

Division of Medical Sciences

Ph.D. Programs at Harvard Medical School

# **Nanocourses**

Spring Semester

2015 - 2016

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:*

**Viruses as Tools for Genetic Analysis**

Nanocourse Director(s): Constance Cepko

Curriculum Fellow: Emily Gleason

Lecturers: Luk Vandenberghe

For decades, the unique properties of viruses have been harnessed by biologists as tools for genetic analysis. Currently viruses are employed in a wide range of techniques from basic research to therapeutic approaches. This course will start with an introduction to viral biology and how aspects of this biology can be harnessed for various research applications. We will then discuss two types of commonly used viruses in more detail; Adeno-Associated Virus (AAV) and retroviruses.

**DROP DEADLINE:** Monday, March 28, 2016

**First Session:** Monday, April 4, 2016, 1 - 4:30 PM

**Location:** TMEC 209

**Second Session:** Monday, April 11, 2016, 1 - 3:30 PM

**Location:** TMEC 448

*Intellectual Unit:*

## **Interorgan Communication Pathways in Physiology and Disease**

Nanocourse Director(s): Norbert Perrimon

Curriculum Fellow: Emily Gleason

Lecturers: Ilia Droujinine, Bruce Spiegelman, Amy Wagers

Local tissue homeostasis is relatively well understood, while long-distance communication between organs is not. Studies from invertebrates (e.g., *Drosophila*) and mammals have documented the existence and importance of a number of factors that mediate the communication between organs – including leptin, irisin, and GDF-11. These factors act to coordinate the function of distal organs in physiological (e.g., starvation, high-fat diet) and disease states. The relevance of interorgan communication factors to diseases is illustrated by systemic conditions including cancer cachexia. The aim of this nanocourse is to provide a broad entry point into the expanding field of interorgan communication. We will identify the known secreted factors for which there is strong evidence of their direct roles in interorgan communication pathways. Further, we will examine the physiological stimuli and mechanisms that induce the secretion of these factors in the organs-of-origin. In addition, we will determine the cellular and tissue processes are induced in the destination organs of the systemic factors. Moreover, we will evaluate the effect of dysregulation of the interorgan communication factor pathways on the overall organism physiology, such that occurring in disease. Finally, we will discuss and propose clinical approaches that could be used to target and treat dysregulated interorgan communication pathways. Throughout the course, we will illustrate how studies in model organisms ranging from *Drosophila* to mammals can be used in high-throughput discovery of interorgan communication secreted factors. With this course, we hope to spark excitement and interest into the novel field of interorgan communication.

Learning Objectives:

1. Identify the secreted factors for which there is strong evidence of their direct roles in interorgan communication pathways (Day 1).
2. Evaluate the effects of dysregulation of interorgan communication factor pathways in disease and discuss treatments targeted at normalizing the systemic signaling (Day 1).
3. Propose experiments to test the involvement of molecules or factors in interorgan communication pathways (Day 2).

Assignment: TBD

**DROP DEADLINE:** Friday, February 19, 2016

First Session: Friday, February 26, 2016, 12:30 – 4 PM

Location: TMEC 250

Second Session: Wednesday, March 2, 2016, 12:30- 3 PM

Location: TMEC L-007

*Intellectual Unit:*

**Applications of Optogenetic and Chemogenetic Tools**

Nanocourse Director(s): Eleftheria Maratos-Flier

Curriculum Fellow: Christopher Burtner

Lecturers: Elda Arrigoni, Melissa Chee

**Applications of Optogenetic and Chemogenetic Tools**

Course Director: Eleftheria Maratos-Flier, MD

Course instructors: Elda Arrigoni, PhD; Melissa Chee, MD; Patrick Fuller, PhD

Curriculum Fellow: Christopher R. Burtner, PhD [Christopher\\_Burtner@hms.harvard.edu](mailto:Christopher_Burtner@hms.harvard.edu)

Optogenetics and chemogenetics are invaluable technologies for neuroscience to study how specific cell types contribute to brain function. Light-sensitive probes (optogenetics) or synthetic receptors (chemogenetics) can be expressed in specific neuronal populations in order to explore neuronal activity in both ex vivo brain preparations and freely behaving animals. This is accomplished through the delivery of viruses that are activated in neurons of interest by genetic targeting, such as by using the cre lox system. This permits researchers to associate causal relationships between neural activity with behavioral and physiological consequences. In optogenetic studies, the delivery of light pulses activates the light-sensitive opsins (ion channels or pumps) to control their electrical activity. In comparison, chemogenetic systems use modified metabotropic or ionotropic receptors that respond to synthetic, pharmacologically inert ligands to control neuronal activity. Collectively, these methods for examining behavior and physiology are powerful tools for understanding brain function.

This nanocourse will:

- introduce you to the variety of optogenetic and chemogenetic tools currently available
- describe the methods of delivery and the instrumentation required
- compare the advantages and limitations of these tools
- use the hypothalamus as a case study to show the significant impact of these applications in neuroscience

The first of two meetings is an interactive lecture with the faculty. At the second meeting, you will complete the course assignment, and receive feedback on your work from your faculty and peers. At the end of this course, you will have explored how these genetic methods can be applied to your research field, and learn how others are using these approaches to answer a range of important questions.

**Assignment:** Propose a project related to your current field of study that applies optogenetic or chemogenetic tools. Please 1) define the hypothesis; 2) describe the rationale for choosing one approach versus the other; 3) discuss expected results, including possible outcomes that disprove your hypothesis; 4) outline potential problems and suggest alternative solutions. Present your proposal in an oral presentation for discussion.

**Schedule:**

Wednesday, April 20 (1:30pm - 5:00pm) **Vanderbilt 101 Joseph B Martin Student Lounge**

Wednesday, April 27 (2:30pm - 5:00pm) **TMEC 144 Student Orientation Room**

**DROP DEADLINE: Wednesday, April 13, 2016**

**First Session: Wednesday, April 20, 2016, 1:30-5pm**

**Location: Vanderbilt 101 Joseph B Martin Student Lounge**

**Second Session: Wednesday, April 27, 2016, 2:30 - 5pm**

**Location: TMEC 144**

*Intellectual Unit:*

## **Making Figures: Designing Professional and Effective Figures for Publication**

Nanocourse Director(s): Fred Winston

Curriculum Fellow: Emily Gleason

Lecturers: Christina Usher

We are scientists. We are highly trained investigators who dive into new hypotheses and datasets with zeal, yet the figures of the resulting papers often lack the thought and diligence with which we approached the science. In this nanocourse, we will learn how to effectively portray our science through figures. Specifically, we will learn how to design our figures to make them highlight our main points, be easily understandable, and look professional. In the first session of the course, we will discuss figure design generally and then apply these principles to designing graphs in the second session of the course. In the third session of the course, registered students will apply figure design concepts to redesigning a graph in Illustrator. Registered students will learn the basics of Illustrator through this process. The class will be a mix of lectures and workshops, with plenty of examples and opportunities for hands-on learning.

Day 1 (No registration required) – 2 hours

Date: Tuesday, April 19th, 2016. 10am -12pm

Location: TMEC 227

Outline:

How to tell your science through pictures.

1. The difference between using graphs to explore your data and using them to present it.
2. Picking which figures go into your main paper and which do not.
3. Redesigning the main figures to best convey your main points.
  - a. Deciding exactly what point you're making.
  - b. Designing a figure that best displays that point.
  - c. Fine-tuning the figure by adding context and adjusting aesthetics, so the point can be understood quickly.
    - i. Color theory
    - ii. Visual weight

Day 2 (No registration required)– 2 hours

Date: Thursday, April 21st, 2016. 10am – 12pm

Location: TMEC 227

Outline:

Applying the general principles of figure construction to graphs.

1. Choosing the right graph to convey the main point.
  - a. Having a third or fourth variable conveyed through colors, volumes, and point shapes.
2. Making the graph easily understandable through.
  - a. Annotation
  - b. Standard conventions

c. Color and point shape selection

3. How to make the graph aesthetic and look professional.

Day 3: Illustrator Workshop (registered students only) – 2 hours

Date: Tuesday, April 26th, 2016. 10am -12pm

Location: TMEC 144

Outline:

Learn how to use Illustrator to edit a graph

DROP DEADLINE: Tuesday, April 12, 2016

First Session: Tuesday, April 19, 2016, 10AM - 12PM

Location: TMEC 227

Second Session: Thursday, April 21, 2016, 10AM - 12PM

Location: TMEC 227

Third Session: Tuesday, April 26, 2016, 10AM-12PM

Location: TMEC 144

*Intellectual Unit:*

**Resistance to Cancer Therapies**

Nanocourse Director(s): , Joan Brugge, George Demetri

Curriculum Fellow: Catherine Dubreuil PhD and Megan Mittelstadt PhD

Lecturers: , Stephen Hodi

While significant advances have been made in the treatment of cancer, both primary and acquired resistance to anticancer therapeutics remain significant barriers that limit our ability to cure disease.

This nanocourse will provide an overview of basic and clinical mechanisms of cancer resistance, including the complexity and plasticity of tumor cells and the microenvironment, heterogeneity within and across tumors, as well as the emerging breakthroughs and challenges in immune-oncology.

Rational combinations to overcome resistance will also be discussed in detail, and students will work in groups to develop practical concepts to test and overcome resistance in cancer.

This nanocourse is sponsored by the Landry Cancer Biology Consortium and the Ludwig Consortium.

Schedule:

First Session (open to the Harvard community): Monday, May 2, 2016 9am-12pm

Location: Goldenson 122

Second Session (limited to registered students): Tuesday, May 24, 9am-12pm

Location: TMEC 447

Assignment:

TBD

Drop Deadline: April 25, 2016

First Session: Monday, May 2, 2016, 9AM - 12PM

Location: Goldenson 122

Second Session: Tuesday, May 24, 2016, 9AM - 12PM

Location: TMEC 447

*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:Bradley Coleman

Lecturers: Christian Suharlim, Emily Burger, Stephen Sy

**Overview**

This course introduces and explores two related topics: decision science and cost-effectiveness analysis. 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.

Cost-effectiveness analyses use decision-analytic methods to inform policies and practices 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. Increasingly, decisions about the allocation of health-related technologies are incorporating these value-for-money and efficiency arguments. During the first session, we will introduce the core concepts of decision science, use common metrics to build a decision tree and explore the critical components of a cost-effectiveness analysis. These concepts will be applied in several hands-on analyses using decision-analytic software (Treeage™ Software (v2015)) during session 2.

**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

**Schedule**

First Session: Tuesday April 19, 1:30 - 4:30 pm. (Location TBD)

Second Session: Tuesday April 26, 1:30 - 4:30 pm. (Location TBD)

Drop Deadline: April 12, 2016

First Session: Tuesday, April 19, 2016, 1:30 - 4:30 PM

Location:

Second Session: Tuesday, April 26, 2016, 1:30 - 4:30 PM

Location:

*Intellectual Unit:*

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

Nanocourse Director(s): Rafael Luna, Haribabu Arthanari

Curriculum Fellow: Jason Heustis

Lecturers:

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

**Nanocourse Director:** Dr. Haribabu Arthanari

**Lecturer:** Dr. Rafael E. Luna,  
Instructor at Harvard Medical School and author of  
*The Art of Scientific Storytelling*.

**Curriculum Fellow:** Dr. Jason Heustis [ronald\\_heustis@hms.harvard.edu](mailto:ronald_heustis@hms.harvard.edu).

**Course Description:**

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.

**Schedule:**

First Session: Thursday, June 2<sup>nd</sup>, 2:00 p.m. – 4:00 p.m.

Location: TBD

Second Session: Wednesday, June 8<sup>th</sup>, 2:00 p.m. – 4:00 p.m.

Location: TBD

Third Session: Friday, June 10<sup>th</sup>, 2:00 p.m. – 4:00 p.m.

Location: TBD

### **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 Jason Heustis ([ronald\\_heustis@hms.harvard.edu](mailto:ronald_heustis@hms.harvard.edu)) by **5pm on Sunday June 5<sup>th</sup>**. Jason 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 Jason Heustis ([ronald\\_heustis@hms.harvard.edu](mailto:ronald_heustis@hms.harvard.edu)) by **5 pm Thursday June 9<sup>th</sup>**. 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 peer-review 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

First Session: Thursday, June 2, 2016, 2 PM - 4 PM

Location:

Second Session: Wednesday, June 8, 2016, 2 PM - 4 PM

Location:

Third Session: Friday, June 10, 2016, 2 PM - 4 PM

Location:

*Intellectual Unit:*

## **Graphic Communication & Visualizing Your Data Using R**

Nanocourse Director(s): Yan Liu

Curriculum Fellow: Ted Feldman

Lecturers:

Data visualization provides a means of revealing the information from data and may help engage more diverse audiences in the process of analytical thinking. Good graphical methods can assist researchers in expanding their ability to dynamically visualize their findings. The goal of this nanocourse is for you to improve your data visualization skills in terms of both conceptual graphical principles and practical skills. After the course, participants will be able to:

have a basic understanding of graphic attributes (e.g., angle/slope, color, area) to maximize the accuracy of readers' graphic perception;

understand the basic principles for making impactful graphics;

distinguish junk graphics from good ones;

make basic graphics using ggplot, an R package;

create web-based interactive graphics using Shiny, an R package

### **Assignment:**

Group project:

- (a) Discuss your proposal with instructors on Day-2;
- (b) Project proposal (1-2 page paper, due 2pm June 5<sup>th</sup>);
- (c) Project presentation in Day-3 (5-10 minutes PowerPoint, due 6pm June 7<sup>th</sup>)

Submission: Submit your word/PDF document to instructors via Google Docs

Things need to include in your project proposal and the PowerPoint of your final presentation:

1. Introduction (e.g., the rationale/significance of your study and who is your audience)
2. What question(s) does your graph intend to answer? (i.e., Research questions/study purpose)
3. How well does this graph answer the question(s)?
4. What are the strength and weakness of your graph?
5. Can you suggest any improvements?

**DROP DEADLINE:** May 24th 2016

**First Session:** Tuesday, May 31, 2016, 10 AM - 12 PM

**Location:** TMEC 227

**Second Session:** Thursday, June 2, 2016, 10 AM - 12 PM and 12:15 PM - 1:15 PM

**Location:** TMEC 209

**Third Session:** Tuesday, June 7, 2016, 10 AM - 12 PM

**Location:** TMEC 209

*Intellectual Unit:*

**Public Health 101: Introduction of missing data with application in the social and behavioral sciences using R**

Nanocourse Director(s): , Eric Rubin

Curriculum Fellow:Bradley Coleman

Lecturers: Xiaoxue Li, Jin Lee

**Public Health 101:** Introduction of missing data with application in the social and behavioral sciences using R

Course Instructors: Xiaoxue Li, Ph.D., Jin Lee, Ph.D.

Curriculum Fellow: Bradley Coleman, Ph.D.: [bradley\\_coleman@hms.harvard.edu](mailto:bradley_coleman@hms.harvard.edu)

Course Director: Eric Rubin, MD, Ph.D.

**Description:**

Missing data occur when data are expected but no value is stored. This is a very common situation, which may have a significant impact on the conclusions. This Nano course will use real and sample datasets to illustrate the possible impacts of missing data on the analyses, interpretation and conclusions of studies in the social or behavioral sciences using R. In session 1, individual examples will be used to explore the possible reasons for missing data. We will talk about types of missing data and potential missing data methods. In session 2, hands-on examples for implementing missing data analyses and visualization in R will be offered.

**Course Objectives**

This course is designed for students with little or no biostatistics experience and will not contain significant discussions of statistical theory, though students are expected to have basic knowledge of R programming. R and Rstudio should already be installed on your laptop prior to the second session. The examples and approaches discussed will be specific to studies in the social and behavioral sciences and are not directly applicable to molecular or laboratory data.

After this course, participants should:

- be aware that missing data problems need to be considered prior to the design of a study.
- have a basic understanding of the potential implications of missing data and potential solutions.

**Schedule**

First Session: Wednesday June 29, 09:00-12:00 pm. Location: TBA

Second Session: Wednesday July 6, 09:00-12:00 pm. Location: TBA

DROP DEADLINE: Wednesday June 22, 2016

***If you are interested in this course (both auditors and enrolled students), please RSVP at: [hsph.me/missingdata](mailto:hsph.me/missingdata)***

***Those taking the nanocourse for academic credit must enroll through the course registration process.***

First Session: Wednesday, June 29, 2016, 9:00am - 12:00pm

Location: TMEC 250

Second Session: Wednesday, July 6, 2016, 9:00am - 12:0pm

Location: TMEC 250

*Intellectual Unit:*

**Public Health 101: Nutritional Epidemiology -- From Dietary Assessment to Public Health Recommendations**

Nanocourse Director(s): Eric Rubin

Curriculum Fellow: Bradley Coleman

Lecturers: Sylvia Ley, Fondell Elinor, Yuan Changzheng,

RSVP HERE: <http://goo.gl/forms/UCptzmmmt3YnrZsmq1>

Diet has a central role in the pathogenesis of most major causes of morbidity and mortality in men and women today. Consequently, research investigating diet-disease relationships has important public health implications; however, studying food consumption and diet patterns has unique challenges. This nanocourse is focused on nutritional epidemiology, the study of dietary assessment, dietary determinants of health-related states or events in specified populations, and the public health application of this research. This nanocourse is intended for individuals who are interested in understanding the overall process of dietary assessment to public health recommendations and learning more about the use of dietary variables in their research.

Learning Objectives - Upon completion of this nanocourse, participants will be able to:

Day 1:

- Understand the methods for assessing the dietary intake of populations and individuals
- Describe studies on specific diet/disease relationships, analyze and interpret nutritional epidemiology literature

Day 2:

- Gain hands-on experience in the actual collection, analysis and interpretation of dietary intake using publicly available online software
- Design nutritional epidemiology studies examining diet-disease relationships.

Course descriptions

Session I:

Intro: Nutritional epidemiology: Dietary Assessment, diet-disease relationships and public health recommendations

- i. News: Dietary Guidelines for Americans
- ii. What is diet and how do we measure it?
  - a. Diet – food, nutrients and dietary patterns
- iii. Current topics in diet and disease – how important is a healthy diet?
- iv. Dietary assessment methods and nutrient data base
  - a. Nutrient and diet validation
- v. How to interpret nutritional epidemiology studies
  - a. Adjusting for diet in other types of studies

Example: From research to public health recommendations and policies

- vi. Example of dietary strategies to stop diabetes
  - a. Dietary transitions and diabetes epidemic
  - b. Nutrients, foods, and dietary patterns in relation to diabetes prevention
- vii. Public health nutrition recommendations and research

- a. Investigating diet quality using different dietary patterns
- viii. Implication of public health recommendations and policies, global perspectives, and strategies for diabetes prevention

Session II:

Practice I: Actual collection, analysis and interpretation of dietary intake using USDA Supertracker

Types of food; Additions to food; Method of preparation; Brand names

Practice II: Design a study to explore the relationship between diet and disease

Hypothesis; Select dietary assessment method; Choose a study design; Analysis plan

Schedule:

First Session: Tuesday, August 16, 2016, 1:00 – 4:00 PM

Location: TMEC 250

Second Session: Thursday, August 18, 2016, 1:00- 4:00 PM

Location: TMEC 250

First Session: Tuesday, August 16, 2016, 1:00 - 4:00

Location: TMEC 250

Second Session: Thursday, August 18, 2016, 1:00 - 4:00

Location: TMEC 250