**Format and Guidelines for Each IOU Deliverable**

**Research Plan Guidelines (due at end of 3rd week of program)**

The *Research Plan* is a required activity for all participants. The purpose of completing a Research Plan is so that the participant and the faculty mentor have a mutual understanding of the scope of work. By completing the Research Plan and reviewing it with your advisor, you will have established communication that will lead to a more purposeful research experience.

Research Plans should be approximately two pages in length.

Research Plans should include the following:

1. An Objective or Thesis – this is a statement of the problem or purpose of the research;
2. Research Methods – this is a description of the plan to approach the problem;
3. Skills Required – this is a list of skills or techniques that are needed to engage in the research methods described (e.g., column chromatography, ability to use a software package, ability to use a specific piece of equipment, etc.);
4. Content Knowledge Required – this is a list of concepts or content needed to successfully carry out the research described (e.g., understanding of ‘molecular hyperpolarizability’, understanding of ‘non-linear optics’, etc.); and,
5. Skills and Content Knowledge Needed – this is a list of skills that *you need to learn* to obtain the skills required as described above.

A draft of the Research Plan should be shared with your advisor by the second week of the program. Finalized Research Plans should be *approved by your faculty advisor* (an email from the faculty is fine) and submitted to the program assistant, Danny Lamoreaux ([dlamoreaux@optics.arizona.edu](mailto:dlamoreaux@optics.arizona.edu)), by the end of the second week of the program.

The first two sections of your Research Plan will serve as a draft for the first two sections of your Extended Abstract.

**Extended Abstract Guidelines (Due on Final Day of REU program)**

The *Extended Abstract* is a required activity for all participants. Building on the *Research Plan*, the purpose of completing an Extended Abstract is to provide participants with an additional opportunity to develop their writing skills associated with communicating research. As revision is a critical part of the writing process, this assignment will be completed in two phases. In the first phase, you will share a draft with your advisor in order to get comments about revising the Abstract. In the second phase**,** the final version will be signed by your advisor and turned in on the Final Day of your REU program.

We recognize that summer schedules are compressed, and thus it may be a challenge to get a productive, thorough review of your work. If circumstances arise, such as traveling research mentors, we ask that you let your program coordinator know what review process would be beneficial and realistic given the context of your lab culture. We suggest that you make an appointment prior to these dates in order to ensure that he or she will have sufficient time to review your work.

Extended Abstracts should be approximately five pages in length. An Extended Abstract template will be drafted for 2016 CIAN REUs and will be sent to you in the near future. In general, extended abstracts should include the following criteria:

* **Title**- in bold
* **Student name, mentor name, PI name, REU Department, REU Institution**- in italics
* **Introduction-** Clearly state the purpose and objectives of the research. Place the work in appropriate context. Include background literature that directly applies to your work.
* **Experimental Methods**- Provide a description of the experiments and techniques that were performed to accomplish the stated objective, including target molecules, reactions, and illustrations of key instruments being developed.
* **Results and Discussion**- Summarize and interpret the data collected. Present sufficient experimental detail to convey your results.
* **Conclusions**- Interpret your results in the context of the original purpose stated in the introduction. Suggestions for further study may be included.
* **References**- Number references sequentially as they appear in text. Corresponding numbers are inserted in text as a superscript.1 General format for periodicals:

1. Author last name, first name; Author 2 last name, first name; etc. *Journal Abbreviation* **Year**, *Volume*, Inclusive pagination.

Detailed information on different reference styles other than periodicals can be found in *The ACS Style Guide,* 2nd ed., available from Oxford Press.

* **Acknowledgements**- Funds for this REU research were provided by the National Science Foundation through CIAN ERC base funds, grant #EEC-0812072. Add anyone else you wish to acknowledge.

Additional Notes:

* All document text should be 12 point, Times New Roman font.
* Graphics- All graphics (figures, schemes, tables, etc.) must be prepared in TIFF format and inserted into the manuscript near their first mention in the text. Ensure that all text on the graphic can be read as sized.
* Figures- Figures are numbered sequentially and include a figure caption at the bottom of the image. The caption should be understandable without reference to the text.

Tables- Tables and schemes must be numbered sequentially and include a short descriptive title (bold) above the table (e.g., **Table 1. Title of Table** or **Scheme 1. Synthesis of Q**).

**Oral Presentation Guidelines**

**(Ask your site coordinator if this applies to you, as not all sites require Oral Presentations- Lydia Reyes for Columbia [lr5@columbia.edu], Zenora Spellman for NSU [zespellman@nsu.edu], and Lea Marlor for Berkeley [lkmarlor@berkeley.edu])**

The *Oral Presentation* may be a required activity for some CIAN REU sites. Drawing from the ExtendedAbstract, the purpose of developing and delivering an oral presentation is to provide participants with an additional opportunity to develop their skills associated with communicating research. There are numerous resources on the internet that provide useful advice about giving talks.

Presentations should be approximately 10 minutes in length. You will be required to submit your final PowerPoint file to the REU Program Coordinator, Amee Hennig (amee@optics.arizona.edu). Your seminar should include the highlights of the following aspects of your research:

1. An Objective or Thesis – this is a statement of the problem or purpose of the research;
2. Research Methods – this is a description of the approach to the problem;
3. Results / Intended Results – this is a description of interesting results, and the ways they might have differed from expected results and,
4. Conclusion – this is a summary of the findings and their significance.

**Poster Guidelines (Due on Final Day of program)**

The *Symposia Poster* is a required activity for all participants.  Drawing from the Extended Abstract, the purpose of completing a poster is to provide participants with an additional opportunity to develop their design and writing skills associated with communicating research.  There are numerous resources on the internet that provide useful advice for poster preparation.  Once place to start is <http://www.waspacegrant.org/posterdesign.html>

The poster should measure 36 x 56 inches. IOU posters should include both the NSF logo and grant number and the CIAN logo which your program coordinator will email to you.

Other key elements include:

1. The Objective or Thesis – this is a statement of the problem or purpose of the research.

1. A nugget, or highlight of your work this summer.  This is one piece of your project that you should represent with both text and a visual.

# *Poster presentation guidelines*

Posters are an increasingly popular means to disseminate research.  In fact, some researchers prefer a poster presentation to an oral presentation because of the increased interaction with conference participants.  Additionally, attendance at a conference is a good opportunity to establish a network within your field of interest and to obtain ideas for further research topics.

Any and all of these objectives must be considered in the design of a poster if it is to meet your expectations.  It is the responsibility of the author to decide what and how information should be presented on the poster.  Research information, as with any visual medium, will be communicated much more successfully if it is presented in a well-designed, attractive poster.  Additionally, the quality of the session seems to indicate the quality of the research.  Design and layout, therefore, should be thoroughly considered, and the guidelines from the supporting institution should be closely followed.  Finally, it should include all of the following items that apply to your research:

         Title of the study

         Author

         Institutional affiliations

         Introduction:  Purpose of the study, research question, or hypothesis (brief)

         Method:  procedure and tools

         Results: tables, figures, illustrations, or graphs with a simple explanation.

         Conclusion

         Recommendations for future research

         Acknowledgements

         References

1. **Content** should/may include

         Simple information

         Short or medium length sentences

         Most important information (Underline only main points of text and use them)

         Information grouped into conceptual units to contribute to reading efficiency.  To link components use:

       Subheadings to point to corresponding text

       Transitional words and phrases

       Graphic devices, such as arrows or bold lines

       Lists for procedures or selected topics that may require quick comprehension

       Icons which often support lists (example:  use numbers, %)

**2.** **Adjunct Materials** include brochures, printed summaries, resumes, business cards, book for comments, or other appropriate types of handout material.  These materials may be for take-home information, to guide participants through the display, or so participants may follow up with questions or further discuss the research.  Carefully display and distribute these materials.  If the sponsoring organization does not provide tables, pockets or shelves for these materials could be incorporated into the poster.

**3.** **Format** for poster sessions typically fit on 4’ x 6’ or 4’ x 8’ surface.  *A poster template will be made available for you to download.* They are mounted to these panels with some sort of tack (thumbtack, map tack, or push pin) or with hook tape.  They may consist of:

         Single large panel (3’x3’ or 4’x3’)

         Several smaller panels

         Tabletop display that usually consists of two or more panels that are interconnected and self supporting

         Pieces that mount on surfaces provided by the sponsoring organization

**4.**  **Layout** organization is just as important to the poster as it is to a written or oral presentation for coherence.

         Balance:  To develop balance in both the individual and the larger entity, consider size, shape, contrast, and color.  On the heavy side of balance are large, circular, dark, or irregular elements.  They contrast with lighter weight factors, such as small, rectangular, and light-colored elements.

         Placement:  Most items should be placed between four and seven feet high for standing audiences that will view the poster from three feet away.

         Arrangement:  The visual elements of a poster paper must be arranged in logical manner that directs the viewer easily from one section to the next.  For instance, sequencing the individual items of the poster paper in the same order they would be found in a paper helps the viewer to digest the information in the proper order.  This may be accomplished one of two ways.

-   Arrange in either a horizontal or vertical fashion

-   Arrange with a window area

1. **Text and Type** is critical as well.  The size and shape of text used in creating the poster paper depends on several variables.

**Headlines**

           Headline and subhead height:  1/2’’ minimum (36 point)

           Headlines larger than subheads

           Subheads larger than body

           Upper case/all caps (to slow reading)

           Less than eight words (longer occupies too much space)

           Bold for differentiation

           Type face suggestions:  Times Roman, Bookman, Palatino, and their clones (but be consistent)

           No more than six total headings for whole session

           Active verbs (not verbs turned into nouns)

**Body**

           Body height:  1/4’’ tall (if possible) (24 point)

           Upper and lower case

           Italicize for differentiation from rest of text

           Type face suggestions: Times Roman, Bookman, Palatino, and their clones (may be coherent with, but different than that of headlines and consistent)

**6.  Graphics** are included in most displays.  In fact, they may include graphs, charts, maps, or some other visual devices that convey information quickly and concisely.  The primary purpose is to draw relationships among numerical values into picture form.  Most importantly, they should be kept simple to be easily and quickly absorbed by the viewer.  Additionally, you should make sure that the graphic represents the data accurately and does not bias it in any way.

         Bar graphs or histograms should have separated bars of the same width

         Line graphs should be limited to 3-4 lines, each thicker than axis lines

         Units should be defined on both x and y axes

         Pie graphs should be limited to 6 wedges (if possible)

         Contrasting colors or shading can be used

         Graphical information should not be duplicated in the text

         Graphics should each contain only one message

         Graph size should relate to viewing distance

         Column heading should be in singular form, not plural

         Rules should be horizontal, not vertical

         Decimal points should be aligned in columnar material

**7.  Photographs** are occasionally needed to illustrate or document certain information that cannot be accurately conveyed in any other manner.  To be effective, photographs should be at least 8’’ x 10’’ unless a smaller photograph is used as an insert.  Finally, images in the photo should be sharp and clear with good contrast.

**8.**  **Color** can greatly enhance the effectiveness of a poster when used effectively.  Muted blues, greens, or grays are good background colors that seem to move back in space and don’t tend to overwhelm.  Bright, warm, and vibrant colors should be restricted to small accents, to lead the eye from section to section, and as a visual clue to divisions within the poster.  The overuse and clashing of color within graphs, pictures, and mounting papers should be carefully considered before final actions are taken.  Ultimately, if you are using a computer, don’t trust what you see on the screen, but use a printout to make sure colors work together.