Research Plan/Project Summary Instructions

A complete Research Plan/Project Summary is required for ALL projects and must accompany Student Checklist (1A).

1. All projects must have a Research Plan/Project Summary
   a. Written prior to experimentation following the instructions below to detail the rationale, research question(s), methodology, and risk assessment of the proposed research.
   b. If changes are made during the research, such changes can be added to the original research plan as an addendum, recognizing that some changes may require returning to the IRB or SRC for appropriate review and approvals. If no additional approvals are required, this addendum serves as a project summary to explain research that was conducted.
   c. If no changes are made from the original research plan, no project summary is required.

2. Some studies, such as an engineering design or mathematics projects, will be less detailed in the initial project plan and will change through the course of research. If such changes occur, a project summary that explains what was done is required and can be appended to the original research plan.

3. The Research Plan/Project Summary should include the following:
   a. **RATIONALE:** Include a brief synopsis of the background that supports your research problem and explain why this research is important and if applicable, explain any societal impact of your research.
   b. **RESEARCH QUESTION(S), HYPOTHESIS(ES), ENGINEERING GOAL(S), EXPECTED OUTCOMES:** How is this based on the rationale described above?
   c. Describe the following in detail:
      - **Procedures:** Detail all procedures and experimental design including methods for data collection. Describe only your project. Do not include work done by mentor or others.
      - **Risk and Safety:** Identify any potential risks and safety precautions needed.
      - **Data Analysis:** Describe the procedures you will use to analyze the data/results.
   d. **BIBLIOGRAPHY:** List major references (e.g. science journal articles, books, internet sites) from your literature review. If you plan to use vertebrate animals, one of these references must be an animal care reference.

Items 1–4 below are subject-specific guidelines for additional items to be included in your research plan/project summary as applicable.

1. **Human participants research:**
   a. **Participants:** Describe age range, gender, racial/ethnic composition of participants. Identify vulnerable populations (minors, pregnant women, prisoners, mentally disabled or economically disadvantaged).
   b. **Recruitment:** Where will you find your participants? How will they be invited to participate?
   c. **Methods:** What will participants be asked to do? Will you use any surveys, questionnaires or tests? If yes and not your own, how did you obtain? Did it require permissions? If so, explain. What is the frequency and length of time involved for each subject?
   d. **Risk Assessment:** What are the risks or potential discomforts (physical, psychological, time involved, social, legal, etc.) to participants? How will you minimize risks? List any benefits to society or participants.
   e. **Protection of Privacy:** Will identifiable information (e.g., names, telephone numbers, birth dates, email addresses) be collected? Will data be confidential/anonymous? If anonymous, describe how the data will be collected. If not anonymous, what procedures are in place for safeguarding confidentiality? Where will data be stored? Who will have access to the data? What will you do with the data after the study?
   f. **Informed Consent Process:** Describe how you will inform participants about the purpose of the study, what they will be asked to do, that their participation is voluntary and they have the right to stop at any time.

2. **Vertebrate animal research:**
   a. Discuss potential ALTERNATIVES to vertebrate animal use and present justification for use of vertebrates.
   b. Explain potential impact or contribution of this research.
   c. Detail all procedures to be used, including methods used to minimize potential discomfort, distress, pain and ~~injury~~ to the animals and detailed chemical concentrations and drug dosages.
   d. Detail animal numbers, species, strain, sex, age, source, etc., include justification of the numbers planned.
   e. Describe housing and oversight of daily care
   f. Discuss disposition of the animals at the termination of the study.

3. **Potentially hazardous biological agents research:**
   a. Give source of the organism and describe BSL assessment process and BSL determination.
   b. Detail safety precautions and discuss methods of disposal.

4. **Hazardous chemicals, activities & devices:**
   - Describe Risk Assessment process, supervision, safety precautions and methods of disposal.
   - Material Safety Data Sheets are not necessary to submit with paperwork.

Ashley Cammiso

The Effect of Cell-Cell Communication on the Polarization of Hair Cells on the Lateral Line of Zebrafish

Animal Sciences

Research Plan

3. a. **RATIONALE:** Include a brief synopsis of the background that supports your research problem and explain why this research is important and if applicable, explain any societal impact of your research.

Hair cells are found in the human inner ear and are responsible for the process of mechanotransduction, or sending mechanical stimuli to the brain. The cells may die for a number or reasons (including exposure to loud noises or aging). These cells can not regenerate in mammalia and their loss contributes to loss of hearing and deafness, which can be socially isolating and linked to higher instances of mental illness and addiction. Studying these cells and their regenerative properties in zebrafish would allow for a better understanding of the mechanisms underlying hair cells communication. Furthermore, these studies would provide a foundation for later regenerative therapies to be created. This would improve quality of life for deaf individuals who seek treatment options beyond cochlear implants, which are ineffective for many hard of hearing individuals.

3. b. **RESEARCH QUESTION(S), HYPOTHESIS(ES), ENGINEERING GOAL(S), EXPECTED OUTCOMES:** How is this based on the rationale described above?

It is hypothesized that if cell communication is interrupted during the span of the lateral inhibition process, the cells will demonstrate polarity bias rather than the typical random distribution expected in wildtype fish. Ablating a single cell in a sister pair should cause the remaining cell to lose Notch activation, adopt a low-Notch state and subsequently establish a posterior polarity.

3. c. Describe the following in detail:

- **Procedures:** Detail all procedures and experimental design including methods for data collection. Describe only your project. Do not include work done by mentor or others.
    - Fish ranging from 2 to 7 days post fertilization will be anesthetized and screened for Green Fluorescent Protein (GFP). Fish will be mounted in an agarose solution and placed underneath an iSim microscope where all seven neuromasts will be marked. One cell in a nascent pair will be ablated at random. The fish will be monitored for new divisions in order to ablate as many cells as possible. The fish will be imaged for approximately 24 hours. This will be repeated for as many fish as possible.

- **Risk and Safety:** Identify any potential risks and safety precautions needed.
    - Basic safety procedures will be observed at all times, including the use of goggles and gloves in the laboratory. No additional safety measures are expected to be needed.

- **Data Analysis:** Describe the procedures you will use to analyze the data/results.
    - To analyze the data, the programming language Python will be used to create codes that sort the data. These codes will allow a user to manually separate viable image compositions from disposable ones, record notable data from the valid data collected, and sort said data into a table that can be interpreted. Any discarded images will be more closely analyzed to allow a user to salvage potential images as well.

3. d. **BIBLIOGRAPHY:** List major references (e.g. science journal articles, books, internet sites) from your literature review. If you plan to use vertebrate animals, one of these references must be an animal care reference.

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        - Not applicable.
    b. **Recruitment: Where will you fi nd your participants? How will they be invited to participate?**
        - Not applicable.
    c. **Methods: What will participants be asked to do? Will you use any surveys, questionnaires or tests? If yes and not your own, how did you obtain? Did it require permissions? If so, explain. What is the frequency and length of time involved for each subject?**
        - Not applicable.
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        - Not applicable.

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Addendum:

No changes were made to the original research plan.