet on a regular basis with the Director of the rotation to discuss their performance.

Residents are evaluated on medical ability, knowledge, work habits, educational initiative, and personal attributes. Evaluations are forwarded to the Residency Program Director.

The ability of the resident to correctly identify pathogens, perform appropriate susceptibility testing, select appropriate antibiotics for organism and patient specimen and correctly interpret susceptibility testing results are also evaluated by the use of graded unknown bacterial and viral specimens.

A final written examination covering all aspects of microbiology is also a major part of the evaluation.