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

PRELIMINARY
Nanocourses

Fall Semester
2009 – 2010

(Updates will be posted on the new website:
https://nanosandquarters.hms.harvard.edu/)

For information email:
nanocourses@hms.harvard.edu

What is a Nanocourse?

Nanocourses represent a dynamic way of teaching specific subjects at an advanced level in a condensed fashion. These courses are an educational tool meant to bring students and other interested individuals in the Harvard community up to date on a particular field, to provide insight into the current problems in that field, and to, in general, define a solid basis for further study in that field, in a short time period. The idea behind creating such a teaching tool, is to develop a curriculum that will stay fresh, will be easily updated in response to the changing nature of the field and the needs of the students, will take maximum advantage of the scientific potential of the faculty across the Harvard campus, and will appeal to a wide-variety of students, post-docs, fellows and faculty who don't traditionally participate in classes.

For credit purposes, 3 nanocourses are equivalent to one quarter course. Therefore, the following guidelines for classroom hours are recommended. Nanocourses should meet for 6 hours over a period of 2 days. The first session is lecture-based and is taught by 2 or more faculty members over 3-4 hours. The lectures should be contiguous with one another and aim to provide an advanced level of knowledge on current research areas, specific experimental approaches and new technologies. This lecture-based session is open to the entire Harvard community. The second session is discussion-based and is intended only for students taking the nanocourse for credit. The format of this second session, which lasts for 3 hours, is flexible. It can include discussion of relevant papers, brainstorming about future research, or whatever is deemed appropriate by the course director to assess student progress.

Given the focused theme of each nanocourse topic, we anticipate that the first lecture-based meeting of each nanocourse will attract a sizeable audience. The second discussion-based meeting will likely have a smaller audience, which is practical for discussions and exploring the topic more in depth.

For didactic purposes and in order to provide students with a framework for a course of study, nanocourses will be grouped into thematically related groups. Groups of complimentary nanocourses will be classified as intellectual units to provide students with a framework for a course of study. Students can take 3 nanocourses from the same intellectual unit or can choose courses from different units, allowing them to tailor their course-load to their own interests. Although students can take as few as one nanocourse in any semester, students cannot register on their study cards for the nanocourses they have taken until they have taken six nanocourses, or 3 nanocourses and one quarter course. See the "Guidelines for Students" for more information.

For additional information, please visit the IDB website at http://idb.med.harvard.edu/.

Guidelines for Students

Part of the reason for designing the nanocourse format was to attract senior graduate students. We hope that the up-to-date nature of the science presented in the courses and the relatively modest time investment required would prove attractive for students who are immersed in their thesis research. We encourage the participation of all students. While G1s are permitted to take nanocourses, their intense nature and high expectation of participation make them suitable for students only after they complete one semester of graduate work. Students in any HILS-associated graduate program may register for nanocourses. *Credit for nanocourses is given only after students complete 6 or 3 nanocourses + 1 quarter course.*

Credit

1) 3 nanocourses are the equivalent of one quarter course.

2) Students register for credit on their study cards in the semester that they plan to complete their 6th nanocourse, or when they plan to complete a combination of 3 nanocourses and one quarter course.

3) To receive credit for a nanocourse, students must attend both meetings of the nanocourse and complete all assignments.

4) Nanocourses need not be taken in the same semester to count for credit.

5) All nanocourses are graded on a pass/fail basis.

6) Nanocourse attendance and participation is monitored by the iDB Teaching Fellow and the DMS office.

Enrollment

1) Enrollment is not required to attend the first lecture-based meeting of a nanocourse.

2) Enrollment is required to attend the second discussion-based meeting of a nanocourse and to receive credit. Enrollment is online at the https://nanosandquarters.hms.harvard.edu/ website and begins December 22nd. ***Deadline for nanocourse enrollment is September 4th and students will receive email confirmations of enrollment by September 12th.***

Online Enrollment for Nanocourses!

If you are planning on taking **any** nanocourses this semester, you should enroll online at https://nanosandquarters.hms.harvard.edu/.

Enrollment helps us keep track of students taking nanocourses and makes it easier to correctly award credit at the end of the semester. Plus, it gives everyone accurate confirmation of their enrollment. **If you are not enrolled in a nanocourse, you cannot attend the second session or receive credit.**

To enroll in nanocourses, go to https://nanosandquarters.hms.harvard.edu/.

Online enrollment simply reserves your spot in a particular nanocourse. You must put nanocourses on your study card to receive credit. Pay attention! This is the important part! *You only put nanocourses on your study card in the semester in which you complete your 6th nanocourse OR your 3rd nanocourse plus 1 quarter course. Visit https://nanosandquarters.hms.harvard.edu/ to find out how to put nanocourses on your study card.*

One week before the first session of each nanocourse, the registered students will receive an email with information specific to participation in that particular nanocourse.

Important Dates for Students to Remember!

First Day for Online Nanocourse Enrollment: August 21, 2009
Study Card Day: September 8, 2009 (G3s and higher) and September 9, 2009 (for G1s and G2s)
Deadline for Online Nanocourse Enrollment: Friday, September 4th, 2009

First Day of Classes: Wednesday, September 8, 2009
Columbus Day: Monday: October 12th, 2009
Veteran's Day: Monday, February 16th, 2009
Thanksgiving Break: Wednesday, November 25th through Sunday, November 29th, 2009
Last Day of Classes: Friday, December 18th, 2009

Nanocourse Organization

Nanocourses are grouped into intellectual units. Frequently, a nanocourse topic can fit into multiple intellectual units, but below we provide some organization to help you make decisions. Bold indicates that a course will be offered in the Fall 2009 semester. Non-bolded course titles have been offered in previous semesters and are included to give students an idea of other courses within intellectual units. See full nanocourse descriptions on the subsequent pages.

Intellectual Unit: Neural Development and Regeneration
Neural Cell Identity
Neuron Migration and Axon Guidance
Neural Survival and Regeneration

Intellectual Unit: Tissue Development
Formation and Regeneration of Skeletal Muscle
Epithelia: Tissue Regeneration and Wound Healing
Development and Disease of Cardiac Muscle
Stem Cells and Development
Mechanotransduction Mechanisms in Development
How to Build a Blood Vessel

Intellectual Unit: Cell Fate Decisions
Autophagy in Cell Death and Survival
B Cells: A Model for Studying Development
Apoptotic and Non-Apoptotic Mechanisms of Cell Death
Epithelia to Mesenchyme and back again: Cell Transitions in Organogenesis and Disease
Mechanisms of microRNA Silencing
Glia: More than Nerve Glue

Intellectual Unit: Experimental Tools for Biological Discovery

Fluorescence Live Cell Imaging
Live Cell Imaging of Membrane Trafficking
Analytical Approaches: Mass Spectrometry
From Chemical Biology to Drug Discovery
Advanced Genome Browsing/BLAST
Single Molecule Biophysics
Quantitative Microscopy Part I: Quantitative Image acquisition and Processing
Quantitative Microscopy Part II: Image Segmentation and Analysis
Synthetic Biology: Cellular and Molecular Engineering
Using Immunohistochemistry Correctly and Effectively
Genetic Interactions: Principles, Measurements and Interpretation
RNAi Screening: From Design to Data Analysis
Next Generation Sequencing Technologies: Principles and Applications
Nuts and Bolts of Microarray Technology
Flow Cytometry: A Practical Perspective
What can NMR do for you?
Introduction to Molecular Electron Microscopy
2-Photon Microscopy: Past, Present and Future

Intellectual Unit: Structural Biology Tools & Biological Computing
Molecular Visualization
Introduction to Protein Crystallography I
Introduction to Protein Crystallography II
Visualizing Molecular Processes with Maya for Beginners
Visualizing Molecular Processes with Maya, Advanced
Introduction to Data Analysis and Visualization with MATLAB

Intellectual Unit: Signaling Molecules in Development and Disease Progression
Notch Signaling in Vascular Biology and Disease
Nitric Oxide: Biochemistry and Clinical Correlations
Wnt Signaling in Development and Disease
mTOR in Development and Disease
Calcium Signaling in Health and Disease

Intellectual Unit: Mechanisms of Disease
Spinal Muscular Atrophy: A pathological link between RNA processing and neurodegeneration
Fetal Programming of Type 2 Diabetes and Metabolic Syndrome
The Ubiquitin-Proteasome System and Disease
Alzheimer's Disease
Autism: Searching for a Cause and a Cure

Intellectual Unit: Understanding the Complexity of Cancer
The Molecular Pathology of Cancer
Viruses and Cancer
Apoptosis and Cancer
Cancer Genomics
Kinases and Kinase Inhibitors in Cancer

Intellectual Unit: Building a Better Scientist
Experimental Design for Biologists
Positive Psychology: The Science of Happiness
Teaching 101: Bringing Effective Teaching Practices to your Classroom
Professional Development I and II

Intellectual Unit: Cellular and Molecular Machines
Vesicular Transport: Mechanisms, model systems and physiology
The Ubiquitin-Proteasome Pathway, Part I
The Ubiquitin-Proteasome Pathway, Part II
Chromatin Dynamics: A Molecular View
Molecular approaches to study faithful chromosome duplication: from single molecules to cell-free systems
The Life and an mRNA Molecule
Cilia in Development and Disease

Intellectual Unit: Topics in Translational Biology
Novel Approaches to Development of Anti-Infectives and Vaccines
Medicine 101: From Bioscience to the Bedside

If you see a nanocourse in this list that you would like to have offered again, please email your request to nanocourses@hms.harvard.edu

Thanks for your participation!

Intellectual Unit: Experimental Tools Discovery for Biological

2-Photon Microscopy: Past, Present and Future

Course Director: Sean Megason
Course Lecturers: Sean Megason, Thorsten Mempel and Clay Reid

2-photon fluorescence microscopy utilizes highly focused photons of light in order to image biological processes deep within a tissue. Since multiple, low energy wavelengths of light are used for excitation, 2-photon microscopy reduces the phototoxicity and light scattering that are unavoidable in other types of fluorescence microscopy. Ultimately, the development of 2-photon microscopy has allowed scientists to study biological processes in a more 'natural' setting by imaging in whole mount preparations and even in live, whole animals. 2-photon microscopy was first described in 1990, and its applications and utilization have been expanded ever since. In this nanocourse, lecturers will review the basic theory that makes 2-photon microscopy so useful and describe how they utilize the technology in their own research. We will end the nanocourse with lecturer's own predictions on the future use of multiphoton microscopy technology.

First Meeting: Monday, September 28th, 1-4:30pm
Location: TBD

Second Meeting: Friday, October 2nd, 2-5pm
Location: TBD

To sign up for this course, please enroll online at https://nanosandquarters.hms.harvard.edu/ beginning, August 21, 2009

Intellectual Unit: Experimental Tools for Biological Discovery

Fluorescence Live Cell Imaging

Course Lecturers: Jennifer Waters

Fluorescence microscopy has become increasingly important in biological research as novel fluorescent probes and increasingly sensitive detectors allow us to visualize subcellular entities in live specimens with unprecedented speed and resolution. The aim of this practical course is to introduce students to the wide range of fluorescent probes and fluorescence microscopy techniques available for imaging live specimens (including optical sectioning techniques such as confocal and total internal reflection fluorescence).

First Meeting: Thursday, October 22nd, 1-4:30pm
Location: TBD

Second Meeting: Friday, October 23rd, 1-3pm
Location: TBD

To sign up for this course, please enroll online at https://nanosandquarters.hms.harvard.edu/ beginning, August 21, 2009

Intellectual Unit: Understanding the Complexity of Cancer

Kinases and Kinase Inhibitors in Cancer

Course Director: Tom Roberts
Course Lecturers: Nathanael Gray, Tom Roberts and Jean Zhou

First Meeting: Tuesday, October 13th from 1-4:30pm
Location: TBD

Second Meeting: Friday, October 16th from 2-4pm
Location: TBD

To sign up for this course, please enroll online at https://nanosandquarters.hms.harvard.edu/ beginning, August 21, 2009

Intellectual Unit:

Chromatin Modifications and Epigenetic Regulation of Gene Expression

Course Lecturers: Robert Kingston (HMS), Danesh Moazed (HMS), and Bradley Bernstein (HMS)

Although each cell within an organism possesses the same DNA, the variability in gene expression between cells is critical in defining cell type and function. Much of the regulation of gene expression is defined by alterations in chromatin state that heritably determine if a gene is expressed or not. An open or active chromatin state is often associated with gene expression, while a closed or inactive chromatin state is often associated with gene silencing. This nanocourse will discuss the various modifications that can be made to chromatin, such as chromatin remodeling, the generation of heterochromatin via silencing complexes and RNA interference, and the numerous protein complexes that carry out these functions. The role of genome-wide chromatin states during development and disease will also be discussed.

First Meeting: Tuesday, November 10th, 2nd, 1-4:30pm
Location: Armenise Amphitheater

Second Meeting: Friday, November 13th , 2-4:30pm
Location: TMEC Bldg., Room 333

To sign up for this course, please enroll online at https://nanosandquarters.hms.harvard.edu/ beginning, August 21, 2009

Intellectual Unit:

Epigenetics and the Rise of Allelic Non-Equivalence

Course Lecturers: Andrew Chess and Jeannie Lee

While it is generally assumed that when a given gene is turned on, its transcripts come from both alleles. However, there are a number of interesting exceptions that will be the focus of this course. We will explore aspects of X-inactivation, imprinting (parent-of-origin determined) and random monoallelic expression on autosomes. In thinking about epigenetics, monoallelic expression is inherently interesting because within the same nucleus, two sequence-equivalent (indeed sometimes sequence-identical) pieces of DNA are somehow differentially regulated even though they are exposed to the same transcription factor milieu.

First Meeting: Monday, December 7th, 1-4:30pm
Location: TMEC Bldg., Room 227

Second Meeting: Friday, December 11th, 2-4:30pm
Location: TMEC Bldg., Room 333

To sign up for this course, please enroll online at https://nanosandquarters.hms.harvard.edu/ beginning, August 21, 2009

Intellectual Unit: Building a Better Scientist

Professional Development I

Nanocourse Lecturers: Monica Kerr

First Meeting: TBD
Location: TBD

Second Meeting: TBD
Location: TBD

To sign up for this course, please enroll online at https://nanosandquarters.hms.harvard.edu/ beginning, August 21, 2009

Intellectual Unit: Building a Better Scientist

Professional Development II

Nanocourse Lecturers: Monica Kerr

First Meeting: TBD
Location: TBD

Second Meeting: TBD
Location: TBD

To sign up for this course, please enroll online at https://nanosandquarters.hms.harvard.edu/ beginning, August 21, 2009

Intellectual Unit: Experimental Tools for Biological Discovery

Next Generation Sequencing Technologies: Principles and Applications

Course Director: Chad Nusbaum
Course Lecturers: Mark Daley, Gabor Marth and Chad Nusbaum

Traditional capillary sequencing technology using base-specific chain termination by fluorescent di-deoxy nucleotides represents modifications to the original sequencing methodology devised by Sanger and colleagues in the 1970s. Recent years have seen the development of next generation parallel sequencing technologies that are rapidly replacing older methodologies. Sequencing by synthesis enables the simultaneous sequence analysis of millions of DNA templates at the same time, or in parallel. These new approaches allow for DNA sequencing at a markedly faster pace, and often at a much cheaper price, making sequencing projects feasible for an ever-expanding number of researchers. This nanocourse will explore the methodology and principles behind parallel sequencing technology, and how it measures up to traditional sequencing methods. Examples of the numerous applications of this ever-evolving technology, as well as the limitations of parallel sequencing, will also be discussed.

First Meeting: Wednesday, October 7th, 9am-12:30pm
Location: TMEC Bldg., Room 250

Second Meeting: Friday, October 9th, 1-3:30pm
Location: TMEC Bldg., Room 109

To sign up for this course, please enroll online at https://nanosandquarters.hms.harvard.edu/ beginning, August 21, 2009

Intellectual Unit:

Glia: More than Nerve Glue

Course Lecturers: Azad Bonni, Gabriel Corfas and Beth Steven

Glia are non-neuronal cells that populate both the central and peripheral nervous systems. For more than a century since their discovery, glial cells were considered to act as the connective tissue for the nervous system. However, recent studies have made clear that glial cells not only support a number of essential neuronal functions, but also actively communicate with neurons and with one another to influence nervous system functions that have long been thought to be strictly under neuronal control. Glial cells, which include astrocytes, oligodendrocytes, ependymal cells, radial glial, schwann cells and satellite cells, outnumber neurons by 10 to 1. These cells are critical to many aspects of nervous system development, including neuronal migration, maturation, nutrition, myelination and survival. Glia are also relevant for human health as their dysfunction causes neurological diseases and when their proliferative behavior is altered they can give rise to very aggressive and fatal tumors. Moreover, the observation that some glial cells act as neural precursors in the adult brain and also regulate the formation and plasticity of synapses make these cells important to regenerative medicine.

First Meeting: Thursday, November 12th, 1-4:30pm
Location: TBD

Second Meeting: Thursday, November 19th, 2-4pm
Location: TBD

To sign up for this course, please enroll online at https://nanosandquarters.hms.harvard.edu/ beginning, August 21, 2009

Additional nanocourses may be added to the Fall 2009 schedule. Please check the nano and quarter website often to take full advantage of the nanocourse offerings!

https://nanosandquarters.hms.harvard.edu/