BI 182 2018

Animal development and genomic regulatory network design

Lectures 2:30-4PM Tuesday Thursday, 200 Broad

BI182 will be taught from a book by Eric Davidson and Isabelle Peter "Genomic Control Process, Development and Evolution" (Elsevier, 2015), plus various other materials assigned ad hoc. For some lectures students will also be asked to read specific papers. This is an advanced course, and some background in respect to molecular biology is expected. The course is offered for letter grades. The format is lecture plus discussion. In addition, problems will be assigned after each lecture, and the solutions presented in class by students the following week. Two exams will be given: one midterm and another at the end of the term. For those registered in the course attendance at lectures is required (except for emergencies). Any who might wish to audit this course are welcome to sit in.

The Course Syllabus will be as follows:

Thu January 4, Lecture 1: Introduction to genomic control of animal development (Stathopoulos/Peter)

Module 1: Control of developmental gene expression (Stathopoulos)

Tue January 9, Lecture 2. Animal genomes and what they encode

Thu January 11, Lecture 3. Interpretation of maternal inputs: Anisotropies, maternal mRNAs and other molecules present in the egg, start of the zygotic network, strategies used by different animals

Tue January 16, Lecture 4. Structure/function relations in developmental cis-regulatory modules

Thu January 18, Lecture 5. Dorsal-ventral patterning of the Drosophila embryo: dynamics and precision of the Dorsal gradient

Tue January 23, Lecture 6. Dorsal-ventral patterning of the Drosophila embryo: evidence for cis-regulatory codes

Thu January 25, Lecture 7. Anterior-posterior patterning of the Drosophila embryo: cis-regulatory modules and cross-repression

Tue January 30, Lecture 8. Hedgehog-dependent patterning: vertebral neural tube, limb bud, *Drosophila*

Thu February 1, Lecture 9. Hox genes as vectorial patterning devices

Tue February 6, no Lecture (midterm)

Module 2: Developmental Gene Regulatory Networks (Peter)

Thu February 8, Lecture 10. Introduction to gene regulatory networks and the genomic control of development

Tue February 13, Lecture 11. Network components and the molecular biology of gene regulation

Thu February 15, Lecture 12. Experimental evidence for gene regulatory networks: The sea urchin endomesoderm GRN

Tue February 20, Lecture 13. Design and function of small regulatory circuits

Thu February 22, Lecture 14. Hierarchical structure and modularity of gene regulatory networks

Tue February 27, Lecture 15. Modeling of network function I: ODE-based continuous models

Thu March 1, Lecture 16. Modeling of network function II: Discrete Boolean models

Tue March 6, Lecture 17. Evolution of gene regulatory networks

Thu March 8, Concluding Discussion

March 13/15 FINALS

Grading:

25% participation (attendance and contribution to discussions)

25% presentations (2-3 presentations to the class of answers to homework problems)

20% midterm (same format as homework but must be done individually, without consulting others – midterm will be passed out Feb. 2nd, in class; due by Feb. 5th to Prof. Stathopoulos's office 261 Broad)

30% final (same format as homework but must be done individually, without consulting others – final will be passed out March 10th, in class; due by March 17th to Prof. Stathopoulos's office 261 Broad)