

Division of Medical Sciences

Ph.D. Programs at Harvard Medical School

Nanocourses

Spring Semester

2014 - 2015

Full listings available at:

<https://nanosandothercourses.hms.harvard.edu/>

For information call: 617-432-0162

Division of Medical Sciences (DMS) Nanocourse Policy

Read below to learn how to receive course credit and register for a nanocourse:

Course Credit:

Although students are encouraged to take as many nanocourses as they please, official credit will be granted for up to six nanocourses only. Students must participate in all sessions of a nanocourse and complete all the assignments in order to qualify for credit. Completion of three nanocourses will be equivalent to a quarter course credit.

Course Registration:

Nanocourse enrollment is required only for students who wish to accrue credit. Students are required to enroll on the web site in advance of the course (as specified per course on the web site). Students may drop a course using the web site, up to one week prior to the first session of the course. Failure to attend or complete the course will result in an incomplete grade for students who do not drop the course one week before the course date. An incomplete grade will also be given to students who do not attend both days of a nanocourse for which they have enrolled if they do not drop the course as specified above.

Intellectual Unit:

Nanocourse: Functional Genomics and Screening

Nanocourse Director(s): Fred Winston

Curriculum Fellow: Emily Gleason

Lecturers: Stephen Elledge, Norbert Perrimon, Stephanie Mohr, Jen Smith

Additional Lecturer: Dr. Caroline Shamu, Director ICCB-Longwood Screening Facility, Harvard Medical School

Cultured cells provide a powerful system for studying fundamental problems in topics such as signal transduction, cell differentiation and physiology. Several approaches can be used to interrogate gene function at genome-wide scale in cultured cells, including established techniques such as RNA interference (RNAi) and over-expression, and newer techniques such as the use of miRNA mimics and inhibitors. In addition, the new genome engineering technologies, including the CRISPR/Cas system, can be used to modify cell lines (e.g. for assay development), to screen at high-throughput, and to follow up on screen candidates. This nanocourse will introduce the types of cell-based assays that can be performed at high-throughput scale; the types of reagents and genome-scale reagent libraries available to interrogate protein-coding and non-coding genes; and how bioinformatics and experimental approaches are used to analyze, verify and validate screen data. We will discuss advantages and caveats to the approaches presented, as well as discuss how RNAi and the CRISPR/Cas system can be used in a complementary fashion to interrogate specific cell functions and generate high-confidence results.

(First session is open to public, second is for registered students only)

DROP DEADLINE: Wednesday, January 21, 2015

First Session: Wednesday, January 28, 2015, 1 - 4:30 PM

Location: TBD

Second Session: Wednesday, February 4, 2015, 1 - 3:30 PM

Location: TBD

Intellectual Unit:

Presentation Techniques for Scientists

Nanocourse Director(s): Sarah Jessop, Fred Winston

Curriculum Fellow: Emily Gleason

Lecturers:

Nanocourse Lecturers:

- Sarah Jessop, Associate Director for Speaking Instruction, Derek Bok Center for Teaching and Learning, Harvard University
- Fred Winston, Professor of Genetics, Harvard Medical School

Presentations are an essential part of a scientist's career. From pre-qualifying exams to job talks, seminars, and classroom teaching, it is important to effectively communicate one's ideas to a wide range of audiences. During the first two sessions of this course we will discuss many aspects of an effective scientific presentation including developing oral communication techniques, creating clear visual aids, and developing talks for different audiences. Registered students will then put these skills to work the following week by creating and delivering a brief practice presentation. Registered students are expected to attend both lecture sessions and at least one of the practice presentation sessions. At the end of the course students will have gained skills they can apply to future presentations.

DROP DEADLINE: Monday, January 19, 2015

Assignment

Using the techniques discussed in class, students should prepare a brief presentation on their current research project. Presentations should be no more than 7 minutes long and geared towards a broad audience of scientists. Students will present their talk at one of the two presentation sessions and receive feedback from the audience. Students are also expected to participate in the discussion of fellow students' presentations.

First Session: Monday, January 26, 2015, 1:30 – 3:30 PM

Location: TMEC 227

Second Session: Thursday, January 29, 2015, 1 – 3 PM

Location: TMEC 227

Third Session: Monday, February 2, 2015, 1 – 3 PM

Location: TMEC 109

Fourth Session: Thursday, February 5, 2015, 1 – 3 PM

Location: TMEC 109

Intellectual Unit:

The Art of Scientific Storytelling: Transform Your Research Manuscript Using a Step-By-Step Formula

Nanocourse Director(s): Fred Winston

Curriculum Fellow: Emily Gleason & Joya Mukerji

Lecturers: Rafael Luna

Research manuscripts are written to have an impact on the scientific community and to be cited by others. However, there are thousands of research articles published in our respective fields each year. Is it possible to distinguish one's research paper by communicating science in a clear and compelling fashion?

This interactive nanocourse provides instruction on how to write a scientific manuscript using the structural aspects of storytelling, i.e. dramatic arc. We will explore the logic of narrative craft and adapt it to writing a scientific manuscript. Dr. Luna will introduce his Scientific Storytelling method for writing research manuscripts. During the first session, instruction will be provided on the implementation of the Scientific Storytelling method into the basic components of a research manuscript: Title, Abstract, Figures, Results, Introduction, and Discussion. Registered students will then apply these concepts towards writing a title and an abstract for their own research, which will be critiqued and revised during the second and third sessions. Registered students must attend all three sessions and write and revise a title and abstract (see assignment) to receive credit for this course.

Assignment: After the first session, registered students should prepare and submit a title and abstract of their current graduate research or research of their respective laboratory. The title (115 character limit including spaces) and abstract (200-250 words) should incorporate aspects of the Scientific Storytelling method discussed in the first session. Please send your documents (either Word or pdf files) to Emily Gleason (Emily_Gleason@hms.harvard.edu) by 5pm on Sunday April 19th. Emily will then compile these documents and share them with the class prior to the second session. Please come to the second session prepared to critique your peers' work (see guidelines below). A subset of the titles and abstracts will be discussed in class.

At the end of the second session, Dr. Luna will return comments on the titles and abstracts to each participant in the class. Students will then revise their work in response to the feedback they received. Revised abstracts will be due prior to the start of the third session. Please send your documents (either Word or pdf files) to Emily Gleason (Emily_Gleason@hms.harvard.edu) by 12pm Thursday April 23rd. We will workshop the remaining titles and abstracts that were not discussed in the second session and discuss some of the students' revisions.

Guidelines for critical analysis:

Your critique should be divided into two halves: 1) the areas that worked well and 2) the areas that may need improvement. One must remember that the focus is to improve the scientific writing abilities of each participant. If there are grammar mistakes, please note them on the title or abstract. However, please keep the emphasis of the critical analysis on the content and clarity of the work. We will consider major aspects of the Scientific Story in your analysis. Finally, let's write our commentaries in a positive

and helpful manner.

Registered students will receive a complimentary book: *The Art of Scientific Storytelling: Transform Your Research Manuscript with a Step-By-Step Formula*.

<http://www.amazon.com/The-Scientific-Storytelling-Step-Step/dp/0615821995>

DROP DEADLINE: Tuesday, April 7, 2015

First Session: Tuesday, April 14, 2015, 2 - 4 PM

Location: TBD

Second Session: Tuesday, April 21, 2015, 2 - 4 PM

Location: TBD

Third Session: Friday, April 24, 2015, 2 - 4 PM

Location: TBD

Intellectual Unit:

Transposon-Insertion Sequencing: the design and analysis of a new approach for bacterial genetics

Nanocourse Director(s): Matthew Waldor

Curriculum Fellow: Zofia Gajdos

Lecturers: Michael Chao, Troy Hubbard, Kasia Baranowski, Karen Kieser

Day 1: 1 hour introductory lecture to TIS followed by a 2-hour interactive presentation that covers the implementation of TIS and relevant experimental considerations for every step of the process.

Day 2: A 3-hour hands-on workshop that focuses on how to use custom programs in Python and Matlab to visualize and analyze important TIS experimental metrics. Attendees will also utilize several methods to analyze existing TIS data and generate biologically meaningful results.

Overview:

Transposon-Insertion Sequencing (TIS) is a revolutionary microbial genetic technique that unites high-density genome-wide transposon mutagenesis with high-throughput parallel sequencing to identify genes and regulatory networks necessary for bacterial growth under virtually any experimental condition. As a computational approach, there are many experimental factors that can affect the applicability of the TIS technique and also impact the accuracy of downstream analysis methods. This course aims to introduce and discuss the implications of these experimental parameters and offer practical experience in the analysis of TIS data using a variety of computational platforms. There are two components to this course: a 3-hour lecture-based seminar and a 3-hour hands-on data analysis workshop. The lecture will present experimental considerations for different types of TIS studies, and examine their respective merits and pitfalls, relevant quality controls, and impact on downstream statistical analyses. In the follow-up workshop, participants will be introduced to the Python and Matlab platforms and use a variety of custom scripts to carry out a full analysis of existing TIS data, including mapping raw sequence information, normalizing the data for experimental biases, and finally performing statistical analyses and generating biologically meaningful results.

Goal:

Participants should leave this course with an understanding of fundamental experimental and statistical considerations that can affect the accurate implementation of the TIS approach. Through hands-on training, the participant will be familiarized with the tools necessary to perform a TIS study from start to finish and assess the quality of the resulting data.

DROP DEADLINE: Wednesday, January 21, 2015

First Session: Thursday, January 29, 2015, 1 - 4 PM

Location: NRB, Room 1031

Second Session: Wednesday, February 4, 2015, 1 - 4 PM

Location: Countway Library, Room 403

Intellectual Unit:

The Microbiome in Health and Disease

Nanocourse Director(s): Wendy Garrett

Curriculum Fellow: Zofia Gajdos

Lecturers: Curtis Huttenhower

Interest in host-associated microbial communities has exploded over the past few years, and the roles of the human microbiome in health and disease have emerged as key areas of biological interest. The microbes that live within different body sites and their functions are essential parts of human biology, influencing development, metabolism, the immune system, and overall physiology. Advances in sequencing technology, bioinformatic tools, and chemical biology have resulted in increasingly large and rich data collections.

These are beginning to detail the community structure and biomolecular functions of the microbiota at different human body sites, and they shed light on how microbes may contribute to host tissue and organ function. Functional meta'omics technologies (transcriptomics, proteomics, glycomics, lipidomics, and metabolomics) are further furnishing insights into how the microbiome may affect and be affected by health status and disease susceptibility. This nanocourse will thus provide an overview of the role of microbiome in health and disease, with a focus on computational biology approaches to the intersection of microbiome, microbial chemistry, and human health as well as the role of the microbiome in the development and function of the immune system.

First Session: Thursday, April 9, 2015, 1 – 4:30 PM

Location: TBD

Second Session: Thursday, April 16, 2015, 1 – 4:30 PM

Location: TBD

Intellectual Unit:

Microbial Genomics

Nanocourse Director(s): Bill Hanage

Curriculum Fellow: Zofia Gajdos

Lecturers: Cheryl Andam, Daria Van Tyne

Genomic analysis of microbes can be used for questions from identifying genes under selection to the contents of the microbiome or tracking outbreaks and their evolution. The nanocourse in microbial genomics will introduce students to the principles of genome sequencing and assembly, and then what you do with the data you get out. It will be taught by Drs Cheryl Andam and Daria Van Tyne along with the course organizer Dr Bill Hanage from the Faculty in the Department of Epidemiology at the Harvard T. H. Chan School of public health.

The course will take place over two afternoons, one week apart. In the first week we will discuss how genome sequencing works with a focus on Illumina technology, the ways in which raw data can be combined into an assembled ‘draft’ genome, the difference between this and a ‘finished’ genome, and how data can be used without assembly in microbiome studies. We will then talk about variation in a population sample, and how it can be identified, with a special focus on variation in genome content – a common feature of closely related bacteria – and SNP calling. We will also introduce a recent paper for discussion in a journal club format in the 2nd week.

In the first week, students will be grouped together into teams and challenged to develop a proposal for research making use of genomic methods. The second week students will introduce short presentations, pitching their ideas to faculty and their peers. The goal of this is to foster creative thinking about how to use these novel technologies, and develop robust research questions. Following this, the class will close with a journal club discussion of the paper introduced in the first week.

If enrollment permits, students will be grouped on the basis of their pre-declared interests and background, to work on proposals that are maximally relevant to their own academic development.

DROP DEADLINE: Wednesday February 25, 2015

First Session: Wednesday, March 4, 2015, 1 - 4 PM

Location: TMEC Building, Room 227

Second Session: Wednesday, March 11, 2015, 1 - 4 PM

Location: TMEC Building, Room 448

Intellectual Unit:

Metabolism in immunology and infectious disease

Nanocourse Director(s): Wendy Garrett

Curriculum Fellow: Zofia Gajdos

Lecturers: Barbara Burleigh, Eric Rubin

Both host and microbial metabolism contribute to maintenance of normal immune function and successful infections by pathogens. In this nanocourse, we will explore recent developments in understanding the metabolic coupling of symbiotic and pathogenic microbes and host cells. We highlight three examples: the pathogenic protozoa, *Trypanosoma cruzi* (etiologic agent in human Chagas' disease), the pathogenic bacterium *Mycobacterium tuberculosis* (etiologic agent in tuberculosis), and anaerobic gut symbiotic bacteria (producers of microbial metabolites that affect T cell function).

DROP DEADLINE: Friday March 13, 2015

First Session: Friday, March 20, 2015, 1 - 4 PM

Location: TBD

Second Session: Friday, March 27, 2015, 1 - 4 PM

Location: TBD

Intellectual Unit:

Public Health 101 Nanocourse

Nanocourse Director(s): Eric Rubin

Curriculum Fellow: Zofia Gajdos

Lecturers: Morteza Asgarzadeh, Courtney Carignan, Catherine Kreatsoulas, Jin Lee

Graduate students and postdocs at HSPH and elsewhere at Harvard have had limited opportunities outside of traditional coursework to gain a basic understanding of the multidisciplinary areas of study within public health and the roles they each play in improving health. To provide a succinct overview and introduction to the field of public health, we have developed the “Public Health 101” nanocourse. The nanocourse will give an overview of the five core areas of public health (epidemiology, biostatistics, social and behavioral sciences, environmental health, and health policy and management). Attendees will learn about various epidemiologic study designs (epidemiology and biostatistics), calamities, chemicals in consumer care products, and gene-environment interactions (environmental health), safety climate research (social and behavioral sciences), and health financing (health policy and management).

In the second session, attendees will use a case-based approach to integrate the skills and knowledge gained in the first session in the context of an exercise related to public policy.

Registration is not required to attend session 1, but we are trying to get a sense of who our audience is in order to estimate attendance and appropriately target the level of the presentations. If you're interested in attending session 1, please fill out our informal pre-course survey here: <http://goo.gl/kytKfY>.

(Please note: if you are unfamiliar with the nanocourse format, please see this page for more information about registration and credit.)

This course is a modified and updated version of the previous Public Health 101 nanocourse offered in October 2013.

Additional Instructor: Christian Shuarlim

DROP DEADLINE: Tuesday, March 24, 2015

First Session: Thursday, March 26, 2015, 1 - 4:30 PM

Location: Goldenson Building, Room 122

Second Session: Thursday, April 2, 2015, 1 - 4:30 PM

Location: TMEC Building, Room 144

Intellectual Unit:

Public Health 101: Introduction to decision analysis and cost-effectiveness analysis for public health and clinical decision making

Nanocourse Director(s): Eric Rubin

Curriculum Fellow: Zofia Gajdos

Lecturers: Christian Suharlim, Emily Burger, Stephen Sy

Day 1 Interest Form: <http://goo.gl/forms/5IlZ2cy8Et>

Decision science is the study of how people make decisions and how people can make better decisions in the presence of uncertainty, complexity and competing values. Decision-analytic methods utilize an interdisciplinary approach that provides a structured and systematic method to inform complex decisions by enumerating the tradeoffs that accompany any particular action or inaction. Decision science has been applied in several fields, including: business, military, clinical, and public health, including healthcare and the environment.

All countries face resource constraints, either economic (e.g., money) or physical (e.g., time), that require stakeholders to make difficult but necessary decisions. Worldwide, countries are increasingly using value for money and efficiency arguments associated with new interventions and pharmaceuticals as a specific criterion on which to allocate new health technologies. Cost-effectiveness analyses can use decision-analytic methods to inform policies and practices in healthcare by systematically integrating scientific evidence with explicit consideration of individual and societal values for outcomes including mortality, morbidity (e.g., quality of life), resource use and monetary costs. This course encompasses introductory analytic approaches such as decision tree modeling and cost-effectiveness analysis.

Course objectives

This course is designed to provide an introduction to the methods and applications of decision analysis and cost-effectiveness analysis. Upon completion of this Nanocourse, participants are expected to be able to:

- Understand the importance (and limitations) of decision analysis in clinical and public health decision making
- Identify elements of a decision problem and the information required for decision analysis in clinical and public health decision making
- Apply decision tree techniques to aid clinical and public health decision making
- Incorporate diagnostic test information and enumerate the health and economic consequences of alternative health interventions
- Understand the basic concepts of economic evaluation and the importance of cost-effectiveness analysis
- Identify components of a cost-effectiveness analysis

Course Outline

First Session: Introduction, structuring, and evaluating a decision problem

- Introduction to decision science, concepts and common applications

- Structuring a decision problem and identify decision problem components
- Building a decision tree model and calculating expected value
- Incorporating test information to decision tree model
- Incorporating quality of life to decision tree model
- Sensitivity analysis and threshold analysis
- Background on economic evaluation and resource allocation
- Identifying components of a cost-effectiveness analysis
- Incorporating economic consequences into a decision tree problem
- Hand out case example

Second Session: Cost-effectiveness analysis using decision-analytic software (Treeage™ Software (v2015))

- Shopping spree vs competing choice (hands on exercise)
- Calculating the cost-effectiveness of a program
- Societal willingness-to-pay (WTP) threshold and interpreting CEA results
- Introduce case example II
- Lab session using Decision science software: structuring decision trees, calculating expected value, conducting one-way sensitivity analysis and cost-effectiveness analysis
(Note: students to bring laptop installed with Treeage™: trial version)
- Brief introduction to advanced modeling methods and available courses in decision science at Harvard TH Chan School of Public Health

Suggested Reading / Assignments (due before class)

First Session:

- Goldie S, Corso P. Chapter 7, Decision Analysis in Haddix AC, et al. Prevention Effectiveness: A Guide to Decision Analysis and Economic Evaluation.
- Hunink MGM, Glasziou PP, et al. Decision Making in Health and Medicine, Chapters 2, 3, 5 (Section

First Session: Thursday, April 23, 2015, 1:30 - 4:30 PM

Location: TMEC, 309

Second Session: Thursday, April 30, 2015, 1:30 - 4:30 PM

Location: TMEC, 447

Intellectual Unit:

Public Health 101 - Metabolomics: an exciting and novel approach for the exploration of human nutrition, health and disease

Nanocourse Director(s): Eric Rubin

Curriculum Fellow: Zofia Gajdos

Lecturers: Kerry Ivey, Rachel Kelly

Metabolomics, an interdisciplinary “omics” science, that combines bioinformatics, epidemiology, analytical biochemistry and biology, may represent the ‘final frontier’ in biomarker development.

Metabolomics is the agnostic study of all the low molecular weight compounds in a biological sample to provide a dynamic down-stream measure of a whole system’s activity defined as the metabolome; a global measure analogous to the genome. The metabolome reflects the genome, epigenome, transcriptome and proteome. It also reflects current exposure experience such as diet.

Crucially to public health, the metabolome has been shown to be reflective of disease state. As such, it represents a rich resource for the identification of exposure, predictive, diagnostic and prognostic biomarkers. With the advancement of high-throughput technologies, metabolomics is now emerging as a powerful and unique tool that will make a substantial impact on discovery-driven science.

In this nanocourse, we will provide an overview of metabolomics, the concepts and technologies underlying it, and recent developments in the field. We will provide the basic framework for planning and executing successful metabolomic studies, enabling nanocourse participants to take advantage of this exciting new technology in their future work.

DROP DEADLINE: Wednesday, June 3, 2015

First Session: Wednesday, June 10, 2015, 1:30-4:30 PM

Location: FXB G12 (Harvard Chan School of Public Health)

Second Session: Wednesday, June 17, 2015, 1:30-4:30 PM

Location: FXB G12 (Harvard Chan School of Public Health)