

## Scientific Research Proposal Rubric

| <b>1) Identifies and summarizes the problem/question to be investigated</b>                   |   |   |  |
|---|---|---|--|
| <i>Inadequate</i>   | <i>Minimally Developed</i>  | <i>Moderately Developed</i>   | <i>Substantially Developed</i>   |
| <p>Research question identified is too broad or vague to guide an experiment design.</p>      | <p>Has identified an appropriate research question to be studied, but lacks a clearly stated objective.</p> <p>Hypotheses are not stated, are not testable, or do not address the objective(s)</p> <p>Research plan is present in a broad outline, but lacks specifics.</p> | <p>Uses prior knowledge to identify a research question to be studied.</p> <p>Has clearly stated hypotheses that are testable and directly address the objective(s).</p> <p>Breaks questions down into smaller steps, but has not identified all the complexities and nuances inherent in the question.</p> <p>Has an adequate research plan, although it does not address all the alternative outcomes that may arise.</p> | <p>Uses prior knowledge to identify a question to be studied.</p> <p>Has clearly stated hypotheses that are testable and directly address the objective(s).</p> <p>Breaks question down into a series of steps that will lead to an answer. Identifies complexities and nuances in the question and explains possible alternative hypotheses.</p> <p>Uses these steps to create a thorough plan for the research project that can account for multiple outcomes.</p> |
| <b>2) Identifies existing, relevant knowledge and views</b>                                   |   |   |  |
| <i>Inadequate</i>   | <i>Minimally Developed</i>  | <i>Moderately Developed</i>   | <i>Substantially Developed</i>   |
| <p>Review of relevant knowledge is seriously incomplete.</p> <p>Major issues are ignored.</p> | <p>Uses some appropriate sources to discover what is already known about the system/problem, but omits important aspects of the problem.</p>  | <p>Uses appropriate sources to discover what is already known about the system/problem, but does not make clear connections between this information and the question to be investigated.</p> <p>Little or no justification of relevance to funding source or call for proposals.</p>   | <p>Provides a thorough and relevant literature review, and makes clear connections between this information and the question to be investigated.</p> <p>Makes direct connection to relevance of work to funding source or call for proposals.</p>  |

| <b>3) Uses appropriate methodology and experiments to collect data</b>   |  |   |  |
|--|--|---|--|
| <i>Inadequate</i>  | <i>Minimally Developed</i>   | <i>Moderately Developed</i>   | <i>Substantially Developed</i>   |
| <p>Research plan provided will not answer the question, does not control relevant variables, or uses other inappropriate methodology.</p> <p>No evidence of data quality control or assurance is provided. No evidence of proper safety procedures or applicable animal care procedures is provided.</p> | <p>Experiments will be carried out with appropriate methodology and controls to answer the question.</p> <p>Data quality control and assurance plan is provided. Safety procedures and animal care assurance is provided.</p> <p>Not clear that data collected will be sufficient for statistical significance, and little or no evidence of sample size considerations.</p> | <p>Experiments will be carried out with appropriate methodology and controls to answer the question.</p> <p>Data quality control and assurance plan is provided. Safety procedures and animal care assurance is provided.</p> <p>An appropriate number of trials are carried out, and statistical design will allow for unequivocal hypothesis testing.</p> | <p>Experiments will be carried out with appropriate methodology and controls to answer the question.</p> <p>Data quality control and assurance plan is provided. Safety procedures and animal care assurance is provided.</p> <p>An appropriate number of trials are carried out, and statistical design will allow for unequivocal hypothesis testing.</p> <p>Uses initial data to refine the experiment.</p> <p>Considers possible criticisms of the experimental plan and addresses them.</p> |
| <b>4) Analyzes data in an appropriate manner</b>   |  |   |  |
| <i>Inadequate</i>  | <i>Minimally Developed</i>   | <i>Moderately Developed</i>   | <i>Substantially Developed</i>   |
| <p>Plan for data analysis is incomplete.</p> <p>Does not demonstrate an appropriate understanding of the relationship between theory and experiment.</p> <p>Does not identify assumptions made in the analysis.</p>  | <p>Proposes to analyze data via graphs, statistics, and curve fitting.</p> <p>Does not demonstrate an appropriate understanding of the relationship between theory and experiment.</p> <p>Does not identify assumptions or consider alternative interpretations</p>  | <p>Proposes to analyze data via graphs, statistics, and curve fitting.</p> <p>Demonstrates understanding of the relationship between experiment and theory.</p> <p>Identifies assumptions, but does not consider alternative interpretations.</p>   | <p>Proposes to analyze data via graphs, statistics, and curve fitting.</p> <p>Demonstrates understanding of the relationship between experiment and theory.</p> <p>Identifies assumptions.</p> <p>Considers alternative interpretations of the data and, if possible, proposes additional experiments that will allow distinction between these interpretations.</p>   |

| <b>5) Draws sound inferences and conclusions from expected results</b>                                       |  |   |  |
|--|--|---|--|
| <i>Inadequate</i>  | <i>Minimally Developed</i>   | <i>Moderately Developed</i>   | <i>Substantially Developed</i>   |
| Describes expected results that are not justified.   | Describes expected results that are justified from the experimental design.  | Describes expected results that are justified from the experimental design and explores alternative outcomes based on demonstrated knowledge of the system under study. | Describes expected results that are justified from the experimental design and explores alternative outcomes based on demonstrated knowledge of the system under study.    |
| Does not recognize the limits or implications of their conclusions.  | Draws reasonable conclusions from the expected results, but does not convincingly connect the conclusions to the expected results. | Draws sound conclusions from the expected results, and communicates a logical path from them to the conclusions.  | Draws sound conclusions from the expected results, and communicates a logical path from them to the conclusions. Identifies how assumptions may influence the conclusions. |
| Does not anticipate or describe the broader impacts of the work (relevance to funding agency or to society). | Considers the broader impacts of the expected results, but only in a narrow regime.  | Considers the broader impacts of the expected results, but they are not complete or do not fully address relevance to funding agency or society.                        | Fully considers the broader impacts of the expected results both to the funding agency and to society.   |
| <b>6) Reflects on own work to assure that conclusions are justified</b>                                      |  |   |  |
| <i>Inadequate</i>  | <i>Minimally Developed</i>   | <i>Moderately Developed</i>   | <i>Substantially Developed</i>   |
| Does not identify or discuss sources of uncertainty.   | Identifies sources of uncertainty, but discussion is not present or is limited.  | Adequately identifies and discusses sources of uncertainty.   | Identifies and provides an extensive discussion of sources of uncertainty.   |
| Has not considered alternative approaches to the experiment or alternative conclusions.                      | Considers alternative approaches or alternative conclusions, but this is clearly incomplete.                                       | Considers alternative approaches or alternative conclusions, but does not explain why some were or were not proposed  | Explains why alternative approaches to the experiment or alternative interpretations of the data were accepted or rejected.  |

| <b>7) Suggests steps for further inquiry</b>                                   |   |   |  |
|--|---|---|--|
| <i>Inadequate</i>  | <i>Minimally Developed</i>  | <i>Moderately Developed</i>   | <i>Substantially Developed</i>   |
| Has not considered implications of the current work for future investigations. | Has proposed some logical steps on how results can be used to design further investigation, but this is clearly incomplete. | Identifies questions remaining unanswered.<br><br>Proposes next logical steps for continued inquiry into this system. | Identifies questions remaining unanswered.<br><br>Proposes next logical steps for continued inquiry into this system.<br><br>Proposes methods for verifying the consequences identified in Step 5.<br><br>Identifies how the conclusions might apply to new or different situations. |