Student Guide 2018/19

Greetings

Welcome to the Ottawa Science Innovation Challenge!

In this document, you will find all the details and instructions you need to create an excellent proposal to submit for the competition. Although it might seem intimidating to read through scientific literature and to be judged by graduate students and professors at the university level, this student guide will help you with the entire process. We hope you have a lot of fun creating your research proposals and find this entire competition an enriching experience. We cannot wait to see what kind of creative and innovative ideas you will all come up with!

- The OSIC Organizing Team

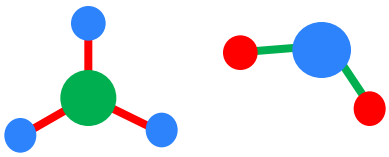
Important Dates

Date	Event
November 1st	Round 1 begins: Case Reveal
December 10th	Round 1 ends: Written submission deadline
*January 15th	Round 1 results announced
Mid-February	Final round at uOttawa

*Approximate date

Submission Information

Your written research proposals are due at **11:59 pm** on **December 10th, 2018** in pdf format. Please submit it to osic.uottawa@gmail.com. Submit with only one email per team and make sure the email appears in your "sent" mailbox. You will receive a submission confirmation via email within 24 hours.



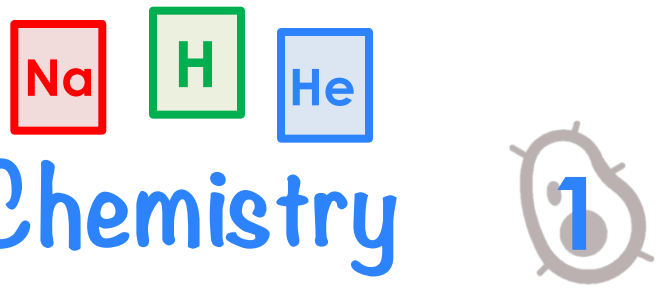
Submission Guidelines:

- Submit two copies of your written proposal in PDF format
- Both copies must include a title page
  - The first should contain your school name and team members' names underneath the title
    - Name the first PDF file **your_group number: your_project_title_keywords.pdf** (Shorthands are allowed)
    - Ex: E24:ROSGlycMitosis.pdf (Where E24 is the group's number)
  - The second should ONLY contain your team number (Should not contain any other identifying information)
    - Name the second PDF file **your_group_number.pdf**
    - Ex: E24.pdf (Where E24 is the group's number)

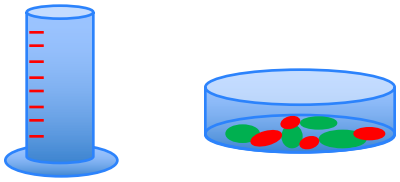
* Any violations to these guidelines (ex. Submitting a non pdf file, or including identifying information in both files) will result in disqualification.

Written Proposal Content Requirements – 1000 word limit

- **Abstract** (not included in word limit, but must not exceed 250 words)
- **Background Information**
- **Research Idea/Hypothesis**
- **Rationale**
- **Significance of Research Idea**
- **Research Approach/Methodology**
- **Conclusion**
- **References** (not included in word limit)



Student Guide



Written Proposal Format:

Abstract

Your abstract should include a clear and concise **summary** of your research proposal. It should include the issue it is trying to resolve, the methods you will use, your expected results, and a conclusion. Your abstract should be **no more than 250 words**.

Abstract Example:

Lyme Disease, a prevalent bacteria-caused illness, requires a long period of time to diagnose. If identified during its early stages, late symptoms of the disease and post treatment Lyme Disease syndrome could be prevented. The primary pathological cause of Lyme disease, bacteria Borrelia Burgdorferi (B), has been shown to thrive when using a host's transition metals, incorporating them in a process to achieve microbial growth. Research has shown that B differs from other organisms in that it utilizes other metal ions instead of iron in this process. This, among other mechanisms, allows it to thwart the immune system. The aim of this study is to research a possible connection between concentration of transition metals in the body and presence of the bacteria B. A mouse model will be used, in which half of the mice will be infected with B and half will be healthy. At scheduled times over the course of five weeks, blood tests will be taken from every subject and analyzed for concentrations of various selected metals. While the ultimate goal is to develop faster methods to accurately test for Lyme, this research can progress experimental work in treatment of the illness.

Background Info

This section is a complete ensemble of the information you have gathered that relates to the main ideas of your proposal. It's important that the section also elaborates on why said issue is relevant. You must refer to previous experiments performed in literature to explain why your idea has potential. Your background info must connect what is already being researched (scientific studies and current knowledge) with what you're attempting to find out (the answer to your research question), in an interesting way. Keep in mind that many who will be reviewing your research proposal will not necessarily have the knowledge to understand how your idea works and why it is relevant. **This section should only be written in a third person pretense.**

Use this section to walk your reader through how you got your idea and why you think it will work.

1) Identifying the problem you chose, then introduce research that adds helpful insight.
2) Start to connect ideas in a cohesive manner that shows your train of thought in coming up with your research idea. This linking of thoughts should hint at your research idea, but not explicitly state it (you'll state your idea later). You must mention social and economic factors that may play a part in your proposed research. The background info section is your chance to show off all of the cool research that fueled your ideas. **Remember to cite your sources.**

In this section, the problem has been identified and the writer made a link to a social and economic impact

Background Info Example:

Modern detection of Lyme Disease can be inaccurate and time-consuming. Late diagnosis leads to development of severe symptoms and Post Treatment Lyme Syndrome. This study aims to research a possible connection that would lead to better testing and treatment methods of the illness. For Lyme, blood testing is often done in two parts, most commonly an Enzyme Immunoassay test followed by a Western Blot test. In most cases, both tests need to be positive in order to give a positive diagnosis. Methods such as these are most reliable a few weeks after infection. These antigen tests assume that specific antibodies will be produced when corresponding proteins from the cell surface of infectious organisms are present. Because they rely on the detection of antibodies, these tests may give false negatives, if the body hasn't yet started fighting off an infection. Polymerase chain reaction (PCR) tests may be used, but their verdicts may produce false negatives or conflict with other tests' results. PCR involves many complex stages of precise analysis of DNA samples. These methods are relatively difficult to access and require weeks of time. Microorganisms such as Borrelia Burgdorferi (B) require metals to survive. Pathogens use a host's store of iron, zinc, manganese, and more, to grow and flourish. The body attempts to hide, or "sequester" its metal ions to starve bacteria, with a process termed "nutritional immunity". The body has been shown to flood areas infected with salmonella with antimicrobial proteins, removing zinc-a physiological need of salmonella. The bacteria uses specialized transporter proteins in order to overcome the immune response and use the zinc anyway. This suggests the infected area may have lower levels of zinc. If salmonella could have an impact on concentration of zinc in a host, can B? In fact, the body appears to hinder microbial growth of B specifically, by sequestering zinc and hiding it from the bacteria. Zinc transporters in immune system cells control intracellular movement of the zinc ions, effectively "hiding" them. Although the primary metal ion required by bacteria is iron, B has adapted to use manganese instead, and there are manganese transporters as well. Presence of the bacteria B could influence how much manganese, zinc, or iron is in an infected area.

Include the source

In this section, the writer identified his research idea with a clear and concise sentence

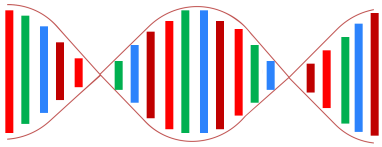
Judges Notes & Comments:

It would be more appropriate to call the bacteria B Burgdorferi throughout the entire text rather than call it "bacteria B" in some cases and "B" in others. The use of these different terms could cause some confusion.

Don't miss the helpful tips.

Research Idea/Hypothesis

Your research idea/hypothesis will consist of a proposed explanation for the outcome of your elaborated research method. It needs to solidate the theory and ideas mentioned in the background information. It should be clearly stated and well researched. Avoid things you can't control as these will restrict you in your methodology (e.g.: the growth of a population). Remember, be creative, as this is an innovative challenge.



Research Idea/Hypothesis Example:

Aim/Goal: The purpose of this research is to determine if there is a link between selected transition metal levels in a host and the presence of B.
Research Question: Will the presence of B affect concentrations of zinc, iron, and manganese in a host?
Hypothesis: Throughout five weeks of blood tests, the levels of zinc and manganese in a group of mice infected with B will become lower than those in a control group of healthy mice. The levels of iron will remain constant throughout the two groups.

Consider hypothesis versus prediction

Rationale

A rationale is a justification offered by a researcher for conducting research on a specific subject. As a researcher, you want to explain why you think your methodology will work. You must state your reasons with support from existing literature which will reinforce your justification. The rationale can be placed before or after the hypothesis.

Rationale Example:

Here, the writer briefly explains why he/she thinks their idea will work

This section serves as the rationale

Microorganisms require metal to grow, and bacteria such as B take those metals from a host. However, B has been shown to use manganese as a substitute to iron, so we hypothesize levels of iron in infected mice should be unaffected by the bacteria. Once the body has realized it is under attack, it attempts to hide or sequester the metal ions in an attempt to starve the bacteria. Both of these phenomena (B consuming the metal and the body sequestering that metal) could result in lower concentrations of the metals used by B in an infected host. B has been shown to use zinc and manganese, so we hypothesize the infected mice will demonstrate lower concentrations of zinc and manganese ions.

This part offers support to the main research idea

This sentence represents a hypothesis

Significance

What is the significance of your proposed research? What are the benefits and what impact can it potentially have? These are the questions you need to ask yourself when writing your significance. What will be the advancements in the field and what will be the outcome on treatment of this particular disease.

Significance Example:

If the link is indeed there, it would be very useful in finding a possible way of determining the state of illness faster and more effectively, along with potential treatment methods for the illness. A trend could be key in determining if a patient is infected much faster than current methods.

Research Approach/Methodology

The methodology section of your research proposal is not the classic "list your materials and methods". This section is one of the largest and most important ones on the poster as it outlines the various scientific techniques and control groups that you will use. It should explain how you will test your hypothesis in the lab by using various scientific techniques.

It is very important to:

1) **Outline the different groups that will be involved in your experiment** (experimental group vs control group)
2) **Size of these groups**. The sizes of groups you're using is key—they must be realistically large (you may need to research what is considered reasonable).
3) **Put controls.** Aim to reduce the number of variables so as to increase the validity of your findings.
4) **Choose a model in which you will conduct your experiments:** either **in vitro** (on cells) or **in vivo** (on animals) and why you chose this model.

Does the proposed study have experimental controls and if so, what are they and what purpose does it serve to control them?

Research Approach Example:

Should be in paragraph form

Examining the passage of the bacteria in the circulatory system of the mice allows more comparability to human systems than an in vitro study. An in vivo mouse model will be used to study the effect of the independent variable on the dependent variables in live mammalian hosts.

Independent variable: presence of B in the mouse.
Dependent variables: levels of iron, zinc, and manganese in the mouse. In order to provide accurate results, controls will be put in place on our study. A control group of healthy mice will be used.
Controlled variables: weight of mouse (mice of similar mass will be selected), diet of mouse (all mice will have identical nutrition), sex of mouse (half female, half male), size of enclosure, absence of other drugs/treatments on mouse, health of mouse.

Are there potential confounding variables of particular concern that are not addressed via experimental controls? If so, what are they and will they be measured and accounted for in the statistical analysis?

Methodology Example:

1. Identify whether the model is in vivo or in vitro
2. Establish an approximate experimental size

1. Selection Process: 20 mice of similar mass and seemingly good health are selected. 10 are female and 10 are male. Two groups are formed: X and Y. Each group is split up, half males and half females. Each mouse is assigned a value to keep track of them.
2. Preliminary Testing: Basic tests such as blood pressure, heart rate, etc. are performed to make sure there are no initial health concerns in each mouse. Mice deemed unhealthy or unfit will not be used.
3. Baseline Metal Testing: Blood samples (~50 µL) from the mice undergo careful electrothermal atomization. The now gaseous sample becomes the analyte in an absorption test. This process is called atomic absorption spectroscopy and it will be used to quantitatively test concentrations of zinc, iron, and manganese in the sample. These measurements are recorded as individual baselines. The average concentration of each metal is calculated per group to compare with final results.

4. Infection: Every mouse in group Y is injected with B in the ventral artery of the tail; allowing the bacteria into the bloodstream. Group X is not a part of this step as they are healthy controls.
5. Metal Research Process: The process from step 3 is repeated every week over a five week period, results are recorded. (average concentrations calculated weekly)
6. Analysis: The average concentrations from each week are compared. This gives an idea of when a possible trend may have appeared. Visuals and percent difference are used to analyze results.

Judges Notes & Comments:

Firstly, you should explain how you chose your time-frame and how it impacts the experiment. Secondly, deepen your explanation of the techniques you'll be using; blood extraction from the mice. Thirdly, you should expand your sample size to thoroughly support your hypothesis.

Conclusion

The conclusion section should be a short summary of the content and purpose of your proposal. You need to answer the questions what, how, and why. You should link your proposal to a real-life application in this section. You should **reinforce that your research idea is feasible, worthwhile, and important in real-life applications.**

Conclusion Example:

If the hypothesis is proven after the first week or two of testing, this trend can be used to accurately detect the Lyme disease bacteria faster than modern tests. If a trend at any point is noticeable during the course of the study, this knowledge could be used in further experimental research in treatment of Lyme. If no trend is noticed, this knowledge may eliminate a possible area of study and open the door to other research.

Judges Notes & Comments:

This conclusion is missing a summary of the main topic. However, it has a great flow and addresses every possible outcome.

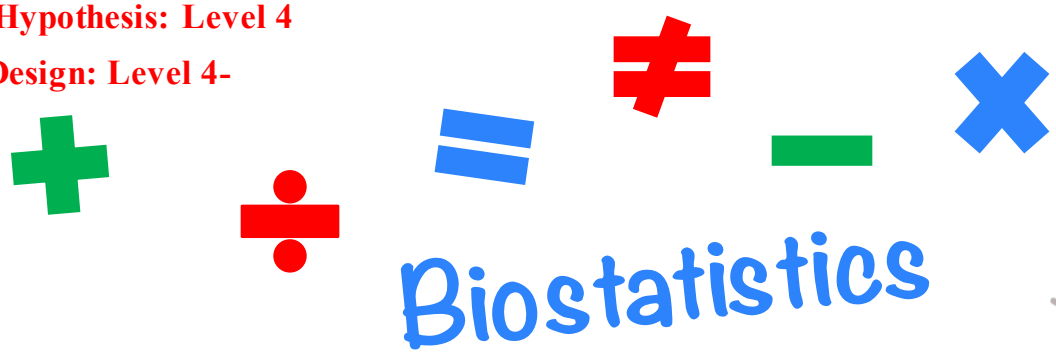
Grade for Example:

Background Info/Knowledge: Level 4

Research Idea/Hypothesis: Level 4

Experimental Design: Level 4-

Total: 90%



References

Citing reliable sources is an essential part of your proposal. Any time you mention what you found in your research, you must give credit to where that information came from.

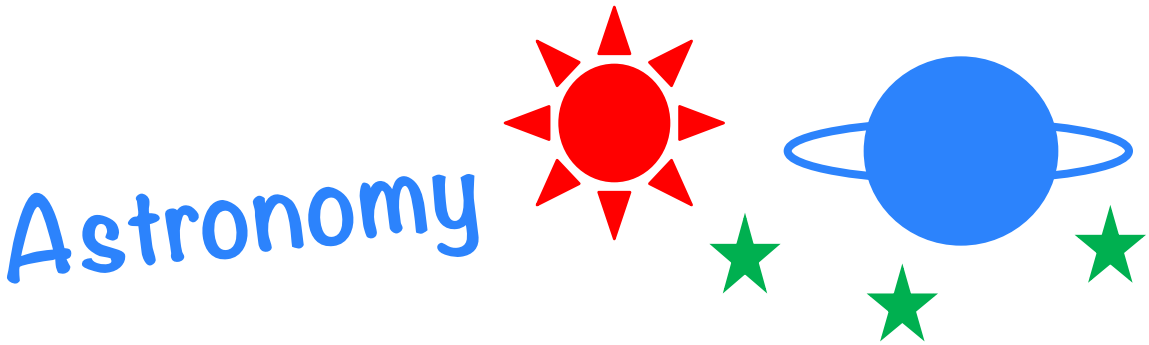
To do this, **put a superscript number after you state the information** (fact, concept, idea...etc.), and then later reference it in the "references" section. Reference section is a list of full citations, in the same order as the corresponding numbers appear in your proposal. **Do not include in-text citations,** as the references section will include all of your references at the end of your proposal. Cite your sources in the style of **APA 6th edition**. Mendeley is an excellent program for compiling and creating a reference list. Check it out here: https://www.mendeley.com/reference-management/reference-manager/

Lastly, remember to use credible sources. Stay away from websites that are full of ads or personal blogs. Referencing journals and papers is ideal. You may find an online news story about a study with valuable information. While it is acceptable to cite this news story, you can usually dig deeper and find the actual paper they're talking about. You can also use tools like Google Scholar and medical databases (such as Pubmed) to find reliable sources. If you come across a paper that is locked or costs money, simply email the OSIC team (osic.uottawa@gmail.com) and we can unlock the document for you free of charge.

Referencing sources will take time, but putting the effort in to do it properly will pay off. It is important to note that the font of the References section of your poster does not need to be as large as the rest of your poster so that it doesn't take too much space.

Reference Example:

1. Margolis, S., M.D., Ph.D. (2012). Antigen/Antibody Tests for Infectious Disease. December 28, 2017, from http://www.healthcommunities.com/infectious-diseases/antigen-antibody-tests.shtml.



Rubric

Criteria	Level 1 (50-59%)	Level 2 (60-69%)	Level 3 (70-79%)	Level 4 (80-100%)
Research and knowledge of the subject (25%)	Less than 2 articles are cited. Very little basis for ideas presented. Background presented is not relevant to the question or hypothesis posed.	2-4 articles are cited in the background presented. Two or fewer ideas are supported. Background presented is only weakly relevant to the question or hypothesis posed.	5-6 articles are cited in the background presented. Most ideas are supported with research. Background presented is relevant to the question or hypothesis posed.	Research is thorough and ideas are well supported. Background presented is clearly relevant to the question or hypothesis posed.
Formulating a question or research hypothesis (30%)	Question or hypothesis is not stated or is a simple repetition of a hypothesis found in published research. Hypothesis is irrelevant to the field.	Question or hypothesis stated but unclear or is just a slight variation of the published research.	Question or hypothesis is stated, is clear and relevant.	Question or hypothesis is clearly stated, is well researched and relevant to the field.
Experimental design (25%)	Experimental design is unclear. Some steps are missing or not sequentially listed. No justification for the choice of experimental design is given. No mention of sample size and variables not explained or missing.	Experimental design is appropriate however still lacking some steps. Justification for the choice of experimental design is given. Sample size is inappropriate and variables are somewhat explained.	Experimental design is appropriate. Steps are listed in sequence. Justification for the choice of experimental design is given. Sample size is appropriate and variables are explained.	A clear, controlled experimental design is presented. All steps are listed. Clear, concise justification for the choice of experimental design is given. Sample size is appropriate and variables are clearly identified and explained.
Creativity and novelty (10%)	Research idea is not creative. Hypothesis and experimental design are closely replicated and bring no knowledge to the field.	Research idea is somewhat creative. Hypothesis and experimental design contain similarity with previous research and bring little knowledge to the field.	Research idea is creative. Hypothesis and experimental design are novel and provide knowledge to the field.	Research idea demonstrates great creativity. Hypothesis and experimental design are novel and bring insight to the field.
Expression, organization, written ideas and information in written form (10%)	Proposal lacks organization or logical structure. Overuse of technical jargon.	Proposal is somewhat organized but contains logical gaps. Overuse of technical jargon makes understanding challenging.	Proposal is organized. One or two logical gaps or unaddressed issues leave the reader with unanswered questions.	Proposal is well organized with logical arguments. References are written in proper format.

How to Generate an Idea

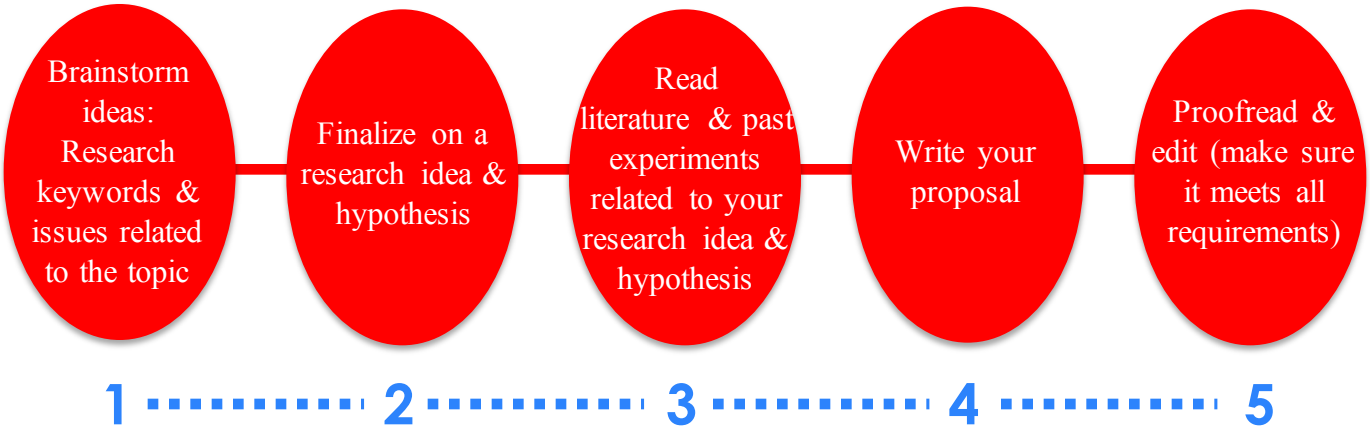
- Research and google **keywords** and related topics
- Look for **unsolved problems/issues** related, or **criticisms**
- Research and read **articles/reviews** on these unsolved problems and criticisms
- Identify the **problem**

Firstly, start off by googling some keywords and terms related to the case topic. Inform yourself on the case by reading news articles, research papers and anything that may increase your knowledge on this topic. The more knowledgeable you are regarding the general information of the case, the greater will be your perspective of approach to find and identify where you wish to solve the problem. If you find something interesting and want to find out more about it and current research, read a review paper on it. This will give you a clear idea on where further research is needed, and where your idea will fit in.

Case Specific Example – Lyme Disease:

1. **Obtain general knowledge on Lyme disease by reading articles and encyclopedias on the disease**
2. **Afterwards begin to research more specific aspects of the disease, such as, the transmission of the bacteria to the host, the tick's life cycle, why humans aren't immune to the bacteria…**
3. **Look up current scientific advancements and discoveries on the topic of Lyme disease so that you may have an idea of how this issue was solved by others**
4. **While reading up on the transmission of the Lyme disease bacteria to the host you notice that in the saliva of the tick that enters the bloodstream, there are several other proteins accompanying the bacteria that suppress the immune system and allow the bacteria to go unnoticed**
5. **You then decide you want to find a way to eliminate these immunosuppressive proteins from the ticks saliva so that when a tick transmits the Lyme disease bacteria to its host, the immune system will not be suppressed and will be able to eliminate the bacteria**

Suggested Timeline



First Round

Each submission is judged according to the given rubric by 3 or 4 judges who are either professors or graduate students. The scores from each judge will be standardized so that each judge's average score is approximately the same. The average of the scores will be the project's final score. The top teams will be invited to the final round. Written feedback will be provided.

Resources Available

1. Information Session:

An informal information session will be held to help students with the rules and regulations of the competition, as well as offer general guides to follow. The information session will be non-mandatory, offered both in French and English and will require registration beforehand.

2. Email:

Feel free to email us at osic.uottawa@gmail.com if you have any questions or concerns.