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Homework 6
Due May 22th at the beginning of lecture

Instructions:

You are welcome to discuss concepts with your classmates but must compose your own answers. If you are unsure of the honor code for this course, please ask or look at the course website. http://www.its.caltech.edu/~bi1/Bi1__Micro-_to_Macro-Biology/Policies.html
The goal of this assignment is to help you understand a dense research paper. Many of the questions do not have a single correct answer. You will be given full credit as long as your answer is reasonable. The point is for this to help train you to pull out the main point from a paper, even if you don't get every last detail.
The answers must be legible and should not extend past the allotted space. Keep in mind that a few well-written sentences can give a higher score than a whole page of text.
Remember to write your full name on each page.
Read Hamamura, Y, et. Al (2011) Live-cell imaging reveals the dynamics of two sperm cells during double fertilization in *Arabidopsis thaliana*. *Curr Biol* 21: 497-502 **carefully and answer the following questions.**

1) What are the main goal and significance of the paper? (4 points)

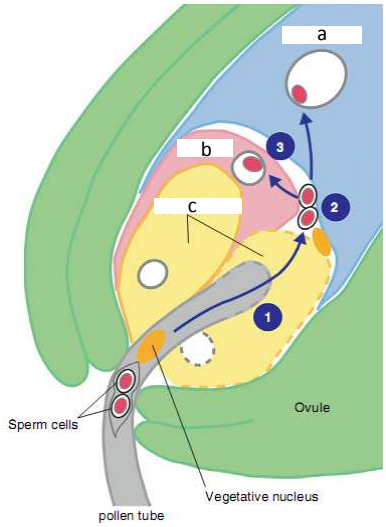

Figure 1:
Steps of double fertilization in *Arabidopsis thaliana*

2) Refer to Figure 1
i. Write down the name of cell a, b and c. (2 points)

ii. In your own words, describe the three steps (1, 2 and 3) of sperm cell behavior observed by the authors (5 points)

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iii. The chromosome number of haploid cells is 1n, diploid cells is 2n and triploid cells 3n. Write down the chromosome numbers of cells a, b, and c before and after fertilization in the following table. (4 points)

	Before Fertilization	After
Cell a		
Cell b		
Cell c		

3) One conclusion of the paper is that there is no preferential fertilization in *Arabidopsis thaliana*. Explain what preferential fertilization is. From which experimental result(s) could the author make the conclusion? (4 points)

4) Some plants can be fertilized by their own pollen, called self-fertilization, but the majority of angiosperms have developed mechanisms to prevent it from happening.

i. What might be the benefit of self-fertilization? (3 points)

ii. Under what circumstance would self-fertilization be detrimental? What might be the evolutionary advantage of preventing self-fertilization? Describe two strategies can plants use to prevent self-fertilization? (7 points)

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Fluorescent Microscopy

5) Write a short description of how fluorescent tags function and how are they visualized in fluorescent microscopy? Explain the difference between the excitation spectrum and emission spectrum of a fluorescent tag and how this affects fluorescent microscopy. (5 points)

6) In a few sentences, describe how fluorescent tags can be attached genetically to a protein of interest and how this fluorescent tag can be useful for cellular and sub-cellular localization? (Hint: look back at earlier recitation sections and papers!) (5 points)

7) What do you think are some possible problems that could occur? (5 points)

8) Design an experiment to better visualize any pathway discussed in class to this date with the use of one or more fluorescent tags and describe what the results will tell you. What pathway interests you? What would you label? What would the expected results be? (6points)