BIOB 595/491 Concepts In Developmental Biology

Seminar Course for Graduate Students and Senior Undergraduates
Spring 2016
Fridays 10:10-11:30am ISB 103b
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This course covers key topics in developmental biology through the detailed study of the primary literature. Seminar topics are listed below. With help of the instructor, the students present each topic and lead a discussion each class period based on the assigned research paper and one or two review articles to provide background on the topic and research.

Objectives:

- Learn about developmental mechanisms
- Learn to critically read and discuss scientific literature
- Become fluent in development terminology
- Be able to design and interpret developmental biology experiments

Class Format:

The class is based on presentation and detailed analysis of primary journal articles, which are required reading. Topics and papers for students' presentations will be assigned in advance to allow sufficient time for preparation. The student's presentation should start with introducing the topic drawing on the recent reviews. When presenting the paper, keep in mind the important questions addressed in the reading summaries assignments, and bring them up for discussion in class. Discuss the experiments performed in the paper, with an eye to whether the experiments address the stated question, is the interpretation of the experiments valid, and are proper controls included? It is very important for our own scientific development to look critically at the data, the methods, and the interpretations in published manuscripts.

All students in the class need to read the paper assignments before class in order to productively participate in discussion. You will complete reading summaries assignments for each class in order to encourage this practice. All students will be required to ask questions of the presenter. Participation includes: bringing up significant questions regarding the paper and being able to describe each figure in terms of how the data was generated, and how to interpret it to draw conclusions.

Assignments and Assessments:

1. **Reading Summaries**. Assigned readings can be obtained for free from Pubmed (on campus). Before each session, students will answer a set of questions regarding the assigned reading: A description of the major question, problem or a technical issue addressed in the paper. Identification of the hypothesis or idea leading the authors to perform the experiments described. Selection and explanation

of the experiment you think is the most interesting or important. Your conclusion on whether the experiments address the hypothesis. Additionally, include two questions to ask of the presenter. Reading summaries are expected of all students, except the presenter of the day.

2. **Oral Assignments**.

Long Presentation: Each student will use PowerPoint or similar presentation software to present the paper, including a brief introduction, figures, and a summary. Students should present a critical analysis of the paper. For each figure, answer the following questions: what is the hypothesis that the authors are addressing? What are the experiments and techniques used to address the question? What are the controls for the experiments? What is the conclusion stated by the authors? Is this conclusion substantiated? Most importantly, students should identify the key figure(s)/table(s) of the paper and the key control experiment(s) for that figure or table.

Conference-Style Presentation. Much cutting-edge research is presented in scientific conferences, where the time allotted for each speaker is quite brief. To gain practice in this presentation format, the last two meetings of the class will be in the format of Developmental Biology Mini-Conference. Each student will select with help from the instructor a recent publication in the field of Developmental Biology, which they will present in the final class session. All presentations will be limited to 10 minutes, with 5 minutes for questions. Presentation will have 1 or 2 introduction slides, 4 figures, and a brief summary.

Syllabus

Date	Discussion topic, reading assignment *=paper for reading summary
Jan 29	Introduction to class, discussion of topics and expectations for presentations
Feb 5	***Arranging organelles just right*** * Zhao T, Graham OS, Raposo A, St Johnston D. 2012. Growing microtubules push the oocyte nucleus to polarize the *Drosophila* Dorsal-Ventral axis. *Science* 336: 999-1002 Bowerman B and O'Rourke SM. 2012. Pushing your back into place. *Science* 336: 984-985
Feb 12	***Oocyte maturation*** * Kim B, Zhang X, Kan R, Cohen R, Mukai C, Travis AJ, Coonrod SA. 2014. The role of MATER in endoplasmic reticulum distribution and calcium homeostasis in mouse oocytes. *Dev Biol* 386(2):331-9. doi: 10.1016/j.ydbio.2013.12.025 Coticchio G, Dal Canto M, Mignini Renzini M, Guglielmo MC, Brambillasca F, Turchi D, Novara PV, Fadini R. 2015. Oocyte maturation: gamete-somatic cells interactions, meiotic resumption, cytoskeletal dynamics and cytoplasmic reorganization. *Hum Reprod Update* 21(4):427-54. doi: 10.1093/humupd/dmv011

Feb 19	***Cleaning the slate for development*** * Drake M, Furuta T, Suen KM, Gonzalez G, Liu B, Kalia A, Ladbury JE, Fire AZ, Skeath JB, and Arur S. 2014. A Requirement for ERK-Dependent Dicer Phosphorylation in Coordinating Oocyte-to-Embryo Transition in *C. elegans*. *Dev Cell* 31: 614-628; doi:10.1016/j.devcel.2014.11.004 Morrison DK. 2012. MAP Kinase Pathways. *Cold Spring Harb Perspect Biol* 4:a011254; doi:10.1101/cshperspect.a011254
Feb 26	***Activating embryonic transcription*** * Harrison MM, Li X-Y, Kaplan T, Botchan MR, Eisen MB. 2011. Zelda Binding in the Early *Drosophila melanogaster* Embryo Marks Regions Subsequently Activated at the Maternal-to-Zygotic Transition. *PLoS Genet* 7(10): e1002266. doi:10.1371/journal.pgen.1002266 Tardos W and Lipshitz HD. 2009. The maternal-to-zygotic transition: a play in two acts. *Development* 136: 3033-3042; doi:10.1242/dev.033183
Mar 4	***Building a blueprint for development. Localizing mRNAs*** * Wilkie GS and Davis I. 2001. *Drosophila wingless* and pair-rule transcripts localize apically by dynein-mediated transport of RNA particles. *Cell* 105: 209-219 Median C, Mowry K, and Besse F. 2012. Principles and roles of mRNA localization in animal development. *Development* 139: 3263-3276; doi:10.1242/dev.078626
Mar 11	***Pigmentation*** * Li J, Song JS, Bell RJA, Tran T-NT, Haq R, Liu H, et al. (2012) YY1 Regulates Melanocyte Development and Function by Cooperating with MITF. *PLoS Genet* 8(5): e1002688. doi:10.1371/journal.pgen.1002688 Reissman M and Ludwig A. 2013. Pleiotropic effects of coat color-associated mutations in humans, mice and other mammals. *Semin Cell Dev Biol* 24:576-586
Mar 18	***Cell signaling integration*** * Vasudevan HN, Mazot P, He F, Soriano P. 2015. Receptor tyrosine kinases modulate distinct transcriptional programs by differential usage of intracellular pathways. *eLife* 4:e07186. doi: 10.7554/eLife.07186 Volinsky N and Kholodenko BN. 2013. Complexity of Receptor Tyrosine Kinase Signal Processing. *Cold Spring Harb Perspect Biol* 5:a009043; doi:10.1101/cshperspect.a009043
Mar 25	***Bringing the next generation on board: the germ line*** * Nakamura T, Extavour CG. 2016. The transcriptional repressor Blimp-1 acts downstream of BMP signaling to generate primordial germ cells in the cricket *Gryllus bimaculatus*. *Development* 143(2):255-263; doi: 10.1242/dev.127563 Magnúsdóttir E, Surani MA. 2014. How to make a primordial germ cell. *Development* 141(2):245-52; doi: 10.1242/dev.098269

Apr 1	***Organization of cell signaling*** * Inaba M, Buszczak M, Yamashita YM. 2015. Nanotubes mediate niche-stem-cell signaling in the *Drosophila* testis. Nature 523: 329-332 Wrana JL. 2013. Signaling by the TGFbeta Superfamily. *Cold Spring Harb Perspect Biol* 5:a011197; doi:10.1101/cshperspect.a011197 Harrison DA. 2012. The JAK/STAT Pathway. *Cold Spring Harb Perspect Biol* 4:a011205; doi:10.1101/cshperspect.a011205
Apr 8	spring break
Apr 15	***Stem cells and reprogramming*** * Worringer KA, Tand TA, Hayashi Y, Sami S, Takahashi K, Tanabe K, Narita M, Srivastava D, and Yamanaka S. 2014. The *let-7*/LIN-41 Pathway Regulates Reprogramming to Human Induced Pluripotent Stem Cells by Controlling Expression of Prodifferentiation Genes. *Cell Stem Cell* 14: 40-52; doi:10.1016/j.stem.2013.11.001 Tanabe K, Takahashi K, Yamanaka S. 2014. Induction of pluripotency by defined factors. *Proc. Jpn. Acad.*, Ser. B 90: 83-96
Apr 22	***Stem cell differentiation*** * Kobayashi T, Yamaguchi T, Hamanaka S, Kato-Itoh M, Yamazaki Y, Ibata M, Sato H, Lee YS, Tsui J, Knisely AS, Hirabayashi M, Nakauchi H. 2010. Generation of rat pancreas in mouse by interspecific blastocyst injection of pluripotent stem cell. *Cell* 142: 787-789 TED talk by Anthony Atalia. Growing new organs
Apr 29	Student Presentations - 1. Developmental Biology Mini-Conference
May 6	Student Presentations - 2. Developmental Biology Mini-Conference