Biology 457: Seminar on Developmental Genetics: Germline

Spring 2020 Professor Goutte Science CenterB218

**Preamble:** For this semester I have chosen to focus our discussion on the **germline** - in our first meeting this week we will define the germline and look at early studies (50-100 yrs ago) that began to probe the existence, the function, and the power of "germ plasm." We will follow classic developmental biology approaches that observed, measured, and began to perturb the germ plasm. From this point we will follow seminal papers in which molecular detail is sought to explain how germ cells are made to be so dramatically different from the rest of an animal's cells. We will pay particular attention to experimental evidence that supports or tests or refines working models, and to the new questions that are born with each new result. Ending up with articles published in the last 5 years, we will have made a clear progression towards the questions that remain unanswered today. Along the way we will pay particular attention to the reliability and the limits of evidence, and to the art of a beautifully designed experiment.

**The specific goals of this course are:**

1) Explore and learn about germ cells (developmental biology, genetics, cell biology)

2) Explore and learn about inquiry-based experimentation and specific genetic approaches

3) Practice extracting the scientific process, not just the conclusions, from primary literature

(tractable questions, experimental design, interpretation, model building and model testing, and become comfortable critiquing styles, strengths and weaknesses of papers

4) Practice and sharpen critical thinking and analysis skills

5) Practice and hone skills in oral scientific communication

a) participation in class discussions (informed, casual, collaborative, inquisitive) b) as presenter (informed, more planned and structured, but still collaborative, inquisitive)

6) Practice and hone skills in written scientific communication

a) In three written “perspective” pieces (<1000 words, focused on 1- 2 papers) This format [called by different names: “preview” (*Cell*), “dispatch” (*Current Biology*), “perspectives” (*Science*), News & Views”(*Nature*)] presents a short highlight of a recent paper, adding context and perspective and explanation of what’s so great/novel/surprising about this paper – journals typically have one or two per issue in which they invite an expert in the

field to write such a piece for a particularly impactful paper that has just come out in their area (for which they are not an author). I will give you examples of this genre of scientific communication, and then you’ll write three of your own throughout the semester. This format makes you think hard to extract the most salient nuggets of information or tour de force accomplishments or important impacts on an existing body of understanding, and also gives you opportunity for creativity in choice of perspective and emphasis.

b) In one mini-grant proposal due on the last day of class

**Structure of Course:** This course focuses on readings from the scientific literature. Your responsibilities will be to engage with the readings assigned each week. This means understanding the foundation of the paper, the questions sought, the approaches taken, and the results obtained (this will mean working with the figures to understand what/why/how). You will follow the author’s conclusions, but also add your own emphasis and/or questions and connections. Throughout the semester, you should strive to make connections between different papers, whether to compare different lines of inquiry, different experimental approaches, different results, or just to compile findings together in one place. Of course the more we learn about how things work, the more our perspective changes, and that always brings new questions! See the last page for week-by-week information.

**Reading:** You will be able to access all the required articles (as well as many extra) through E reserve on the class Moodle site. I have also provided a link to PubMed so that you can easily search additional relevant papers at your “leisure.” **“Reading”** a scientific paper is an oversimplification of what we do. In this course, I define three ways in which you will approach a paper, and I will provide opportunities for you to practice each of these, and to recognize which will suit your goals for particular situations:

**(I)** Seeking Information **(S)** Surfing (reading the whole paper as a follower) **(D)** Digging in (reading the whole paper as a skeptic eager to evaluate the data yourself) Each week there will be at least one paper for which you will do D, and more than one that you will do I and S. Sometimes, you may do D just for one part of a paper (one experiment/one figure/one claim), and often you will come back to a paper in a different role, doing an S or I for a paper you had previously done D, or vice versa.

**Class Participation:** The flavor of this class will depend entirely on your level of involvement as a participant armed with curiosity and questions and interpretations. Be sure to do your weekly readings with plenty of time in advance so that you have time not just to read, but importantly, to decipher, to tackle, to question, to reflect, etc. Then, bring these thoughts, these questions and concerns to class so that we can all consider them....sometimes something is unclear in a paper simply because the experiment was actually not very thorough, and an important control is missing; other times there are parts of an experiment that are indeed critical, but the authors do not explain it well, and it is important to ask why that part of the experiment was carried out. Class participation should be viewed not as an opportunity to display how much you know, but rather, as an opportunity to question what we (or an author) know, or think we know, and how important it is to define the limits of our knowledge and, having identified those boundaries, to freely go forth and speculate and question further... Throughout the semester you will have several

opportunities to present a paper or part of a paper to the group. As a presenter, you will want to plan how you will present the paper and what relevant context is needed, and which experiments you will choose to highlight (details will be explained in class).

**Written Assignments:** You will turn in three short papers (“perspectives”) each focused on only 1-2 readings (this format will be explained in class, and we will work with some examples to see how this format works), and at the end of the semester you will turn in a short-format research proposal (see below).

**Research Proposal:** In April you will choose one key question from the course material that has intrigued you about the germline, and collect a few key papers in that area as well as 2-3 recent papers. This will be an extension of something we have touched upon in class, but maybe not followed to the present state of knowledge. As a first step in this exploration, on April 1st you will turn in a “paragraph of research interest” along with a list of relevant references that you are considering concentrating on. This will allow me to help you bring your interests to a focus, and to choose the most pertinent papers to pursue. Following this initial step, your next task (April 15th or 22nd ) will be to bring your new found “expertise” to the group, and do an oral presentation of the state of knowledge in the field that you have chosen. The presentation will NOT include the experiments that you propose to do, but rather will summarize the state of knowledge in the field as it is today, and touch upon some remaining unresolved issues that intrigue you. The research you do for this presentation, and the presentation itself will serve you well as this material will constitute the first third or half of your grant proposal. Hopefully this session will help bring up interesting questions, and ideas for experiments. The last task is to put together the research proposal itself– this mock grant application is due on the last day of classes to the private “Goutte Foundation of Developmental Research” (guidelines will be discussed in class, as well as tips on making your proposal successful).

**Overall performance in course will be evaluated based on the following:** 1) Class participation (20%) 2) Perspective x 3 (5%, 10%, 10%) 3) Class Presentations (25%) 4) Oral Research Presentation (10%) 5) Written Grant Proposal (20%)

**Amherst College Statement of Intellectual Responsibility** Every person's education is the product of their intellectual effort and participation in a process of critical exchange. Amherst cannot educate those who are unwilling to submit their own work and ideas to critical assessment. Nor can it tolerate those who interfere with the participation of others in the critical process. Therefore, the College considers it a violation of the requirements of intellectual responsibility to submit work that is not one's own or otherwise to subvert the conditions under which academic work is performed by oneself or by others. **BIOL 457:** all writing components must be your own work. Don’t be tempted to use sentences from published work because it sounds more eloquent or succinct – it is far more important to use your own language to express your thinking, or explain an experiment (you may do it better than the author!). If you find that an author’s phrase is just too perfect to miss, then use quotations and citation, but this should rare, as scientists are not particularly known for eloquence. If you have any questions or concerns about what can or cannot be used, please ask.

Specific week-by-week information will be posted on Moodle; See below for key deadlines for assignments

**DATE Discussion Topic In Class Due in class** Wk 1 1/29

Intro to Germ Cells Model system germlines

learning from the paper Intro: identifying ?s and flow of inquiry Wk 2 2/5

Early germ plasm experiments Show it, Lose it, Move it!

Discuss papers (ea person has 1 D, 2 S) Wk 3 2/12

Search for molecular components of germplasm: Genetic approaches

Discuss papers Work w/ ex’s of Perspectives Wk 4 2/19

Molecular identities of germ plasm RNA world

Discuss papers Perspective#1

Wk 5 2/26

Continued from above Discuss papers

Wk 6 3/4

Transcriptional Silencing in Germline Discuss papers Perspective#2

Wk 7 3/11

Continued from above Discuss papers

Break Wk 8 3/25

Germ cell proliferation; Stem cells Discuss papers Perspective#3

Research ¶\* Wk 9 4/1

The Niche: soma – germline interactions Discuss papers Research ¶\*

Wk 10 4/8

Continued from above Discuss papers

Wk 11 4/15

Continued from above Individual Research Question

Presentations

Presentation

Wk 12 4/22

TBD Individual Research Question

Presentations

Presentation

Wk 13 4/29

TBD Discuss papers Research

Proposal

\* Depending on how soon you want feedback on your research area, you can choose to turn in your Research ¶ anytime in the last week of March;