SIO 278: Marine Cell Biology

Syllabus v.1 – 5 Jan 2015 V2
Winter 2015, Tu 3:00-4:50, Vaughn Hall 300
2 units credit, P/NP or letter grade

Facilitator and contacts:
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Check your email for the invite to the course dropbox folder "SIO278". PDFs and course data will live there.

Please follow at @hamdounlab for links to articles and news reports relevant to course material. Feel free to post your own material with the #SIO278

Course goals: The overall goal of this course is to study emerging topics in cell biology and discuss how they may be applied to understanding marine systems. The second goal of this course is encourage, collaboration discussion and interaction among the community of researchers at SIO who are engaged in cellular and molecular biology. This is not traditional course in that there is no prescribed curriculum, where information unidirectionally transferred from professor to student. Instead this course might be better thought of as the equivalent of a cooperative, where each of us owns an equal share. You'll notice I called myself the "facilitator", and that's because I will be as much a student in this as each of you. Ultimately the course is deemed a success if it fosters your (and my own) development as researchers.

Course description: For more than a century marine organisms have been used to answer fundamental biological problems. The electrical conductivity of neurons, proteins that govern cell cycle and fluorescent proteins were all first described in marine systems. In each of these cases the application of modern cell biological approaches, along with the tractability of a unique marine organism, were the key agents for these discoveries.

Modern marine cell biology now encompasses wide range of organisms from unicellular organisms to mammals and an equally wide array of problems, from understanding the evolution fo the nervous system, to the genetic engineering of diatoms as biofuels. A (the) major enabling technology has been the rapid decline in the cost of gene sequencing. However descriptive genomics have largely outpaced the rate of progress in manipulation and analysis of the corresponding genes. A gap in knowledge has been to figure what all of these genes actually do.

Until recently most of these "functional" questions were the domain of small number of organisms for which the tools were readily available. But recent progress in cell and molecular biology has made it possible to address new questions that were previously inaccessible in these marine organisms. In my view, among the key technologies are genome editing (CRISPR/CAS9), high-resolution imaging, synthetic genomics and single domain antibodies.

Based on my informal discussion with you CRISPR/CAS9 stands out as the single thing more of us want to learn about than anything else. So in 2015 we will tackle this subject together, starting with the history and background of the topic, to its societal impacts through to the application fo this technology in sea urchins. I will open up my lab to course participants who want to try this hands on and assist with microinjection and imaging.

Course format and evaluation: I would like to try an experiment with course format. I suggest that we take 5-6 weeks to discuss the topic(s) we choose in traditional "journal club style". Then we should take 3-4 weeks to conduct projects together, and reconvene for the last week to report progress. You are welcome to take this class P/NP or for a letter grade. There are two ways for you to earn your grade. The first is what I'll call the "coursework" option – you present a paper(s) and lead the class in discussion. The second option is to conduct a short project on course material. At the end of the class you will submit a 2 page (not including refs) report and give a short presentation (10 minutes) about your project. This can be an imaging project or taking a stab at CRISPR for gene of interest. My only rule is that this should be totally non-disruptive to your existing research.

To keep the course running smoothly papers must be distributed by email one week prior to class and posted on dropbox. Attendance and participation are of course mandatory – what's the point if we don't talk to each other! For paper presenters I strongly encourage making a 1-2 page handout to share with everyone and help explain key concepts.

Course Schedule:
January 5. Amro Hamdoun: Course Introduction. Discussion of course objectives. Doudna Video on CRISPR.

January 12: **Jose Espinoza and Hannah Rosenblatt**: Discovery, history and molecular principles of CAS9 mediated genome editing

Jan 19: **Reggie Blackwell and Megan Barron**. Major papers, limitations and pitfalls. Whole genome CRISPR. Germline modification.

Jan 26: **Sarah Lerch and Por Tangwancharoen**. Detailed analysis of CRISPR/CAS 9 in marine organisms. Delivery issues.

Feb 2: **Daniel Yee and Alice Harada**. CRISPR resources, commercial resources, Addgene, protocols and guides.

Feb 9: **Helen Meigs and Mikki Dochez**, Ethical and societal concerns.

Feb 16 – **Sascha Nicklisch and John Stires** Imaging and other unconventional applications of CRISPR.

Feb 23-March 1: TBD Project. Feb 20 and 27 lab and imaging sessions for those who want.

March 8 – **Course summary. Project report.**