

OVERVIEW OF THE INDEPENDENT RESEARCH REQUIREMENT

The Five College Coastal and Marine Sciences Program *Certificate* requires students to complete an independent, marine-related research project. The research may be conducted through participation in an internship, independent study, field course, volunteer work or job, and can also be used for Thesis and Division III projects.

Basic steps to complete your project:

1. You consult with a FCCMS faculty advisor in advance of starting your project.
2. You and your FCCMS faculty advisor complete and sign the “Marine-related Research Project Proposal” form found in the certificate requirements description.
3. You then conduct the approved research.
4. You prepare a final poster about your research (students receiving a five college-funded internship must also give a research talk in addition to preparing and presenting a poster).
5. You present your poster at the FCCMS Undergraduate Research Symposium and give a copy of your work to your FCCMS advisor for review along with your completed certificate application.

GUIDELINES FOR PRESENTING YOUR INDEPENDENT RESEARCH PROJECT---THE CONTENT

Your poster (and research talk for FCCMS-funded interns) should clearly include answers to each of the following questions:

1. What is your scientific question or hypothesis? (poster and talk)
2. Why is your research question important or relevant? (poster and talk)
3. What methods did you use to address this question? (poster and talk)
4. What were your main findings? (poster and talk)
5. How did those findings directly address your question? (poster and talk)
6. What uncertainty remains in your methods, data and/or interpretation? (talk only)
7. What are the next steps in research directions that follow from the work you did? (talk only)
8. How does your research fit into the context of other related research? (talk only)
9. What are the bigger-picture implications of the work you have done?(poster and talk)

Now, let's expand on each of these questions:

1. What is your scientific question or hypothesis?

In your *proposal* developed prior to conducting your research, and in the *product* of your research (poster or research talk), you must clearly articulate a *scientific question or hypothesis* that guides your research.

A good scientific question:

- leads via experimentation to a fact-based answer
- implies its own method of analysis
- is verifiable
- is non-trivial and represents a true unknown

2. Why is your research question important or relevant?

You should outline in your *proposal*, and address in detail in your talk or poster, the justification for this research. This should address specific unknowns or knowledge gaps in our scientific understanding. In a formal scientific paper, this justification will appear in both the Introduction and in the Conclusions.

3. What methods did you use to address this question?

You should describe what you did clearly enough so that it could be repeated by someone else, but you should avoid going into ridiculous detail—this is often a tricky balance to achieve. Be precise about the measurements you made—include nearest units of measurement, for example— and fully describe the equipment you used. Describe how data were analyzed, including the statistics software you used. All of these descriptions go into the Methods and Materials section, which should not include any information about your findings. That comes next...

4. What were your main findings?

You should outline in your *proposal* your expectations for, and describe in detail in the *product* of your research, exactly what your research found out. In a formal scientific paper, findings go in their own section called Results.

These may include:

- a detailed description of all of the data you collected in your research
- basic statistical descriptions, as appropriate, such as number of repeat measurements, means and standard deviations, p-values, r^2 values, etc.
- figures that show your data as well as any dataset comparisons you wish to highlight (i.e. linear regressions or other types of graphical comparisons)

Findings **do not** include any discussion of the *interpretation* of your data.

5. Did your findings directly address your research question?

You should outline in your *proposal* your expectations for, and describe in detail in the *product* of your research, exactly how your data are logically connected to your research question. To answer this, you want to make a logical connection between the data and the question. You also present your interpretation of your data, describing what you concluded from your research. This is more difficult than it seems. Make sure that the reader knows exactly how and why your data are tied to your question. In a formal scientific paper, this is the beginning of the Discussion section.

6. What uncertainty remains in your methods, data and interpretation?

You should address in detail in the *product* of your research any competing alternative explanations for the observations and data you have obtained. In a formal scientific paper, this is also part of the Discussion section.

To answer this, you want explore:

- the limits (background, noise, detection limits) of your analytical methods
- what other scenarios could yield similar types of findings, other than your interpretation
- some assessment of how confident you can be in your interpretation (e.g. if more data are needed, how many, what type and why?)

7. What are the next steps in research directions that follow from the work that you did?

You should address in detail in the *product* of your research both what you conclude from your research and, importantly, what *new* research this now lets us conduct. In other words, explore how your work provides a benefit to our body of knowledge in a specific field and allows us to ask another research question. In a formal scientific paper, this is also part of the Discussion section, usually towards the end. It may also form part of the Conclusions of the paper.

8. How does your research fit into the context of other related research?

You should address in detail in the *product* of your research the context for this research. What have other researchers found when working on similar research questions? Are your findings similar? Can you explain any differences, or devise a new research question that would help to explain any differences? In a formal scientific paper, this context will appear in both the Introduction and in the Conclusions.

9. What are the bigger-picture implications of the work you have done?

You should outline in your *proposal*, and address in detail in the *product* of your research the context for this research. How might your findings and interpretations be useful to researchers outside the immediate circle of your lab group, or researchers working on very similar types of questions? How does this research contribute to knowledge and/or understanding outside of science?

In a formal scientific paper, this context will appear in both the Introduction and in the Conclusions.

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GUIDELINES FOR PRESENTING YOUR INDEPENDENT RESEARCH PROJECT: THE FORMAT

Scientific Posters

Scientists typically communicate the results and significance of their investigations by giving research talks, poster presentations, and ultimately, through publishing in scientific journals. As a five college coastal and marine sciences scholar, you are required to present your independent research to your peers and faculty advisors using the poster format. We hope that this exercise will prepare you for future success as scientists and teachers. This requirement also gives us the opportunity to learn about your work and celebrate your accomplishments as a community via the yearly poster session.

Scientific talks, posters and papers all have the following components— Abstract (for papers and sometimes posters), Introduction, Methods and Materials, Results and Discussion—though how these components are used differs. In the poster, graphic presentation is very important and the text is reduced; also a lot of the details that appear in scientific papers, like extensive background information and a more substantive literature review, are absent.

Please refer to the following websites for design ideas and poster templates:

<http://colinurrington.com/tips/academic/posterdesign>

<http://www.aspb.org/education/poster.cfm>

http://www.kumc.edu/SAH/OTEd/jradel/Poster_Presentations/PstrStart.html

Please send us your poster as an attached pdf or ppt file two weeks before the poster session. We will print the poster for you and pay for the printing costs.

If you have any questions, please email: Renae rbrodie@mtholyoke.edu

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CREATING A POSTER IN POWER POINT

***Please note that you can also find and download poster templates from the web; use these instructions if you prefer to design your own poster, *de novo*.**

These instructions will allow you to create one slide formatted to a large size (48" wide by 36" tall).

File > New > Blank presentation

Home tab > Layout > Blank

Design Tab > Page Setup > Sides Sized for > Custom

Enter 48" for Width and 36" for Height and select Landscape Orientation

File > Options > Advanced > Set Default Target to 220 ppi (or Advanced > Print > High Quality)

To help you align the elements in your poster, place a grid over the slide:

View Tab > Gridlines. Click on the little "Show" arrow and select the grid spacing.

This grid will not print with the poster, but is just to help you lay things out. You can get rid of it any time by unchecking the Gridlines box.

Keep your layout and use of color simple; you don't want the design to be distracting. The focus should be on your experiment.

Background color, if used, should be a light solid (not gradient) color:

Design Tab > Background Styles > Format Background > Solid Fill > Color

Select a color and use the transparency slider to lighten it if desired.

To insert text: **Insert Tab > Text Box.** Copy and paste text into the text box if you already have a draft. Keep your text color black. It is best to use a nonserif font in bold (e.g., Arial or Helvetica) for Titles, Subtitles and Section Headers, while a serif font such as Times New Roman is best for the body text.

Font Sizes: You want all of the text to be readable from 6 feet away. Use the following guidelines:

Title: 80-120 pt.

Subtitles: 48-60 pt.

Section Headers: 36-60 pt.

Body text: 24-30 pt.

To put a box around a section:

Insert Tab > Shapes

Select Rectangle

Under the **Drawing Tab**, click on **Format**

Shape Fill > (none if you want the it to match the background or select white to set it off from the background if it is colored)

Shape Outline > select color and weight of the line surrounding box, if you want one. Otherwise, select “no outline.”

If your text ends up behind the box so that you can’t see it, select the box and then: **Drawing Tools > Format > Send Backward > Send to Back.**

To insert images: **Insert > Picture.** Your images shouldn’t be so small that they need a lot of resizing. If you need to adjust them a bit, hold the Shift key while dragging the corner of the image (this will keep the proportions the same). Follow the instructions above to put a box around the image, if desired.