Regulated Research Institutional/Industrial Setting Form (1C)

This form must be completed AFTER experimentation by the adult supervising the student research conducted in a regulated research institution, industrial setting or any work site other than home, school or field.

Student's Name(s) Ashley CAMMISO

Title of Project The Effect of Cell-Cell Communication on the Polarization of the Lateral Line of Zebrafish

To be completed by the Supervising Adult in the Setting (NOT the Student(s)) after experimentation:
(Responses must be on the form as it is required to be displayed at student's project booth; please do not print double-sided.)

The student(s) conducted research at my work site:

1. Did you or your proxy (e.g. graduate student, postdoc, employee) mentor or provide substantial guidance to the student researcher? ☑ Yes ☐ No
   a. If no, describe your and/or your institution's role with the student researcher and his/her project (e.g. supervised use of equipment on site without ongoing mentorship and sign below.

   b. If yes, complete questions 2–5.

2. Is the student's research project a subset of your ongoing research or work? Use questions 3, 4 and 5 to detail how the student's project was similar and/or different from ongoing research or work at your site. ☐ Yes ☑ No

3. Describe the independence and creativity with which the student:
   a. developed the hypotheses or engineering goals for the research project

   We are interested in the regeneration of hair cells, the ear's sensory receptors. Although these cells do not regenerate in humans - leading to deafness - they do so in the zebrafish. We had delineated the molecular signals used in this process; Ashley independently hypothesized that she could determine the timing of signaling by a novel experimental approach.

   b. designed the methodology for his/her research project

   Pairs of hair cells originate in the zebrafish by mitosis (cell division) of a precursor. Each cell then assumes a unique fate: one is sensitive to water movement toward the head, the other to tailward motion. Ashley determined how to kill one cell of the pair immediately after division, and by that means to determine when the molecular signals specifying cellular fate were transmitted.

   c. analyzed and interpreted data

   Ashley followed the development of individual hair cells by video microscopy, then analyzed the time-lapse videos to ascertain which fate each cell assumed. To accomplish this, she learned the Python computer language from her postdoctoral preceptor and successfully applied it for analysis and statistics.

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Regulated Research Institutional/Industrial Setting Form (1C) Continued

Student's Name(s) Ashley CAMMISO

4. Detail the student's role in conducting the research (e.g. data collection, specific procedures performed). Differentiate what the student observed and what the student actually did.

Ms. Cammiso conducted her principal study independently. We had earlier established that pairs of new hair cells arise by a single division of a precursor cell; they then engage in a competitive biochemical interaction termed Notch-delta signaling, which results in one cell sensitive to tailward water movements and another responsive to headward stimuli. When Ashley killed one daughter cell of each pair within one-and-a-half hours of division, she found that the survivor was always of the latter class. After that interval, however, the surviving cell would adopt either polarity with an equal probability. The implication of the work is that every cell has a default fate—sensitivity to headward water movement—that in half the instances is overridden by intercellular competition. The competition does not occur during the first hour or so, hence the survivor after killing one cell expresses the default fate. By an hour later, however, signaling has occurred, so each cell is locked into a fate that becomes apparent after the other cell has been killed. By delineating the temporal window during which the competitive process occurs, this insightful experiment will facilitate our investigation of the proteins involved in signaling and will potentially help us design regenerative therapies for deafness.

5. Did the student(s) work on the project as part of a group? ☐ Yes ☑ No
If yes, how many individuals were in the group and who were they (e.g. high school students, graduate students, faculty, professional researchers)?

Ashley made two important contributions to our research during the past summer. In addition to the study described above, she worked in conjunction with two other highschool students to establish that relatively high concentrations of vitamin C (ascorbic acid) protect hair cells and their precursors from oxidative damage during video microscopy. By preventing cellular damage, this approach has allowed members of our group to observe and video regenerating cells for as long as two consecutive days, a fourfold improvement over the previous situation. This capability, which enables us to document the entirety of a cycle of regeneration, has already yielded new insights into the basis of the process.

I attest that the student has conducted the work as indicated above and that any required review and approval by institutional regulatory board (IRB/IACUC/IBC) has been obtained. Copies are attached if applicable.
I further acknowledge that the student will be presenting this work publicly in competition and I have communicated with the student research regarding any requirements for my review and/or restrictions of what is publicized.

Dr. A. J. Hudspeth	AJHudspeth Digitally signed by AJ Hudspeth Date: 2019.12.16 12:23:40 -05'00'	Professor
Supervising Adult's Printed Name	Signature	Title
Rockefeller University		12/16/2019
Institution		Date Signed (must be after experimentation) (mm/dd/yy)
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