Advanced Research Methods (AP)
Summer 2022

Rising Senior Summer Assignment

Congratulations on another successful year in the Science Research Program. Your performance at this year's Symposium was inspiring and made your parents and teachers proud. It is amazing to see the difference a year makes in terms of your comfort and knowledge in speaking about your individual topics. We hope that this summer's research experience is rewarding. It is now time to think ahead to writing your research paper which will fulfill part of the requirements for senior year and will be submitted to various competitions including Regeneron and NJRSF and for publishing in various high school science research journals.

Summer Research Instructions – At the Lab

1. Follow all instructions exactly. Do not make assumptions - ask questions before starting your research.

2. You are working with professionals. Make sure to conduct yourself as one, both in the lab and out. You represent not only yourself, but also this program. Future research students might want to work with your mentor and your actions will influence the mentor's decision to host future research students.

3. Research Notebook: Your research notebook is an essential part of your research process and we will be checking it when you return in the fall. It is a DETAILED document of your research process, not just a time log, not just a recording of data. Take meticulous notes in your lab notebook as to what you did, why you did it, what you used (materials and apparatus), and what you found. Every thought, idea, modification, article that you find, picture, diagram, data, analysis, ... should be recorded in your research notebook. Each entry should be appropriately dated with a time spent. Review your notes each night to make sure that it is neat and organized and that you have everything you need to write your paper. Once the research is done, you can't "go back" so you must document these things as you go. Your mentor must sign your logbook. If done correctly, it will be an invaluable resource to you as you write up your work and it will be a very impressive document to show to future mentors and university admissions personnel.

4. Take pictures and draw diagrams where possible, especially of your test results and experimental apparatus. You may be able to use them in your paper as reference materials. Make sure you have access to your data and analysis (graphs, tables) in case you need to rework some graphics during the school year. Also, make sure that you have permission to use those data for submission to competitions.

5. Make sure that you have your mentor help you with the analysis of the data and the drawing of conclusions based on your results.

6. It is essential in fulfilling your requirements for senior year and for competition entry that the research work you do is your own. That doesn't mean that you have to think of something big all on your own within the lab you are working with. What it means is that
   a) you need to fully understand every part of the work that you do. In the fall, when you are asked a question about how the data was gathered or analyzed or what equipment was used, you cannot give an answer like "That part was done by someone else" or "I didn't do that part of the experiment." If you include work in your poster, paper, presentation, you must be able to explain it and explain your contribution to it. If you are including someone else's work that led to yours, you must properly cite it. It is OK that you are collaborating in the lab with others and that those others are guiding you, but make sure that you are familiar and knowledgeable about every part of the process that you are involved in by the time you leave the lab. Towards that end, ask your mentors and lab members lots of questions, read necessary background literature and take detailed notes in your Research Notebook (of learned info, of experimental protocols, of data gathered, of how you analyze that data, of anything you learn in the lab) because you will not remember it all.
   b) The other part of making the work your own is to go beyond simply carrying out someone else's research by taking your own small step, make a small modification to answer your own related question. Think of a small variation on what you have learned in the lab in order to make the research more of your own. Jot those ideas in your research notebook. Discuss your ideas and requirements with your mentors in the lab. They will usually be happy to let you pursue your spin on the problem and they can offer you advice and guidance without telling you what to do. It may be that in order to start or finish your own spin on the work that you would have to return to the lab once the school year starts (on weekends/ breaks). Make any necessary arrangements.

7. At the end of the summer, it is strongly recommended to present your mentor with a thoughtful card, expressing your gratitude as well as her/his impact on your life.

Summer Research Instructions – Writing Your Research Paper and Competition Forms

1. Research Paper: You are required to write a final and formal research paper that fulfills requirements for our course, for AP Research and for competition entries. When you return to school, most of that paper should be completed and handed in. The format of the research paper is on the back of this page. You have already written a Research Proposal (Introduction with literature review and Methods with references) - be sure to review and modify this where necessary as you carry out your research. As you do your research over the summer, you should be piecing together the draft of the Methods, Results and Discussion sections. The finished paper will be completed in school before November.

2. Competition Forms: The competitions that you can enter in the fall include Regeneron STS and NJRSF. Know that there are rules for each of the competitions that you plan to enter, and that you will need to modify your paper and/or abstract when you submit to each competition. Some forms

that are required for competitions MUST be completed in the summer. Please see these websites for competition details and necessary forms:
https://njrsf.org/
https://www.societyforscience.org/regeneron-sts/

3. Everyone will enter JSHS and NJRSF. You MUST return to school with your required paperwork for NJRSF completed. ISEF is the international society for the regional (NJRSF) competitions. Please use the 'Rules Wizard" to identify the forms you need.
Intel ISEF Rules Wizard: https://ruleswizard.societyforscience.org/

Final Research Paper

I. Introduction

a. Review of Literature

1. Is there a critical mass of published articles (including manuscripts, personal communication, etc.)?
2. Is the literature correctly cited?
3. Is the cited literature developed into paragraphs organized in a logical progression (i.e., general to specific) leading to the gap in knowledge that you plan to fill?

b. Objective/purpose

1. Is the objective/purpose of your research constructed in clear unambiguous language?
2. Does the objective/purpose reflect the introductory paragraphs (i.e., same terminology, same vocabulary)?
3. Does the objective/purpose reflect the most recently reported research and gap in knowledge?
4. Does the objective/purpose identify the new area of research (i.e., the next logical step)?

II. Methods

1. If the present research follows a protocol (research procedure) previously reported in the literature, does it follow this protocol exactly? If so, is it clearly stated in the text and properly cited?
2. If the present research follows protocol in part from previously reported research, does it clearly state the deviation in protocol, and give clear reasons? Is it written in enough detail that the reader could duplicate the experiment?
3. If the present research uses a new protocol, is it written in enough detail that a reader could duplicate the experiment?

III. Results

a. Data

1. Does the paper clearly and logically display results in appropriate graphics (tables, charts, graphs, photos, figures)?
2. Are graphics accurately and clearly labeled and titled? Axes and variables labeled? Captions complete?

b. Discussion

1. Is each graphic referenced, interpreted, and discussed, in a logical and meaningful order?
2. Does the discussion give greater clarity to the research by relating the various data?
3. Does the discussion clearly relate back to the research objective/purpose?

IV. Conclusion and Future Research

1. Are the main and subordinate finds of the present research clearly stated?
2. Are you visionary as to how this research benefits society and how it can be used in the future?

Senior Year:

Upon returning to school, we will meet for the first week in class and you will be expected to give an 8-10 minute presentation of your summer work. Make sure you prepare something. No need to be a formal PowerPoint, but feel free to display photos and data graphics. Wow us with your work!

After that, you will be working on your papers every day until November. Meetings will be on an as needed basis so that we can help each of you with your papers, forms, etc.

We wish you the best of luck this summer! You need to email us twice during your research to update us as to your progress. Also, you can email us anytime if there's anything we can do for you.

Enjoy your summer!

Mr. Carey (bcarey@livingston.org)

NOTE: ***It is imperative that you finish your research over the summer. Some latitude may be given for projects that will be finished before October 15 provided that a letter is received from the student's mentor attesting to the reasonable expectation of completion of this project or prior arrangements with Mr. Carey have been made. Projects given an extension but not completed by October 15 will result in the potential removal of the student from this class.***

Advanced Research Methods (AP - Summer Assignment Rubric

Student Name _____	**Points Possible**	**Points Earned**
Minimum logged hours (50 hours)	25	
Research Notebook with meticulous notes (enabling duplication of your research)	50	
Data and Analysis	30	
NJRSF forms	25	
Presentation first week of school	25	
Email #1 (time frame Jul 1-31)	10	
Email #2 (time frame Aug 1-30)	10	
Total Points	**175**	