Division of Medical Sciences
Ph.D. Programs at Harvard Medical School

Nanocourses
Spring Semester
2013 - 2014

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:

Genetic Influences on the Developing Central Nervous System

Nanocourse Director(s): Fred Winston
Curriculum Fellow:Emily Gleason
Lecturers: David Van Vactor, Elizabeth Engle, Constance Cepko,

This nanocourse will explore the fundamental mechanisms underlying the development of the Central Nervous System (CNS) with a focus on the genes that drive this process. We will discuss a variety of topics relating to nervous system development the role of genetics in normal and abnormal neurodevelopment.

DROP DEADLINE: Monday, May 5, 2014

First Session: Monday, May 12, 2014, 9 AM - 12:30 PM
Location: Goldenson 122

Second Session: Monday, May 19, 2014, 10:30 AM - 1 PM
Location: TBD

Intellectual Unit:

Genetics, Development, and Evolution

Nanocourse Director(s): Fred Winston
Curriculum Fellow:Emily Gleason
Lecturers: Elena Kramer, Cassandra Extavour

Evolution and natural selection are the cornerstones of modern biology. Genetic variation in a population provides the raw material for evolution and natural selection while small changes in an organism's developmental program can have large effects. In this course we will discuss how our understanding of genetic and developmental mechanisms in a variety of species can inform our understanding of the process of evolution.

First Session: Monday, April 14, 2014, 9 AM - 12:30 PM
Location: TMEC Building, Room 209

Second Session: Friday, April 18, 2014, 10 AM - 12:30 PM
Location: TMEC Building, Room 109

Intellectual Unit:

Ciliogenesis and Human Disease

Nanocourse Director(s): Iain Drummond
Curriculum Fellow:Henrike Besche
Lecturers: Eric Pierce, Jing Zhou, Detina Zalli

Cilia are present on almost every cell type in the human body. After years of scientific disregard, the cilium has emerged as a key organelle in numerous physiological and developmental processes. Indeed, it is now clear that the ciliary localization of a variety of receptors, ion channels, and transporter proteins effectively positions the cilium for different types of signalling, including responses to distinct morphogens, hormones or growth factors. In fact, many key processes that occur during development are coordinated by the cilium. These include cell migration, differentiation and/or re-entry into the cell cycle, specification of the plane of cell division, and apoptosis.

Defects in ciliary assembly and function lead to a wide range of human diseases, including polycystic kidney disease, hydrocephalus and retinal degeneration, collectively known as ciliopathies. Despite the severe nature of many of these diseases, the precise mechanisms underlying primary cilium assembly and operation are still poorly understood. Indeed, it is now thought that defective ciliary signaling may also be important in cancer.
This nanocourse is designed to provide an introduction and an overview of the ciliogenesis and diseases related to it. By the end of the course students will have a clear idea of what “ciliopathies” are, mechanisms of actions associated with ciliogenesis and the recent molecular tools and advances in molecular biology of primary cilia and ciliopathies.

Information for registered students:
Students that are taking this course for credit will be provided with additional literature by the instructors. Students are asked to prepare a short (1-2 pages) research proposal on one specific problem and then to defend their proposal in form of a short presentation (power point or chalk talk) on the second day of the Nanocourse. Enrollment limit for this class is 9 students.

Timeline
Tuesday, Jan 28 – 1st day of class
Friday, Jan 31st – submit proposal
Tuesday, Feb 4th – students receive written feedback on proposal
Friday, Feb 7th - presentation of research proposal

First Session: Tuesday, January 28, 2014, 10 AM - 2 PM
Location: Building C, Cannon Rm.

Second Session: Friday, February 7, 2014, 10 AM - 1 PM
Location: TMEC Building, Rm. 425

Intellectual Unit:

Quantitative Imaging Part I: Image Acquisition

Nanocourse Director(s): Jennifer Waters
Curriculum Fellow:Henrike Besche
Lecturers:

The accuracy and precision of quantitative light microscopy measurements depends on the quality of the acquired digital images. Obtaining digital images suitable for quantitation requires careful consideration of specimen preparation, the mode of microscopy, and the optics, filters, and detector. In Part I of this two-part course, we will (1) learn how to judge image quality; (2) discuss how the various choices of equipment and imaging parameters affect image quality; and (3) learn how to best make the compromises necessary in live cell experiments to balance image quality and acquisition speed while minimizing photo-toxicity.

Please note: These courses were designed to complement one another, and therefore students who wish to take the courses for credit are required to register for both (1 Nanocourse credit will be given for each course). The only exception are students that have taken Dr. Water's Nanocourse on Quantitative Imaging in the past, these students may register for Dr. Hunter's Image Analysis Nanocourse separately. The second day will feature hands on instruction in data acquisition at the Nikon Imaging Center (3/3/14) followed by quantitative image analysis (3/5/14). Students that are interested in the second session should sign up on the website. However space is limited to 12 students and signing up on the website will not guarantee a spot in theses sessions. To be considered for the second section of this course, students should submit a statement of interest (three sentences at the most). In this statement, please say whether you have any experience with imaging (and if so, how much experience) and why you would like to take the second session for both of these nanocourses. These should be emailed to the curriculum fellow (Henrike Besche, henrike_besche@hms.harvard.edu) no later than February 4th, 2014. They will be reviewed by the course directors, Dr. Jennifer Waters and Dr. Hunter Elliott. Students will then be notified by email regarding whether or not they will be able to attend the laboratory sessions.

First Session: Tuesday, February 18, 2014, 1 - 4 PM
Location: Building C, Cannon Room

Second Session: Tuesday, March 4, 2014, 1 - 4 PM
Location: TBD

Intellectual Unit:

Quantitative Microscopy Part II: Image Analysis

Nanocourse Director(s): Hunter Elliott
Curriculum Fellow:Henrike Besche
Lecturers:

Often acquiring fluorescence images is only the first step in answering your biological question: The images contain the information you're interested in, but now how can you extract it? We will start with the basic concepts necessary for understanding and utilizing images as data, and then survey the most commonly applied image analysis methods. Topics include segmentation, filtering, co-localization, particle detection and tracking, super-resolution methods and more. No computational or mathematical background is required, and all topics will be illustrated with easy-to-understand examples using real data.

Please note: These courses were designed to complement one another, and therefore students who wish to take the courses for credit are required to register for both (1 Nanocourse credit will be given for each course). The only exception are students that have taken Dr. Water's Nanocourse on Quantitative Imaging in the past, these students may register for Dr. Hunter's Image Analysis Nanocourse separately. The second day will feature hands on instruction in data acquisition at the Nikon Imaging Center (3/3/14) followed by quantitative image analysis (3/5/14). Students that are interested in the second session should sign up on the website. However space is limited to 12 students and signing up on the website will not guarantee a spot in theses sessions. To be considered for the second section of this course, students should submit a statement of interest (three sentences at the most). In this statement, please say whether you have any experience with imaging (and if so, how much experience) and why you would like to take the second session for both of these nanocourses. These should be emailed to the curriculum fellow (Henrike Besche, henrike_besche@hms.harvard.edu) no later than February 4th, 2014. They will be reviewed by the course directors, Dr. Jennifer Waters and Dr. Hunter Elliott. Students will then be notified by email regarding whether or not they will be able to attend the laboratory sessions.

First Session: Tuesday, February 25, 2014, 1 - 4 PM
Location: Building C, Cannon Room

Second Session: Wednesday, March 5, 2014, 1 - 4 PM
Location: L2-025 (Electronic Classroom, Countway Library)

Intellectual Unit:

Tumor Heterogeneity

Nanocourse Director(s): Franziska Michor, Kornelia Polyak
Curriculum Fellow:Meg Mittelstadt
Lecturers:

There is a high degree of diversity within tumors despite a largely monoclonal origin, including differences in cellular morphology, cytogenetics, growth rates, cell products, receptors, and immunological characteristics. Together these factors determine neoplastic development, risk of disease progression, and response to therapies. Recent technological developments such as whole-genome sequencing allow us to analyze tumors at unprecedented depths. This nanocourse is designed to provide an introduction and overview of tumor heterogeneity and the current technologies aimed at gleaning multidisciplinary data from tumor populations.

DROP DEADLINE: Tuesday, April 8, 2014

First Session: Tuesday, April 15, 2014, 12 - 3 PM
Location: Building C, Cannon Room

Second Session: Tuesday, April 22, 2014, 12:30 - 3 PM
Location: TMEC Building, Room 447

Intellectual Unit:

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

Nanocourse Director(s): Fred Winston
Curriculum Fellow:Emily Gleason
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. How is it possible to distinguish one's research paper from all of the other publications? By communicating one's 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 how to 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.

Visit the nanocourse website for course assignment.

DROP DEADLINE: Wednesday, April 16, 2014

First Session: Wednesday, April 23, 2014, 1:30 - 3:30 PM
Location: TMEC Building, Rm. 227

Second Session: Wednesday, April 30, 2014, 1:30 - 3:30 PM
Location: TMEC Building, Rm. 446

Third Session: Friday, May 2, 2014, 2 - 4 PM
Location: TMEC Building, Rm. 446

Intellectual Unit:

Data Processing in Crystallography Part I: Elements of Data Processing

Nanocourse Director(s): Piotr Sliz
Curriculum Fellow:Jason Heustis
Lecturers: Kay Diederichs, Zbyszek Otwinowski, Jim Pflugrath (Rigaku), Phil; Benning, Matt Evans

High resolution macromolecular structural models are dependent not only on the quality of samples and the equipment used to generate structural data, but also on the subsequent processes of processing and analyzing that data. Progress in developing enhanced structural models is dependent on refinements to the computational models used to process this data. Two nanocourses, conducted in conjunction with the 2014 Quo Vadis Structural Biology? training workshop, will present contemporary techniques and recent advances in data processing. These are advanced nanocourses for students with experience in data processing for structural biology.

Both nanocourses are jointly presented by the Department of Biological Chemistry and Molecular Pharmacology and the Therapeutics Graduate Program.

Full program for the event is available at SBGrid website: http://www.sbgrid.org/news/article/id=393.

As part of the event registered students can present posters, can join Phenix Workshop, and can participate in meet-with-experts session.

Data Processing in Crystallography Part I: Elements of Data Processing
This nanocourse introduces contemporary techniques and recent innovations in data processing that will be useful for structural biologists presented by HMS and invited lecturers. This nanocourse covers indexing and integration, scaling and merging, linking crystallographic model and data quality, presenting data statistics in Table I, and data processing and archiving tools in the SBGrid collection. These concepts are re-inforced in a demonstration session where leading software developers will provide examples of data processing with Molsfm, HKL and XDS .

First Session: Thursday, June 5, 2014, 9 AM - 12 PM
Location: Armenise Building, Armenise Amphitheater

Second Session: Thursday, June 5, 2014, 2 PM - 5 PM
Location: Armenise Building, Armenise Amphitheater

Intellectual Unit:

Data Processing in Crystallography Part II: Elements of Data Collection and Processing Fast Lane

Nanocourse Director(s): Piotr Sliz
Curriculum Fellow:Jason Heustis
Lecturers: Nick Sauter, Dominika Borek, Clemens Schulze-Briese,

High resolution macromolecular structural models are dependent not only on the quality of samples and the equipment used to generate structural data, but also on the subsequent processes of processing and analyzing that data. Progress in developing enhanced structural models is dependent on refinements to the computational models used to process this data. Two nanocourses, conducted in conjunction with the 2014 Quo Vadis Structural Biology? training workshop, will present contemporary techniques and recent advances in data processing. These are advanced nanocourses for students with experience in data processing for structural biology.

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As part of the event registered students can present posters, can join Phenix Workshop, and can participate in meet-with-experts session.

Data Processing in Crystallography Part II: Elements of Data Collection and Processing Fast Lane

Lecturers: Members of the Northeastern Collaborative Access Team at Advanced Photon Source, Nick Sauter (Laurence Berkeley National Laboratory), Dominika Borek (UTSW), Clemens Schulze-Briese (Dectris).

This nanocourse reinforces concepts of data processing and focuses on strategies for data collection at synchrotrons. Covered topics will include optimizing data collection with micro-diffraction tools, dose-sliced data collection, data collection with PAD dectectors, and optimizing output from remote data collection. It follows with presentations on advanced data reduction using DIALS, RAPD, and cctbx. xfel.

DROP DEADLINE: Thursday, May 29, 2014

Please note: These courses are designed to complement one another, and specifically the second nanocourse builds on the first. All students who wish to get credit for these nanocourses are required to register for the first nanocourse (Day 1) and have the option of registering for the second nanocourse (Day 2). One nanocourse credit will be given for each nanocourse; 1 credit for the Day 1 nanocourse and 1 credit for the Day 2 nanocourse.

Location: Armenise Building, Armenise Amphitheater

Second Session: Friday, June 6, 2014, 1:30 - 4:30 PM
Location: Armenise Building, Armenise Amphitheater

Intellectual Unit:
Public Health 101: Social & Behavioral Sciences

Nanocourse Director(s): Candace Nelson, Madina Agenor, David Hurtado, Roman Pabayo
Curriculum Fellow:Zofia Gajdos
Lecturers:

Graduate students and postdocs at Harvard School of Public Health 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 nanocourse series. “Social and Behavioral Sciences 101” is the first in the series and will provide an introduction to the discipline of Social and Behavioral Sciences. During the first session, course instructors will present an overview of the social determinants of health framework and discuss how social, economic, and contextual factors influence health behavior and population health. We will conclude by covering the ways in which evidence-based interventions at the individual and group levels can change the social determinants of health to promote population health and reduce health disparities. During the second session, instructors will lead students through group and individual activities that center on key concepts presented during the first session. Through these activities, students will gain a more thorough understanding of and identify how social and behavioral sciences principles relate to their own work.

DROP DEADLINE: Thursday, April 17, 2014

First Session: Thursday, April 24, 2014, 1:30 – 4:30 PM
Location: FXB G13

Second Session: Thursday, May 1, 2014, 12 – 3 PM
Location: Kresge 213

Intellectual Unit:

Public Health 101: Nutritional Epidemiology

Nanocourse Director(s): Jessica Smith, Liana Del Gobbo, David St. Jules, Mercedes Prieto
Curriculum Fellow:Zofia Gajdos
Lecturers:

Diet has 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 the distribution of usual intake, and dietary determinants of health-related states or events in specified populations, and the application of this research. This nanocourse is intended for individuals who have a background in epidemiology, and are interested in learning more about the use of dietary variables in their research.

LEARNING OUTCOMES - Upon completion of this nanocourse, participants will be able to:

- describe the approaches and important considerations of dietary assessment.
- analyze and interpret nutritional epidemiology literature.
- design nutritional epidemiology studies examining diet-disease relationships.

COURSE OUTLINE

Title: Understanding the Link Between Diet and Disease: Nutritional Epidemiology

Session I: Intro: What is nutritional epidemiology and why is it useful?

Hour 1: Evolution in our thinking about diet and disease

i. Major discoveries and breakthroughs
ii. The deficiency paradigm: micronutrient deficiency and disease
iii. Malnutrition: Undernutrition

Hour 2: Where are we now?

i. Current topics in diet and disease
ii. Shift away from the deficiency paradigm: towards diet quality and dietary patterns, and prevention of chronic disease
iii. Malnutrition: Obesity and related cardiometabolic diseases

Hour 3: Why do we do this research, and where are we going?

a.) Policy development/public health implications
b.) The future: key unanswered questions

Homework- select a publication from a provided list of current manuscripts which highlight a key debate or important finding in the field of nutritional epidemiology and prepare a presentation detailing:

a) what is previously known on the topic,
b) objective/design/methods of the paper
c) results
d) implications, and what this paper adds to the literature regarding the debate/advancement of thinking on the topic

e) strengths and weaknesses of the study

Session 2: Methodological considerations for nutritional epidemiology

Hour 1-2: Methods used in Nutritional Epidemiology

a) Overview and validation of diet assessment methods

b) Correction for measurement error

d) Strengths and limitations in current dietary assessment methods

e) Independent and mediated effects of diet on chronic disease

f.) The future: improving our methods

Hour 3: Journal club group presentations and discussions

DROP DEADLINE: Thursday, May 1, 2014

First Session: Thursday, May 8, 2014, 1:30 – 4:30 PM
Location: FXB G13

Second Session: Thursday, May 15, 2014, 12 – 3 PM
Location: Kresge 213

Intellectual Unit:

Public Health 101: Epidemiology of Chronic Diseases

Nanocourse Director(s): Catherine Kreatsoulas, Kjetil Bjornevik
Curriculum Fellow:Zofia Gajdos
Lecturers:

Overview

Chronic disease, such as cardiovascular disease and cancer are the leading causes of death, accounting for over 50% of deaths among adults of all ages, in the western world and are a rising cause of death among the developing world. Cardiovascular deaths in the United States have declined by almost two-thirds in the past 50 years and despite this progress, it remains the leading cause of death among Americans.

Epidemiology is the study of how often diseases occur in different groups of people and why. From a public health perspective, information is used to plan and evaluate strategies to prevent illness and as a guide to the management of patients in whom the disease has already developed. Important methodologic concepts described in this course will be centered around 1) descriptive epidemiology and 2) analytic approaches. Multiple interactive examples will be used to illustrate these concepts.

I: Introduction
- Brief overview of chronic diseases at a public, population and global health level
- Understanding causes of chronic disease through epidemiologic research
- Understanding the evidence for prevention and control through intervention research

II: Descriptive Epidemiology
- Surveillance methods
- Measures of health, illness and disease (incidence, prevalence)
- Longitudinal studies

III: Analytic Approaches
- Observational studies (cohort, case-control, cross-sectional)
- Experimental studies (randomized controlled trials, quasi-experimental designs)

IV: Application in the Real World
- Practice guidelines
- Knowledge translation
- Current challenges

DROP DEADLINE: Thursday, May 29, 2014

First Session: Thursday, June 5, 2014, 1:30 – 4:30 PM
Location: FXB G13

Second Session: Thursday, June 12, 2014, 1:30 – 4:30 PM
Location: Kresge 202

Intellectual Unit:

Fundamentals of Data Analysis for Experimental Biologists

Nanocourse Director(s): David Van Vactor
Curriculum Fellow:Abha Ahuja
Lecturers:

Biological research is becoming increasingly quantitative. Several user-friendly statistical programs have made it easy to apply advanced analytic methods. However some basic background is needed in order to fully harness the power of these packages. This nanocourse is designed to teach basic statistical concepts and theory in the context of real biological data and results analysis. This course will help students to:

- Analyze their data
- Interpret and understand the output from any statistical package or primary literature
- Communicate their results accurately and effectively
- Prepare for more advanced courses in statistics

Lectures will be interspersed with in-class exercises. The lecturer will teach each topic using real biological data. Students will explore each topic by conducting simple calculations using a calculator. At the end of each topic students will discuss a thought question or solve a problem in pairs or small groups.

Topics Covered:

1) Describing your data and summary statistics
2) Parametric vs. Non-Parametric Methods
3) Making inferences using confidence intervals
4) Making inference using statistical tests:
   - t-test
   - Wilcoxon rank sum
   - Correlation and Regression
5) Use and abuse of p values

Assignment:

All students are required to attend the pre course meeting. Students will be given readings to complete before Day 1. In addition, students will complete a take-home assignment at the end of day 1. They can do these assignments using a calculator, excel or their favorite statistical software.

Mandatory pre-course meeting (joint with Technologies pre course meeting)
Wednesday April 30th, 5:15-6:00pm
TMEC 109

First Session: Tuesday, May 6, 2014, 1 - 4 PM
Location: TMEC Building, Room 109

Second Session: Tuesday, May 13, 2014, 1 - 4 PM
Location: TMEC Building, Room 109

Intellectual Unit:

Technologies for Data Analysis for Experimental Biologists

Nanocourse Director(s): David Van Vactor
Curriculum Fellow:Melanie Stefan
Lecturers:

Registration information: Registration is required, even if you are auditing. Attendance at both sessions and the pre-course meeting is required. Enrollment for this course is limited, enrolled students will be notified via email. Priority will be given to students on the waitlist from earlier course offerings. Priority may also be given to students also enrolled in the Fundamentals of Data Analysis nanocourse.

This course is designed to be taken in conjunction with the "Fundamentals of Data Analysis for Experimental Biologists" Nanocourse, but can also be taken as a standalone course. This course will teach students to use the JMP statistical software, which is available to everybody in the Harvard community. This will enable students to Implement the concepts learned in the "Fundamentals of Data Analysis" nanocourse (e.g. summary statistics, parametric and nonparametric testing, correlations)

Use the software to illustrate some of the concepts and improve statistical intuition (e.g. on p values, confidence intervals and sample distributions)
Become familiar with JMP and start using it to analyze their own research data

The focus of this course will be on exercises, both in class and at home. Students should bring their laptops with JMP installed (information on how to do this will be provided in advance). Everyone (including auditors) is required to sign up and attend both sessions.

Assignment: All students are required to attend a pre course meeting. Students will be given an assignment to complete before Day 1 (which consists of installing JMP and going through an entry-level tutorial). There will also be two take-home assignments, one after each day of class.

Schedule:

Mandatory pre-course meeting (joint with Fundamentals pre course meeting)
Wednesday April 30th, 5:15-6:00pm
TMEC 109

DROP DEADLINE: Thursday, May 1, 2014

First Session: Thursday, May 8, 2014, 1 - 4 PM
Location: TMEC Building, Rm. 126

Second Session: Thursday, May 15, 2014, 1 - 4 PM
Location: TMEC Building, Rm. 109