

BICD194 ~ Epigenetics in Gene Regulation, Development and Cancer

Winter 2020

Course Organizers:

Kees Murre (murre@biomail.ucsd.edu)

Diana Hargreaves (dhargreaves@salk.edu)

GOALS OF THE COURSE:

The course is focused on epigenetic mechanisms that control gene expression. There will be a heavy emphasis on understanding the basis of design, execution and interpretation of relevant scientific experiments. The goal of the course is to read, critically evaluate and present primary data from research articles.

COURSE WEBSITE: [Tritoned](#)

All reading assignments will be posted on the website as well as other notifications. You will be responsible for locating and printing the weekly reading assignments.

TEXT BOOK: No text is required.

CLASS TIME AND PLACE: Monday 9.00 AM York 3010.

PREREQUISITE: BIMM100 (Molecular Biology).

GRADING: There will be no final exam. Your performance in the course will be determined by the quality of oral presentations and written work. Evaluations will be based on performance with these requirements:

PRESENTATIONS (50%): Participation and quality of presentation.

WRITTEN REVIEWS (50%): One-page critiques of three articles

Each paper will be discussed. Students will be randomly assigned into groups during the day of presentation that will be responsible for presenting the papers. This includes approximately 45 minutes for the presentation and 15 minutes for questions and discussion. All students should be prepared for each session to participate.

Presentations should be thoroughly prepared and clearly delivered. Furthermore, you may need to search additional publications to assist in your understanding and presentation. The aim is to help the class gain a clear understanding of the conceptual context, purpose, approaches taken and significance of each paper. A good understanding of the experimental methods employed is also essential for critical reading of any paper. Leading the group discussion consists of taking the class step-by-step through the rationale, approach and results in each paper. This often requires judicious choices regarding which figures and concepts are central and which are secondary. Several of the manuscripts are complicated but by working together, we will achieve a common level of understanding of the research described in the manuscripts

Presentation Content

In general, each group presentation should include the following information:

Background/Introduction. Offer the necessary background to provide context for the paper. i.e. What are the authors attempting to show? How does this work fit into the broader view of the field? What tools are used to approach the problem?

Discussion of Data/Results. Provide a thorough description of the techniques employed in the paper. Describe the specific experiments, highlighting any controls that are important for the interpretation of the data. Summarize the results of the experiment, including whether what *you* observe within the provided figures actually supports (or not) what the author's write in the text. Discuss any reservations you may have about the data. Figures should be divided between members of the group.

Conclusions and implications. Discuss the major conclusions from the findings presented in the paper. Where possible, include a model (often included at the end of the paper) to provide an overview of the findings. Discuss any caveats to the interpretation, and discuss the long-term implications of the work.

There are four major questions should be addressed during the presentation:

1. What is the most important conclusion and take home message? 2. What is the most critical experiment that supports their main conclusion? 3. Are there major caveat in the study? 4. What are the most important follow up questions that should be addressed?

Presentation Format

All students should be prepared to present and discuss assigned papers for each class.

Written Reviews

You are expected to read EVERY assigned paper before coming to class. In addition, you are required to write a 1-page maximum review for three of the assigned research articles. The first paragraph should succinctly describe the results of the research (what did they find). This should be followed by details regarding the research with a focus on the assigned paper that was discussed in class (how did they find it). Lastly, attempt to frame the discovery in a broader biomedical context (why was it important and why should you care). You will turn in your review at the beginning of class following the chosen presentation. You will be responsible for three reviews in addition to the oral presentation.

Participation

Participation during discussions will be a factor of our evaluation in assigning final grades. It is assumed that each student has read carefully, and is conversant with the contents of each of the papers assigned for a given week. Anyone in the class may (and will) at any time be called upon by the presenters or instructor to discuss a particular figure or finding in the paper under discussion. In addition, it is expected

that each student will regularly make spontaneous contributions to the discussion.

SCHEDULE FOR SEMINARS AND READING MATERIAL

January 6

Lecture: Kees Murre

Overview of the course.

January 13

Moderator: Kees Murre

Lucas et al. 3D-Trajectories adopted by coding and regulatory DNA elements: First-passage times for Genomic Interactions. Cell 158, 339-352 (2014).

January 20

Moderator: Kees Murre

Lieberman-Aiden et al. Comprehensive mapping of long-range interactions reveals folding principles of the human genome. Science 326, 289-293 (2009).

January 27

Moderator: Diana Hargreaves

Bernstein et al. A bivalent chromatin structure marks key developmental genes in embryonic stem cells. Cell 125, 315-326 (2006).

February 3

Moderator: Diana Hargreaves

Soufli et al. Facilitators and impediments of the pluripotency reprogramming factors initial engagement with the genome. Cell 151, 994-1004 (2012).

February 10

Moderator: Diana Hargreaves

Luk et al. Stepwise histone replacement by SWR1 required dual activation with histone H2A.Z and canonical nucleosome. Cell 143, 725-736 (2010).

February 17

Moderator: Kees Murre

Takahasi and Yamanaka. Induction of pluripotent stem cells from mouse embryonic and adult fibroblast cultures by defined factors. Cell 126, 663-676 (2006).

February 24

Moderator: Kees Murre

Rao et al. A 3D-map of the human genome at kilobase resolution reveals principles of chromatin looping. Cell 159, 1665-1680 (2014).

March 2

Moderator: Kees Murre

Sabari et al. Co-activator condensation at super-enhancers links phase separation and gene control. Science 361, eaar3958 (2018).

March 9

Moderator: Kees Murre

Boija et al. Transcription factors activate genes through the phase-separation capacity of their activation domains. Cell 175, 1842-1855 (2018).