Mini Project Description

Literature Analysis in Neurobiology: Mini Project Overview

For this course, students will complete a single **Miniproject** aimed at developing two essential skills in academic research: **Methodology Extraction** and **Peer Review Simulation**. These tasks will help you engage deeply with scientific literature, understand research methodologies, and critically evaluate academic papers.

Miniproject: Methodology Extraction and Peer Review Simulation

This project involves two main tasks:

1. **Methodology Extraction**
2. **Peer Review Simulation**

Miniproject Format and Grouping Instructions

For the upcoming miniproject you are required to form groups consisting of two individuals. In cases where the class size renders this impractical, a group of three may be formed to accommodate an odd number of students.

Each group will be responsible for completing the assignments, each focused on a distinct research paper. Groups will have two weeks from today to notify me of their finalized partnerships.

This collaborative approach not only fosters peer learning but also emulates the teamwork often necessary in academic research. Please ensure that your groups are finalized and reported within the designated timeframe to facilitate the smooth execution of these assignments.

Task 1: Methodology Extraction

In this task, you will extract, analyze, and evaluate the methodologies used in one peer-reviewed research paper. The focus is on understanding the detailed research processes and preparing a comprehensive experimental protocol.

Your responsibilities include:

- Carefully reviewing the methods section of each assigned paper.
- Preparing a detailed protocol as if you were to replicate the experiment, including specific reagents, steps, product IDs, and concentrations.
- Identifying sources of reagents and calculating any dilutions necessary for the experiment.

Submission Components:

- **Protocols**: A detailed, step-by-step experimental guide for each paper.
- **Short Description**: A one-page summary (Times New Roman, 11-point font, 1.5 line spacing) that highlights key observations from preparing the protocols.
- **Presentation**: A flash presentation during the last session of the course, summarizing your findings.

Evaluation Criteria:

- The thoroughness of the protocol
- Attention to detail in reagent identification and operational steps
- Quality of the short description
- Effectiveness of the presentation

Additional Guidelines:

Include references to any other papers you had to consult to complete the protocol. Point out any difficulties or challenges you encountered while constructing the protocol.

Example of Methodology Extraction

Cell Cycle Phase Quantification under Shh Stimulation In Vitro

This example illustrates how to prepare a protocol for quantifying cell cycle phases under Sonic Hedgehog (Shh) stimulation in vitro.

Cloning of Virus:

- **Reagents:**
  - pLenti plasmid: Purchase from Addgene (Product ID: 12345)
  - Competent E. coli cells: Purchase from Invitrogen (Product ID: 67890)
- **Procedure:**
  - Thaw competent cells on ice for 10 minutes.
  - Add 1 µL of pLenti plasmid (Concentration: 1 ng/µL; dilute from stock 10 ng/µL using nuclease-free water).
  - Incubate on ice for 30 minutes, heat-shock at 42°C for 45 seconds, and place back on ice for 2 minutes.

Viral Infection:

- **Reagents:**
  - Shh Protein: Purchase from Sigma (Product ID: 11223); available at 1 mg/mL; dilute to 500 µg/mL for use.
- **Procedure:**
  - Prepare a 6-well plate with cells at 70-80% confluency.

    - Add 1 mL of viral supernatant containing Shh (500 µg/mL) to each well.
    - Incubate at 37°C for 24 hours.

Imaging for Cell Cycle Phases:

- **Reagents:**
    - Hoechst 33342: Purchase from Thermo Fisher (Product ID: 98765); stock concentration 10 mg/mL; dilute to 1 mg/mL for use.
- **Procedure:**
    - Wash cells once with PBS.
    - Add 1 mL of Hoechst 33342 solution (1 mg/mL) to each well.
    - Incubate at 37°C for 15 minutes.
    - Image cells under a fluorescence microscope, capturing at least five random fields per well.

Short Description Example: In preparing these protocols, several challenges were encountered, such as finding the appropriate concentration for the Shh protein, as the original paper lacked clarity. The dilutions for Hoechst 33342 also required additional consultation with the manufacturer's guidelines.

Task 2: Peer Review Simulation

In this part of the Miniproject, you will perform a peer review of a research paper, assessing its methodology, claims, and overall scientific validity. Your goal is to provide constructive feedback, simulating the role of a reviewer in the scientific publishing process.

Submission Components:

- **Peer Review Report**: A 400-700 word referee report that includes:
    - **Initial Summary**: A brief summary of the paper, including its main claims and an indication of your general impression.
    - **Evaluation**: Critically assess the methodology, relevance, and whether the authors' claims are supported by the data.
    - **Recommendations**: Offer suggestions for improvement, separated into majorand minor comments.

Expected Components and Structure of the Peer Review Report

A well-composed peer review report serves as a dual dialogue: it communicates with both the editor and the authors. While some portions of the report may clearly target one audience over the other, remember that both parties will read the entire document.

A well-executed referee report balances critique and guidance. It is meticulous in its examination of the methodology, claims, and conclusions. The reviewer should identify discrepancies, inconsistencies, or insufficiencies, and clearly articulate these in the report. A

good report is not just a list of errors but provides actionable recommendations for improvement. Lastly, professionalism and respect should underpin all comments made.

Initial Summary: Start by summarizing the article to the editor, do not only summarize the key take home but summarize briefly how the claim is achieved and presented in the key narrative. This is also an opportunity to hint at your general impression of the paper by how you phrase your summary. Include the authors' claims and subtly indicate whether you believe these are supported.

Value to the Field: Comment on the paper's relevance, both intrinsically and in relation to existing literature. Highlight how the work contributes to current understanding and its significance in broader academic discourse. An expert refereeing the work, should easily gauge if the work is outstandingly novel or incremental.

Editorial Recommendation: Offer your opinion on what action the editor should take. Be cautious in this segment; your role is to assess the adherence to the claim and if they are supportive and advice on the quality of the science and not to make editorial decisions about where the paper should be published.

Revision Recommendations: Elaboration and Examples

The revision recommendations are the essence of your peer review report. This section is generally subdivided into major and minor comments, each serving distinct functions:

- ***Major Comments*:** These are the critiques that deal with the core aspects of the research. They usually require substantial effort from the authors to address. Major comments may include:
    - *Methodological Flaws*: If the methodology is unsound, the results cannot be trusted. Identify and articulate any such flaws.
    - *Unsupported Claims*: Point out instances where the authors make claims that are not substantiated by the presented data.
    - *Incomplete Analysis*: Indicate if further statistical tests are needed or if additional data should be collected.

      For example, a major comment might read: "The authors claim that the drug X reduces tumor size significantly, but the statistical analysis provided does not adjust for multiple comparisons, rendering the conclusion questionable."

- **Minor Comments:** These are smaller issues that do not fundamentally affect the validity of the research but do contribute to its overall quality. Minor comments often relate to:
    - *Clarity and Language*: Suggest rephrasing sentences that are difficult to understand.
    - *Figure and Table Improvements*: Recommend changes that make graphs or tables more informative and easier to interpret.
    - *Reference Updates*: Point out if key literature is missing or if existing citations are outdated.

      An example of a minor comment could be: "Figure 3 would benefit from a logarithmic scale to better visualize the smaller values."

Structuring the Comments

Typically, each comment should form a concise paragraph rather than a bullet point, providing enough detail for the authors to understand the issue and its solution. Major and minor comments usually appear in separate sections for clarity and ease of reading.

Concluding Remarks

While not mandatory, a concluding statement can wrap up the review, summarizing the key points and reiterating the recommended actions for the authors and editor. Since the beginning of the report already contains summaries and recommendations, the conclusion is optional but can add a final touch of coherence.

Additional Consideration: Your Role as a Reviewer

It’s important to remember that you are not a co-author. While you assess the paper's methodology, claims, and relevance, you should not introduce new claims or hypotheses. The aim is to evaluate the paper's current state and its capacity to support its conclusions, not to redefine its scope or aims. Your role is not to dictate the research direction but to assess the validity and quality of the work presented.

Evaluation Criteria

- Clarity and thoroughness in the initial summary.
- Insightfulness in the assessment of the paper's value to the field.
- Appropriateness of the editorial recommendation.
- Comprehensiveness and specificity in the revision recommendations.

Additional Guidelines

For a clearer understanding of what constitutes a high-quality peer review report, it is recommended to read published referee reports, such as those found in eLife.