MEDT 477 - Clinical Microbiology Practicum

COURSE SYLLABUS

INTRODUCTION

The clinical practicum is the culmination of several years of study. It is an exciting time for students, and offers unique experiences in the clinical laboratory setting. Students will achieve from this experience benefits comparable to the effort they put forth.

STUDENT LEARNING GOALS

Student learning goals for the clinical microbiology practicum focus on active participation in daily laboratory operations and personal performance as a laboratory professional. Thus, the learning goal for the technical portion of the clinical microbiology practicum is to facilitate and enhance the student's application of clinical microbiology theory, laboratory experience, and test data interpretation learned in campus courses to an active clinical laboratory setting. To accomplish this goal, students will apply principles of pre-analytical, analytical, and post-analytical components of laboratory practice in clinical microbiology to the performance of laboratory operations in a contemporary clinical setting. The learning goal for the professional component is for students to attain high level interpersonal performance so as to interact professionally with fellow staff and all consumers of laboratory testing. The ultimate outcome of a successfully completed practicum experience is the ability to perform testing of the highest quality to support the laboratory's role in quality patient care and safety. Student achievement during this practicum course will lay the foundation for success as an entry-level medical laboratory scientist.

GENERAL COURSE OBJECTIVES

Upon the completion of this course, based upon the objectives detailed in this document, the student must achieve a final minimum average of 70% on the assessment tools utilized in this course.

Upon successful completion of the clinical practicum, studying assigned materials, and reviewing materials associated with the course objectives from MEDT 360/362, 390/391, 406/416, and 430/431, the student will:

1. Demonstrate proper procedures for the collection, safe handling, and analysis of biological specimens to the satisfaction of the clinical instructor.

2. Utilize scientific principles, methods for identifying, and clinical decision making for the identification of clinically significant microorganisms.

3. Perform laboratory testing with accuracy to the satisfaction of the clinical instructor.

4. Operate equipment properly and perform preventive and corrective maintenance according to the manufacturer's directions to the satisfaction of the clinical instructor.

5. Apply problem solving steps for determining instrument/methodology problems utilizing instrument manuals, laboratory procedure manuals, and information contained in package inserts to the satisfaction of the clinical instructor.

6. Utilize proper techniques in the performance of all laboratory testing to the satisfaction of the clinical instructor.

7. Evaluate correctly laboratory test results to determine disease diagnosis.

8. Evaluate correctly acceptability of quality control and test result data.

9. Discuss the impact of total quality management on laboratory operations, including relevance to the pre-analytical, analytical, and post-analytical stages of the testing process.

10. Comply with established safety regulations and regulations governing regulatory compliance related to laboratory practice to the satisfaction of the clinical instructor.

11. Assess correctly critical pathways to facilitate diagnosis and to determine additional testing as warranted.

12. Communicate effectively and professionally as a member of the healthcare team to enable consultative and educational interactions with other healthcare personnel, the public, and patients to the satisfaction of the instructor.

13. Demonstrate ethical behavior and professionalism, including maintaining the confidentiality of patient information to the satisfaction of the instructor.

14. Participate in continuing education as opportunities arise for one's own professional career development to the satisfaction of the instructor.

OUTCOME EXPECTATION FOR STUDENTS BASED ON UNIVERSITY, PROGRAM, AND COURSE STUDENT LEARNING GOALS AND OBJECTIVES

The student learning goals and objectives, as stated for MEDT 477 Clinical Microbiology Practicum, provide the foundation for student achievement of the Medical Laboratory Science Program's student learning goals and objectives. Achievement of the Program's combined goals and objectives is necessary for students to gain the knowledge needed to be successful entry-level medical laboratory scientists, as well as successful on passing the Board of Certification national examination. Additionally, the Medical Laboratory Science Program's student learning goals and objectives support student accomplishment of the University's general education goals for undergraduate students. The University's general education goals support a comprehensive understanding of the liberal arts and sciences, fostering student development for success in an increasingly challenging global society. The synergy for this collaborative educational effort is expressed in the table entitled "University and MLS Program Educational Goals and Objectives".

University and MLS Program Educational Goals and Objectives

UNIVERSITY GENERAL EDUCATION GOALS	MLS PROGRAM OBJECTIVES, SUPPORTING GEN ED GOAL(S) GED ED #:	MEDICAL LABORATORY SCIENCE PROGRAM EDUCATION OBJECTIVES	MEDT477 COURSE OBJECTIVE(S) SUPPORTING MLS ED OBJECTIVES COURSE OBJ #
1-Read critically, analyze arguments & information, & engage in constructive ideation.	**5**	**1**-Demonstrate proper procedures for the collection of safe handling & analysis of biological specimens.	**1**
2-Communicate effectively in writing, orally, & through creative expression.	**5**	**2**-Utilize scientific principles (e.g. physiology, immunology, biochemistry, molecular biology, genetics, microbiology, etc.), laboratory principles and methodologies for the clinical setting.	**2**
3-Work collaboratively & independently within & across a variety of cultural contexts and a spectrum of differences.	**5**	**3**-Perform laboratory testing with accuracy.	**3**
4-Critically evaluate the ethical implications of what they say and do.	**1,3**	**4**-Evaluate problems that impact on laboratory services and take corrective action.	**4**
5-Reason quantitatively, computationally, and scientifically.	**1,5**	**5**-Operate equipment properly, troubleshoot, and perform preventive and corrective maintenance.	**5**
	5	**6**-Utilize proper technique in the performance of all laboratory testing.	**6**
	1,5	**7**-Interpret clinical significance, clinical procedures, & laboratory test data accurately.	**2, 7, 11**
	5	**8**-Evaluate laboratory data using statistical analysis.	**8**
	1,5	**9**-Apply principles of continuous assessment to all laboratory services.	**9**
	1,2,5	**10**-Utilize principles of quality assurance and quality improvement for all phase of laboratory services (i.e. pre-analytical, analytical, & post-analytical).	**9**
	2,4	**11**-Comply with established laboratory safety regulations & regulations governing regulatory compliance related to laboratory practice.	**10**
	2,3	**12**-Communicate through oral and written skills effectively & professionally to enable consultative & educational interactions with healthcare personnel, the public, & patients in order to function successfully as a member of the healthcare team.	**12**
	4	**13**-Demonstrate ethical behavior & professionalism, maintain confidentiality of patient information, & participate in continuing education for one's own professional career development.	**13, 14**
	2,3	**14**-Apply principles of educational methodology to educate providers & users of laboratory services.	**N/A**
	1,5	**15**-Evaluate published scientific studies utilizing knowledge of research design.	**N/A**
	1,2,3,5	**16**-Apply principles & concepts of laboratory operations to critical pathways and clinical decision making, performance improvement dynamics of healthcare delivery systems in relationship to laboratory services, human resource management & financial management.	**11**
	1,3	**17**-Demonstrate a commitment to the future of medical laboratory profession through involvement in a national professional society.	**N/A**
	1,2,3	**18-**Demonstrate an understanding of human creativity & of various types of aesthetic & intellectual expression through study of the liberal arts.	**N/A**
	1,3	**19**- Demonstrate an understanding of the significance of cultural diversity as exhibited within the United States through study of the liberal arts including completion of a multicultural course.	**N/A**
	1,3	**20**-Demonstrate an understanding of the impact of globalization on society through study of the liberal arts.	**N/A**

COURSE DETAILS

This is a clinical practicum course, and it will meet at a clinical affiliate to be determined by the University instructor. Students will be notified of this location prior to the commencement of the clinical practicum. **Attendance at all clinical practicums is MANDATORY, and missed time must be rescheduled with the date/time at the discretion of the clinical instructor and the University instructor. See http://sites.udel.edu/mls/clinical-practicum-schedule/for further details about attendance expectations.**

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MODES OF INSTRUCTION

Clinical faculty will utilize various methods of instruction, including but not limited to a combination of:

- Clinical specimens
- Quality control materials
- Microbiology automated analyzers
- Assay of CAP survey samples previously analyzed and stock cultures
- Gram stain slides
- Positive O&P specimens
- Case studies

Students will receive instruction about proper operation of equipment, specimen processing, quality control, the use of the laboratory information system, and result interpretation and reporting mechanisms specific to the clinical facility where they are assigned.

METHODS OF ASSESSMENT

Upon the completion of this course, based upon affective, cognitive and psychomotor objectives, the student must achieve a final minimum average of 70% (C-) on the assessment tools utilized in this course. The clinical instructor will administer written quizzes. In addition, the clinical instructor will assign papers or projects that are relevant to the practicum. This component of the Evaluation comprises 40% of the practicum grade.

A practical examination is another means of assessment employed by the clinical instructor. The instructions and rubric for the practical examination will be provided to the student prior to commencing the practical examination. The clinical instructor will complete the practical grading rubric and will return it to the University instructor. This component of the Evaluation comprises 40% of the practicum grade.

Affective assessment is incorporated into the mid- and final-evaluation process. A mid-evaluation will be completed by the clinical instructor and will be discussed with the student. If there are any issues to be addressed, this will also be shared with the University instructor. The final MEDT 477 Clinical Microbiology Practicum Evaluation will be completed by the clinical instructor and discussed with/reviewed by the student. The affective component on the final Evaluation comprises 20% of the practicum grade.

A written final examination will be administered by the University instructor at the conclusion of the practicum. The University-administered written final examination component of the Evaluation does not affect the practicum grade, but is included on the form.

A sample MEDT 477 Clinical Microbiology Practicum Evaluation can be found at the end of this syllabus.

Additional Requirements
Journals are one of the most frequently prescribed methods of reflecting on lifetime experiences. Each student is required to maintain a journal for each clinical practicum period. The student may record the

sequence of daily events, as well as unusual or memorable situations or events that transpired and how he/she reacted to them. Think about what happened. How would you react the next time you encounter a similar situation? Or perhaps provide a commentary about a particular laboratory employee or environment that you encounter. Think about how your day impacted you professionally. Write regularly and record the date of each entry. Adhere to HIPAA and confidentiality guidelines; do not disclose any identifying facts or information. For more information and guidelines for the journal, see: http://sites.udel.edu/mls/clinical-practicum-evaluation/

Paperwork documenting attendance and orientation to the affiliate institution must be submitted to the University instructor at the conclusion of the practicum. Note that the attendance sheet must be signed by the Clinical instructor prior to completion of the practicum.

Site evaluations are a tool used by the Clinical and University instructors to assess the achievement of the clinical practicum experience and the academic preparation for it. Students are required to submit a completed Site Evaluation for each clinical practicum to the University instructor. These will be collated by affiliate institution and discipline, and will be provided in an anonymous format to the Clinical instructors during the summer following completion of the clinical practicums. Comments regarding academic preparation will be shared and discussed with the University instructors, and used to enhance the curriculum as indicated.

COURSE PREREQUISITES

MEDT 430/431
RESTRICTIONS:
Open to medical laboratory science majors only.

TEXTBOOKS AND OTHER RESOURCES

One of the following review books is required for all clinical practicums senior year and should be taken daily to your clinical practicum sites for review during slower periods:

Ciulla AP, Lehman DL. *Success! In Clinical Laboratory Sciences.* 4th ed. Upper Saddle River, NJ: Pearson Education, Inc.; 2010. ISBN: 978-0-13-512648-6

Tanabe, Patricia A., Holladay, E. Blair., eds. *BOC Study Guide: Clinical Laboratory Certification Examinations*. 5th ed. Chicago, Ill.: American Society For Clinical Pathology, 2014, c2009. Print. ISBN: 978-089189-5879

Students should refer to the textbook and lecture and laboratory course materials from MEDT 360/362, MEDT390/391, MEDT 406/416, and MEDT 430/431. Students are expected to review these materials in preparation for this clinical practicum experience. In addition, students are expected to use these materials as resources during this practicum, as well as in preparation for the written final examination.

Through the University of Delaware, students have online access to DELCAT – UD's library online catalog https://library.udel.edu/.

DRESS CODE

All University of Delaware Medical Laboratory Science majors assume responsibility for their own attire while in the clinical setting. Each site has established guidelines for employee/students. In addition to abiding by the guidelines of the site at which the rotation occurs, each student must adhere to the following minimum guidelines of the University of Delaware Medical Laboratory Science Program described below.

- Navy medical scrub uniforms are required. Clothing must be neatly pressed and colors must match. Hose or socks are required when wearing pants. Female students must wear neutral or white stockings/panty hose when wearing a skirt. White shoes are recommended; flat shoes are required. Cloth or open-toed shoes, jeans, and sweat shirts are not acceptable.

- Hair styles which extend below the shoulder must be tied back.

- A clean, white labcoat is required unless otherwise specified by the clinical site. A University of Delaware pin with your name, denoting status as a University of Delaware student must be worn at all times while at the clinical affiliate sites.
- Safety glasses must be worn while in the clinical laboratory as per University of Delaware requirements.

- For safety reasons, most jewelry is limited. Small post earrings that do not extend below the ears are acceptable, long necklaces or dangling bracelets are not. Facial, ear cartilage and tongue piercings must be removed while at the affiliate institution. Tattoos that are visible must be covered.

- The various clinical sites may have additional dress code requirements. The student must adhere to any additional requirements at that site.

- Each student is expected to present a professional appearance and attitude at all times. NO EXCEPTIONS!!

ACADEMIC HONESTY

Honesty is essential in the profession of Medical Laboratory Science. You are encouraged to become familiar with the UD Student Guide to University Policies <http://www.udel.edu/stuguide/current>. The content of the handbook applies to this course. If you have any questions about this policy please consult with the instructor.

ACADEMIC SERVICES

The University of Delaware offers a variety of academic services for students. These services include coordinating tutoring sessions, providing academic skills workshops, and providing assistance for students with ADHD and learning disabilities. Students are encouraged to contact the Academic Enrichment Center at 831-2805 or <http://www.aec.udel.edu> to take advantage of these services.

AFFECTIVE OBJECTIVES

The following objectives have been listed as general affective objectives, since they apply to the overall performance and participation by the student during clinical rotations at the affiliate institutions. Among other qualities, the student is expected to demonstrate dependability, organizational skills, time efficiency and the ability to work with others in accordance with a professional program of study. As a member of the health care team, it is expected that the student will maintain an appropriate professional demeanor at all times.

During the clinical rotations and upon completion of the program of study in Medical Laboratory Science, the student will:

1. Comply with the established dress code policy as outlined in the clinical practicum manual.
2. Report to the laboratory at the scheduled time.
3. Notify the Clinical Coordinator and the University Education Coordinator when unable to report to the clinical practicum.
4. Comply with the attendance policy as outlined in the clinical practicum manual.
5. Comply with instructions given either orally or written.
6. Demonstrate the ability to ask pertinent questions or for assistance if needed.
7. Demonstrate the ability to work independently within student guidelines.
8. Communicate courteously, effectively and professionally with instructors, laboratory staff, other healthcare personnel, patients, and visitors.
9. Demonstrate interest and enthusiasm for the medical laboratory science profession.
10. Accept evaluation of performance as constructive when offered by instructors and other laboratory personnel, and follow through with suggestions made.
11. Adhere to laboratory safety regulations in each clinical area.
12. Maintain a clean, organized work area.
13. Utilize reagents and supplies judiciously.
14. Replenish supplies required in the laboratory work area.
15. Demonstrate self-confidence in the operation of equipment and in the performance of laboratory procedures.
16. Report patient laboratory results only to authorized personnel.
17. Maintain the confidentiality of all privileged information.
18. Cooperate with other laboratory personnel to create a pleasant and efficient work environment.
19. Demonstrate the ability to concentrate on the laboratory test procedure being performed and the need to avoid distractions.
20. Demonstrate organizational skills through ability to coordinate the quantity of work needed to be done with the time available for its completion.
21. Practice acceptable quality assurance as established for each clinical area.
22. Defend the policy of running quality control samples according to laboratory protocol.
23. Coordinate theory with laboratory analysis to appropriately judge patient data.
24. Offer assistance to other laboratory personnel when scheduled assignment is complete.
25. Recognize technical problems and plan possible corrective action.

26. Maintain composure and work quality under stressful conditions.
27. Demonstrate concern for professional self-image and that of the medical laboratory science profession by practicing ethical behavior, participating in professional activities and attending professional seminars to maintain knowledge base.

COURSE OBJECTIVES RELATED TO SPECIFIC CONTENT AREAS

Upon the completion of this course, based upon the objectives detailed in this document, the student must achieve a final minimum average of 70% on the assessment tools utilized in this course.

I. **Professionalism**
II. **Specimen Management/Safety**
III. **Quality Control / Quality Assessment / Total Quality Management**
IV. **Blood Cultures**
V. **Respiratory Cultures**
VI. **Stool Cultures**
VII. **Urine Cultures**
VIII. **Anaerobic Cultures**
IX. **Miscellaneous**
X. **Susceptibility Testing**
XI. **Mycology**
XII. **Mycobacteriology**
XIII. **Parasitology**
XIV. **Virology**
XV. **Molecular Diagnostic and Immunologic Assays**

I. PROFESSIONALISM

Introduction
The student is expected to conduct himself/herself in a professional manner at all times. The ability to communicate in a respectful manner under all circumstances is an expectation of a professional. The student must remember that all patient information is privileged and as such strict confidentially must be maintained. The student should realize that in some ways his/her education is just beginning, and to remain current during the work years ahead, it is important to participate in continuing education activities on a routine basis. If continuing education activities are available at the affiliate institution during the practicum, it is expected that the student will avail himself/herself of the opportunity. Professional performance is guided by the affective objectives previously listed, and professional behavior is evaluated using the form located at the end of this syllabus.

Objectives
Upon successful completion of the clinical practicum, studying assigned materials, and reviewing materials associated with the course objectives from MEDT 390/391, 430/431, and 461/471, the student will:

1. Communicate effectively and professionally as a member of the healthcare team to enable consultative and educational interactions with other healthcare personnel, the public, and patients to the satisfaction of the instructor.
2. Demonstrate ethical behavior and professionalism to the satisfaction of the instructor.
3. Maintain confidentiality of patient information to the satisfaction of the instructor.
4. Participate in continuing education as opportunities arise for one's own professional career development to the satisfaction of the instructor.

Note: Review affective objectives and affective evaluation form.

II. SPECIMEN MANAGEMENT/SAFETY

Introduction
Thorough knowledge of safety procedures is essential before performing any duties in the clinical laboratory which might be hazardous to personnel. The microbiology department is responsible for monitoring departmental criteria for specimen acceptance, processing of various testing, evaluating and reporting laboratory results. The first step in the accurate diagnosis of infectious diseases is the proper collection and handling of specimens. These pre-analytical, analytical, and post-analytical factors are essential for quality assessment in the laboratory. Specimen handling involves the following steps:

- correct identification of patient
- correct specimen collection
- correct use of appropriate specimen containers
- correct labeling of forms and containers
- timeliness of transport
- correct identification of special procedures based on suspected pathogens
- correct handling in the laboratory with respect to selection of growth media, stains, incubation times and temperatures
- correct reporting of results
- correct time for specimen collection – blood cultures, etc.
- correct identification of special handling – ice, prechilled tubes, spin immediately, etc.

Prerequisite
The student will familiarize herself/himself with the overall management of the Microbiology Department.

Objectives
Upon successful completion of the clinical practicum, studying assigned materials, and reviewing materials associated with the course objectives from MEDT 380, 390/391, 406/416, and 430/431, the student will:

1. Explain the importance of safe and proper specimen collection and transport.
2. Evaluate the criteria for determining specimen quality.
3. State corrective actions to be taken to resolve specimen quality problems.
4. Discuss the specimen management system used by the microbiology laboratory.
5. Demonstrate the ability to accession specimens accurately according to laboratory protocol.
6. Demonstrate the ability to label specimens accurately according to laboratory protocol.
7. Distribute specimens to workstations appropriately to the satisfaction of the instructor.
8. Complete correctly daily worksheets according to laboratory protocol.
9. Report and/or call results according to laboratory protocol to the satisfaction of the instructor.
10. Identify correctly which specimen is appropriate for the culture requested, e.g., anaerobic cultures are not performed on stool specimens.
11. Examine correctly specimens for acceptance or rejection using laboratory guidelines.
12. Document correctly specimen rejection according to laboratory guidelines.
13. Demonstrate correctly the ability to enter patient information and culture results into a laboratory information system (LIS) if applicable.
14. Demonstrate proper technique in preparing smears for direct microscopic examination according to laboratory protocol to the satisfaction of the clinical instructor.
15. For each patient specimen, choose correctly appropriate media, proper atmospheric conditions, and incubation times and temperatures according to laboratory protocol.
16. Select potentially clinically significant isolates for identification.
17. Perform appropriate biochemical and molecular biology tests for the identification of microorganisms, according to laboratory protocol, to the satisfaction of the laboratory instructor.
18. Evaluate the results of biochemical and molecular biology tests to determine the most likely identification of microorganisms.
19. Explain the rationale for use of the biological safety cabinet.

20. Utilize correctly safe techniques in handling and disposal of infectious materials according to laboratory protocol.
21. Explain the function of an autoclave.
22. State the pressure (p.s.i.), temperature, and time most commonly used for sterilization of media and contaminated laboratory waste.
23. Comply with established safety regulations and regulations governing regulatory compliance related to laboratory practice to the satisfaction of the instructor.

III. QUALITY CONTROL / QUALITY ASSESSMENT / TOTAL QUALITY MANAGEMENT

Introduction
Quality is of utmost importance in every laboratory. Today's laboratories have a variety of programs in place to control, assess, and improve their quality. The purpose of quality control in the microbiology department is to ensure that the final product has an acceptable degree of conformity within previously established tolerance limits. It is only by constant self-evaluation of the laboratory's performance by thorough monitoring of reagents, equipment, culture media, and proficiency that a high level of expertise and accuracy can be attained.

Prerequisite
The student should read the department's quality control (QC), quality assessment (QA), total quality management (TQM), individualized quality control plan (IQCP) and/or continuous quality improvement (CQI) policies.

Objectives
Upon successful completion of the clinical practicum, studying assigned materials, and reviewing materials associated with the course objectives from MEDT 362, 390/391, 406/416, and 430/431, the student will:

1. Compare and contrast QC, QA, and TQM.
2. Evaluate laboratory QC data according to laboratory protocol.
3. Demonstrate the ability to identify appropriate corrective action when data fall outside of control range to the satisfaction of the instructor.
4. Justify the rationale for the QC program in the clinical microbiology laboratory.
5. List specific areas which require surveillance.
6. Discuss the criteria and frequency of media performance evaluations.
7. List each media component that allow for the selection and differentiation of organisms.
8. Explain the mechanism of each media component that allows for the selection and differentiation of organisms.
9. Evaluate reactivity of media using proper quality control procedures.
10. Discuss the necessity of written record keeping for: 1) all quality control, 2) periodic review of surveillance records, and 3) corrective action documentation.
11. Discuss accreditation requirements with regard to thermometers, CO_2 incubators, and sterilization procedures (i.e., autoclaving).
12. Discuss the use of proficiency testing.
13. Discuss the impact of TQM on laboratory operations, including relevance to the pre-analytical, analytical, and post-analytical stages of the testing process.
14. Apply correctly principles of TQM on laboratory operations, including relevance to the pre-analytical, analytical, and post-analytical stages of the testing process.
15. Discuss the role of the medical laboratory scientist in maintaining laboratory quality.

IV. BLOOD CULTURES

Introduction
Blood is one of the most important specimens received in the microbiology laboratory. Quick and accurate reporting of preliminary and final results can have lifesaving effects for the patient. The blood specimen must be handled correctly from collection to subculturing for the results to be valid.

Prerequisite
The student will complete assigned readings in procedure manuals, handouts, and reference books.

Objectives
Upon successful completion of the clinical practicum, studying assigned materials, and reviewing materials associated with the course objectives from MEDT 390/391, 406/416, and 430/431, the student will:

1. Explain proper blood culture collection procedures, including the recommended number of cultures to be collected and total blood volume relating to patient age.
2. Identify the proper incubation temperatures, times, and growth requirements for blood cultures.
3. List the major components of blood culture media.
4. Justify the inclusion of the major components of blood culture media.
5. Justify the rationale for performing blind subcultures on negative blood cultures maintained by a manual detection system.
6. Identify correctly visual signs of a positive blood culture.
7. Select correctly, procedures for the handling of positive cultures.
8. Perform correctly procedures for the handling of positive cultures according to laboratory protocol.
9. Explain the procedure and principle of automated blood culture detection systems used in the affiliate's laboratory.
10. Name the most frequently detected organisms isolated from blood cultures.
11. Differentiate correctly, possible blood culture contaminants from pathogens.
12. Discuss the significance of a positive blood culture.
13. Perform correctly blood culture Gram stains according to laboratory protocol.
14. Interpret correctly blood culture Gram stains read microscopically according to laboratory protocol.
15. Explain the principle of the acridine orange stain.
16. Perform blood culture acridine orange stain according to laboratory protocol to the satisfaction of the instructor.
17. Interpret correctly blood culture acridine orange stain read microscopically according to laboratory protocol.
18. Demonstrate positive blood culture work-up to include: 1) proper subculturing, 2) biochemical identification, 3) susceptibility testing and 4) molecular testing methods to the satisfaction of the clinical instructor.
19. Identify colony morphology and growth characteristics of pathogenic organisms commonly isolated from blood culture specimens to the satisfaction of the laboratory instructor.
20. Explain the affiliate's procedure for reporting positive blood cultures.
21. Correlate positive blood cultures with positive cultures from other sites for the same patient.
22. Correlate culture results with patient history and presentation.

V. RESPIRATORY CULTURES

Introduction
Respiratory cultures include all routine cultures of mouth, throat, nose, nasopharynx, ear, sputum, endotracheal tube aspirates, transtracheal aspirates and bronchial wash. These cultures are difficult to interpret, but with the help of a Gram stain, potential pathogens and contaminants may be recognized and differentiated
from those organisms representing "normal biota."

Prerequisite
The student will complete assigned readings in procedure manuals, handouts, and reference books.

Objectives
Upon successful completion of the clinical practicum, studying assigned materials, and reviewing materials associated with the course objectives from MEDT 390/391, 406/416, and 430/431, the student will:

1. List examples of all respiratory specimens possibly encountered in the clinical microbiology laboratory
2. Evaluate expectorated sputum culture rejection criteria by Gram stain review.

3. Perform correctly direct Gram stains of respiratory specimens according to laboratory protocol.
4. Interpret correctly direct Gram stains of respiratory specimens read microscopically according to laboratory protocol.
5. List organisms considered normal oropharyngeal biota.
6. List organisms commonly considered pathogenic from different respiratory sites.
7. Explain the rationale for selecting primary plating media for each respiratory specimen.
8. Use correctly primary plating media for each respiratory specimen.
9. Plate correctly all respiratory specimens to appropriate media.
10. Identify the proper incubation temperatures, times, and growth requirements for respiratory cultures.
11. Describe colony morphology and growth characteristics of normal biota and pathogens.
12. Differentiate correctly pathogens from normal biota in respiratory cultures.
13. Correlate colony morphology and growth characteristics of pathogenic organisms commonly isolated from respiratory specimens to the satisfaction of the laboratory instructor.
14. Quantify correctly potential pathogens in respiratory cultures.
15. Correlate direct specimen Gram stains with culture results.
16. Determine appropriate biochemical tests or adjunct procedures required for identification of significant isolates, e.g., X and V factor requirements for *Haemophilus* spp.
17. Perform correctly antimicrobial susceptibility tests as required, evaluating their appropriateness with regard to organism isolation.
18. Justify the rationale for use of transtracheal aspiration for collection of respiratory specimens.
19. Explain the principle of the agglutination test for *Streptococcus pyogenes* and other beta-hemolytic streptococci.
20. Correlate culture results with clinical history and presentation.
21. Evaluate respiratory cultures for epidemiological problems.
22. Evaluate the special procedures required for the isolation of *Nocardia, Actinomyces*, *Bordetella*, *Mycoplasma*, *Legionella*, fungi, and viruses from the respiratory tract.
23. Correlate culture results with patient history and presentation.

VI. STOOL CULTURES

Introduction
In most clinical laboratories, a stool specimen submitted for routine culture is examined for *Salmonella*, *Shigella*, and *Campylobacter*. Proper media selection and a rapid identification procedure are important tools for the microbiologist. The physician must alert the laboratory to look for other suspected pathogens. These pathogens might include *Yersinia*, *Vibrio*, *Aeromonas hydrophila*, *Pleisiomonas shigelloides*, *Staphylococcus aureus*, *Clostridium difficile*, enterohemorrhagic *E. coli*, and yeast.

Prerequisite
The student will complete assigned readings in procedure manuals, handouts, and reference books.

Objectives
Upon successful completion of the clinical practicum, studying assigned materials, and reviewing materials associated with the course objectives from MEDT 390/391, 406/416, and 430/431, the student will:

1. List the major bacterial pathogens found in stool specimens.
2. List each media component that allow for the selection and differentiation of all bacterial pathogens encountered in stool specimens.
3. Explain the mechanism of each media component that allows for the selection and differentiation of all bacterial pathogens encountered in stool specimens.
4. Explain the growth requirements and selective and differential media necessary for the isolation of:
    - *Campylobacter*
    - *Salmonella* and *Shigella*
    - *Vibrio, Aeromonas* and *Pleisiomonas*
    - *Yersinia*

- *Staphylococcus aureus*
- enterohemorrhagic *E. coli*
- yeast

5. Identify the proper incubation temperatures, times, and growth requirements for stool cultures.
6. Examine specimens for leukocytes utilizing direct stool smears to the satisfaction of the laboratory instructor.
7. Identify correctly suspicious colonies of each of the possible enteric pathogens on all differential and selective media.
8. Identify correctly colonies of normal fecal biota organisms on all types of media.
9. Select correctly the proper biochemicals, molecular biology methods, and serotyping to identify all pathogens.
10. Inoculate correctly the proper biochemicals, and serotyping, to identify all pathogens.
11. Identify colony morphology and growth characteristics of pathogenic organisms commonly isolated from fecal specimens to the satisfaction of the laboratory instructor.
12. Perform antimicrobial susceptibility testing on appropriate stool pathogens to the satisfaction of the laboratory instructor.
13. Perform correctly slide agglutination tests for serogrouping *Salmonella* and *Shigella.*
14. Explain what should be done if an organism does not serotype because of the presence of Vi antigen.
15. Compare and contrast the different mechanism of *Clostridium difficile* detection including: 1) bacterial cultures, 2) ELISA toxin assay, 3) glutamate dehydrogenase assay and 4) PCR.
16. Justify the rationale for screening stools for non-lactose fermenters.
17. Justify the rationale for screening stools for oxidase positive gram-negative rods.
18. Correlate culture results with patient history and presentation.

VII. URINE CULTURES

Introduction
Urinary tract infection is one of the most common bacterial diseases. The urine specimen is easy to obtain and can be collected in several different ways. A quantitative culture result can help diagnose significant bacteriuria and is performed by most laboratories.

Prerequisite
The student will complete assigned readings in procedure manuals, handouts, and reference books.

Objectives
Upon successful completion of the clinical practicum, studying assigned materials, and reviewing materials associated with the course objectives from MEDT 390/391, 406/416, and 430/431, the student will:

1. Compare the different methods employed to obtain urine specimens suitable for microbiologic analysis.
2. Plate urine specimens on the appropriate media to the satisfaction of the laboratory instructor.
3. Justify the use of each primary plating medium.
4. Identify the proper incubation temperatures, times, and growth requirements for urine cultures.
5. Quantify colonies of urine cultures plated with calibrated loops (e.g., 0.01 and 0.001 mL) to the satisfaction of the laboratory instructor.
6. Evaluate colony counts that do not correspond on both plates from the same urine and explain possible discrepancies.
7. Perform correctly quality control on a calibration loop.
8. Discuss the significance of colony counts as related to the methods of urine collection.
9. List organisms that are often urine contaminants.
10. Differentiate correctly grossly contaminated specimens from those which should be considered likely to contain pathogens.
11. Identify colony morphology and growth characteristics of pathogenic organisms commonly isolated from urine specimens to the satisfaction of the laboratory instructor.
12. Select correctly media to isolate overgrown organisms on subculture.

13. Select correctly appropriate biochemical tests for the identification of isolates.
14. Perform antimicrobial susceptibility testing as required to the satisfaction of the instructor.
15. Compare urine screening methods available.
16. List transport media available for urine specimens to decrease overgrowth of contaminants.
17. Correlate culture results with patient history and presentation.

VIII. ANAEROBE CULTURES

Introduction
Anaerobic bacteria are found in a variety of clinical specimens and often are involved in clinically significant infections. Because antimicrobial therapy is dependent on the species involved, it is important for the laboratory to isolate and identify these etiologic agents.

Prerequisite
The student will complete assigned readings in procedure manuals, handouts, and reference books.

Objectives
Upon successful completion of the clinical practicum, studying assigned materials, and reviewing materials associated with the course objectives from MEDT 390/391, 406/416, and 430/431, the student will:

1. Compare the following groups of bacteria in relation to their oxygen requirements:
    - obligate aerobes
    - obligate anaerobes
    - microaerophiles
    - facultative anaerobes
    - aerotolerant anaerobes
2. Identify correctly anaerobes found as normal biota in:
    - skin
    - upper respiratory tract
    - gastrointestinal tract
    - genitourinary tract
3. Discuss the types of infectious diseases commonly caused by anaerobes or their toxins.
4. Evaluate the types of specimens that are appropriate for the diagnosis of specific anaerobic infections.
5. List specimens that are usually unacceptable for anaerobic culture.
6. Explain the techniques and importance of proper collection and handling of anaerobic specimens.
7. Justify the rationale for the use of:
    - primary anaerobic plating media
    - enrichment broth media
    - primary aerobic plating media
8. List the key components of primary plating media.
9. Justify the use of the key components of primary plating media in culturing anaerobic bacteria.
10. Discuss the rationale for the aerotolerance test on all anaerobic isolates.
11. Select incubation temperature and time for each clinical specimen to the satisfaction of the laboratory instructor.
12. Compare the anaerobic incubation systems in use at the affiliate microbiology laboratory:
    - Gas-Pak
    - evacuation-replacement jar
    - glove box (anaerobic hood)
    - Bio-Bag
    - oxyrase ^{R} plates
    - Anoxomat system
13. Describe the microscopic, colony and biochemical characteristics of selected anaerobes including:
    - *Clostridium perfringens*
    - *Fusobacterium nucleatum*

- *Bacteroides fragilis group*
- *Prevotella melaninogenica*
- *Porphyromonas* spp.
- *Actinomyces* spp.
- *Peptococcus/Peptostreptococcus/Peptoniphilus* spp.
- *Propionibacterium acnes*
- *Veillonella*

14. Correlate Gram stains of direct smears or enrichment broths with culture results.
15. Identify medically important anaerobic genera of:
    - gram-negative rods
    - gram-negative cocci
    - gram-positive cocci
    - gram-positive spore-forming rods
    - gram-positive nonspore-forming rods
16. Justify the rationale for differentiating the *Bacteroides fragilis* group from other anaerobic gram-negative rods.
17. Identify anaerobic isolates with one or more of the following systems to the satisfaction of the laboratory instructor:
    - conventional biochemicals
    - micromethods dependent on growth of viable cells
    - rapid enzyme systems not dependent on bacterial growth
    - molecular biology methods
18. Describe the methods of performing anaerobic antimicrobial susceptibilities.
19. Discuss the problems encountered in performing anaerobic antimicrobial susceptibilities.
20. Correlate culture results with patient history and presentation.

IX. MISCELLANEOUS

Introduction
Miscellaneous cultures include all routine cultures of tissue, bone, CSF and other body fluids, wounds, genital tract, catheter tips, etc. Miscellaneous cultures are all routine cultures other than respiratory specimens, stools, anaerobic cultures, urines and blood cultures, which have individual unit objectives.

Prerequisite
The student will complete assigned readings in procedure manuals, handouts, and reference books.

Objectives
Upon successful completion of the clinical practicum, studying assigned materials, and reviewing materials associated with the course objectives from MEDT 390/391, 406/416, and 430/431, the student will:

1. List examples of miscellaneous specimens acceptable for culture.
2. List commonly detected normal biota and pathogenic isolates recovered from each miscellaneous source.
3. Differentiate sterile from non-sterile sites that may have normal biota.
4. Discuss the predisposing factors allowing normal biota to cause infection.
5. Justify the use of each of the primary plating media for each miscellaneous specimen.
6. Demonstrate specimen plating to appropriate media to the satisfaction of the laboratory instructor.
7. Identify the proper incubation temperatures, times, and growth requirements for each miscellaneous culture.
8. Perform correctly direct Gram stains of miscellaneous specimens according to laboratory protocol.
9. Interpret correctly direct Gram stains of miscellaneous specimens read microscopically according to laboratory protocol.
10. Interpret correctly Gram stains of bacterial growth read microscopically according to laboratory protocol.

11. Describe colony morphology and growth characteristics of pathogenic organisms commonly isolated from miscellaneous specimens.
12. Identify colony morphology and growth characteristics of pathogenic organisms commonly isolated from miscellaneous specimens to the satisfaction of the laboratory instructor.
13. Explain the growth requirements and selective and differential media necessary for the isolation of pathogens from miscellaneous specimens.
14. Perform antimicrobial susceptibility test as required to the satisfaction of the laboratory instructor.
15. Evaluate appropriate sensitivity patterns specific for each microorganism tested.
16. Select correctly proper media for subculture of potential pathogens.
17. Differentiate correctly commensals from potential pathogens.
18. Select correctly the proper biochemical and molecular biology methods to identify all pathogens.
19. Evaluate culture results with respect to type of specimen submitted.
20. Correlate direct specimen Gram stains with culture results.
21. Correlate culture results with clinical history and presentation.
22. Perform correctly a wet preparation for trichomonads.
23. Interpret correctly a wet preparation for trichomonads.
24. Explain the procedure for darkfield examination for spirochetes of syphilis.
25. If available, observe molecular testing method used for the identification of *Chlamydia trachomatis* and *Neisseria gonorrhoeae*.
26. Explain the theory for each molecular testing methods used for the identification of *Chlamydia trachomatis* and *Neisseria gonorrhoeae*.
27. Correlate culture results with patient history and presentation.

X. ANTIMICROBIAL SUSCEPTIBILITY TESTING

Introduction
One of the important services offered by the microbiology laboratory to the attending physician is the determination of the antimicrobial susceptibility pattern of bacterial pathogens by standardized methods.

Prerequisite
The student will complete assigned readings in procedure manuals, handouts, and reference books.

Objectives
Upon successful completion of the clinical practicum, studying assigned materials, and reviewing materials associated with the course objectives from MEDT 390/391, 406/416, and 430/431, the student will:

1. Compare and contrast the methods available in antimicrobial susceptibility testing (e.g., minimal inhibitory concentration vs. minimal bacteriocidal concentration).
2. For the Kirby-Bauer (K-B) method:
    - Describe the principle and procedure
    - Choose correctly the appropriate test medium and incubation conditions for fastidious organism such as *Haemophilus influenzae*, *Streptococcus pneumoniae,* and *Neisseria gonorrhoeae.*
    - Describe the appropriate cultural conditions for detecting methicillin-resistant *Staphylococcus aureus* (MRSA)
3. Discuss the effects of the following factors on the K-B method:
    - blood
    - cations
    - pH
    - inoculum size
    - temperature
    - agar depth
    - thymidine
    - length of incubation
    - atmospheric conditions

4. Select correctly appropriate antimicrobial agents for testing:
    - gram-positive organisms
    - gram-negative organisms
    - anaerobic organisms
    - mycobacteria
    - yeast
5. If appropriate, perform a K-B antimicrobial susceptibility test according to laboratory protocol to the satisfaction of the laboratory instructor.
6. Interpret correctly a K-B antimicrobial susceptibility test.
7. Describe the storage requirements for antimicrobial disks and Etest.
8. Identify the major antimicrobial families.
9. List agents found in each major antimicrobial family and the mechanism of microbial inhibition employed by each commonly used family.
10. Define "beta-lactam" and "penicillinase-resistant" antibiotics.
11. Give an example of “beta-lactam” and “penicillinase-resistant” antibiotics.
12. Perform correctly an assay for beta-lactamase.
13. Identify antimicrobial agents which are effective against *Mycobacterium* sp.
14. Identify antimicrobial agents which penetrate the blood brain barrier.
15. Identify antimicrobial agents used primarily for urinary tract infections.
16. List the attributes of an ideal antimicrobial agent.
17. Justify performing direct susceptibility tests on clinical materials.
18. For the agar dilution minimal inhibitory concentration (MIC) method:
    - describe the principle and procedure
    - discuss the preparation of the antimicrobial agents and their dilution
    - discuss the preparation of inoculum
19. For the broth microdilution MIC method:
    - discuss the principle and procedure
    - discuss the significance of cation supplemented medium
    - discuss the storage conditions for MIC trays
    - discuss the alternative methods of inoculum preparation
    - discuss the rationale for purity checks on inocula
20. If appropriate, perform a broth microdilution antimicrobial susceptibility test according to laboratory protocol to the satisfaction of the laboratory instructor.
21. Interpret correctly a broth microdilution antimicrobial susceptibility test.
22. For quality control (QC) of susceptibility testing:
    - discuss the rationale for QC testing
    - discuss the required frequency of testing for different systems
    - list the QC organisms required for the K-B and MIC procedure
    - discuss acceptable methods for the acquisition and propagation of QC strains
    - discuss corrective measures for out of control results
23. Correlate MICs to blood levels of antimicrobial agents.
24. Explain therapeutic considerations in the selection of appropriate antimicrobial therapy.
25. Explain the principle and rationale of the following special screening tests:
    - beta-lactamase
    - extended-spectrum beta-lactamase (ESBL)
    - vancomycin-intermediate and resistant *Staphylococcus aureus* (VISA/VRSA)
    - vancomycin-resistant *Enterococci* (VRE)
    - methicillin-resistant *Staphylococcus aureus* (MRSA)
    - inducible-clindamycin resistance (D-test)
    - penicillin-resistant *Streptococcus pneumoniae* (PRSP)
    - Hodge test

XI. MYCOLOGY

Introduction

Since symptoms of fungal infection are often nonspecific and appear similar to other infections, it is especially important for the physician to gather all pertinent information regarding the patient's medical history, background, and travel. This information must be communicated to the microbiology laboratory so that

proper specimens will be collected and the correct media inoculated. Complete identification of yeasts and fungi is especially important today due to the increased number of immunocompromised patients. It has become harder for the physician and microbiologist to distinguish between pathogen and nonpathogen as many organisms formerly termed nonpathogens have now been shown to be opportunistic pathogens.

Prerequisite
The student will complete assigned readings in procedure manuals, handouts, and reference books.

Objectives
Upon successful completion of the clinical practicum, studying assigned materials, and reviewing materials associated with the course objectives from MEDT 390/391 and 430/431, the student will:

1. Describe safety precautions, including the use of biological safety cabinets, for handling fungal cultures.
2. List each fungal medium component that allows for the selection of fungal isolates and inhibition of contaminating bacteria.
3. Explain the mechanism of each fungal medium component that allows for the selection of fungal isolates and inhibition of contaminating bacteria.
4. Identify the proper incubation temperatures, times, and growth requirements for fungal cultures.
5. Inoculate fungus specimens onto appropriate media to the satisfaction of the laboratory instructor.
6. Describe the principles of the procedures for direct microscopic detection of fungi in specimens and the identification of fungi in cultures.
7. Perform correctly the procedures for direct microscopic detection of fungi in specimens and the identification of fungi in cultures.
8. Interpret correctly the direct methods of detecting fungi in clinical specimens read microscopically according to laboratory protocol.
9. Interpret correctly the methods of detecting fungi in cultures read microscopically according to laboratory protocol.
10. Differentiate correctly fungi isolated as nonpathogens or contaminants versus those considered pathogenic.
11. Identify the important dimorphic fungi, growth requirements for mold and yeast phase, endemic areas and associated diseases to the satisfaction of the laboratory instructor.
12. Explain the rationale for complete identification of yeasts and fungi.
13. Compare and contrast the different methods for identifying yeasts, including commercial methods.
14. Describe the pathogenic *Actinomycetes*, including related organisms and the diseases that they cause.
15. Describe methods for identifying molds.

XII. MYCOBACTERIOLOGY

Introduction
Mycobacteria are acid-fast aerobic bacilli which grow very slowly compared to other aerobic bacteria. For this reason, specimens that might contain other bacteria or normal flora must be "decontaminated" prior to plating so that overgrowth doesn't occur. Direct and concentrated smears for acid fast bacilli, therefore, may provide for a rapid presumptive diagnosis of *Mycobacterium tuberculosis*. Actual colonies of *Mycobacterium tuberculosis* may take 6 to 8 weeks for growth and identification.

Prerequisite
The student will complete assigned readings in procedure manuals, handouts, and reference books.

Objectives
Upon successful completion of the clinical practicum, studying assigned materials, and reviewing materials associated with the course objectives from MEDT 390/391, 406/416, and 430/431, the student will:

1. List safety measures that must be employed in processing cultures for acid-fast bacilli (AFB).
2. Justify the use of safety measures when processing specimens and cultures for mycobacteria.

3. Discuss the appropriate digestion/decontamination procedure as outlined in the procedure manual for contaminated specimens.
4. Select correctly the appropriate digestion/decontamination procedure as outlined in the procedure manual for contaminated specimens.
5. Perform the appropriate digestion/decontamination procedure as outlined in the procedure manual for contaminated specimens to the satisfaction of the laboratory instructor.
6. Explain the action of each component in the digestion/decontamination procedure.
7. Identify specimens which do not require decontamination.
8. Perform correctly direct plating of cultures, utilizing appropriate media, incubation times and temperatures.
9. Compare the media, incubation times, incubation temperatures, and growth conditions for the growth of the most commonly isolated mycobacteria.
10. Discuss the necessity for a gastric lavage.
11. Explain the procedure for processing a bronchial lavage for AFB.
12. Perform correctly both the Ziehl-Neelsen (or Kinyoun's) and fluorochrome stains for mycobacteria, on direct and concentrated smears according to laboratory protocol.
13. Describe DNA probe technology for identification of mycobacteria.
14. Describe colony morphology and growth characteristics of pathogenic mycobacteria commonly isolated from clinical specimens.
15. Identify colony morphology and growth characteristics of pathogenic mycobacteria commonly isolated from clinical specimens to the satisfaction of the laboratory instructor.
16. Identify correctly appropriate biochemical tests for the identification of pathogenic organisms.
17. Identify correctly *Mycobacterium tuberculosis* by accurately interpreting the following test results:
    - rate of growth
    - pigment production
    - catalase (room temperature and 68°C)
    - niacin
    - nitrate
    - molecular biology methods
18. Explain the principle of using high-performance (pressure) liquid chromatography (HPLC) for the identification of *Mycobacteria* sp.
19. Correlate culture results with patient history and presentation.

XIII. PARASITOLOGY

Introduction
The accurate identification of ova and parasites requires expertise. It is important for the clinical scientists and the physician to communicate patient's history (i.e., immunosuppression) or travel to areas of the world where parasites are endemic.

Prerequisite
The student will complete assigned readings in procedure manuals, handouts, and reference books.

Objectives
Upon successful completion of the clinical practicum, studying assigned materials, and reviewing materials associated with the course objectives from MEDT 390/391 and 406/416, the student will:

1. Describe appropriate collection techniques for stool specimens including timing, number of specimens and special procedures.
2. List specimens other than stool which may be submitted for detection of parasites.
3. List parasites which might be present in the specimens identified in objective #2.
4. List substances which would interfere with a fecal exam for parasites.
5. Compare and contrast several stool preservatives, including advantages and disadvantages of each.
6. Explain the flotation and formalin-ethyl acetate sedimentation procedures for examining stool specimens.
7. Perform the formalin-ethyl acetate concentration procedure on stool specimens following the laboratory protocol to the satisfaction of the laboratory instructor.

8. Interpret correctly direct saline wet mounts of watery stools for parasites read microscopically according to laboratory protocol.
9. Interpret correctly iodine wet mounts of stool concentrates for parasites read microscopically according to laboratory protocol.
10. Justify the need of the ocular micrometer for parasitology.
11. Calibrate correctly the ocular micrometer.
12. Use correctly the ocular micrometer to measure the size of microscopic objects.
13. Describe common methods of staining parasites.
14. Based on morphology, differentiate among the intestinal protozoa.
15. Based on morphology, differentiate among the intestinal helminths.
16. Based on morphology, differentiate each stage of the life cycle of *Plasmodium vivax, P. falciparum, P. malariae,* and *P. ovale* to the satisfaction of the instructor.
17. Explain methods of examining specimens for *Cryptosporidium*, including the acid-fast stain and fluorescent stain.
18. Perform correctly an acid fast stain for *Cryptosporidium* following the laboratory protocol.
19. Interpret correctly an acid fast stain for *Cryptosporidium* to the satisfaction of the laboratory instructor.
20. Prepare stool smears using the trichrome stain according to laboratory protocol to the satisfaction of the laboratory instructor.
21. Interpret correctly stool smears using the trichrome stain.
22. If available, correctly perform an antigen defection assay for *Giardia* and/or *Cryptosporidium*.
23. Compare the methods used to prepare and examine blood smears for parasites.
24. Describe the morphology of *Babesia* sp.

XIV. VIROLOGY

Introduction
The commercial availability of rapid detection systems for the diagnosis of viral infections makes this aspect of microbiology increasingly accessible to most clinical laboratories. A laboratory may elect to limit its services to the isolation of only herpes simplex viruses by utilizing one of the several available rapid systems, or may elect to give a slightly more extensive service by employing a limited but select number of cell lines to detect the presence of viruses due to their cytopathic effect (CPE) and then submitting only those cultures showing positive CPE to reference laboratories for complete identification. *Chlamydia trachomatis,* an obligate intracellular bacterium requires cell culture for growth and is therefore included in this unit. The objectives can only be completed at affiliate locations that offer virology services.

Prerequisite
The student will complete assigned readings in procedure manuals, handouts, and reference books.

Objectives
Upon successful completion of the clinical practicum, studying assigned materials, and reviewing materials associated with the course objectives from MEDT 360/362 and 390/391, the student will:

1. Compare and contrast primary, semi-continuous (finite), and continuous cell lines.
2. List cell cultures and appropriate specimens used for the rapid isolation of herpes simplex virus.
3. Describe the media and key supplements used to propagate cell cultures.
4. List the types of specimens suitable for viral cultures.
5. Explain the procedures for the proper handling, transport and storage of viral specimens.
6. If appropriate, prepare correctly clinical specimens for inoculation onto cell monolayers for the recovery of viruses.
7. Describe the cytopathic effects produced by clinically significant viruses.
8. If appropriate, perform correctly a molecular biology assay on a clinical specimen for the detection of viruses.
9. Compare molecular diagnostic methods currently used in the affiliate's laboratory for the detection of viruses.

10. Compare methods used for the diagnosis of *Chlamydia trachomatis* infection.
11. List the cell culture line most commonly used for the isolation of *Chlamydia trachomatis*.
12. Describe the appearance of *Chlamydia trachomatis* in
    - cell culture
    - direct specimen smears
13. Correlate serologic test results with patient history and diagnosis.

XV. MOLECULAR DIAGNOSTIC and IMMUNOLOGIC ASSAYS

Introduction
Molecular diagnostic testing is used for the identification of various pathogenic microorganisms.

Prerequisite
The student should review the laboratory procedure manual for the performance and reporting of various molecular diagnostic assays.

Objectives
Upon successful completion of the clinical practicum, studying assigned materials, and reviewing materials associated with the course objectives from MEDT 360/362, 390/391, 406/416, and 430/431, the student will:

1. Identify each molecular diagnostic assay utilized in the affiliate microbiology laboratory.
2. Explain the principle and clinical significance of each molecular based assay.
3. Perform correctly each molecular diagnostic assay offered by the affiliate laboratory according to laboratory protocol.
4. Interpret correctly molecular diagnostic assays offered by the affiliate laboratory.
5. Illustrate the humoral-mediated and cell-mediated immune responses identifying key cells involved.
6. Evaluate the factors involved in the binding of antibody to an epitope on an antigen.
7. Evaluate the assays used to diagnosis immunologic disorders (e.g., immunodeficiencies, rheumatoid arthritis, systemic lupus erythematosus, etc.)
8. Identify each immunologic assay utilized in the affiliate microbiology laboratory.
9. Explain the principle and clinical significance of each immunologic assay.
10. Perform correctly immunologic assays offered by the affiliate laboratory according to laboratory protocol.
11. Define the following: sensitivity, specificity, positive predictive value, and negative predictive value.
12. Explain how to determine an antibody titer.
13. Compare the significance of a high IgM titer to a high IgG titer when diagnosing an infectious disease.
14. Describe the use of acute vs. convalescent serum sample antibody titers when diagnosing infectious diseases.
15. Evaluate the serologic markers for the diagnosis of hepatitis B virus infection.
16. Compare treponene antigen serologic assays to non-treponene assays.

ASSESSMENT TOOLS

See below for:
Clinical Practicum Student Affective Evaluation Grading Scale
Clinical Practicum Practical Evaluation Instructions
Clinical Practicum Practical Evaluation Grading Rubric
Clinical Practicum Student Evaluation

Clinical Practicum Student Affective Evaluation Grading Scale:

Instructions: For items #1 through #15: Rate on 1 - 5 point scale below. Record rating in the column provided.

Space is provided with each evaluation item for narrative appraisal. Any unsatisfactory evaluation **must** be documented. Please indicate strong points exhibited. **The completed evaluation form must be discussed with the student at mid-point and end of the clinical practicum.**

Performance Level	Rating Value	Performance Indicators
Outstanding	5	Contribution **far exceeds** what is normally expected of a student. Personal commitment to a high level of performance and professionalism is clear.
Exceeds Expectations	4	Seizes initiative in development and implementation of challenging projects. Accomplishments **exceed** requirements. Requires minimal direction
Fully Satisfactory	**3**	**Performance is what is expected in senior clinical practicum. Does not require significant improvement. Errors are minimal and seldom repeated. Requires only normal supervision and follow-up.**
Less Than Satisfactory	2	Performance generally does not meet minimum requirements for senior clinical practicum. Errors are significant and frequently repeated. Requires close surveillance and guidance.
Unacceptable Performance	1	Has had sufficient exposure to have shown better performance. Does not grasp basic concepts no matter how many times they have been explained. Does not demonstrate commitment to this aspect of professional development.

Practical Evaluation Instructions

Student: _____ Date: _____

Evaluated by: _____

Clinical Microbiology Practical

For the Clinical Microbiology Practical you will be given:

_____

Directions

As detailed in the practical evaluation rubric, perform the following on each specimen:

1. Plate the assigned unknown specimens to appropriate media.
2. Perform direct gram stain on each specimen (if required).
3. Incubate each media.
4. Interpret each direct gram stain and report according to format appropriate for the source.
5. Examine growth and perform appropriate biochemical tests for identification of all isolates if required.
7. Perform and interpret antimicrobial testing on appropriate isolates.
8. Generate preliminary and final reports according to format appropriate for the source.
9. Perform and record quality control for all testing performed if required.
10. Record all results on the following Laboratory report sheets.

Clinical Microbiology Practical Evaluation Grading **Student:** _____

Eval by: _____ **Date:** _____

	TOTAL POINTS POSSIBLE:	TOTAL POINTS EARNED:	COMMENTS
Unknown samples processed, plated, labeled and incubated following appropriate procedures for specific source	**20**		
Direct gram stain, preliminary and final reports recorded accurately and using source appropriate format	**20**		
Organisms identified and reported correctly according to source specific procedures	**20**		
Appropriate QC processed, accurately evaluated, and documentation recorded accurately and legibly	**10**		
Reagents and supplies utilized efficiently, no unnecessary waste of materials	**10**		
Critical results noted and reported appropriately, all necessary documentation recorded accurately and legibly	**20**		
Other:			
TOTALS:			
PRACTICAL GRADE:			

Laboratory Report

Name: _____

Specimen#: _____

Source: _____

Received Date: _____

Direct Gram Stain Report

Result:

Date: _____ Time: _____

Preliminary Report:

Result:

Date: _____ Time: _____

Preliminary Report #2 (If needed)

Result:

Date: _____ Time: _____

Final Report:

Result:

Date: _____ Time: _____

Organism Workup Information

(Attach Automated or manual identification/ sensitivity printouts)

Isolate # _____

Media/ colony description:

Date	Tests set up/ Performed	Results	QC

Isolate # _____

Media/ colony description:

Date	Tests set up/ Performed	Results	QC

UNIVERSITY OF DELAWARE

DEPARTMENT OF MEDICAL LABORATORY SCIENCES

MEDT477 CLINICAL LABORATORY PRACTICUM - STUDENT EVALUATION

Student's Name: _____

Affiliate Site: _____

Discipline: **MICROBIOLOGY**

Signature of Evaluator(s): _____

Date of Mid Evaluation: _____
(due at the end of the first two weeks of the clinical practicum period)

Date of Final Evaluation: _____
(due at the completion of the clinical practicum period, please mail completed evaluation to UD coordinator)

Affective Evaluation

5 = Outstanding *Far exceeds expectations*
4 = Exceeds expectations *Seizes initiative*
3 = Fully satisfactory *Meets expectations*
2 = Below expectations *No self-motivation*
1 = Unacceptable performance *No commitment*

Please circle score below and add comments for all scores below/above "3":

1. Dress Code: (Obj. #1) Complies with the established dress code policy as outlined in the clinical practicum guidelines; gives evidence of good grooming.

	MID					FINAL			
5	4	3	2	1	5	4	3	2	1

Comments: _____

2. Punctuality & Attendance: (Obj. #2, 3, 4) Arrives in the laboratory with adequate time to start as scheduled. Returns from breaks as scheduled. Complies with attendance policy; notifies appropriate personnel at affiliate and University in a timely fashion.

	MID					FINAL			
5	4	3	2	1	5	4	3	2	1

Comments: _____

3. Safety: (Obj. #11) Adheres to laboratory safety regulations; works in an orderly and safe manner.

	MID					FINAL			
5	4	3	2	1	5	4	3	2	1

Comments: _____

4. Attention: (Obj. #5, 6, 19) Follows both verbal and written instructions. Asks pertinent questions when necessary. Neither distracts others nor allows distractions to affect the completion of assignment.

	MID					FINAL			
5	4	3	2	1	5	4	3	2	1

Comments: _____

5. Independence: (Obj. #7) Demonstrates the ability to work independently within student guidelines. Student draws on previously gained knowledge to solve problems. Student seeks activities to expand knowledge, ability and performance.

	MID					FINAL			
5	4	3	2	1	5	4	3	2	1

Comments: _____

6. Interpersonal Skills: (Obj. #8, 18) Communicates in a professional, tactful manner with instructors, staff, other health care personnel, patients and visitors. Consistently shows common courtesy and contributes toward achieving an environment conducive to work and learning for self and others.

	MID					FINAL			
5	4	3	2	1	5	4	3	2	1

Comments: _____

7. Self-Confidence: (Obj. #15) Demonstrates self confidence in the operation of instrumentation and in the performance of laboratory procedures.

MID					FINAL				
5	4	3	2	1	5	4	3	2	1

Comments: _____

8. Organization: (Obj. #20) Demonstrates organizational skills through ability to coordinate the quantity of work needed to be done with the time available for its completion. Able to perform multiple tasks without jeopardizing accuracy and precision.

MID					FINAL				
5	4	3	2	1	5	4	3	2	1

Comments: _____

9. Management & Economy: (Obj. #12, 13, 14) Conserves reagents and supplies; replenishes supplies required in the laboratory work area.

MID					FINAL				
5	4	3	2	1	5	4	3	2	1

Comments: _____

10. Composure: (Obj. #10, 26) Maintains composure and work quality under stressful conditions and adapts quickly to new situations. Accepts evaluation of performance as constructive and follows through with suggestions made.

MID					FINAL				
5	4	3	2	1	5	4	3	2	1

Comments: _____

11. Initiative: (Obj. #24) Offers assistance to other laboratory personnel when scheduled assignment is complete. Identifies tasks in the lab that need to be done and does them without being asked.

MID					FINAL				
5	4	3	2	1	5	4	3	2	1

Comments: _____

12. Enthusiasm: (Obj. #9) Shows interest and enthusiasm in clinical laboratory work and the medical laboratory science profession.

MID					FINAL				
5	4	3	2	1	5	4	3	2	1

Comments: _____

13. Professionalism and Integrity: (Obj. #16, 17, 27) Accepts accountability for work performed. Readily admits errors, follows procedures as written, and maintains patient confidentiality. Attends continuing education sessions when given the opportunity.

MID					FINAL				
5	4	3	2	1	5	4	3	2	1

Comments: _____

14. Decision Making & Problem Solving: (Obj. #23, 25) Demonstrates the ability to solve problems and seeks corrective action. Coordinates theory with lab analysis as it applies patient data.

MID					FINAL				
5	4	3	2	1	5	4	3	2	1

Comments: _____

15. Quality Assurance: (Obj. #21, 22) Practices acceptable quality assurance as established in specific clinical area. Runs quality control samples according to laboratory protocol. Demonstrates the importance of proper recordkeeping.

MID					FINAL				
5	4	3	2	1	5	4	3	2	1

Comments: _____

FINAL CLINICAL PRACTICUM GRADE REPORT

Please provide scores and a description for the written assessments and practical below – the UD Clinical Education Coordinator will calculate the final grade based upon these scores and the affective score. Thank you.

Written Assessment(s) – please include brief description below	**QUIZ grades**	**TEST grades**	**PROJECT grades**
Practical – please include brief description of practical below	**Practical Score achieved _____**		

Description of Written Assessment Tools and Practical:

Additional Instructor Comments: _____

_____

_____

Mid Evaluation

Signature of student _____ **Date** _____

Final Evaluation

Signature of student _____ **Date** _____

Student Comments: _____

_____

STOP – Grade will be calculated by the UD Education Coordinator. Thank you ☺

Student Affective Evaluation 20%

Average Points: $\frac{\text{total points}}{15}$ = ___ =

Look up grade below: _____X 20% = _____

Example: 52/15 = 3.47 = B- (**80** x 20%) = **16**

Average points = grade:	Average points = grade:
5.00 – 4.50 = A = 95	**2.49 – 2.00 = C- = 70**
4.49 – 4.00 = A- = 90	**1.99 – 1.50 = D = 65**
3.99 – 3.50 = B = 85	**1.49 – 1.00 = D- = 60**
3.49 – 3.00 = B- = 80	**<1.00 = F = 55**
3.00 – 2.50 = C = 75	

Written Assessment Ave. Score ____ X .40 = _____

Practical Score ____ X .40 = _____

Affective Score ____ X .20 = _____

Grade for Practicum = _____

PASS or FAIL

UD end-of-rotation exam grade _____