BISP194 Regeneration: welcome and syllabus

Andrew D. Chisholm

All Sections

Welcome to BISP194/Biology of Regeneration! Our first meeting will be in-person this Friday April 7, 0900-1020 in York Hall 3010. No preparation is needed.

Advanced Topics in Modern Biology: Biology of Regeneration

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DRAFT syllabus v1 (4/3/23). Subject to changes – any changes will be announced in class.

Class meetings will be in-person, Fridays 0900-1020 in York Hall 3010. As this is a discussion-based course, in-person participation is required.

Office Hours: in-person, Wednesdays 0900-1000 in Bonner Hall 2402, or by appointment

Meeting Schedule

**students will be assigned to discussion groups in week 4

Date/Week	Format	Topic
April 7/Week 1	Lecture 1	Logistics; kinds of regeneration
April 14/Week 2	Lecture 2	Analyzing regeneration
April 21/Week 3	All-class discussion	Presenting and critiquing a research article: heart regeneration

April 28/Week 4	No meeting; read papers	
May 5/ Week 5	Group Discussion 1	Appendage regeneration
May 12/Week 6	Group Discussion 2	Whole body regeneration
May 19/ Week 7	Group Discussion 3	Skin regeneration
May 26/Week 8	Group Discussion 4	Neural regeneration
June 2/Week 9	Group Discussion 5	Antler regeneration
June 9/Week 10	No meeting	*Choices of article for final paper due by June 9. Final paper due 5 PM Friday June 16 by email*

Prerequisites: This course assumes knowledge of molecular biology, genetics, and cell biology. BICD100 (Genetics) is a prerequisite; BICD110 (Cell Biology) is strongly recommended.

Course Description

Student-led group discussions of primary research on regenerative biology.

Evaluation: Your grade will be based on:

30% group presentation

30% participation

40% final paper (critique). Your final paper will be a one-page critique of any primary research article in the area of regenerative biology, subject to my approval. The paper may

not be one that we discussed in the 5 class discussions.

Discussions will be on **primary research** papers, review articles are for background

PDFs of all discussion and background papers will be on course Canvas web site under **Files**. Presenters may also want to find the HTML versions, which sometimes have better images/movies. All papers can be found on PubMed, Google Scholar, or (for preprints) Biorxiv.

Expect to spend 1-2 hours a week reading, more if presenting

RESOURCES

There is no suitable text specifically on regeneration, here are two general developmental biology textbooks that cover it among other dev bio topics.

Developmental Biology (Barresi and Gilbert 12th edition, OUP, 2019), is the leading textbook. The library has copies of earlier editions. Regeneration is covered in Chapter 22.

Essential Developmental Biology (Slack and Dale, 4th edition, Wiley-Blackwell, 2021) is shorter and cheaper, though at the expense of some experimental design and 'interesting historical details'. An earlier edition is on Ebook via UCSD library.

Stem cells are key in regenerative biology. You may want to check out **Stem Cell Core Concepts** from the International Society for Stem Cell Research.

https://www.isscr.org/scientific-clinical-resources/education-resources (https://www.isscr.org/scientific-clinical-resources/education-resources)

iBiology talks https://www.ibiology.org/ (https://www.ibiology.org/) are aimed at non-experts. There are over 600 covering many areas of basic biology; most relevant are those by **Alejandro Sanchez Alvarado** (history of regeneration, planaria), **Peter Reddien**(planaria), and **Elly Tanaka** (axolotl limb regeneration). I recommend Reddien's talk here: **https://www.ibiology.org/development-and-stem-cells/drive-regeneration/ (https://www.ibiology.org/development-and-stem-cells/drive-regeneration/)**

The talk by **Susan McConnell** on giving a scientific presentation is recommended.

GROUP PRESENTATIONS

- The group presentation is to stimulate an interactive class discussion (meaning: not a lecture). For this to work it is essential that everyone read the research article before the presentation.
- The presenting group should prepare **~10-12** slides on the discussion paper (~2 slides per member of the group) for ~ 30 minute presentation. The slides should be in a single PPT (or Google slides, etc) that will be uploaded to the course canvas site after the grup discussion.
- The presenting group should discuss with me at least 1 day before the class meeting and send me the final presentation prior to the class meeting. I will be available Thursday afternoons for in-person meetings with that week's group.
- Each member of the group should be prepared to answer questions and facilitate class discussion.
- Week 4 will be a 'trial run' of how to present a paper.

PRESENTATION CONTENT

- *Rationale*: What is the *biological problem*? What is the question or hypothesis that motivates the study? (this can be asked of the overall study and of individual sections)
- *Methods*. What are the tools and methodologies used? It is important to spend time on this so the results can be fully understood. Especially: what are the positive and negative controls in the experimental design?
- *Results*: Each discussion group member should present one or two Figures/Tables. The discussion leaders are responsible for raising stimulating questions.
- **There is no need (or time) to go through every Figure or panel. Focus on the key points, or points that you think are worth discussing.** I will discuss with the presentation groups which aspects to focus on.
- We will not have time to discuss any supplemental information (SI) or extended data in class, but these should at least be skimmed and often contain important clarifying information.
- *Rigor and reproducibility:* presenters should stimulate discussion on how 'solid' the experimental design and results are. Sample sizes, controls, statistical tests, data transparency.
- *Conclusions:* How well do the results support the model or test the hypothesis? What are the remaining questions and next steps?
- *For an effective class discussion it is essential to read the discussion paper **before** Grades are based on active participation in discussions.*

FINAL PAPER

- For your final paper you will critique a research article of your choice on regenerative biology. Papers must be full primary research articles (meaning: not reviews/brief notes/case studies/correspondence). Send me your choice(s) of paper by June 9.
- Final papers should be 1 page, single or double spaced and in a standard 12 point font.
- You don't need to include references but if you do, they must also fit on the 1 page.
- By 'critique' I mean *evaluation* as well as summary of the work. Address strengths and weaknesses: what is good about the paper, what could be improved, what was unclear, and any questions raised by the work. Examples of final papers will be posted on Canvas.

ACADEMIC INTEGRITY

Group presentations are collaborative efforts and each member of the group will receive the same points for the presentation.

Paper critiques are expected to be your own individual work as outlined in the UCSD **Policy on Integrity of Scholarship (https://academicintegrity.ucsd.edu/process/policy.html)** . Do not plagiarize either from online resources or from each other. If you quote from the paper or from another source, make the source of the quotation clear.

Academic misconduct includes using any prohibited or dishonest means to receive course credit, a higher grade, or avoid a lower grade. For example use of AI-based tools to write papers is academic misconduct. Evidence of academic misconduct will be reported to the Office of Student Conduct and will result in a zero grade for the assignment or the course.

ACCOMMODATIONS

Students requesting accommodations and services due to a disability for this course need to provide a current Authorization for Accommodation (AFA) letter issued by the **Office for Students with Disabilities (https://osd.ucsd.edu/)** (OSD), prior to eligibility for requests. Receipt of AFAs in advance is necessary for appropriate planning for the provision of reasonable accommodations. Instructors are unable to provide accommodations without authorization by OSD. For more information, contact the OSD at (858) 534-4382.

ATTENDANCE/PARTICIPATION

'Participation' counts for 30% of your grade. Sessions will allow ample time for everyone to participate.

UCSD Principles of Community

Class meetings should be a safe environment for all students and instructors. Class discussions should be conducted in a respectful and collegial manner, in accord with

UCSD's **Principles of Community (https://ucsd.edu/about/principles.html)** . Disruptive behavior may be referred to the UCSD **Office of Student Conduct (https://students.ucsd.edu/sponsor/student-conduct/)** .

READING LIST (Subject to change)

To find these articles, look up in PubMed (https://pubmed.ncbi.nlm.nih.gov) using the PMCID or PMID number. All should be freely available online—anything that is not will be posted on Canvas. For free access you may need UCSD IP address or VPN.

Week 1: Course logistics, examples of biological regeneration and towards a definition

Week 2: Key questions and how to study regeneration

--Key questions in biological understanding regenerative phenomena

--Review the 'conceptual tool kit' of developmental and stem cell biology

Background reviews for lectures 1 and 2.

Reddien and Tanaka 2011. The cellular basis for animal regeneration. PMCID: PMC3139400

Slack 2017. Animal regeneration: ancestral character or evolutionary novelty? PMCID: PMC5579372.

Maden 2018. The evolution of regeneration – where does that leave mammals? PMID: 29938749,

Mokalled and Poss. 2018. A regeneration toolkit. PMCID: PMC6373444

Week 3: Presenting a research article

Presenters: everyone.

Discussion paper: Kikuchi et al 2010. Primary contribution to zebrafish heart regeneration by gata4(+) cardiomyocytes. Nature. PMCID: PMC3040215.

Background reading: Tzahor and Poss 2017. Cardiac regeneration strategies: staying young at heart. Science.PMCID: PMC5614484

Week 4: No meeting

Week 5/April 28: Presentation group 1. Appendage regeneration

Presenters: TBD

Discussion paper: Sugiura et al. 2016. MARCKS-like protein is an initiating molecule in axolotl appendage regeneration. Nature. PMCID: PMC4795554

Background reading: Cox, Yun and Poss. 2019. Can laboratory systems instruct human limb regeneration? Development. PMCID: PMC6917474

Week 6: Presentation group 2. Whole body regeneration

Presenters: TBD

Discussion paper: Wagner, Wang and Reddien 2011. Clonogenic Neoblasts Are Pluripotent Adult Stem Cells That Underlie Planarian Regeneration. Science. PMCID: PMC3338249

Background reading: Reddien 2018. The cellular and molecular basis for planarian regeneration. Cell 175: 327-345. PMCID: PMC7706840

Week 7: Presentation group 3. Skin regeneration

Presenters: TBD

Discussion paper: Seifert et al 2012. Skin shedding and tissue regeneration in African spiny mice (*Acomys*). Nature. PMCID: PMC3480082

Background reading: Erickson and Echeverri 2018. Learning from regeneration research organisms: the circuitous road to scar free wound healing. Dev. Biol. PMCID: PMC5914521

Week 8: Presentation group 4. Neural regeneration

Presenters: TBD

Discussion paper: Nogueira-Rodrigues et al. 2022. Rewired glycosylation activity promotes scarless regeneration and functional recovery in spiny mice after complete spinal cord transection. Dev Cell. PMID: 34986324

Background reading: Sofroniew 2018. Dissecting spinal cord regeneration. Nature. PMID: 29769671

Week 9: Presentation group 5. Antler regeneration.

Presenters: TBD

Discussion paper: Sinha et al. 2022. Fibroblast inflammatory priming determines regenerative versus fibrotic skin repair in reindeer. Cell. PMID: 36493752.

Background reading: Li et al. 2014. Deer antler – A novel model for studying organ regeneration in mammals. Int J Biochem Cell Biol. PMID: 25046387

Week 10: No meeting; Final papers due by 5 PM Friday June 16.

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