Student Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Advisor Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **Category & Criteria** | Outstanding (10) | Good (9) | Satisfactory (8) | Marginal (6) | Unacceptable (2) |
| **Introduction: Context**Demonstrates a clear understanding of the “big picture”. * Why is this question important/ interesting in this field?
* What do we already know?
* What problem/ question is this research addressing?
 |
|  | 10 | 9 | 8 | 6 | 2 |
| **Introduction: Accuracy and relevance*** Content knowledge is accurate, relevant, thorough and provides appropriate background for reader including defining critical terms

NOTE: Websites or review papers are not primary references |
|  | 10 | 9 | 8 | 6 | 2 |
| **Hypotheses: Testable and consider alternatives*** Hypotheses are clearly stated, testable and consider plausible alternative explanations.
 |
|  | 10 | 9 | 8 | 6 | 2 |
| **Hypotheses: Scientific merit*** Hypotheses have scientific merit.
* Predictions are given using operational definitions
 |
|  | 10 | 9 | 8 | 6 | 2 |
| **Methods: Controls and replication*** Appropriate controls (including appropriate replication) are present and explained.
 |
|  | 10 | 9 | 8 | 6 | 2 |
| **Methods: Experimental design*** Experimental design is likely to produce salient and fruitful results, and is explicitly related to their predictions (tests the hypotheses posed.)
* Methods description is thorough enough to allow for replication by others.
 |
|  | 10 | 9 | 8 | 6 | 2 |
| **Results: Data Selection & Presentation*** Data are comprehensive, accurate and relevant.
* Data are summarized in a logical format (e.g., table, graphs, or diagrams)
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| **Category & Criteria** | Outstanding (10) | Good (9) | Satisfactory (8) | Marginal (6) | Unacceptable (2) |
| **Results: Statistical Analysis*** Statistical analysis is appropriate for hypotheses tested and appears correctly performed and interpreted with relevant values reported and explained.
 |
|  | 10 | 9 | 8 | 6 | 2 |
| **Discussion: Conclusions based on data selected*** Conclusion is clearly and logically drawn from data provided
* A logical chain of reasoning from hypothesis to data to conclusions is clearly and persuasively explained.
* Conflicting data, if present, are adequately addressed.
 |
|  | 10 | 9 | 8 | 6 | 2 |
| **Discussion: Alternative explanations*** Alternative explanations are considered and clearly eliminated by data in a persuasive discussion.
 |
|  | 10 | 9 | 8 | 6 | 2 |
| **Discussion: Limitations of design*** Limitations of the data and/or experimental design and corresponding implications discussed
 |
|  | 10 | 9 | 8 | 6 | 2 |
| **Discussion: Significance of research*** Paper gives a clear indication of the significance of the research and its future directions (future research questions).
 |
|  | 10 | 9 | 8 | 6 | 2 |
| **Use of Primary Literature*** Relevant and reasonably complete discussion of how this research project relates to others’ work in the field (scientific context provided)

*Primary literature is defined as:** Peer reviewed
* Reports original data
* Authors are people who collected the data
* Published by a non-commercial publisher
 |
|  | 10 | 9 | 8 | 6 | 2 |
| **Writing quality*** Grammar, word usage and organization facilitate the reader’s understanding of the paper.
 |
|  | 10 | 9 | 8 | 6 | 2 |
| **Independence & Self-Motivation*** Independence or leadership in project from experimental design to data analysis
 |
|  | 10 | 9 | 8 | 6 | 2 |

Students are expected to score a minimum of Satisfactory in all categories

For purpose of assigning letter grade use the following scale:

A: 100 – 90%

B: 89 – 80%

C: 79 – 70%

D: 69 – 60%

F: <60%

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| **Category & Criteria** | Outstanding (10) | Good (9) | Satisfactory (7) | Marginal (5) | Unacceptable (0) |
| **Introduction: Context** |
| Demonstrates a clear understanding of the “big picture”. * Why is this question important/ interesting in this field?
* What do we already know?
* What problem/ question is this research addressing?
 | * The writer provides a **compelling** **argument** as to why this knowledge may be of value to other researchers in that field.
* The writer describes the current gaps in our understanding of this field and provides **compelling reasons** as to how this research will help fill those gaps.
 | * The writer provides a **clear sense** as to why this knowledge may be of interest to other researchers in that field.
* The writer describes the current gaps in our understanding of this field and **explains** how this research will help fill those gaps.
 | * The writer provides **one explanation** of why others would find this topic interesting.
* The writer provides **some relevant context** for the research question(s).
 | * The writer provides a **generic or vague rationale** for the importance of the question.
* The write provides **vague or generic references** to the broader context of neuroscience.
 | * The importance of the question is **not addressed.**
* How the question relates within the broader context of neuroscience is **not addressed.**
 |
| **Introduction: Accuracy and relevance** |
| * Content knowledge is accurate, relevant and provides appropriate background for reader including defining critical terms
* NOTE: Websites or review papers are not primary references
 | * Background information is **completely accurate and thorough**.
* Background information has the appropriate level of specificity to provide **useful context to aid the reader’s understanding**.
* Primary literature references are relevant, adequately explained, and **indicates a reasonable literature search**.
 | * Background is accurate, but may contain **minor omissions**, but which do not detract from the major point of the paper.
* Background information has the appropriate level of specificity to provide relevant context.
* Primary literature references are **relevant and adequately explained**, but few are included.
 | * Background may contain **omissions or inaccuracies that do not detract** from the major point of the paper.
* Background information has the **appropriate level of specificity** to provide relevant context.
* Primary literature is **inadequately explained**.
 | * Background **omits information or contains inaccuracies** which detract from the major point of the paper.
* Background information is **overly narrow or overly general** (only partially relevant).
* Primary literature, if present, are inadequately explained and **contain website or secondary references**.
 | * Background is **missing** or contains major inaccuracies.
* Background information is accurate, but **irrelevant or too disjointed** to make relevance clear.
* Primary literature references are **absent or irrelevant**. May contain website or secondary references.
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| **Category & Criteria** | Outstanding (10) | Good (9) | Satisfactory (7) | Marginal (5) | Unacceptable (0) |
| **Hypotheses: Testable and consider alternatives** |
| * Hypotheses are clearly stated, testable and consider plausible alternative explanations.
 | * A comprehensive **suite of testable hypotheses** are clearly stated which, when tested, **will distinguish between major factors or potential explanations** for the phenomena at hand.
 | * **Multiple relevant, testable hypotheses** are clearly stated. Hypotheses **address more than one major potential mechanism**, explanation or factors for the topic.
 | * A **single relevant, testable hypothesis** is clearly stated. The hypothesis may be compared with a “null” alternative which is usually just the absence of the expected result.
 | * A clearly stated, but **not testable hypothesis** is provided.
* A clearly stated, but **trivial hypothesis** is provided.
 | * **No hypothesis** is indicated.
* The hypothesis is stated but **too vague or confused** for its value to be determined.
 |
| **Hypotheses: Scientific merit** |
| * Hypotheses have scientific merit.
 | * Hypotheses are **novel, insightful, or actually have the potential to contribute useful new knowledge** to the field.
 | * Hypotheses **indicate an integration of material** provided within the course and outside resources.
 | * Hypotheses **indicate a level of understanding beyond the material directly provided** to the student in the lab handout or lecture.
 | * Hypotheses are **plausible and appropriate** though likely or clearly taken *directly* from course material.
 | * Hypotheses are **trivial, obvious, incorrect or completely off topic**
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| **Category & Criteria** | Outstanding (10) | Good (9) | Satisfactory (7) | Marginal (5) | Unacceptable (0) |
| **Methods: Controls and replication** |
| * Appropriate controls (including appropriate replication) are present and explained.
 | * Controls consider *all* relevant factors.
* Controls have become **methods of differentiating between multiple hypotheses**.
* Replication is **robust** (sample size is larger than average for the type of study).
* **Explanations of why these controls matter** to the experiment are thorough, clear and **tied into sections on assumptions and limitations**.
 | * Controls **consider *all* relevant factors**.
* Controls are **capable of differentiating between 2** or more hypotheses.
* Replication is appropriate (**sample size is larger than average** for the type of study).
* **Evidence of a reasonable sense of why controls/ replication matter** to this experiment.
* Explanations are **accurate**
 | * Controls **takes most relevant factors into account**.
* Controls include **positive and negative controls** if appropriate.
* **Replication is appropriate** (average sample size with reasonable statistical power).
* **Explanations of controls and/or replications are vague**, indicating only some understanding of the need for controls and/or replication.
 | * Controls **consider one major relevant factor**.
* **Replication is modest** (weak statistical power).
* **Explanations** of controls and/or replication are **inaccurate or indicate a rudimentary sense of the need** for controls and/or replication.
 | * Controls and/or replication are **nonexistent**.
* Controls and/or replication may have been present, but just **not described**
* Controls and/or replication were **described but inappropriate**.
* Student **fails to mention controls and/or replication** or the explanation is **incomprehensible**.
 |
| **Methods: Experimental design** |
| * Experimental design is likely to produce salient and fruitful results (tests the hypotheses posed.)
* Methods are explicitly related to the hypothesis and predictions
* Methods description is thorough enough to allow for replication by others.
 | * Appropriate with rationale as to selection choices.
* Clearly explained.
* A synthesis of multiple previous approaches or an entirely new approach.
* **Images provided greatly enhance the reader’s understanding** of the experimental approach.
 | * Appropriate.
* Clearly explained.
* **A synthesis of multiple previous approaches** or an entirely new approach.
* **Some images are provided** to assist in understanding experimental execution.
 | * Appropriate.
* **Clearly** explained.
* **Modified from coursework** in appropriate places.
* Or **drawn directly from a novel source** (outside the course).
* Images provided, if any, are **minimally helpful in understanding the experiment**.
 | * **Appropriate**.
* Poorly explained.
* **Drawn directly from the coursework**.
* **Not modified** where appropriate.
* **No images** are included.
 | * **Inappropriate.**
* **Poorly explained/ indecipherable**.
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| **Category & Criteria** | Outstanding (10) | Good (9) | Satisfactory (7) | Marginal (5) | Unacceptable (0) |
| **Results: Data Selection & Presentation** |
| * Data are comprehensive, accurate and relevant.
* Data are summarized in a logical format (e.g., table, graphs, or diagrams)
 | * Data are relevant, accurate, comprehensive, and represented through **clear & appropriate figures**.
* Reader can fully evaluate validity of writer’s conclusions and assumptions.
* Data is **synthesized or manipulated in a novel way** to provide additional insight.
 | * Data are relevant, accurate and **comprehensive**.
* Reader **can fully evaluate** validity of writer’s conclusions and assumptions.
 | * Data are **relevant, accurate and complete** with any gaps being minor.
* Reader **can satisfactorily evaluate** whether the hypotheses were supported or rejected with the data provided.
 | * **At least one relevant dataset per hypothesis** is provided but some necessary data are missing or inaccurate.
* Reader **can satisfactorily evaluate some but not all** of writer’s conclusions.
 | * Data are **too incomplete or haphazard** to provide a reasonable basis for testing the hypothesis.
 |
| **Results: Statistical Analysis** |
| * Statistical analysis is appropriate for hypotheses tested and appears correctly performed and interpreted with relevant values reported and explained.
 | * Statistical analysis is **appropriate, correct and clearly explained**.
* Includes a **description of what constitutes a significant value and why that value was chosen** as the threshold (may choose values beyond p<0.05)
 | * Appropriate descriptive & inferential (comparative) statistical analysis is **properly performed and reasonably well explained**.
* **Explanation of significant value may be limited** or rote (ex. use of p<0.05 only)
 | * **Appropriate, correct descriptive & inferential statistics** are provided, but **lack sufficient explanation**
 | * Appropriate, accurate **descriptive statistics only** are provided.
* Inferential statistics are provided but **either incorrectly performed or interpreted or an inappropriate test** was used.
 | * **No statistical analysis** is performed.
* Statistics are provided but are **inappropriate, inaccurate or incorrectly performed** or interpreted so as to provide no value to the reader.
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| **Category & Criteria** | Outstanding (10) | Good (9) | Satisfactory (7) | Marginal (5) | Unacceptable (0) |
| **Discussion: Conclusions based on data selected** |
| * Conclusion is clearly and logically drawn from data provided
* A logical chain of reasoning from hypothesis to data to conclusions is clearly and persuasively explained.
* Conflicting data, if present, are adequately addressed.
 | * Conclusions are **completely justified** by data.
* Connections between hypothesis, data and conclusions are **comprehensive and persuasive**.
* Conclusions **address and logically refute or explain conflicting data**.
* **Synthesis of data** in conclusion may generate new insights
 | * Conclusions are **clearly and logically drawn from and bounded by the data** provide with no gaps in logic.
* A **reasonable and clear chain of logic** from hypothesis to data to conclusions is made.
* Conclusions **attempt to discuss or explain conflicting or missing data**.
 | * Conclusions have **some direct basis in the data**, but may contain some gaps in logic or data or are overly broad.
* Connections between hypothesis, data and conclusions are **present but weak**.
* Conflicting or missing data are poorly addressed.
 | * Conclusion have **little basis in data** provided.
* Connections between hypothesis, data and conclusions are **vague or otherwise insufficient** to allow reasonable evaluation of their merit.
* Conflicting or missing data are **poorly addressed**.
 | * Conclusions have **no basis in data** provided.
* Connections between hypothesis, data and conclusions are **non-existent**.
* Conflicting data are **not addressed**.
 |
| **Discussion: Alternative explanations** |
| * Alternative explanations are considered and clearly eliminated by data in a persuasive discussion.
 | * Have become a suite of **interrelated hypotheses that are explicitly tested** with data.
* Discussion and analysis of alternatives is **based on data, complete and persuasive** with a single clearly supported explanation remaining by the end of the discussion
 | * Some alternative explanations are tested as hypotheses; those not tested are **reasonably evaluated** in discussion.
* Discussion of alternatives is **reasonably complete, uses data where possible and results in at least some alternatives being persuasively dismissed**.
 | * Alternative explanations are mentioned but **not discussed or eliminated** by data
 | * Alternative explanations are **trivial or irrelevant**.
 | * Alternative explanations are **not provided**.
 |
| **Discussion: Limitations of design** |
| * Limitations of the data and/or experimental design and corresponding implications discussed
 | * Limitations are presented as factors modifying the author’s conclusions.
* Conclusions **take these limitations into account**.
 | * Limitations are presented **as factors modifying the author’s conclusions**.
 | * Limitations are discussed are relevant, but **not addressed in a comprehensive way**.
 | * Limitations are discussed in a **trivial way** (ex. ‘human error’ is the major limitation involved)
 | * Limitations are **not discussed**.
 |
| **Discussion: Significance of research** |
| * Paper gives a clear indication of the significance of the research and its future directions (future research questions).
 | * Future directions are salient, plausible and insightful.
* Writer clearly explains how work fills gaps in knowledge & **new questions/opportunities that are opened up** as a result of this work.
 | * Future directions are **salient, plausible and insightful**.
* Writer **clearly explains how this work fills our knowledge gaps**.
 | * Future directions are useful but **indicate incomplete knowledge** of the field (suggests research already done or is improbable).
* Significance **demonstrates only partial knowledge** of field.
 | * Future directions are **vague, implausible** (not possible with current technologies or methodologies), **trivial or off topic**.
* Mentions of significance are **vague or inappropriate**
 | * Future directions are **not addressed**.
* Significance of the project is **not addressed**.
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| **Category & Criteria** | Outstanding (10) | Good (9) | Satisfactory (7) | Marginal (5) | Unacceptable (0) |
| **Use of Primary Literature** |
| * Relevant and reasonably complete discussion of how this research project relates to others’ work in the field (scientific context provided)

*Primary literature is defined as:** Peer reviewed
* Reports original data
* Authors are people who collected the data
* Published by a non-commercial publisher
 | * Primary literature references **indicate an extensive literature search** was performed.
* Primary literature references frame the question in the introduction by **indicating the gaps in current knowledge** of the field.
* Primary literature references are used in the discussion to **make connections** between the writer’s work and other research in the field clear.
* Primary literature references are properly and accurately cited.
 | * Primary literature references are more extensive (at least one major citation for each concept).
* Literature cited is **predominately (>90%) primary literatures**.
* Primary literature references are used primarily to provide background information and context for conclusions.
* Primary literature references are properly cited.
 | * Primary literature references are **more extensive** (at least one major citation for each concept).
* Literature cited is mainly **(>50%) primary literatures**.
* Primary literature references used provide some background information and context for conclusions.
* Primary literature references are **properly cited**.
 | * Primary literature references are **limited** (only 1-2 primary references in the whole paper).
* References to the textbook, lab handout, or websites may occur.
* Citations are at least **partially correctly formatted**.

NOTE: proper format includes a one-to-one correspondence between in-text and end of text references) as well as a citation style currently used by a neuroscientific, or discipline-specific journal. | * Primary literature references are **not included**
 |
| **Writing quality** |
| * Grammar, word usage and organization facilitate the reader’s understanding of the paper.
 | * **Correct** grammar and spelling.
* Word usage **facilitates reader’s understanding**.
* Informative subheadings **significantly** aid reader’s understanding.
* A clear organizational strategy is present with a logical progression of ideas. There is **evidence of an active planning** for presenting information; the paper is easier to read than most
 | * Grammar and spelling have **few mistakes**.
* Word usage is **accurate** and aids the reader’s understanding.
* Distinct sections of the paper are delineated by **informative subheadings**.
* A clear organizational strategy is present with a **logical progression of ideas**.
 | * Grammar and spelling **mistakes do not hinder the meaning** of the paper.
* General word usage is appropriate, although **use of technical language may have occasional mistakes**.
* Subheadings are used and **aid the reader somewhat**.
* There is some **evidence of an organizational strategy** though it may have gaps or repetitions.
 | * Grammar and spelling errors detract from the meaning of the paper.
* Word usage is frequently confused or incorrect.
* Subheadings are **vague and overly general**.
* Information is presented in a format which **suggest lack of an organizational strategy**.
 | * Grammar and spelling **errors detract from the meaning** of the paper.
* Word usage is **frequently incorrect or irrelevant**.
* Subheadings are **not used**.
* Information is presented in a **haphazard way**.
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| **Autonomy & Self-Motivation** |
| * Independence or leadership in project from experimental design to data analysis
 | * **Demonstrates ownership** of research question, experimental design and data collection
* Seeks **consultation** with PI other team members without prompting
* **Works collaboratively** to exceed or meet deadlines
 | * Demonstrates **leadership** of project in experimental design and data collection & analysis
* Consistently communicated with PI and other team members
* Meets **all deadlines** without prompting
 | * May receive research question from PI, but **collects experimental data**
* Meets **most deadlines** with occasional prompts
 | * Receives research question from PI and relies upon others for **most data** collection
* **Occasional communication** with PI
* Meets **some but not all deadlines** but only with prompting
 | * **Relies upon others** for research question and all data collection
* **Lack of communication** with PI
* Repeated fails to make deadlines
 |