This is a course intended to bring students up to date concerning our understanding of gene regulation in eukaryotes. It will be based on assigned topics and readings, formal presentations by individual class members, and the critical evaluation of primary data. Each student will be responsible for one topic supported by one or two primary papers. The course covers a variety of experimental systems and concepts.

Individual presentations should be organized as seminars, and include approximately 25 minutes of introduction. This introduction should supply the necessary background information to place the paper in context. It should also summarize the initial observations in the literature (original key publication(s)) that opened up this area of investigation. This introductory material should be derived from extensive additional reading, not just the assigned papers. After the introduction, the presentation will be devoted to a critical evaluation of the experiments and conclusions of the assigned papers (~30 minutes), followed by discussing future experiments and directions (~15 minutes). Students should not simply give a blow-by-blow account of each experiment and the authors’ conclusions. The papers should be presented more as if they were the students’ own work — it is possible that some of the figures in the highlighted paper will not be discussed in detail. The topics that we cover in this course build on one another, so as the course proceeds students should be able to relate and compare the data and conclusions of the papers being discussed to those of previous discussions, pointing out apparent consistencies and differences.

Preparation deadlines are as follows. On the Thursday or Friday before their talks (which occur on Tuesdays), presenters will discuss their presentations with their faculty preceptor (an outline and/or preliminary PowerPoint presentation is recommended). Call or email to make an appointment well in advance. This will allow sufficient time for feedback on the presentation and for the presenters to practice their deliveries. Students will post the pdf of their paper, supplemental figures, as well as a review article covering their topic on the Canvas course website a week before their presentation. The papers will also be critically evaluated by each class member. Lively discussion and criticism involving all members of the class is expected. The papers should be treated as if they were being reviewed for publication in a journal—despite the fact that they’re already published—and students should be prepared to discuss both a paper’s strengths and weaknesses. A high level of discussion will not occur unless each participant thoroughly reads the papers and formulates questions. Accordingly, each student will be required to prepare one question (at least one) from each of the assigned papers prior to class, and raise up the question in a round table format at the beginning of class. These questions will be discussed during the presentation, when possible.

Grades for the course will be based on students’ presentations (~50%), weekly participation in the discussions (~40%), and raised questions (~10%). The faculty will provide an evaluation of each student’s performance with the student in a private setting immediately after the class. Evaluations of each presentation will also be provided by the class using standard forms; these evaluations must be filled out by each student prior to leaving the class. These will be given directly to the presenter at the end of class for his/her own use; they will not be read by the faculty. This peer review will allow the presenters to obtain more input concerning their presentations (style, clarity, content). This sort of unfiltered feedback should help in the preparation of future scientific talks such as thesis committee meetings, thesis defenses, and eventually job seminars.
Aug. 30
Organizational meeting

Sep. 13
Topic: Pol II pausing
Student Presenter:
Faculty preceptor: Steve
Coordination of RNA Polymerase II Pausing and 3' End Processing Factor Recruitment with Alternative Polyadenylation.
Fusby B, Kim S, Erickson B, Kim H, Peterson ML, Bentley DL.

Sep. 20
Topic: Transcriptional bursting
Student Presenter:
Faculty preceptor: Doug
Enhancer Control of Transcriptional Bursting.
Fukaya T, Lim B, Levine M.
Cell. 2016 Jul 14;166(2):358-68.

Sep. 27
Topic: Alternative splicing
Student Presenter:
Faculty preceptor: Steve
Rbfox Proteins Regulate Splicing as Part of a Large Multiprotein Complex LASR.
Damianov A, Ying Y, Lin CH, Lee JA, Tran D, Vashisht AA, Bahrami-Samani E, Xing Y, Martin KC, Wohlschlegel JA, Black DL.

Oct. 4
Topic: Alternative 3' processing
Student Presenter:
Faculty preceptor: Steve
Ubiquitously transcribed genes use alternative polyadenylation to achieve tissue-specific expression.
Lianoglou S, Garg V, Yang JL, Leslie CS, Mayr C.

Alternative 3' UTRs act as scaffolds to regulate membrane protein localization.
Berkovits BD, Mayr C.

Oct. 11
Topic: Hypermethylation, insulators and glioma
Student Presenter:
Faculty preceptor: Doug
Insulator dysfunction and oncogene activation in IDH mutant gliomas.
Flavahan WA, Drier Y, Liau BB, Gillespie SM, Venteicher AS, Stemmer-Rachamimov AO, Suvà ML, Bernstein BE.
Oct. 18
Topic: Enhancer breaks
Student Presenter:
Faculty preceptor: Doug
Suppression of Enhancer Overactivation by a RACK7-Histone Demethylase Complex.
Cell. 2016 Apr 7;165(2):331-42.

Oct. 25
Topic: uORFs and Occult ORFs
Student Presenter:
Faculty preceptor: Steve and Yoseph Barash
Upstream ORFs are prevalent translational repressors in vertebrates.
Johnstone TG, Bazzini AA, Giraldez AJ.
EMBO J. 2016 Apr 1;35(7):706-23.

Thousands of novel translated open reading frames in humans inferred by ribosome footprint profiling.
Elife. 2016 May 27;5. pii: e13328.

Nov. 1
Topic: Cytoplasmic polyadenylation as a determinant of development
Student Presenter:
Faculty preceptor: Steve
POS-1 Promotes Endo-mesoderm Development by Inhibiting the Cytoplasmic Polyadenylation of neg-1 mRNA.

Nov. 8
Topic: lncRNA and genome interactions
Student Presenter:
Faculty preceptor: Doug
Rapid evolutionary turnover underlies conserved lncRNA-genome interactions.
Quinn JJ, Zhang QC, Georgiev P, Ilik IA, Akhtar A, Chang HY.

Nov. 15
Topic: Transcription factor binding and cell fate decisions
Student Presenter:
Faculty preceptor: Doug
Long-Lived Binding of Sox2 to DNA Predicts Cell Fate in the Four-Cell Mouse Embryo.
Nov. 22
Topic: Noncoding variants and human disease risk I
Student Presenter:
Faculty preceptor: Casey
Direct Identification of Hundreds of Expression-Modulating Variants using a Multiplexed Reporter Assay.

Nov. 29
Topic: Noncoding variants and human disease risk II
Student Presenter:
Faculty preceptor: Casey
Parkinson-associated risk variant in distal enhancer of α-synuclein modulates target gene expression.
Soldner F, Stelzer Y, Shivalila CS, Abraham BJ, Latourelle JC, Barrasa MI, Goldmann J, Myers RH, Young RA, Jaenisch R.

Dec. 6
Topic: Single cell RNA-seq and cancer heterogeneity
Student Presenter:
Faculty preceptor: Golnaz
Dissecting the multicellular ecosystem of metastatic melanoma by single-cell RNA-seq.
Science. 2016 Apr 8;352(6282):189-96.

Dec. 13
Topic: Single cell chromatin accessibility
Student Presenter:
Faculty preceptor: Golnaz
Lineage-specific and single-cell chromatin accessibility charts human hematopoiesis and leukemia evolution.
Nat Genet. 2016 Aug 15. doi: 10.1038/ng.3646. [Epub ahead of print].