BIMM 124: Medical Microbiology, Fall 2019

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Lecture meets at:
Center 105, MWF 3-3:50 pm

Dr. Gus' office hours: Monday 12:30-1:25 Bonner 3146 (starting Oct 7)

Website: http://ted.ucsd.edu

Podcast: The lectures will be podcast. If you notice that the microphone is not working during lecture, be sure to let Dr. Gus know, as this is required for recording. Sometimes there are other technical problems with the podcast. Please do not contact Dr. Gus about these, because she has no control over them. Instead, you may contact EdTech directly at https://ucsdservicedesk.service-now.com/its

Instructional Assistants office hours (Start Oct 3. You may attend the office hours of any IAs!)

Name	Day	Time	Location
Alex Lindsey	Wed	6-7:50 pm	Price Center Theater Lounge
Claire Morris	Thursday	4-5 pm	Sixth Commuter Lounge
Brian Shing	Friday	4:30-5:30 pm	PSB Room 1182

Sections (Start Oct 1.)

Section	Days	Time	Location	IA	Email
A01	Tues	4-4:50 P	CENTR 217B	**Brian Shing**	bjshing@ucsd.edu
A02	Wed	8-8:50 P	CENTR 207	**Alex Lindsey**	avlindse@ucsd.edu
A03	Wed	9-9:50 A	SOLIS 105	**Claire Morris**	clm021@ucsd.edu
A04	Wed	10-10:50 A	CENTR 217B	**Brian Shing**	bjshing@ucsd.edu
A05	Wed	11-11:50 A	CENTR 217B	**Alex Lindsey**	avlindse@ucsd.edu

Introduction

The near doubling in lifespan in the past 1-2 centuries has been due mostly to our control of infectious diseases. However, they are threatening to reemerge again. **The main themes we will emphasize in Medical Micro are**:

1. How infectious agents can be beneficial or cause disease, and how our immune system responds. The response can lead to tolerance or to full-fledged biological warfare with counter measures, counter-counter measures…
2. How the scientific method is used to study host-microbe interactions and how this knowledge can be used to prevent and treat disease. Mastering the scientific method will help you outside microbiology too!

This is an active learning class that requires active participation and critical thinking skills and de-emphasizes memorization. *All exams and assignments are open book and notes.* This will require you change the way you think about science and learning. Some of the knowledge we cover in class will be obsolete in a few years — critical thinking never will be. Memorization is a skill that got you this far. It will not get you much further. Waiting

to the last minute to study for an exam may have worked before, but it works poorly here. Critical thinking skills have to be developed incrementally over time; they cannot be crammed. Today is a new day!

Learning outcomes – At the end of this class you will be more skilled at:

1. knowing how microbes benefit our health
2. knowing how microbes cause disease
3. knowing how the immune system protects us
4. knowing how inappropriate responses of immune system harm us
5. knowing how microbial disease is diagnosed and treated
6. taking charge of your own learning
7. being confident in tackling new questions and challenges
8. reading and understanding primary literature; understanding the scientific method; knowing how the scientist thinks and performs research. These skills will help you learn new things in biology and beyond, empowering you to address challenges in your professional and personal lives.
9. researching and communicating about science, disease, and health. YOU can be a source of knowledge for your family and friends in these issues.

Required materials

1. **Textbook**: *Schaechter's Mechanism of Microbial Disease, 5th Edition.* Note: the exams are open book but closed computer, so **possession of a hard copy of the book is needed**. Copies have been placed on reserved in the library.

   We encourage you to delve deeper as your time, curiosity, and necessity permits. To assist you, UCSD has many additional textbooks online that you can access; there are links on the class web site. If you find something confusing in *Schaechter*'s, you can turn to another resource, such as *Sherris Medical Microbiology, Harrison's Principles of Internal Medicine* or others, available free online via the UCSD library (use a VPN on your personal computer for access).

2. **Papers** assigned for lecture will be posted in the "Lecture materials" folder on CANVAS. You will need to print out all assigned papers and bring them with you to class, and to your exams. Also, the **supplement** to each paper is usually posted. You are NOT required to read the supplement in detail; however, you will often find useful information there. For example, details of the methods may help you understand the paper. And sometimes a supplemental figure will be of interest. Occasionally in class you will be directed to information in the supplement.

3. **Clickers** (basic iClicker is fine) are **required for this class**. Register your clicker on the BIMM 124 website on CANVAS.

How we will achieve the aims of this class:

1. **Readings** are mandatory and must be completed *before* each lecture.

   a. Textbook: The first lecture on each pathogen will be an introduction to the infection. Your textbook provides foundational information for class, *e.g.* information about the immune system, disease symptoms, mechanisms of pathogenesis and protection. Prior reading of the textbook **before** lecture **is required** in this class. Unlike many other classes you have taken, the instructor will <u>not</u> focus primarily on restating what was in the textbook readings. Rather the readings will serve as a starting point for discussions in class, where we will delving into much more interesting and applied topics. If you have

not done the reading, you will not be able to follow the lectures or participate in the discussions. *We recommend that you do all your readings in groups*.

Remember, the exams are open-book. Read in order to comprehend the background for class. Although you do not have to memorize, you still must *have a working knowledge* of what is in the readings in order to benefit from the lectures and, perhaps more importantly, to complete the exams. "Read before to soar." This is an opportunity to take charge of your own success!

b. Primary literature: The second lecture (on most pathogens) will focus on primary literature relevant to that pathogen, *e.g.* how it causes disease, interactions with the immune system, or animal models of disease. Virtually everything we know about immunology and microbial pathogenesis is based on published research. This takes you right to the "font of scientific knowledge." Further, by delving into primary literature, your **critical thinking skills** will grow like on steroids! This is one of the most important skills we can teach you—a skill you can apply long after UCSD, in professions such as medicine, research, pharmacy, industry, law, journalism, politics, economics... It will enrich your life in many ways.

Each week, you will have 1-2 papers to study and discuss in lecture and/or sections. As with textbook readings, lecture papers must be read **before** lecture. This preparation is essential for the paper to make sense and for you to learn how to read, think about, and work with research literature. Knowing how to do this affects a significant part of your grade: you will use these tools on the exams and your "Final Paper." We want to give you ample opportunity to practice and succeed. "Read before to soar." This is another opportunity to take charge of your own success. *We urge you to do all your readings in groups*.

WHY DO WE REQUIRE READINGS BEFOREHAND? AND WHY WILL WE NOT SIMPLY BE LECTURING FROM THE READINGS AS IN MANY OTHER CLASSES? We assume you are here to learn. Just like athletic training for your body, learning requires **effort**. If the lecture simply rehashes the readings, we will be spoon-feeding you, robbing you of the valuable opportunity to develop your learning and critical thinking skills. For a college junior or senior, preparing for imminent entry into the real world, this would be a disservice. Did you know that focusing on higher level learning skills results in physical brain development? Research shows this! BIMM 124 is a weight-lifting class for your brain. No one else can do the exercising for you. If you do it, your "thinking muscles" will grow and so will your success in life. Our goal is your success. We are equipping you to change the world!!!

2. Quizzes on reading. Each class will begin with a 3-question, multiple-choice, clicker quiz. The goal of this quiz is to give you added incentive to do the reading ahead of time. The quiz will cover a basic understanding of the readings.

- Quizzes on the **textbook** focus on the most important facts regarding the type of pathogen, transmission, entry, spread/multiplication, damage, diagnosis, treatment and prevention (categories repeated in every chapter).
- Quizzes on the **papers** focus on the purpose, hypothesis, basic methods (not too detailed), models used (tissue culture, mice, etc), significant results, importance, take-home message, application, *etc.*

The expectation is that >70% of the class will usually get the answers right, *provided* they have done the readings. These questions will be shown on slides framed by an **orange** box. (See below for grading.)

3. Interactive lectures with additional clicker questions. These form the "meat" of each class. Dr. Gus will pick a few topics from the readings and present multiple-choice questions that require deeper

thinking/cognitive analyses. You will independently click in to vote on an answer, based upon your initial impression. Many of these questions you will not get right the first time around. Then, you will work in assigned groups to discuss the question for a few minutes, followed by a second opportunity to click in, based upon your group's consensus. The slides with these questions will be framed by a **green** box. (See grading below.) From here, we will have in-class discussions as to what the right answer is and why. The goal of these sessions is to prompt you to think about complex concepts, to actively engage you in YOUR learning process. Our goal is to help you develop your mind and thinking capabilities, so that you will be academically and professionally successful. Our goal is your empowerment!

If you do not do the reading before coming to lecture, you will be very bored, because you will have nothing to do. Further, you will have let down your group members, who depend on one another to come to class ready to work together.

Note on clickers: The primary impetus for using clickers is not to force attendance. Rather, the goal is to promote participation in class, reading ahead of time, and your success and learning.

4. Sections. Sections are mandatory and play a significant role in reinforcing and strengthening your analytical skills. You will receive participation points in section. This is also where your "Section Papers" are discussed and graded. You must be present to receive a grade on your Section Papers, which can help your course grade. Section papers are excellent practice for classroom discussions, for your exams, and for your Final Paper … another opportunity to take charge of your success! On days when there is no Section Paper, you will have the opportunity to practice exam questions (a VERY helpful activity) and to clarify concepts from the readings and lecture.

5. Multimedia. There are two films and one podcast required for this class:

- The 1-hour film, *Hunting the Nightmare Bacteria*, will be shown in class on Wed, Oct 30. It is also available online; there is a link on course web site. It will be covered on the midterm.
- The 35 minute podcast, *Threat of a Post-antibiotic Era*, is linked on the course web site. Students are required to listen to this podcast on their own time. It will be covered on the midterm.
- The 1-hour film, *Influenza 1918*, will be shown in class on Wed, Nov 27. It is also available online; there is a link on course web site. It will be covered on the final exam.

How you will be evaluated

1. **Clickers**, **10%** of your grade:
   a. **Orange box (quiz) questions** = **5%** of your grade.
      - Get **72%** of these questions correct to get full credit for the quarter.
      - Get **50%** of these questions correct to get half credit for the quarter.
      - These are the only possibilities.
   b. **Green box questions** = **5%** of your grade.
      - It does not matter whether you get these right or wrong.
      - Participating in **75%** of these questions during **75%** of the lectures gives you full credit.
      - No partial credit.

Most students will have a legitimate excuse for a couple of unavoidable absences during the quarter. This is already factored into the grading scheme for clicker points, and it is why you do not have to be there every day to get full credit. DO NOT ASK TO MAKE UP CLICKER POINTS IF YOU ARE

ABSENT, EVEN IF YOU ARE ABSENT FOR A GOOD REASON. If you are not in class, you do not get points. And that is OKAY.

Clicker scores will not be posted on CANVAS. The answers to the quiz questions (orange box questions) are announced during lecture, which is podcast. If you want to keep track of your performance on quiz questions you should keep a record of your answers in your notes. The slides are posted after each lecture on CANVAS. You may also keep track of your responses to the green box questions and compare them to the total number of questions asked. Again, you will find the questions among the slides on posted on CANVAS.

2. **Section participation**, **5%** of your grade:

You will receive these points for attending and *participating* in your sections each week. Participation in nine sections (out of ten possible weeks) yields full credit.

3. **Section Papers**, **optionally 10%** of your grade: There are three optional write-ups on primary literature due in Discussion Section. Instructions will be given with each paper. You can read and discuss these research papers in groups, but you must then write up your own answers individually. It is critical that your responses be formulated in your own words, that you NOT copy sentences or phrases from the published paper. Your written response will be submitted to Turnitin through CANVAS, to check for plagiarism. Bring a hard copy of each write-up to section, where it will be discussed and graded. You must be present in section to get credit for your Section Paper; no exceptions.

The questions in these assignments will be similar to those on the exams and Final Paper. They are, therefore, *good, low-stress practice for both*. However, the material in these research papers will NOT be covered on the exams (because they are "optional").

For each Section Paper, you may receive:

- "S" (satisfactory) 1 full point
- "I" (improvement needed) ½ point
- "N" (no credit) 0 points

At the end of the quarter, if your Section Paper total score is:

- ≥2 points, then 10% of your final grade is an A (100%)
- 1.0 or 1.5 point, then 5% of your final grade is an A (100%). The other 5% of credit will transfer to your final exam score.
- <1 point, all of the 10% of credit will transfer to your final exam score.

3. **Exams**. There are two exams in this class:

- **midterm** on Wed, Oct 30, 8-9:50 PM (outside regular lecture time!)
- **final exam** on Friday, Dec 13, 3-6 PM

Both exams are cumulative, *open book, and open notes*. No electronic media (cell phones, computers, calculators, etc…) are allowed. Exams emphasize problem-solving skills and being able to analyze and extrapolate information from readings. The information in the section papers is not included on the exams (because they are "optional), but the research article for the Final Paper WILL be covered on the final exam (because it is "required"). You will have opportunities to practice sample exam questions in weekly discussion sections.

The **midterm** is worth **15%** of your grade, but that 15% will be replaced with your final exam score if you do better on the final (most students do). The midterm is a low pressure opportunity to practice for the final. If you miss the midterm (for ANY reason, including illness), the credit rolls over to the final exam.

The **final exam** is worth **40-50%** of your grade **depending on whether you get credit for section papers**.

The exam scores will be normalized, against the top 12 grades in the class. In other words, your grade will be your score as a percentage of the average of the top 12 scores. For example, let's say the average of the top 12 scores is 90 out of 100 points, and your raw score is 75 points. Your normalized score will be 75/90 = 83%.

There is **no re-grading** of the exams, except for incorrect addition of points.

We realize you may have many finals. Please look at your finals week schedule now. If the timing of this final conflicts with other finals, then you need to drop one of the conflicting courses. Writing a fair exam for this class takes a lot of time and effort. Therefore I can write only one version of the exam. To be fair to everyone, I regret I can only offer the final at the time scheduled, except under extraordinary, documented circumstances (*e.g.* documented illness that requires hospitalization), and I must be notified of that extraordinary circumstance *prior* to the final exam (unless you are unconscious!).

4. The **Final Paper** is an analysis of a primary research article, due at the START of lecture on **Monday, Dec 2**, and is worth **20%** of your grade. The format of this paper and what will be expected from the students will be made explicitly clear when the paper is assigned. The prompt will be similar to the section paper assignments leading up to this. *You are to work on this individually*, <u>not</u> in groups, and are expected to do your own thinking and writing. We use Turnitin to detect plagiarism, which will be treated as a breach of academic integrity.

   The material in this research paper WILL be fair game on the final exam (because this is "required" work).

   To get full credit you *must* hand in your assignment on time. If you submit it late, there will be several unavoidable consequences. One is, we may not be able to find time to grade it (which would result in a zero), because we have scheduled readers with limited time to grade these. The second is your peers will justly complain that it is unfair you got more time. The third is your peace of mind will probably suffer since you will be piling on your workload before/during finals week. If, for some reason *outside your control*, you cannot meet this deadline, email Dr. Gus before the due date. There are no re-grades of the Final Paper.

Grades

The class will be graded on a standard scale (<u>not on a curve</u>) so that everyone has the opportunity to achieve a high grade. There will be pluses and minuses.

Course grades will be assigned as follows:

A	89-100%
B	80-88%
C	68-79%
D	55-67%.

Note that the vast majority of students do better on the final exam than they do on the midterm. In this scenario, your final exam grade will replace your midterm score!

Academic Integrity

Academic dishonesty undermines the hard work of all students in the class who take responsibility for their learning. Academic dishonesty is incompatible with science and the search for truth. We do not tolerate it. Out of respect and appreciation for your own efforts, nor should you. We encourage you to talk with any of the BIMM 124 teaching team if you learn of any incidents of academic dishonesty. If we suspect cheating, the case will be referred to the Office of Academic Integrity, who will contact the offending student's college dean.

Academic dishonesty includes:

- clicking in for another student, or having someone click in for you
- copying from or getting answers from another student
- copying from any published source (including patchwriting)
- cheating on an exam

Each student is responsible for knowing and abiding by

- UCSD's policies on Academic Dishonesty
  - https://senate.ucsd.edu/Operating-Procedures/Senate-Manual/appendices/2
- A description of cheating at UCSD can be found here
  - Cheating: The Arch Nemesis of Integrity
- Office of Academic integrity FAQ
  - https://academicintegrity.ucsd.edu/faq/index.html
- There is also a link to the Office of Academic Integrity on the left side of the CANVAS class web site.

All students are expected to read the **BIMM 124 plagiarism policy** (posted on CANVAS) prior to the first discussion section. All students are expected to attend the training presented in the first discussion section and sign the academic integrity agreement. *Students will not receive credit for any papers unless they have signed the agreement.*

Any student violating UCSD's Academic Dishonesty or Student Conduct policies will earn an 'F' in the course and will be reported to their college Dean for administrative processing. Committing acts that violate Student Conduct policies, resulting in course disruption, may be cause for suspension or dismissal from UCSD. Use of two or more clickers in the class (*i.e.* clicking in for someone else or having someone click in for you), plagiarism, and cheating on exams will be treated as violations Student Conduct Policies.

Class etiquette

Come on time. Be present. Turn cell phones off. Focus your laptop on class material.
Texting, social media, internet surfing, *etc*… are disruptive to the students around you.

How to succeed in Medical Microbiology

1. Spend the 8 hours/week reading and studying outside of class, as is expected for a four-unit course.
2. Come to class prepared, having done the assigned readings prior to the lecture. "Read before to soar." Students who do the work and come prepared to class do better. Period.
3. When reading, look up and learn words that you did not know previously.
4. Click in during lecture. Participate. We have run the statistics. Students that participate in lecture and in section statistically do better than those that do not.
5. Attend sections and *participate*! This is an easy way to boost your grade!

6. Ask questions whenever something in not clear, before/during/after class, during Dr. Gus' office hours (please come!), during IA office hours, and in sections.
7. Do all the Section Papers. Whether you get "S" or not, you will learn a lot in the process. Even if you have already gotten credit for two papers, doing a third paper, just for the practice, will further strengthen your analytical skills and empower you to excel on the final exam and final paper.
8. **Study in groups**. Read the textbook in groups. Read the papers in groups. Reading primary literature by yourself is challenging to say the least. It is better in groups. Be a groupie! You learn more from your peers than from instructors. To help, we will arrange assigned groups in section.
9. Talk with Dr. Gus and/or your IA's about any challenges you are having with assignments, with understanding the material, with reading primary literature, with problem-solving techniques. We know this is not easy. Let us know right away how we can help you learn.

Guest speakers - biographies

Jim McKerrow

- Current position
  - Dean - Skaggs School of Pharmacy and Pharmaceutical Sciences
  - Associate Vice Chancellor for Health Sciences
  - Distinguished Professor of Pathology
  - Dr. McKerrow leads a consortium of academic and industry scientists dedicated to the discovery and development of new drugs for neglected tropical diseases
- Education/Training
  - PhD in Biology University of California, San Diego
  - MD State University of New York
- Awards and Honors:
  - Certificate of Recognition for Faculty Diversity, Southern Regional Education Board (2007)
  - President's Speaker, American Society of Microbiology Annual Meeting (2007)
  - Essential Core Teaching Award. "Outstanding Lecture Series," Class of 2009, School of Medicine (2009)
  - Gregor Mendel Honorary Medal. Academy Council of the Academy of Sciences of the Czech Republic (2009)
  - President's Symposium Speaker, American Society of Parasitology (2010)

Rob Knight

- Current position
  - Professor of Pediatrics, UCSD School of Medicine
  - Professor of Computer Science & Engineering, UCSD
  - founding Director of the Center for Microbiome Innovation
  - co-founder of
    - Earth Microbiome Project
    - American Gut Project
    - the company Biota, Inc.
      which uses DNA from microbes in the subsurface to guide oil field decisions

- Education/Training
    - PhD in Ecology and Evolutionary Biology from Princeton University
- Books
    - "Follow Your Gut: The Enormous Impact of Tiny Microbes" (Simon & Schuster, 2015)
    - "Dirt is Good: The Advantage of Germs for Your Child's Developing Immune System" (St. Martin's Press, 2017)
- TED talk 2014
- Created software tools for microbiome science cited by more than 15,000 journal articles
- Awards
    - Fellow of the American Association for the Advancement of Science
    - Fellow of the American Academy of Microbiology
    - Howard Hughes Medical Institute Early Career Scientist Award
    - Massry Prize for outstanding contributions to the biomedical sciences
    - Vilceck Prize in Creative Promise for the Life Sciences
    - Thomson Reuters World's Most Influential Scientific Minds
    - Rady Children's Hospital Scientist of Excellence in Basic Research

Sharon Reed

- Current position
    - Professor of Pathology and Medicine
    - Director of the Clinical Microbiology Laboratory at UCSD
- Education/Training
    - BS in Biology from Stanford
    - M.D. - Harvard University
    - Masters in Tropical Medicine from the London School of Hygiene and Tropical Medicine
    - Residency Training: Brigham Hospital Boston
- Awards
    - Westinghouse Science Talent Search Finalist
    - Bank of America Giannini Foundation Fellowship
    - Southern California American College of Physicians Governor's Trophy
    - American College of Physicians National Associates Research Award
    - Lucille P. Markey Scholar Award in Biomedical Sciences
    - UCSD Distinguished Teaching Award

Steffanie Strathdee

- Current position
    - Associate Dean of Global Health Sciences, UCSD
    - Harold Simon Professor of Medicine, UCSD
    - Co-Director at the Center for Innovative Phage Applications and Therapeutics
- Education/Training
    - Masters and PhD in Epidemiology from University of Toronto

- Awards
    - Young Investigator's Award from the International AIDS Society
    - Award for Leadership in International Collaboration from National Institute on Drug Abuse
    - Women Who Mean Business Award from San Diego Women in Business Journal
    - Top 100 in the Fight against AIDS from POZ magazine
    - TIME's 50 Most Influential People in Health Care

Timothy Rodwell

- Current position
    - Associate Professor and physician in the Division of Pulmonary, Critical and Sleep Medicine, UCSD
    - Senior Scientific Advisor at the Foundation for Innovative New Diagnostics, Switzerland
- Education/Training
    - PhD from UC Davis
    - MD from Stanford University
    - MPH and Preventive Medicine Residency at SDSU and UCSD
- Current research
    - infectious disease diagnostics with an emphasis on the development and implementation of rapid molecular diagnostics for TB

Class schedule – on next page

red text indicates journal articles

days shaded yellow have guest speakers

guest speaker names are in green text

days shaded peach are holidays

Sections	Monday lecture	Wednesday lecture	Friday lecture
			Sept 27 **Intro and course logistics**
Set up groups; Prepare for writing papers	**Sept 30** **Finish intro to course** **Innate Immunity** pg 66 – top of 85	**Oct 2** **Innate Immunity** pg 85-90, 2nd column of pg 184 (survival of …)	**Oct 4** **Innate Immunity** **Brinkmann 2004**
Section paper #1	**Oct 7** **Adaptive Immunity** pg 91- top of 110	**Oct 9** **Adaptive Immunity** pg 110-116	**Oct 11** **Schistosoma, malaria, Trypanosoma cruzi** **pp 506-512, 517-519, 546-548** **Jim McKerrow**
Review; Exam prep	**Bacteria intro** **Oct 14** pp 18 to top of 26 (before "Cytoplasmic membrane") & pp 29 ("Capsules, Flagella…), pp 31, box on pg 172	**Oct 16** **Secretory diarrhea** **Chpt 16**	**Oct 18** **Secretory diarrhea** **Kamada 2012**
Section paper #2	**Oct 21** **Neisseria** **Chpt 14**	**Oct 23** **Staphylococcus** **Chpt 11**	**Oct 25** **Staphylococcus** **Inoshima 2011**
Review; Exam prep	**Oct 28** **Microbiota - Chpt 2** **Rob Knight**	**Oct 30** **Film: Hunting the Nightmare Bacteria (PBS – Frontline)**	**Nov 1** **Microbiota** **Villarino 2016**
Review; Exam prep	**Nov 4** **Virus intro** **Chpt 31**	**Nov 6** **Influenza** **Chpt 36**	**Nov 8** **Influenza** **Gao 2013**
Section paper #3	**Nov 11** **HOLIDAY**	**Nov 13** **GI protozoa** **Chpt 53** **Sharon Reed**	**Nov 15** **HIV** **Chpt 38**
Review; Exam prep	**Nov 18** **HIV** **Hatziioannou 2009**	**Nov 20** **Catch up day**	**Nov 22** **Ebola** **reading TBA**
Review; Exam prep	**Nov 25** **Vaccines** **Chpt 45**	**Nov 27** **Film:** **Influenza 1918**	**Nov 29** **HOLIDAY**
Review; Exam prep	**Dec 2** **Bacteriophage** **Steffanie Strathdee** **FINAL PAPER DUE IN CLASS!!!**	**Dec 4** **Intestinal helminths** **Chpt 54**	**Dec 6** **Mycobacteria** **Chpt 23** **Timothy Rodwell**