BIOB 595/491 Molecular Analysis of Development

Seminar Course for Graduate Students and Senior Undergraduates
Spring 2018
Fridays 3:00-4:30 pm ISB 103b
Instructor: Ekaterina Voronina, ekaterina.voronina@umontana.edu

This course covers key topics in developmental biology through the detailed study of the primary literature. Seminar topics are updated for each year the course is offered and 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.

Learning outcomes:

- Know and understand basic developmental mechanisms
- Be able 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. The instructor will ask questions about the experimental techniques used in the paper; the *participants are expected* to understand the published approaches or approach the instructor with questions before class. 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), or will be distributed to the class by email. Before each session, students will prepare five items regarding the assigned reading:

- What is the major question, problem or a technical issue addressed in the paper?
- What is the hypothesis or idea leading the authors to perform the described experiments?
- What experiment you think is the most interesting or important, and why?
- Do the experiments address the hypothesis?
- Additionally, include two questions to ask of the presenter.

Each of required answers can be 1-2 sentences. 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 (within the past 3 years) 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.

Grading:

Student option, the students may choose traditional grade or credit/no credit

Students with disabilities:

Students with disabilities may request reasonable modifications by contacting the instructor. The University of Montana assures equal access to instruction for students with disabilities in collaboration with instructors and Disability Services for Students, which is located in Lommasson Center 154. The University does not permit fundamental alterations of academic standards or retroactive modifications.

Manuscripts for Discussion

* = the paper for reading summary

Week 1. Jan 26. Introduction to class, discussion of topics and expectations for presentations

Week 2. Feb 2. Cell Biology of Spermatogenesis

* Y Shang, F Zhu, L Wang, Y Ouyang, M Dong, C Liu, H Zhao, X Cui, D Ma, Z Zhang, X Yang, Y Guo, F Liu, L Yuan, F Gao, X Guo, Q Sun, Y Cao, W Li. Essential role for SUN5 in anchoring sperm head to the tail. eLife 2017; 6:e28199. DOI: https://doi.org/10.7554/eLife.28199

Week 3. Feb 9. Maintaining germline identity: transcriptional and translational regulation.

***** T Aguero, Z Jin, S Chorghade, A Kalsotra, ML King, J Yang. Maternal Dead-end 1 promotes translation of *nanos1* by binding the eIF3 complex. Development 2017; 144: 3755-3765; doi:10.1242/dev.152611

T Gross-Thebing, S Yigit, J Pfeiffer, M Reichman-Fried, J Bandemer, C Ruckert, C Rathmer, M Goudarzi, M Stehling, K Tarbashevich, J Seggewiss, Erez Raz. The Vertebrate Protein Dead End Maintains Primordial Germ Cell Fate by Inhibiting Somatic Differentiation. Dev Cell 2017; 43: 704-715 https://doi.org/10.1016/j.devcel.2017.11.019

Week 4. Feb 16. **Building Diversity by Asymmetric Cell Divisions**

***** V Costache, C Hebras, G Pruliere, L Besnardeau, M Failla, RR Copley, D Burgess, J Chenevert & A McDougall. Kif2 localizes to a subdomain of cortical endoplasmic reticulum that drives asymmetric spindle position. Nature Communications 2017; 8:917. DOI: 10.1038/s41467-017-01048-8

Week 5. Feb 23. Fate segregation based on physical location

* E Korotkevich, R Niwayama, A Courtois, S Friese, N Berger, F Buchholz, T Hiiragi. The Apical Domain Is Required and Sufficient for the First Lineage Segregation in the Mouse Embryo. Dev Cell 2017; 40: 235-247; http://dx.doi.org/10.1016/j.devcel.2017.01.006

S Srinivas, TA Rodriguez. A Tale of Division and Polarization in the Mammalian Embryo. Dev Cell 2017; 40: 215-216; http://dx.doi.org/10.1016/j.devcel.2017.01.008

Week 6. Mar 2. Metabolism instructing development

***** AL Figueiredo, F Maczkowiak, C Borday, P Pla, M Sittewelle, C Pegoraro, AH Monsoro-Burq. PFKFB4 control of AKT signaling is essential for premigratory and migratory neural crest formation. Development 2017; 144: 4183-4194; doi: 10.1242/dev.157644

C Pegoraro, AL Figueiredo, F Maczkowiak, C Pouponnot, A Eychène, AH Monsoro-Burq. PFKFB4 controls embryonic patterning via Akt signalling independently of glycolysis. Nature Comm 2015; 6: 5953; doi:10.1038/ncomms6953

Week 7. Mar 9. Developmental regulation, or???

***** E Ben-David, A Burga, L Kruglyak. A maternal-effect selfish genetic element in *Caenorhabditis elegans*. Science 2017; 356:1051-1055; doi: 10.1126/science.aan0621

M Ailion, HS Malik. Genetics: Master Regulator or Master of Disguise? Curr Biol 2017; 27(17): R844-847; doi: http://dx.doi.org/10.1016/j.cub.2017.07.030

Week 8. Mar 16. *In vivo* observation of RTK cell signaling

* I Pinilla-Macua, A Grassart, U Duvvuri, SC Watkins, A Sorkin. EGF receptor signaling, phosphorylation, ubiquitylation and endocytosis in tumors *in vivo*. eLife 2017; 6:e31993; doi: 10.7554/eLife.31993

YP Yang, H Ma, A Starchenko, WJ Huh, W Li, FE Hickman, Q Zhang, JL Franklin, DP Mortlock, S Fuhrmann, BD Carter, RA Ihrie, RJ Coffey. A Chimeric Egfr Protein Reporter Mouse Reveals Egfr Localization and Trafficking *In Vivo*. Cell Rep 2017; 19: 1257-1267; doi:10.1016/j.celrep.2017.04.048

Week 9. Mar 23: **Can embryonic stem cells teach us about gastrulation?**

***** DA Turner1, M Girgin, L Alonso-Crisostomo, V Trivedi, P Baillie-Johnson, CR Glodowski, PC Hayward, J Collignon, C Gustavsen, P Serup, B Steventon, MP Lutolf, AM Arias. Anteroposterior polarity and elongation in the absence of extra- embryonic tissues and of spatially localised signalling in gastruloids: mammalian embryonic organoids. Development 2017; 144: 3894-3906; doi:10.1242/dev.150391

Week 10. Mar 30. spring break, no seminar

Week 11. Apr 6. How to get rid of a synapse

***** T Higashi, S Tanaka, T Iida, S Okabe. Synapse Elimination Triggered by BMP4 Exocytosis and Presynaptic BMP Receptor Activation. Cell Rep 2018; 22: 919-929; doi: 10.1016/j.celrep.2017.12.101

Week 12. Apr 13. Chromatin transitions in cell fate decisions

* K Masuko, N Fuse, K Komaba, T Katsuyama, R Nakajima, H Furuhashi, S Kurata. *winged eye* Induces Transdetermination of Drosophila Imaginal Disc by Acting in Concert with a Histone Methyltransferase, Su(var)3-9. Cell Rep 2017; 22: 206-217; doi: 10.1016/j.celrep.2017.11.105

Week 13. Apr 20. T-*regs* are for *rege*neration

* SP Hui, DZ Sheng, K Sugimoto, A Gonzalez-Rajal, S Nakagawa, D Hesselson, K Kikuchi. Zebrafish Regulatory T Cells Mediate Organ-Specific Regenerative Programs. Dev Cell 2017 43:659-672. https://doi.org/10.1016/j.devcel.2017.11.010

C Jahn, G Weidinger. Regulatory T Cells Know What Is Needed to Regenerate. Dev Cell 2017 43:651-652. https://doi.org/10.1016/j.devcel.2017.12.010

Week 14. Apr 27. Students' Presentations. Developmental Biology mini-conference

Week 15. May 4. **Students' Presentations.** Developmental Biology mini-conference