

# Spring 2017 Course Descriptions

## *Block III*

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## 7508 Advanced Topics in Epidemiology

**COURSE DESCRIPTION:** This 7-week course aims to introduce advanced concepts and topics in epidemiology with the primary goal of expanding knowledge and understanding of evolving methods in this field. Topics will include discussion about causation and causal inference, efficient student designs (e.g. nested case-controls, case-cohort) in biomarker/molecular epidemiological studies: biomarkers of exposure and disease in epidemiological studies, different types of confounding and biases, and methods to address them including causal diagrams and propensity score analysis. The course will also address misclassification and methods to assess reliability and reproducibility of exposure/outcomes measures in epidemiologic studies. At the end of the course, students will have a better understanding of epidemiologic methods and their application in different clinical and epidemiological studies.

**REQUIRED MATERIALS:** Rothman KJ, Greenland S, Lash TL. Modern Epidemiology; 3rd Edition. 2008. Lippincott, Williams & Wilkins, Philadelphia, PA; ISBN-10: 1451190050, ISBN-13: 9781451190052

**PREREQUISITES:** Clinical Research: Summer Intensive and Epidemiology II for Clinical Investigators

**STUDENT PREPARATION:** No specific background preparation needed. All students are expected to have a working knowledge of basic computers and college mathematics.

**SUITABLE FOR 1ST YEAR STUDENTS:** No. This is an advanced course.

**UNIQUE TRAINING OFFERED IN THIS COURSE:** N/A

**STUDENT ASSESSMENTS:** Homework and final exam.

**CREDIT HOURS:** 1.0

## 7505 Biostatistics III w/Data Analysis Lab

**COURSE DESCRIPTION:** Biostatistics III consists of a total of 14 lectures/labs which will be taught in two 7-week modules. The first module will cover logistic regression and the second module will cover survival analysis. Each module has a required textbook and will have weekly reading and graded homework assignments and a take-home exam.

**OBJECTIVES:** To learn the basics and applications of logistic regression in assessing associations between exposure/explanatory variables and a dichotomous outcome variable.

To learn fundamental methods in analyzing time to event data using survival analysis, especially Cox proportional hazards modeling.

Use STATA software to conduct both logistic regression and survival analysis and to be able to interpret the statistical output related to these modeling techniques.

**REQUIRED MATERIALS:** For Module One: Applied Logistic Regression by David W. Hosmer & Stanley Lemeshow (2nd edition), 2000, Wiley; ISBN-13: 978-0471356325

For Module Two: Survival Analysis: A Self-learning Text by David Kleinbaum and Mitchel Klein (3rd edition) Springer; ISBN: 978-1-4419-6645-2 (Print) 978-1-4419-6646-9 (Online) NOTE: this textbook is available via the Einstein library.

**PREREQUISITES:** N/A

**STUDENT PREPARATION:** N/A

**SUITABLE FOR 1ST YEAR STUDENTS:** N/A

**UNIQUE TRAINING OFFERED IN THIS COURSE:** N/A

**STUDENT ASSESSMENTS:** A final grade of pass/fail for Biostatistics III will be assigned based on both modules: Class Participation 10%; Homework 30%; Module one exam 30% and Module two exam 30%

**CREDIT HOURS:** 3.0

## 7017 Cancer: A Basic Science Approach

**COURSE DESCRIPTION:** The course is designed to bring together current approaches in cancer research including cell biology, molecular genetics, and therapy. The course will involve both lectures and paper discussions. Topics will include the pathology of cancer, pathways in the development of cancers, oncogenes, tumor suppressor genes, stem cells in cancer, the metastatic cascade, immune responses to cancer, and treatment modalities. Emphasis will be on classic and emerging genomics approaches in basic cancer research. The overall goal is to establish a firm foundation in the hallmarks of cancer and enable students to gauge difficulties and opportunities for advances in cancer research.

**REQUIRED MATERIALS:** The Biology of Cancer by Robert A. Weinberg, Second edition.

- 6 month rental: ISBN 9781317963462: \$70
- eBook: ISBN 9781317963462 : \$139
- Looseleaf: ISBN 9780815345299: \$100
- Paperback: ISBN 9780815342205: \$199

**PREREQUISITES:** None.

**STUDENT PREPARATION:** Undergraduate training in cell biology, biochemistry and genetics is useful.

**SUITABLE FOR 1ST YEAR STUDENTS:** Yes

**STUDENT ASSESSMENTS:** Homeworks, exams, paper presentations

**CREDIT HOURS:** 3.0

## 7002 Developmental Neuroscience

**COURSE DESCRIPTION:** This 13-week course will cover cellular and molecular principles underlying the construction of a functioning nervous system. The course will begin with overviews of neurogenesis, neural patterning and axon guidance, as well as an introduction to neuroembryology, grant proposal writing and relevant experimental techniques. Subsequent classes will focus on neural induction, patterning of the neuraxis, neural stem cell biology, growth factors/cytokines and relevant signaling mechanisms, neurogenesis, gliogenesis, epigenetics and the nervous system, forebrain development, neuronal cell death, axon guidance and dendrite branching mechanisms, synapse formation, developmental disorders and neural circuit formation. Throughout the course, insights gained from both vertebrate and invertebrate model systems will be discussed. Prior to each class, students will be provided with original research articles and reviews as background and preparatory reading. Each of these classes will involve the presentation of material from faculty members at Einstein and neighboring institutions (five guest class leaders) and require active student participation in the spirited discussion of current topics within each subfield. Eight Student Synopsis and Discussion sections, during which the course leaders facilitate student-centric discussion of original research reports in each subfield, will be distributed throughout this 13-week course. During the course, each student must prepare an original grant proposal on a topic of his or her choice within the field of Developmental Neuroscience and then prepare written critiques of their peers' proposals and present them orally at two student study sections. The 13-week duration is required to provide sufficient time for the students to develop an original grant proposal and have it subjected to two rounds of constructive peer review (see "unique training offered", below).

**REQUIRED MATERIALS:** Development of the Nervous System 3rd Edition. Sanes, Reh, and Harris. ISBN-13: 978-0123745392; ISBN-10: 012374539X. Available on Amazon (\$13.00-\$63.00)

**PREREQUISITES:** Undergraduate courses in Developmental Biology, Molecular Genetics and Neuroscience are recommended, but not required. There are no graduate course prerequisites.

**STUDENT PREPARATION:** rudimentary understanding of the conceptual underpinnings of developmental biology, neuronal development/neuroanatomy and genetics, as well as the techniques utilized to characterize mRNA/protein expression patterns, and familiarity with in vitro and in vivo model systems used to study gene/protein function would be helpful, but is not required.

**SUITABLE FOR 1ST YEAR STUDENTS:** Yes

**UNIQUE TRAINING OFFERED IN THIS COURSE:** Writing and critiquing (written and oral) of original grant proposals. There is no overlap with existing courses.

**UNIQUE TRAINING OFFERED IN THIS COURSE:** Grant Proposal (final version graded by course directors): 50%; Critique of peers' grant proposals at the two Student Study Sections: 25%; Active Participation in all classes, especially the eight course director-facilitated Student Synopsis and Discussion sessions distributed throughout this 13-week course: 25%

**CREDIT HOURS:** 5.0

## 7002 Human Metabolism: Regulation and Disease

**COURSE DESCRIPTION:** The goal of *Human Metabolism: Regulation and Disease* is to provide students with an understanding of the principles of the interrelated pathways of human metabolism and the ability to apply those principles to discussion of the pathophysiology and the design of new therapies for human disease. The course combines lecture, self-study and weekly small group student-led discussions of contemporary literature relevant to the lecture topics.

**REQUIRED MATERIALS:** Students are requested to obtain a copy of the 6th edition of Thomas M. Devlin (ed) *Textbook of Biochemistry With Clinical Correlations* that is used by several of the lecturers. Used copies of this textbook are available online for less than \$10.

**PREREQUISITES:** A passing grade in, or exemption from, course 7001, *Biochemistry*, is required.

**STUDENT PREPARATION:** The student should be conversant in the basic concepts of biochemistry that are presented in the Biochemistry course prerequisite. These include, but are not limited to a familiarity with the fundamental biochemical species of amino acids, lipids, oligosaccharides and nucleic acids, biochemical energetics, the fundamental energy-producing biochemical pathways, enzymatic catalysis and enzyme regulation.

**SUITABLE FOR 1ST YEAR STUDENTS:** Yes

**UNIQUE TRAINING OFFERED IN THIS COURSE:** The course is both an extension of Biochemistry taught during Block 1 as well as an opportunity for students to develop a more cohesive view of the nature and regulation of human metabolism. The course will cover key areas in metabolism and will highlight relationships to clinically relevant topics and the integration and regulation of carbohydrate, lipid, amino acid and nucleic acid metabolism.

**CREDIT HOURS:** 4.0

## 7013 Mechanisms of Disease

**COURSE DESCRIPTION:** This multidisciplinary course will investigate the pathobiology of human diseases and relevant animal models. Topics will include cellular pathology and the mechanisms of cell injury and repair. The course will emphasize the immunologic, molecular, genetic, and biochemical mechanisms that result in the gross and microscopic changes taking place within affected tissues. Types of injury to be explored in depth will include: biochemical/genetic (mechanisms of neurodegeneration and brain disorders, lysosomal storage diseases, expansion of trinucleotide repeats, chromosomal abnormalities), cancer, infectious, inflammatory, immunologic injury (Tuberculosis, Acquired Immunodeficiency Syndrome, Multiple Sclerosis, Malaria), and environmental (DNA damage). **Minimum 12 students.**

**REQUIRED MATERIALS:** Assigned Reading

**PREREQUISITES:** N/A

**STUDENT PREPARATION:** Background Knowledge of Immunology and Biochemistry is helpful.

**SUITABLE FOR 1ST YEAR STUDENTS:** Yes

**UNIQUE TRAINING OFFERED IN THIS COURSE:** This course will offer a broad perspective of pathologic mechanisms and aspects of disease. There is little overlap with existing courses.

**STUDENT ASSESSMENTS:** The course requirements will be assigned readings and open discussion, and 1-2 oral presentations of an assigned paper. Attendance is mandatory.

**CREDIT HOURS:** 3.0

## 7013 Molecular Cell Biology (Parts A & B)

**Molecular Cell Biology is a single course with two parts (A & B). Part A is offered in Course Block II (3 credits) and Part B is offered in Course Block III (3 credits). Both parts A and B of the course must be taken in order to satisfy the course requirement.**

**COURSE DESCRIPTION:** This course will cover basic areas in cell biology with emphasis on selected topics of current interest. The three main areas will be intracellular protein transport, the nucleus, and the cytoskeleton. Topics will include: membrane structure and biogenesis, functions of intracellular membranes and the signal hypothesis, protein trafficking and intracellular sorting, glycosylation, exocytosis, endocytosis and membrane fusion, nuclear structure and organization, nuclear transport, mRNA localization, self assembly of cytoskeletal structures, actin, microtubules, intermediate filaments, molecular motors, mitosis, cell junctions and extracellular matrix, cytoskeleton and signal transduction, calcium as second messenger, and cilia.

**REQUIRED MATERIALS:** "Lewin's CELLS" 2015, Third edition (ISBN: 978-1-284-02939-0); eds. G. Plopper, D. Sharp, and E. Sikorski; Jones and Bartlett Publishers; Sudbury, MA. <http://go.jblearning.com/CELLS3e>

Reading the relevant chapter(s) prior to the lecture is required and essential for understanding the lectures. Several copies are on closed reserve in the library. The cheapest source for the book is Amazon. An electronic version is available from CourseSmart. Go to <http://www.coursesmart.com>, type in "cells" in the search field and follow the instructions.

**PREREQUISITES:** This is a demanding course involving a substantial amount of reading and should only be taken by those first year students with a background in biochemistry and cell biology.

**STUDENT PREPARATION:** N/A

**SUITABLE FOR 1ST YEAR STUDENTS:** Yes

**UNIQUE TRAINING OFFERED IN THIS COURSE:** N/A

**STUDENT ASSESSMENTS:** 4 exams and 4TBL sessions

**CREDIT HOURS:** 6.0



## 7013 Protein Folding: Disease to Design

**COURSE DESCRIPTION:** This course will focus on current research in understanding the relationship between the biophysical nature of proteins, the cellular mechanisms to maintain protein homeostasis and protein mis-folding diseases, and will provide up-to-date insights in current approaches of protein engineering.

**REQUIRED MATERIALS:** Computer; access to internet and Angel website (or equivalent). Student presentations are required.

**PREREQUISITES:** First 'Block' Graduate course in Biochemistry required; Fundamentals of Biophysics recommended.

**STUDENT PREPARATION:** Protein structure and composition; physical chemistry of protein structure; thermodynamics; some basic knowledge of metabolic pathways; enzyme mechanism.

**SUITABLE FOR 1ST YEAR STUDENTS:** Yes

**UNIQUE TRAINING OFFERED IN THIS COURSE:** The uniqueness of the course is that it takes a very broad and comprehensive view of the nature and fundamental role of proteins in life. There is slight overlap in some topics with Fundamentals of Biophysics, Computational Biology of Proteins, and probably others which cover some aspects of the course topics in depth but more narrowly.

**STUDENT ASSESSMENTS:** Throughout the term, students are asked to provide original presentations. A final consisting of thinking through and presenting a research program aimed at some specific disease.

**CREDIT HOURS:** 2.5

## 7010A Quantitative Skills for the Biomedical Researcher I

**COURSE DESCRIPTION:** This 4-week course will meet three times a week for combined lecture/lab sessions to introduce the basic concepts and methods of biostatistics. Concepts include: fundamentals of probability; foundations of statistical inference, confidence intervals, hypothesis tests, and sample size and power calculations. Students will gain familiarity with the freely-available statistical software, R, to explore and analyze data

**REQUIRED MATERIALS:** No Textbook Required; Computer with R freeware installed.

**RECOMMENDED MATERIALS:** Principles of Biostatistics (Second edition) by Marcello Pagano and Kimberlee Gauvreau, ISBN-13: 978-0534229023, ISBN-10: 0534229026.

**PREREQUISITES:** N/A

**STUDENT PREPARATION:** No specific background preparation needed. All students are expected to have a working knowledge of basic computers and college mathematics.

**SUITABLE FOR 1ST YEAR STUDENTS:** Yes

**UNIQUE TRAINING OFFERED IN THIS COURSE:** Students will learn the fundamental concepts of biostatistics and gain proficiency in the R programming language. No overlap with existing courses.

**STUDENT ASSESSMENTS:** One take-home exam (80%) and web-based homework (20%).

**CREDIT HOURS:** 1.5

## 7010B Quantitative Skills for the Biomedical Researcher II

**COURSE DESCRIPTION:** This 2-week course will meet three times a week for combined lecture/lab sessions to introduce the basic concepts and methods of regression analysis. Topics include linear regression, the analysis of two-way tables, One-way and Two-way ANOVA, permutation tests, logistic regression. Introduces and employs the freely-available statistical software, R, to explore and analyze data. This course is pre-requisite for Quantitative Skills for the Biomedical Researcher III.

**REQUIRED MATERIALS:** No textbook required; Computer with R freeware installed.

**PREREQUISITES:** Quantitative Skills for the Biomedical Researcher I or equivalent.

**STUDENT PREPARATION:** No specific background preparation needed.

**SUITABLE FOR 1ST YEAR STUDENTS:** Yes

**UNIQUE TRAINING OFFERED IN THIS COURSE:** Students will learn the basic statistical tools for studying association between variables and gain proficiency in the R programming language. No overlap with existing courses.

**STUDENT ASSESSMENTS:** 40% homework, 60% Take home exam.

**CREDIT HOURS:** 0.75

## 7010C Quantitative Skills for the Biomedical Researcher III

**COURSE DESCRIPTION:** This 2-week course will cover the statistical principles that are pertinent to the study of big –omic data sets being collected in biology. Students will learn about current statistical approaches, issues related to experimental design and reproducible research, and important case studies that illuminate some of the challenges of analyzing big data. This course is the third module of the Quantitative Skills for the Biomedical Researcher series, and builds upon the material covered in the first two modules. As part of the assessment, students will gain practical experience by conducting a mini big data research project while working in small teams.

**RECOMMENDED MATERIALS:** Principles of Biostatistics (Second edition) by Marcello Pagano and Kimberlee Gauvreau, ISBN-13: 978-0534229023, ISBN-10: 0534229026; Laptop with R freeware installed.

**PREREQUISITES:** It is expected that students will have completed Quantitative Skills for the Biomedical Researcher I and II, or have acquired this material through other means (please consult the course leader if in doubt). Programming skills in R is mandatory.

**STUDENT PREPARATION:** All students are expected to have a working knowledge of basic computers and college mathematics.

**SUITABLE FOR 1ST YEAR STUDENTS:** Yes

**UNIQUE TRAINING OFFERED IN THIS COURSE:** Students will learn practical skills to conduct big data analysis and understand the challenges/limitations of this field. There is minor overlap with Computational Genomics and Epigenomics. This course is focuses more on statistical principles.

**STUDENT ASSESSMENTS:** Final project (100%).

**CREDIT HOURS:** 0.75

## 5012 Renal, Respiratory and Acid-Base Physiology

**COURSE DESCRIPTION:** This course will cover the basic principles of renal, respiratory and acid-base physiology from the whole animal to the cellular and molecular levels. It will focus on functional mechanisms and homeostatic regulatory processes that maintain the volume and composition of body fluids. Homeostatic mechanisms will be discussed in relationship to human pathophysiological conditions. The course is required for all first year MSTP students.

**REQUIRED MATERIALS:** Readings from textbooks, journal and review articles will be provided.

**PREREQUISITES:** Membrane Physiology & Transport in Block 1 is a prerequisite to this course. Students should have a year of undergraduate chemistry and biology and preferably physics.

**STUDENT PREPARATION:** Students should be familiar with fundamental membrane and epithelial transport processes, membrane potentials, fluid mechanics and hemodynamics. Students should know about the G-protein coupled receptor second messenger signaling pathways regulating intracellular cAMP, cGMP, protein kinase C and IP<sub>3</sub>.

**SUITABLE FOR 1ST YEAR STUDENTS:** Yes.

**UNIQUE TRAINING OFFERED IN THIS COURSE:** The course has no overlap with any other graduate division course. It will provide the students with an understanding of the kidney and lung function and how their function is homeostatically regulated to maintain the volume, composition and acid-base balance of body fluids.

**STUDENT ASSESSMENTS:** Students will be assessed on in class paper presentations, class participation and a take home essay and short answer exam.

**CREDIT HOURS:** 2.0

## 7029 Special Topics in Molecular

**COURSE DESCRIPTION:** The aim of the course is to acquaint students with scientific literature and progress in selected focused areas of biological research. The topics to be treated will vary from year to year depending on the interests of the teaching faculty. Each year, several topics will be covered in short modules. Lectures may be presented, but a primary focus will be discussion of important background articles and current research papers. Through in-depth analysis of the literature on specific topics, the student is expected to gain a broadened knowledge, increasing appreciation of the process through which scientific understanding develops, and an improved ability to critically read and analyze the original research literature.

### **TOPICS FOR SPRING 2017 SEMESTER:**

- Meelad Dawlaty: Pluripotent Stem Cells: Biology, Reprogramming, Engineering and Applications.
- Fabien Delahaye: New Challenges in Functional Genomics: Avoiding Misinterpretations to Gain Insight into Cellular Physiology.

**REQUIRED MATERIALS:** N/A

**PREREQUISITES:** Molecular Genetics or equivalent.

**SUITABLE FOR 1ST YEAR STUDENTS:** appropriate for 1st year students with prerequisite background. Attendance and participation by more senior students, postdocs and faculty is welcomed. This 1 credit course is not intended to satisfy the requirement that students take one or more advanced courses beyond the core curriculum. Registering students will be asked to specify what other advanced course(s) they are taking.

**UNIQUE TRAINING OFFERED IN THIS COURSE:** N/A

**STUDENT ASSESSMENTS:** Students enrolled for credit will be evaluated according to their attendance and participation in discussion. Class size is limited.

**CREDIT HOURS:** 1.0

## 7029 Stem Cells, Development and Disease

**COURSE DESCRIPTION:** This course focuses on the fundamentals of developmental biology, stem cells and regenerative medicine. The pathways and processes central to embryogenesis are often reused during tissue regeneration. Moreover, many diseases have their origins in misregulation of developmental pathways. A fundamental knowledge of development can thus strengthen your understanding of regenerative biology, aging, and disease. In this course, we will focus on the major principles and appropriate experimental approaches utilized in researching questions in development and stem cell biology. Our goal is for students to be able to read literature and evaluate seminars critically, understand relevant experimental approaches, and develop logical thinking and good experimental design skills for studying development and stem cell biology.

**RECOMMENDED MATERIALS:** For background reading only: Gilbert, Developmental Biology (Tenth Edition, ISBN: 160535192X), Lanza and Atala, Essentials of Stem Cell Biology (Third Edition, ISBN: 0124095038), older editions of these books are also acceptable.

**PREREQUISITES:** N/A

**STUDENT PREPARATION:** Basic understanding of biological principles such as genetics, cell and molecular biology is needed. Important background material and recommended reading for each topic will be posted within the lesson folders on Angel at least one week prior to the lecture.

**SUITABLE FOR 1ST YEAR STUDENTS:** Yes

**UNIQUE TRAINING OFFERED IN THIS COURSE:** Students will learn and discuss concepts of modern and traditional developmental biology, with a strong focus on the biological relevance of stem cells. They will learn to appreciate their importance for the student of complex diseases. Active participation in group exercises and journal clubs is expected.

**STUDENT ASSESSMENTS:** Each student will be responsible for attending and participating in the lectures and exercises. Grade based on participation and quality of student contributions.

**CREDIT HOURS:** 2.0

## 7027 Systems Biology Seminar

**COURSE DESCRIPTION:** It has long been recognized that scientific breakthroughs and groundbreaking research in the coming century requires multidisciplinary approaches to many areas of research. By means of critical reading of classical and contemporary articles the course will cover a broad range of relevant techniques from mathematical, statistical and computational sciences, and their relations to the specific scientific questions in each of the articles discussed. The course will cover 26 articles on biological questions that have been addressed both theoretically and experimentally. These articles will cover a broad range of biological topics from molecular biology, evolutionary biology, genomics and neuroscience.

**REQUIRED MATERIALS:** N/A

**PREREQUISITES:** Quantitative background encouraged

**STUDENT PREPARATION:** Preferred pre-requisite (not required) Calculus, Linear Algebra, Differential Equations and Stochastic Processes.

**SUITABLE FOR 1ST YEAR STUDENTS:** Yes

**UNIQUE TRAINING OFFERED IN THIS COURSE:** The course will be exposed to the need and importance of abstract/theoretical and analytical approaches and their relevancy to experimental biomedical research.

**STUDENT ASSESSMENTS:** Student presentation throughout the course

**CREDIT HOURS:** 2.0



## 7030 Viruses and Other Microbes

**COURSE DESCRIPTION:** The aim of this course is to familiarize students with the principles of microbial pathogenesis and host-pathogen interactions by focusing on viruses, bacteria, fungi, and unicellular eukaryotes. The mechanisms of infection and replication, pathogenesis, host defense evasion, and emergence of “new” pathogens including iatrogenic and zoonotic mechanisms will comprise themes throughout the course and will be explored by lectures, literature reviews, and team based discussions.

The course will begin with an introductory overview of the major types of infectious agents that infect humans, domestic animals, and laboratory model organisms, and the strategies used by pathogens to survive, reproduce, and evade the myriad of host immunity mechanisms that have evolved in response to infectious agents. Due to their lower complexity genomes, viruses will comprise the initial focus of the course, while replication-competent pathogens of increasing genetic complexity plus specialized topics relating to microbial pathogenesis and the host response to microbial pathogens will follow. Throughout the course, specific pathogens of particular medical, evolutionary, and/or molecular mechanistic interest will be utilized as examples to illustrate thematic concepts.

Specific virology topics will include virus structure, mechanisms of virus entry and replication, regulation of viral and host gene expression, virus assembly, virus egress, host responses to viral infections, viral pathogenesis and evolution. These basic virological principles will provide the basis to understand diagnosis, prevention, and treatment of viral diseases, the development of new applications that utilize viruses as tools, and how ‘new’ viruses can emerge and spread rapidly throughout the world, while ‘old’ viruses such as HIV-1 and influenza remain global threats. Similarities and differences in these fundamental principles will then be analyzed with the study of the biology of a spectrum of microbes include bacteria, fungi, and parasites. Organisms including Mycobacteria, Pneumococcus, Helicobacter, Clostridium, Cryptococcus, Candida, Plasmodia, Toxoplasma, and Trypanosoma will be covered. Key aspects of the biology of these microbes will provide the foundation for understanding pathogenesis, transmission, metabolism, host-microbe interactions, innate and adaptive host immunity, and microbial evasion of host immune responses.

In total, the course will expose students to the immense variety of strategies exploited by infectious agents in the never ending arms races with their hosts. Students will be responsible for reading the assigned papers, and leading team based discussions.

**RECOMMENDED MATERIALS:** Principles of Virology 3rd Edition by Sarah J. Flint, Lynn W. Enquist, Vincent R. Racaniello and Anna Marie Skalka (2009) ASM Press. ISBN 978-1555814434.

Microbe 2nd Edition by Michele Swanson, Gemma Requera, and Moselio Schaechter (2016) AMS Press. ISBN 978-1555819125

**PREREQUISITES:** Undergraduate major in Biology or related coursework in Microbiology. If unsure, prospective students can discuss required background with course Leader. This course is less suitable

for students with training predominately in mostly physical/chemical sciences or engineering but with little background in biology.

**STUDENT PREPARATION:** Basic understanding of common pathogens, virulence and immune response to infection. Knowledge of contemporary biology including molecular biology, cell biology and some biochemistry would be necessary.

**SUITABLE FOR 1ST YEAR STUDENTS:** Yes

**UNIQUE TRAINING OFFERED IN THIS COURSE:** N/A

**STUDENT ASSESSMENTS:** Quizzes and participation in discussions at the team based learning sessions, a midterm exam, and a final exam.

**CREDIT HOURS:** 3.0