CAMB 608 -- SUMMER 2020

**REGULATION OF EUKARYOTIC GENE EXPRESSION**

**Tuesday (3-5pm)**

**Via Zoom**

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**Format:** This course is intended to bring students up to date on our understanding of gene regulation in eukaryotes. It is 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 presenting one or two primary research papers. The course covers a variety of experimental systems and concepts.

**Structure of presentation:** Individual presentations should be organized as seminars, and include ~20 minutes of introduction. This introduction should supply sufficient background to place the paper in proper context within its field of study. 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 (~50 minutes) will be devoted to a critical evaluation of the: 1) significance of the study (discuss major hypothesis being tested); 2) experimental design and methods (provide detailed description of new methods); 3) results (discuss their validity, reliability, replicability); 4) conclusions drawn from the study (not just the authors’ but yours as well); and finally 5) a discussion of follow-up experiments (~20 minutes). Students should **not** simply give a blow-by-blow account of each experiment and the authors’ conclusions. Engage your audience and promote discussion by asking direct rather than open-ended questions. The papers should be presented more as if they were the students' own work. It is possible, and often expected, 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:** At least one week prior to their presentation, students will discuss their assigned papers with their faculty preceptor (an outline and/or preliminary PowerPoint presentation is recommended). 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 a review article covering a pertinent aspect of their topic on the Canvas course website a week before their presentation.

**Class participation:** Each class member will also critically evaluate the papers. Lively discussion 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 at least one question from each of the assigned papers prior to class.

**Grading scheme:** Grades for the course will be based on students' presentations (~50%), weekly participation in the discussions (~40%), and quality of questions raised (~10%). The faculty will provide an evaluation of each student’s presentation in a private setting immediately after the class. Students will also provide constructive feedback of each presentation by filling out an evaluation form prior to leaving the class. These forms 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 process will allow the presenters to obtain critical feedback on the style, clarity and content of their presentations.

**June 2**

**Organizational meeting**

**June 16**

**Topic:** Splicing and transcriptional activation

**Student Presenter:**

**Faculty preceptor:** Doug Epstein

[Exon-Mediated Activation of Transcription Starts.](https://pubmed.ncbi.nlm.nih.gov/31787377/?from_term=fiszbein+a&from_pos=2)

Fiszbein A, Krick KS, Begg BE, Burge CB. Cell. 2019 Dec 12;179(7):1551-1565.

**June 23**

**Topic:** Transcriptional bursting

**Student Presenter:**

**Faculty preceptor:** Shawn Little

[Intrinsic Dynamics of a Human Gene Reveal the Basis of Expression Heterogeneity.](https://www.ncbi.nlm.nih.gov/pubmed/30554876)

Rodriguez J, Ren G, Day CR, Zhao K, Chow CC, Larson DR.

Cell. 2019 Jan 10;176(1-2):213-226.

**June 30**

**Topic:** Dosage compensation

**Student Presenter:**

**Faculty preceptor:** Montserrat Anguera

[The Implication of Early Chromatin Changes in X Chromosome Inactivation.](https://www.ncbi.nlm.nih.gov/pubmed/30595450)

Żylicz JJ, Bousard A, Žumer K, Dossin F, Mohammad E, da Rocha ST, Schwalb B, Syx L, Dingli F, Loew D, Cramer P, Heard E. Cell. 2019 Jan 10;176(1-2):182-197

**July 7**

**Topic:** Promoter pausing

**Student Presenter:**

**Faculty preceptor:** Alessandro Gardini

[NELF Regulates a Promoter-Proximal Step Distinct from RNA Pol II Pause-Release.](https://pubmed.ncbi.nlm.nih.gov/32155413/?from_term=yuki+aoi&from_pos=5)

**Aoi Y**, Smith ER, Shah AP, Rendleman EJ, Marshall SA, Woodfin AR, Chen FX, Shiekhattar R, Shilatifard A. Mol Cell. 2020 Apr 16;78(2):261-274.e5.

**July 14**

**Topic:** Transcription factors, phase separation and human disease

**Student Presenter:**

**Faculty preceptor:** Eric Joyce

[Unblending of Transcriptional Condensates in Human Repeat Expansion Disease.](https://pubmed.ncbi.nlm.nih.gov/32386547/?from_term=shaon+basu&from_pos=2)

Basu S, Mackowiak SD, Niskanen H, Knezevic D, Asimi V, … Hnisz D. Cell. 2020 May 5:S0092-8674(20)30481-5.

**July 21**

**Topic:** Nuclear positioning

**Student Presenter:**

**Faculty preceptor:** Raj Jain

[Tissue-Specific Gene Repositioning by Muscle Nuclear Membrane Proteins Enhances Repression of Critical Developmental Genes during Myogenesis.](https://pubmed.ncbi.nlm.nih.gov/27264872/?from_term=robson+mi&from_pos=3)

Robson MI, de Las Heras JI, Czapiewski R, Lê Thành P, Booth DG, Kelly DA, Webb S, Kerr ARW, Schirmer EC. Mol Cell. 2016 Jun 16;62(6):834-847.

**July 28**

**Topic:** Chromatin structure and loop extrusion

**Student Presenter:**

**Faculty preceptor:** Golnaz Vahedi

[The Energetics and Physiological Impact of Cohesin Extrusion.](https://pubmed.ncbi.nlm.nih.gov/29706548/?from_term=vian+l&from_pos=1)

**Vian L**, Pękowska A, Rao SSP, Kieffer-Kwon KR, Jung S, … Casellas R. Cell. 2018 May 17;173(5):1165-1178.

**August 4**

**Topic:** 3D genome organization and gene expression

**Student Presenter:**

**Faculty preceptor:** Eric Joyce

[Control of inducible gene expression links cohesin to hematopoietic progenitor self-renewal and differentiation.](https://pubmed.ncbi.nlm.nih.gov/30127433/?from_term=cuartero+s&from_pos=1)

Cuartero S, Weiss FD, Dharmalingam G, Guo Y, Ing-Simmons E, …Merkenschlager M. Nat Immunol. 2018 Sep;19(9):932-941.

**August 11**

**Topic:** miRNA control of mRNA decay

**Student Presenter:**

**Faculty preceptor:** Colin Conine

[MicroRNAs Cause Accelerated Decay of Short-Tailed Target mRNAs.](https://pubmed.ncbi.nlm.nih.gov/31902668/?from_term=eisen+tj&from_pos=3)

Eisen TJ, Eichhorn SW, Subtelny AO, Bartel DP. Mol Cell. 2020 Feb 20;77(4):775-785.

**August 18**

**Topic:** m6A and chromosome associated regulatory RNAs

**Student Presenter:**

**Faculty preceptor:** Doug Epstein

*N*6-methyladenosine of chromosome-associated regulatory RNA regulates chromatin state and transcription

Jun Liu, Xiaoyang Dou, Chuanyuan Chen, Chuan Chen, … Chuan He

Science. 2020 Jan 31; 367(6477): 580–586.

**August 25**

**Topic:** Enhancer topology

**Student Presenter:**

**Faculty preceptor:** Shawn Little

[Dynamic interplay between enhancer-promoter topology and gene activity.](https://pubmed.ncbi.nlm.nih.gov/30038397/?from_term=Hongtao+Chen&from_pos=1)

Chen H, Levo M, Barinov L, Fujioka M, Jaynes JB, Gregor T. Nat Genet. 2018 Sep;50(9):1296-1303.

**September 1**

**Topic:** Enhancer clusters and tissue specific gene expression

**Student Presenter:**

**Faculty preceptor:** Alessandro Gardini

[A Myc enhancer cluster regulates normal and leukaemic haematopoietic stem cell hierarchies.](https://pubmed.ncbi.nlm.nih.gov/29342133/?from_term=francois+spitz&from_pos=2)

Bahr C, von Paleske L, Uslu VV, Remeseiro S, Takayama N, Ng SW, Murison A, Langenfeld K, Petretich M, Scognamiglio R, Zeisberger P, Benk AS, Amit I, Zandstra PW, Lupien M, Dick JE, Trumpp A,Spitz F. Nature. 2018 Jan 25;553(7689):515-520.