

**BIOC17 Summer 2018
MICROBIOLOGY: THE BACTERIAL CELL
LAB INFORMATION AND SCHEDULE**

Please Check course time-table for the room number of your Lab Section and blackboard for the name and e-mail address of your TA. Announcements and some labs will be posted on Blackboard. Please check this page at a minimum weekly.

The laboratory component of BIOC17 is an intensive 3 hours of laboratory per week where you will be learning valuable microbiology practical skills while developing your analytical and presentation skills. . This laboratory will provide hands on experience in basic microbiology skills applicable to many positions in the workplace. We will supplement the lectures with working examples of concepts discussed in lectures. On occasion concepts that are most easily presented in the laboratory will be addressed in the laboratory only. The Laboratory component represents **41.0% of your final grade.**

Learning objectives:

The objective of the laboratory is to provide you with a comprehensive introduction to basic techniques and concepts required for understanding bacterial growth and physiology with an emphasis on bacterial impact on human health. *On completion of this laboratory the student will understand concepts of microscopy, microbial identification, culturing, quantitative analysis of growth, control of microbial growth and medical microbiology.* Students will gain practical skills in use of microscopes, bacterial identification, aseptic techniques and producing and maintaining bacterial cultures. This background will provide and excellent companion to immunology (BIOC39) and the foundation for fourth year courses in microbiology including BIOD17, BIOD21, BIOD26, and BIOD29. Skills acquired will be useful in laboratory based jobs in industry, government microbiology laboratories, blood services and medical microbiology laboratories. Skills will also provide the foundation for graduate work in fields utilizing microorganisms.

GRADE DISTRIBUTION FOR THE LABORATORY (41.0%)

Laboratory component of final exam:	
During exam period TBA (included with lecture exam)	15%
Lab reports (Assignments, graphs and calculations, FLR)	17.5%
Lab participation / preparation/ performance (TAs will assign flow charts/ mind maps prep /summaries/class presentations/ class write ups/reflective practice/class data presentation)	8.5%

Lab assignments will not be accepted late.

Attendance is mandatory: You must attend all labs for this course! You are allowed a maximum of 2 **excused** absences (ie. you must provide a Self-Declaration of Student Illness form **or** Verification of Student Illness form to both Vania Branker (C17 Lab Coordinator) and Jennifer Campbell (Dept. of Biology Course Coordinator).

Late assignments as a result of excused absences are only accepted up to 7 days past the original deadline, otherwise a mark of zero will be assigned.

Consequences for missing laboratories:

3 or more absences from the lab (regardless of the reason) will result in a loss of **all** marks associated with lab, resulting in failure of the course.

If you have to miss a lab please contact Lab Coordinator Vania Branker prior to the lab to discuss your options.

Use of TURNITIN for Lab report

"Normally, students will be required to submit their course essays to Turnitin.com for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the Turnitin.com reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of the Turnitin.com service are described on the Turnitin.com web site".

For the formal report follow this procedure:

The day your report is due, hand in a hard copy to your TA and submit to turnitin. Each page of the report must be numbered and labeled with the student's name. In addition, you **must initial all the pages** of your hard copy. The total number of pages must be indicated on the cover of your report. The hard copy must be received by the TA in her/his hand. Please, don't pile them up on the front bench.

The entire report including figure legends must be submitted to turnitin in a format that can be read by the program. It is your responsibility to ensure turnitin has evaluated your submission. Format required is word or PDF; no screen shots or scanning of text are accepted. **If your report cannot be evaluated by turnitin or is not submitted then you receive a zero on your report.**

You must inform Professor Terebiznik in writing by the second week of classes if you wish to opt out and you must then provide an electronic copy of your report to Dr. Terebiznik along with all rough work and hard copies of all references.

Academic integrity

The University of Toronto's Code of Behaviour on Academic Matters applies to all University of Toronto Scarborough students. The Code prohibits all forms of academic dishonesty including, but not limited to, cheating, plagiarism, and the use of unauthorized aids. Students violating the Code may be subject to

penalties up to and including suspension or expulsion from the University. See material in the course outline.

Tips sheet provided on the web site

<http://www.uts.utoronto.ca/~vpdean/documents/AcademicIntegrity-Tipsheet2015.pdf>

For each laboratory Data Sheets associated with each Exercise are found in at the back of the Lab Manual "**Microbiology: Laboratory Theory and Application**" custom edition M. Leboffe and B. Pierce. You are strongly encouraged to fill in a data sheet for each laboratory completed during this course for preparation for the lab exam

Laboratory Assignments - Summer 2018

Assignment 1 (5 %) due June 5th at the end of lab

Exercise 3-12 Morphological Unknown

Data Sheet 1 %

Slides (2 slides are handed in):

Gram stain 2 %

Spore stain 2 %

Assignment 2 (3%) due June 26th at the beginning of lab

JS1 bacterial growth: introduction, graphs and generation time determination and short discussion.

Assignment 3 (9.5%) formal research paper on environmental factors that affect growth. due July 24th at the beginning of lab

Hand in hard copy at the beginning of the laboratory and to turnitin by 5 pm on the day of your laboratory.

Ex. 2-14 Effect of disinfectants

Ex. 2-13 Ultraviolet radiation: lethal effect

TAs will go over specific requirements for assignments. An outline of the requirements for the formal report will be posted on blackboard closer to the due date.

Background information about laboratory protocol

This course deals with potentially dangerous, generally unseen living organisms. Therefore, there are strict rules for working in the lab. Compliance with these rules is taken into account when the lab participation grade is determined.

- **If you eat or drink or chew gum you will be asked to leave your lab: associated lost grades**
- If you are immunocompromised you must see the instructor of the course before the lab begins.

Lab RULES (failure to follow the rules can lead to removal from the lab)

- **no cell phone use in the laboratory. With TA's permission you may use your phone to take a picture**
1. Do not bring coats, hats, etc. into the laboratory.
 2. Personal safety equipment is required:
 - lab coat (done up) with the sleeves rolled down,
 - closed toed shoes
 - hair tied back
 - Goggles are required when staining
 3. Do not eat or drink in the laboratory.
 4. Keep paper, pencils, fingers, etc. out of your mouth.
 5. Wash benches down with 70% alcohol at the beginning and end of the lab as described by your TA (see below)
 - . At the beginning and end of each lab session, tidy up your work area as follows: **first shut off bunsen burners**. Squirt /pour an S-shape of 70% isopropanol onto the lab bench. Spread the alcohol with a paper towel to disperse over the bench top, but **do not dry it with the towel; allow the alcohol to evaporate**. Throw the paper towel in the dry waste bag.
 6. Follow directions for disposal of all material used in the laboratory. All material that has been in contact with microorganisms must be disposed of in disinfectant or autoclave bags.
 7. Discard pipettes point-down, in the upright plastic pipette holders. Make sure the pipette tips are covered with disinfectant.
 8. Place all *test tubes* containing living cells in the racks in autoclave basins;
 9. Place all *flasks* in an upright position in the discard pans.
 10. All pipette tips for micropipettors must be disposed in buckets provided
 11. **Microscopes** must be cleaned before being put away following TA's instructions for the correct way to put away your microscope. (see below)
 12. **Wash hands thoroughly with soap and water** once or twice during the lab, any time you come in contact with live cells and also just before leaving the lab.
 13. When leaving the lab, REMOVE YOUR LAB COAT and store it in a locker in the lab (if possible). Although not recommended, it is allowable to wear the lab coat in another lab course. However, DO NOT UNDER ANY CIRCUMSTANCES wear your lab coat in the cafeteria or in any other public place (e.g. the Meeting Place, Library, etc.).

HANDLING OF MICROSCOPES

- 1)** Each microscope and the storage space for that particular microscope will have the same identifying number
 - 2)** Your TA will assign you to a specific microscope. You are responsible for this particular microscope.
 - 3)** When finished for the day, please do the following:
 - a)** Center the mechanical stage
 - b)** Lower the light intensity to the minimum and shut off the light
 - c)** Using a cotton swap and alcohol wipe of the lens and the stage. Then wipe with lens paper
 - d)** Place the lowest objective (4x) over the stage
 - e)** Wrap the electric cord around the base
 - f)** Turn the nosepiece relative to the base (if the nose piece swings), in the direction instructed by the TA. (there is only one way that the microscope will fit into the storage space).
 - g)** Hold the microscope with two hands-(one hand should be under the base of the microscope) while transporting it to the cabinet (and away from the cabinet)
 - H)** Place in the cubbyhole assigned to that particular microscope
- The TAs will check that each microscope has been put away properly.
 - Points will be deducted if the microscopes are not put away properly.

LAB INFORMATION AND SCHEDULE

The lab Exercises (Ex. #) are as designated in the custom Lab Manual. There are additional labs which will be provided as files posted to blackboard at least a week prior to the laboratory these are designated **JS**.

You are responsible for **all the introductory material** in each relevant **Section** and **Exercise** in the lab manual, (even if it appears on pages preceding the actual exercise). **You are also responsible for all Sections/Exercises, etc. of Exercises listed as "read", "read only" or "reading assignment".**

- Supporting information from the custom text book is also indicated where appropriate to assist with understanding laboratory material
- A Lab review will be held outside of the laboratory in the last week of classes.

Links for helpful pictures, videos and animations:

<http://www.asmscience.org/content/education/protocol>
<http://www.asm.org/division/c/library.htm>

FOR THE FIRST LABORATORY

Before coming to the first lab, please read the following in the custom lab Manual: The Introduction pages on Safety and laboratory guidelines, and Section 1 on fundamental skills which includes pgs 14-24, as well as 2-12 theory on steam sterilization from the lab manual. Look carefully at the Figures that describe aseptic techniques. You will need to be proficient at these techniques to function in the Microbiology laboratory. **You are responsible for the theory of READ only laboratories**

LAB SCHEDULE

Week of Laboratory Exercise(s) and Assignments

Before each laboratory read and make notes on introductory materials. We do not use all the organisms listed so your TA will go through the organisms each week

Week :	date	Exercise
1.	May 15	Section 3 Microscopy and Staining read Lab manual pages 1-19 Chapter 3 Microscopy, staining and Classification of your text book Ex. 3-1 The light microscope read and understand: <i>Bring to lab a summary of the major components of the microscope and a description of how to calibrate a microscope (see below). Hand in at the beginning of class for participation credit</i>

Ex. 3-2 Calibration of the ocular micrometer. **You must show your TA the set up and how to calibrate your microscope for participation credit**
Ex. 3-5 Smear preparation and simple stains
Ex. 3-6 The negative stain
Ex. 3-13 Flagella staining - demonstration slides only

2. May 22

Section 3 Microscopy and Staining, continued
Prepare flow charts prior to lab for each of the three staining techniques and have your TA initial. Use these to do your staining

Ex. 3-7 Gram stain
Ex. 3-8 Acid fast staining **READ AND LOOK AT PREPARED SLIDES.** You are responsible for the theory of acid fast staining
Ex. 3- 9 Capsule staining
Ex. 3-12 Wet mount and hanging drop preparations: motility vs. brownian movement

3. May 29

Section 3 Microscopy and Staining, continued
Make flow chart for endospore stain (TA initials) and for the unknown identification (see posted table for organisms) to include with the data sheet when you hand it in next week

Ex. 3-10 Endospore stain
Ex. 3-14 Morphological unknown (begin)
Inoculate Nutrient Agar Slant
EX 5-28 motility tube, controls and unknowns

4. Jun 5

Section 3 Microscopy and Staining, continued

Ex. 3-14 Morphological unknown, completion – **interpret 5-28 and hand in Assignment#1 flow chart (data sheet and summary, Gram stain and endospore stain at the end of lab)**

Section I Fundamental Skills

Refer to pages 141-148 of your text book
Ex. 1-2 Nutrient agar and nutrient broth preparation (read ONLY)
Ex 1-3 aseptic transfer (read only); Have a discussion with your bench for five minutes and per bench **HAND IN AN EXPLANATION OF WHY YOU**

USE THIS TECHNIQUE

Ex. 1-4 Spread-plate technique, organisms to be used will be assigned in lab

Ex. 1-5 Streak-plate technique, mixed population to be assigned in class; read appendix B and C

5. June 12

Data analysis: record results from week 4 Ex 1-4 and 1-5
What is the purpose of these two plating techniques?

Section 6 Quantitative Techniques

Set up:

Refer to chapter 5 pages 149-156 of your text book
Read Appendix C, D, E of manual

Ex. 6-3 Direct count

Ex. 6-1 Standard viable (plate) count (read only /data provided to do calculations)

Ex. 6-4 Closed system growth (read only)

Ex. 6-5 plaque assay, refer to page 450-451 in manual (**construct a flow chart in lab and show to your TA in the lab**)

Ex. JS1 Bacterial growth in a closed system (assignment), Present flow chart to TA at the beginning of the laboratory part of your assignment participation.

Comparison of growth of *E.coli* at 30°C and 37°C.

Exercise JS 1 will be posted as a file one week prior to the lab. Record O.D. measurements as described. Plates from viable counts will be incubated 24h- 48h, then stored next week. **This is assignment # 2**

Reading week: June 19

6. June 26

Data Analysis: Record viable counts for JS1, plaque counts (Ex 6-5)

Section 2 Microbial Growth: Factors Affecting Growth

Refer to pages 131-140 in your text

Set up:

Ex. 2-9 Effect of temperature, Lab 1
Ex. 2-10 Effect of pH, Lab 1
Ex. 2-11 Effect of osmotic pressure, Lab 1
Ex 6-6: Thermal death time versus decimal reduction value

7. July 3 **Hand in Assignment #2 - JS1 Generation time at the beginning of lab.**

Section 2 Microbial Growth: Factors Affecting Growth- killing effect and differential tests

Data analysis : Ex. 2-9 Effect of temperature, Lab 2
Ex. 2-10 Effect of pH, Lab 2
Ex. 2- 11 Effect of osmotic pressure, Lab 2
Ex. 6-6 Thermal death time versus decimal reduction value: Lab 2 (discuss as a class).

Set up : Refer to chapters 6 and 7 in your text
Ex. 2-14 Effect of disinfectants, Lab 1(**formal lab report**)
Ex. 7-3 Antimicrobial susceptibility (effect of antibiotics), Lab 1
Ex. 5-5 Catalase test, (obtain results today) relate the results to EX 2-14
Ex. 5-15 Gelatinase test, Lab 1
Ex 5-24 Bacitracin, Novobiocin and Optochin Susceptibility test , Read only; understand the theory
Ex. JS2 β -lactamase test (obtain results); lab posted on blackboard; relate results to Ex 7-3
Ex 4-4 growth on Mannitol salt agar Lab 1
Ex 7-1 Snyder Test lab 1

8. July 10

Microbial Growth: Factors Affecting Growth

Data analysis:

Refer to pg 145 of text for types of media
Ex. 2-14 Effect of disinfectants, Lab 2 (formal report)
Have each bench present the data
Ex. 7-3 Effect of antibiotics, Lab 2
Bench data presentation and discuss data
Ex. 5-17 Gelatinase test, Lab 2
Ex 4-4 growth on Mannitol salt agar Lab 2
Ex 7-1 Snyder Test Lab2

Set up: refer to page 175 of your text book for background

Ex. 2-13 Ultraviolet radiation: lethal effect, Lab 1
(formal lab report)

Ex. 10-5 Ultraviolet radiation: damage and repair, lab1

Ex. 5-16 DNase test, lab 1 (negative control inoculation)

Medical microbiology

Ex 7-4 Clinical Biofilms Lab 1

Ex. JS3 Effectiveness of hand scrubbing, Lab 1, lab posted on blackboard

Ex 7-6 Epidemic simulation lab 1

9. July 17

Section 2 Microbial Growth/ section 7 Medical Microbiology

Data analysis: Benches present data for 2-13, 10-5

Ex. JS4 Effectiveness of hand scrubbing, Lab 2

Ex. 2-13 Ultraviolet radiation: lethal effect of, Lab 2
(formal lab report) (class results on board)

Ex. 10-5 Ultraviolet radiation damage/ repair, Lab 2
(discuss results as a class)

Ex. 7-4 Biofilms Lab 2

Ex 7-6 Epidemic simulation Lab 2 - class discussion of result

Ex 5-6 DNase test, Lab 2 (compare results to figure posted on the bulletin board in lab)

Set up:

Differential tests /Medical Microbiology

Ex JS5 blood agar week 1 (lab will be posted)

Ex 4-5 MacConkey Agar lab 1

Ex 5-27 Coagulase test **Read and understand the concepts**

Section 10 Microbial Genetics

Ex. 10-3 Bacterial transformation **(flow chart is required; show your TA)**: the pGLO system

Lab 1 (refer to chapter 9 of your text book)

10. July 24 **Hand in Assignment #3 – Formal Lab report at the beginning of lab; Submit to turnitin**
Section 8 Microbial Genetics
refer to chapter 9 of your text book
- Data analysis:**
- Ex. 10-3 Bacterial transformation: the pGLO system, Lab 2 (class participation: lab bench analysis, hand in data sheet at the end of lab)
Ex JS5 blood agar Lab 2
Ex 4-5 MacConkey Agar Lab 2
- Set up:**
- Medical Microbiology**
- Ex 7-2 lysozyme Assay (completed today)**
prepare a flow chart in lab as a group for lysozyme assay: show to TA prior to starting
- Microbial Genetics/differential blood microscopy**
Ex. JS6 Bacterial conjugation: the transfer of antibiotic resistant plasmids between cells. Exercise will be posted
- Section 9 Hematology and Serology**
Ex. 11-1 Differential blood count
11. July 31 **Section 8 Microbial Genetics**
- Data analysis:**
- Ex . JS6 Bacterial conjugation: the transfer of antibiotic resistant plasmids between cells, Lab 2.
Work per group hand in your interpretation and then discuss
- Set up:**
- Section 9 Hematology and Serology**
Ex. 11-4 Slide agglutination
- Reflective Practice (done per bench)
- Lab review for lab component of the final exam by your TA

BACTERIAL NOMENCLATURE

The proper name of an organism is composed of two words. The first word of the name refers to the *genus* to which the organism belongs, and the second word is the “specific epithet”. In most cases the specific epithet used is the *species*. If the specific species has not been designated, then the second term used is the abbreviation “spp.” or “sp”. The name is italicized (or underlined in typewritten manuscripts). The genus name starts with a upper case letter, while the species name starts with a lower case letter (e.g. *Staphylococcus aureus*).

The first time that a microbial name is used in a manuscript (e.g. lab report), both names should be used. Thereafter in the manuscript, when the species is cited, the word that refers to the genus may be abbreviated by using the italicized (or underlined) capital letter, followed by a period (e.g., *S. aureus*). If confusion might result from using only the single letter to represent the genus name, the entire name should be used.

Table 1. Proper and improper usage of bacterial nomenclature in a formal report

Correct	Incorrect
<i>Staphylococcus aureus</i>	Staphylococcus aureus
<u>Staphylococcus aureus</u>	
<i>S. aureus</i>	<i>Staph. aureus</i>
<i>Staphylococcus spp.</i> (where species is not known)	

The genus names of certain bacterial groups are used **(a)** as proper names as above and **(b)** as adjectives to describe the morphology of certain cell types. When a genus name is used as an adjective it is not capitalized, italicized nor underlined. For example:

<u>proper name</u>	<u>adjective</u>	<u>cell shape</u>	<u>general arrangement</u>
<i>Bacillus</i>	bacillus	rod	single or in short chains
<i>Diplococcus</i>	diplococcus	coccus	in pairs
<i>Streptococcus</i>	streptococcus	coccus	in chains
<i>Staphylococcus</i>	staphylococcus	coccus	in clusters