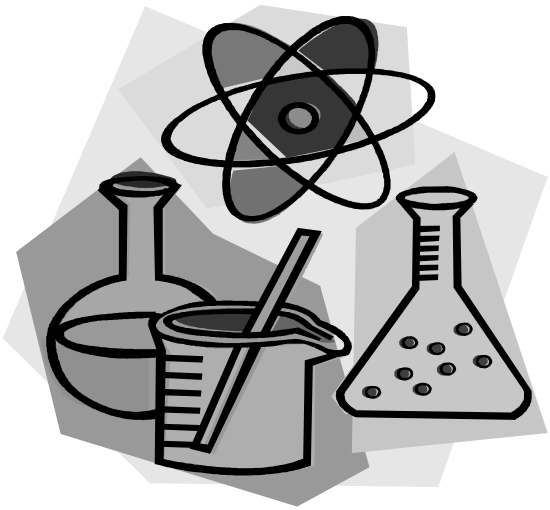

HONORS SCIENCE RESEARCH PROJECT GUIDE

SCIENCE RESEARCH PLANNER

September

- **Start Logbook!**
  - The logbook will be used to track your progress throughout the entire project. See details in packet on how to maintain your logbook.
- **Brainstorm for ideas**
  - Is there a specific question or problem you have that could be answered?
  - Use websites provided and examples presented in class to help you develop a problem/question
  - Make sure your idea follows the criteria listed in packet**.**
- **Project ideas must be turned in for approval by teacher:**
  DUE: _____
- After project has been approved begin gathering research for introduction**. Record all work done for project in logbook.**
- **Complete Annotated Bibliography**
  - Follow procedure listed in packet. **DUE: _____**

October

- **MANDATORY meeting for all students wishing to participate in the science fairs**
  DATE _____ TIME _____ PLACE _____
- **If you are entering the Science Competitions find a sponsor for your project (see packet) and complete all required science research competition forms.**
  DUE: _____
- **Complete Introduction**
  - Make sure you have used the correct type and amount of sources.
  - Make sure you have cited sources properly.
  - DO NOT PLAGIERIZE! (If you are unsure, make sure you ask!)
- Collect materials needed for experiment.
- Write up a step by step procedure to be followed
- **Submit project proposal: Include Problem, Introduction, Hypothesis, Procedure and Bibliography for approval.**
  DUE: _____

*****If you are planning on entering either PJAS or MONTCO your proposal must be approved by your sponsor (signed and dated) no later than _____. The approved proposals can be taken to Mr. Smith (room 32) or Mr. Michener (room 218) no later than _____.**

November

- **Once approved, BEGIN EXPERIMENTATION!**
  - Be aware of timing: Will your experiment need to be repeated? How many times? Will the experiment require weeks of observation?
  - Remember to use **METRIC UNITS!**
  - Record progress with photos.
  - Remember to keep logbook updated.

December

- Type "Final" copies of sections of paper and save so that you can edit as project develops. Make sure you made any corrections that were necessary.
- Continue experimentation and recording progress in logbook.

January

- Experimentation should be completed by the middle of January. (Remember that you have midterms at the end of January- plan wisely!)
- Write first drafts of analysis and summary
- **Make first draft copies of tables and graphs to be submitted for approval. DUE: _____**
- **PJAS REGISTRATION: _____**

February

- If you are competing in PJAS- prepare presentation
- Selection of students who will represent UD at MONTCO Science Fair
- **PJAS COMPETITION_____**

March

- **Submit Abstract of Research for approval**
  - Use guidelines listed in packet and sample provided in class
  - **DUE: _____**
- Make final revisions to complete research paper.
- If you are competing in MONTCO Science Fair build display.
- **MONTGOMERY COUNTY SCIENCE RESEARCH COMPETITION _____**

April

- **HAND IN COMPLETED PROJECTS! DUE: _____**
  *****Carefully check to see you are handing in all expected materials in proper order and expected quality by using rubric provided.**

THE FINAL PAPER

The final paper will contain:

- Title Page – with name, date, period, and title of project
- Abstract (own page)
- Problem/Question
- Introduction (background research)
- Hypothesis
- Procedure
- Data
- Analysis
- Summary/Conclusion
- Bibliography

Formatting the final paper:

- Typed in 12 pt. Times New Roman – double-spaced with top & bottom margins of 1" and side margins of 1.25"
- Pages must be numbered.
- Must be bound in a binder.
- Do not place individual pages in plastic sheet protectors.
- ***MLA format*** is used for all citations. Use the "Pocket Style Manual" you received from your English teacher.
- Use underlined section headings.

YOUR FINAL PROJECT

What you turn in at the end (in April):

- Final paper
- Logbook
- Annotated bibliography
- Appendices/supplemental materials (including photos)

All should be organized neatly into a binder.

HOW YOU WILL BE GRADED

Points will be given for the following:

First Quarter	*Second Quarter*	*Third Quarter*	*Fourth Quarter*
Project idea Annotated bibliography Logbook	Research proposal Logbook (check)	Abstract Data (sample table & graph)	Final project

In the first, second, and third quarters, project points are counted in both the "Lab" and "Project" categories of your overall grade. In the fourth quarter, the final project counts in both the "Project" category and the "Test" category (100 points).

NOTES & TIPS

Starting and Maintaining a Logbook

- Think of the logbook as a "diary" of your project. It should be a detailed account of all work done on the project. Even short written descriptions of your idea searching, library research, and editing on the computer should be included.
- The logbook should be ***started on the very first day*** that you start getting your project idea.
- As you gather data, it should be included in your dated entry for the day you collected it. ALSO start a summary data table in the back of your logbook. This makes the logbook "useful."
- Staple marked up copies of drafts into logbook.
- *Format for the logbook:*
  - Must be handwritten in its own notebook (marble or single subject spiral notebook)
  - Each entry should be dated with the time.
  - Separate entries using a line, or start each entry on a new page.

Picking a Project and Developing Your Problem/Question

- Pick something of interest to you!
- Do some initial research on your idea to learn more about it.
- Make sure your project is doable within the time frame and equipment limitations.
- Can your question be answered? Is it testable?
- *Project Idea Websites:*
  - www.scienceclub.org/scifair.html (look at medium and advanced projects)
  - www.youth.net/nsrc/nsrc.html
  - www.sciserv.org
  - www.dvsf.org (DelVal Science Fair)
  - www.all-science-fair-projects.com

Writing Your Hypothesis

- A statement of the expected outcome of experimentation.
- Based upon your problem/question.
- Must be specific and detailed. No vague terms.
- Must be testable.
- Develop a preliminary one first, then after doing library research, refine it.

Library Research

- *The process includes:*
  - Doing internet searches and physical searches at the library to find sources related to your topic.
  - Reading through the sources you found. Determining which are most useful.
  - Taking notes from the sources and using them to write an annotated bibliography (see section later)
  - You must have a minimum of five sources, with at least one that is a book (not a high school level textbook) and at least one that is a magazine or journal article.

- Writing the actual introduction section to your paper.
  - *The introduction section should…*
    - Include an explanation of why did you choose this topic (one paragraph)
    - Gives relevant background on the topic to the reader so the rest of the project is understandable
    - Pretend the reader knows nothing about your topic.
    - Has anyone else done similar experimentation?
    - Use in-text citations to avoid plagiarism. Citations should use MLA format.
    - Be a minimum of two pages in length

Procedure:

- Includes the following subsections:
  - Listing of independent variable, dependent variable, control group, constants
  - Materials list
  - Numbered procedural steps
- Should be just detailed enough to allow the reader to be able to repeat your experiment without including the obvious. Summarize your steps and include the critical details.
- Be sure to keep all extraneous variables constant so they don't affect your data.
- Be certain you are actually testing your hypothesis.
- All measurements **must be metric!**

Data & Analysis

- Data should be presented in both table and graphical forms.
  - A descriptive title should be given to both tables and graphs, and the measurement units should be indicated.
  - For graphs, the x and y axes should be properly labeled with the correct independent and dependent variables, along with their units.
  - When graphing, choose the appropriate type of graph for the data you have gathered.
    - Line graphs are typically used for data that is along a range – when the independent variable can't be categorized – and when you are trying to extrapolate the equation for the line that fits the data. You will use this most. Example: temperature vs. plant height.
    - Bar graphs are usually more appropriate for graphing data when the independent variable is in categories. Example: color of light vs. plant height.
  - If your graph has multiple lines on it, a key or legend is necessary.

- Photos! Take photos documenting the progress of your experiment. These will be submitted in the appendix with your final project. All photos should have captions.

- The written analysis simply describes WHAT happened.
  - It presents your data in paragraph form, focusing on the big trends (averages, minimums, maximums, etc.).
  - It does not restate all of your raw data.
  - No interpretation of the data should be included… that's for the summary/conclusion section.

Summary/Conclusions

This is where you pull everything together!

- Relate your problem, hypothesis and data to each other.
- Explain WHY your data turned out the way it did. Why did events occur that way?
- Include information from your introduction (library research) to help explain events. This also helps to pull it all together by bringing back into the reading information mentioned at the beginning.
- You may need to do some further research to help you figure out why things occurred. Be sure to include these new sources in your final bibliography and cite them.
- Describe flaws in your experiment and how the procedure could be improved. This includes potential errors that occurred, or areas where you were not as accurate as you could have been. There should be more possibilities than simply "human error."
- Pose some areas of future research that could be done to expand or build upon your project.

Bibliography

- An annotated bibliography will be written towards the beginning of the project. An annotated bibliography is similar to notes taken from your sources. It shows all the sources you used, quotes from those sources, and explains the importance of that source to your project.
  - These will be done and collected in the first quarter. You will continue to update it throughout the year and the rest of your project, turning it in at the end with the final project.
  - See appendix for more
- A standard bibliography will be done as part of the final paper. This lists all of your sources and is the final page of the paper.
- ***MLA format*** is used for all source citations. See the "Pocket Style Manual" for how to properly write the citations.

Abstract

- The abstract is a 250-word, or less, summary of the key points from your project. Although it is the final thing written, it is the first part of your paper.
- The abstract summarizes your project's purpose, procedure, data and conclusions.
  - *Purpose*
    - Introductory statement of the reason for investigating the topic
    - Statement of the problem and/or hypothesis being studied
  - *Procedure*
    - Summary of the key points and an overview of how the investigation was conducted
    - Does NOT give details about materials used unless it greatly influenced the procedure
  - *Data*
    - Provides key results that lead directly to the conclusions drawn
    - Does NOT give too many details about the results nor includes tables or graphs.
  - *Conclusions*
    - Conclusions from the investigation described briefly
    - May reflect on the process and state some applications and extensions of the investigation

General Writing Tips

- No first person. Never use pronouns like "I", "we", etc. Always write as an outsider.
  - Instead of "My hypothesis is…", write "The hypothesis is…"
  - Instead of "I concluded…" use "It was concluded…"
- Be clear and concise. Clarity is very important. The reader should be able to easily understand your project from beginning to end. Your ideas should flow well.

How To Write An Annotated Bibliography

An annotated bibliography is a list of your research sources but each source is followed by the pieces of information you obtained from that source and a brief description of how this source is related to your topic and how it will be helpful in your paper. Does the information you gathered from this source support your experiment with past experimentation? Does it provide you with variables to use in your experiment? Does it provide definitions or descriptions of terminology you did not previously know? How will it be used in your final paper?

When listing the information you have collected from each source in your annotated bibliography copy it ***exactly*** as it was provided in the source. You can later decide if this material should be quoted in your paper or if you should restate important information in your own words. Either way, when used in your paper this information must be properly cited.

EXAMPLE:

The following annotated bibliography is a small sample for a project titled, **The Effects of Radiation on Bean Plants.** The source should appear first written in the correct MLA format. This is followed by quoted text taken from the source. Finally, a paragraph is written explaining why this source is helpful and how the information can be used in the project.

Raworth, Jenny and Val Brady. **The Complete Guide to Indoor Gardening**. New York, NY: Abbeville Press, 1998. Pages 74-75, 101

1. "For the majority of seeds, germination is triggered as soon as they begin to absorb moisture through the seed coat"

2. "A moist environment will prevent the leaves from losing water, which cannot be replaced until a good root system has formed after germination"

3. "Most seeds grow well in a temperature of about 65 degrees F (18 degrees C) but some require higher temperatures in order to germinate successfully"

This source provided some of the basic information I needed about what plants need to grow and what conditions are needed for the bean plants to germinate. This will be helpful in setting up my procedure correctly.

"Radiation Sickness." Columbia Encyclodedia, Sixth Edition. 2 October 2005 <http://www.encyclopedia.com/html/r1/radiasick.asp>

1. "Radiation sickness may be fairly mild and transitory, consisting of weakness, loss of appetite, vomiting and diarrhea"

2. "Exposure to radiation can cause genetic mutations"

3. "Radiation sickness has been known to cause increased incidence of thyroid cancer and genetic mutations"

This source provides me with information on the effects of radiation exposure. I can relate this to how it will affect my bean plants in the experiment. Will it cause noticeable genetic mutations in the plants? I will use some of this information in my introduction explaining why I am doing this experiment. I could also use it to describe steps for further experimentation after I see what I discover about the effects of radiation exposure on the bean plants.

Science Research Competitions

UDHS participates in two science competitions- the Montgomery County Science Research Competition and the Pennsylvania Junior Academy of Science Competition.

The regional PJAS competition is typically held in February at one of the high schools in Montgomery County. In this competition, students must prepare a short presentation on their project to give before a small group of students and a panel of judges. The presentation is limited to overhead projector slides. Students are evaluated using a scoring rubric, and are competing only against that rubric. Students who receive a first at the regional competition will have the opportunity to compete at the state level in the State PJAS Competition held in May at Penn State University.

The Montgomery County Science Research Competition is typically held in March. In this competition students build a traditional "board style" presentation of their work. Their presentation board will be set up for judging and the students will stand with their project to answer questions from the judges. Students are scored and the students receiving the highest scores in their category will receive awards. This is different from PJAS; students compete against each other and not a rubric. Students who do especially well here will have the opportunity to compete in the Delaware Valley Science Fair held in April. Select winners from DelVal will participate in the Intel International Science and Engineering Fair in May.

For interested students, most of the responsibilities are the same as the research project; however, there are a few important differences. Read carefully below!

- You will need a science fair sponsor. The sponsor must be a teacher in UDHS.
- The sponsor does NOT do the project for you.
- The role of the science research sponsor includes the following:
  - ✓ Review the student's proposal and confer with the student
  - ✓ Provide guidance to the student
  - ✓ Check over the student's paperwork and protocols
  - ✓ Make certain that the student is conducting his/her research in a responsible and safe manner
  - ✓ Occasionally check in with the student, remind him/her of due dates, etc.
- You may also want a mentor – someone outside of UDHS who is an expert in the field related to your research topic.
- Some projects will be harmless but other projects students undertake may involve a certain level of "risk." These projects will require additional protocol forms, supervision, and possibly review by institutional and county councils ***before the student begins experimentation***.
  Projects contain risk if they involve any of the following:
  - *Human Subjects, Vertebrate Animals, Potentially Hazardous Biological Agents*, Controlled Substances, Certain Chemicals, Certain Equipment, Firearms, Radioactive Substances, Radiation

Italicized projects may NOT be completed at home. Must be at a certified institution.

EVALUATION GUIDE FOR INDEPENDENT RESEARCH PROJECT PAPER

FORMAT

____ [2] All sections included in the proper order
- Title page, Abstract (separate page), Problem, Introduction, Hypothesis, Procedure, Data, Summary, Bibliography page

____ [2] Neatly organized, all materials in binder
____ [1] Double-spaced, Times New Roman (12pt), margins: 1" top and bottom, 1.25" left and right
____ [1] Numbered pages
____ [2] MLA format throughout

MECHANICS

____ [3] Clarity: Reader can easily follow the flow of ideas
____ [2] Correct spelling, grammar and punctuation throughout
____ [2] Proper use of in-text citations to avoid plagiarism (MUST appear in the Introduction and Summary)

INTRODUCTION(BACKGROUND RESEARCH)

____ [1] Annotated bibliography is included in binder
____ [4] Proper amount of information for the topic (2 page min.)
____ [4] Appropriate depth and scope
____ [2] Required number and types of references

EXPERIMENTAL SECTION

____ [3] Logbook maintained and organized in a neat and useful manner
____ [5] Procedure detailed enough to allow reader to repeat the experiment
____ [5] Constants, independent and dependent variables and control group properly identified and used
____ [4] Controlled extraneous variables
____ [4] Used METRIC measurements throughout
____ [4] Sample size is sufficient for study

DATA/ANALYSIS

____ [8] Data is properly presented in tables AND graphs
- Descriptive titles; units of measurement indicated
- Graph type is appropriate for data, correct variables on the axes, labeled properly (include units)
- Key or legend if necessary

____ [8] Analysis is related to the data, explains **WHAT** happened (trends in data, no interpretation)
____ [4] Photos documenting progress (must have captions)

SUMMARY

____ [4] Relates problem, hypothesis and data to each other
____ [4] Information from research included in summary to help explain events
____ [4] Reasonable attempt made to explain WHY the events occurred
____ [4] Conclusions drawn are valid for the data gathered
____ [4] Improvements and ideas for further research are include

ABSTRACT

_____ [10] How well does it summarize project in 250 words?