

MCDB 485 – Senior Research

MCDB 485 Student Contract:

As a student conducting year-long independent research for Yale College course credit and to fulfill the Senior requirement for the MCDB BS, I agree to the following:

I am expected to devote an average of 10-12 hr/week in the lab to this research. I am aware that failure to do so will result in my withdrawal from the course. I will make every effort to attend my research mentor's laboratory meetings, and present my research at least once/term in my research mentor's lab. I will attend at least 2 of the MCDB Oral Presentation sessions in the **SPRING** and will present my research at one of them. I will make every effort to schedule my MCDB Oral Presentations at the time that fits with my mentor's schedule.

Name: _____ (Please Print)

Signature: _____ Phone: _____ Class _____

Email Address: _____

Research Mentor: _____ Dept.: _____ (Please Print)

Title for Research: _____

MCDB 485 Research Mentor Contract:

I will expect that each 485 student in my laboratory commit an average of at least 10 hours effort per week in the lab. If this is not the case, by mid semester of the term I will notify the student and the MCDB 485 coordinators that an increase in effort is expected. I am aware that failure to meet this expectation will result in withdrawal from the course. I expect 485 students in my laboratory to attend our laboratory meetings and present their research at least once/term in the lab. I will attend my student's MCDB Oral Presentation in the **SPRING**. If I am unable to attend, I will ask another member of my laboratory to attend.

Student: _____ (Please Print)

Research Mentor: _____ (Please Print)

Signature of Research Mentor: _____

Department: _____ Phone: _____

Email Address: _____

It is the Student's responsibility to obtain the signatures and upload this form to the Canvas Assignment section.

If you have questions, contact crystal.adamchek@yale.edu

Due dates: Student and Mentor Contract and 1 Page Summary: MONDAY, SEPTEMBER 9, 2019 @ 12:00noon

Spring Oral Presentations: April 17 through 22, 2020. Oral Presentations meet in YSB 352 at various times. Check Canvas for sign-ups.

Final Report Due:

Fall: FRIDAY, DECEMBER 6, 2019 @ 4:00pm

Spring: FRIDAY, APRIL 24, 2020 @ 4:00pm

Poster Symposium: April 24, 2020 2-4pm Location: YSB Lobby

MCDB 485 – Senior Research

Course Overview:

MCDB 485 is an independent research course designed to promote hands-on biological and biomedical investigation in the laboratory of a faculty member at Yale. The expectation is that students in MCDB 485 are fully committed to a full year of research and will continue their project in the same laboratory for one additional term in MCDB 486. While the minimum workload expectation is for students to be active in the laboratory for 10-12 hours per week, many students discover that data acquisition and fruitful results require more time at the lab bench. This course also requires a final written report in the form of a Research Journal.

Submission and Formatting Instructions for All Written Work: All papers should be uploaded to the Assignment section in Canvas by the deadlines stated. ***Additionally, please follow these formatting instructions:*** Students should follow the American Psychological Association Guidelines for formatting instructions. You can use the following URLs for more information:

- www.apastyle.org
- https://owl.purdue.edu/owl/research_and_citation/apa_style/apa_formatting_and_style_guide/general_format.html (which is referenced by the Center for Teaching and Learning at this URL: <https://ctl.yale.edu/FacultyResources/English>)
- <https://ctl.yale.edu/sites/default/files/files/Formatted%20Writing%20an%20APA%20Style%20Empirical%20Paper%20KVCulin.pdf>

Be sure to include a title page with the following information: (a) Title of Research, (b) Student Name, (c) PI Name and names of other laboratory mentors (other than PI), (e) Course & Term. Make sure to include a header on pages 2 through the end of the document with (a) Student Name, (b) Course & Term and (c) Page Number. Save papers as a pdf using the following nomenclature: *StudentLastName_FirstName_MCDBCOURSE_Term&Year.pdf*. ***Please send a copy to your PI***

Safety Requirements:

Note that you will need to fulfill various safety and associated requirements to begin research, depending on your field of study. If you will be working with radioisotopes in a laboratory you must have attended a radiation safety training seminar at Yale. You will not be able to start your experiments unless this requirement is fulfilled. In addition, you should discuss with your supervisor whether you should take a chemical safety course. For further information on both these topics call the University Safety Dept. at Tel. 5-3550.

If your proposed research involves animal use your professor **must** have an approval for this protocol from IACUC. Your professor must send a new form to IACUC to include you in the protocol once your project has been approved. Finally, if you have not already done so, you need to complete an IACUC course before research can begin.

Course Requirements:

Student and Research Mentor Contracts: Due date: Monday, **September 9, 2019 @ 12:00 noon**.

These should be uploaded to the Canvas Assignment section. Contracts and complete guidelines are available on Canvas and the MCDB Website.

Research Proposal: Due date: Monday, **September 9, 2019 @ 12:00 noon**.

A 1-2 page double-spaced summary of your research (written in collaboration with your research mentor) is due at the beginning of the term. This should include ~ 1 page overview/background of the project (documented with a short bibliography) and a section describing the general objectives and most importantly, the specific aims of your project. For guidance, ask your mentor to see a Specific Aims section of one of their NIH or NSF grants. Please be sure to follow APA formatting – as well as follow **the Submission and Formatting Instructions for All Written Work**.

Inappropriate Proposals include simply analyzing data gathered by someone else, for example entering previously obtained data into a computer and running a statistical analysis program. An unsuitable proposal at the other extreme would be gathering data for another person to analyze, for example taking medical histories or clinical measurements that will be passed on to someone else for study. Projects involving allelic screening of patient populations for SNPs associated with a given disease are also not acceptable unless there is substantive experimental design/content. ***If you are considering a project that may fall into one of the categories above, please discuss this with the instructor in charge prior to committing to that laboratory or project (there may be suitable alternative projects in the same lab).***

Time Commitment:

We are particularly concerned that each student fulfills the minimum 10-12 hr/week in the lab research commitment; part of the Mentor's Contract is to verify that level of participation by mid-semester. ***If for any reason you are unable to fulfill your commitment to the course and laboratory, you will be asked to withdraw from the course.*** Note, if you are planning on attending multiple interviews for medical school in the Fall, you are expected to make up for lost time.

Fall Report – Grant Proposal: Due date: **Friday, December 6, 2019 @ 4:00pm.**

A 5 page (double spaced) **Grant Proposal** should include the following sections, which are patterned after the format of an NIH or NSF Grant: Please be sure to follow APA formatting – as well as follow the **Submission and Formatting Instructions for All Written Work.**

General Objectives (very brief statement)

Specific Aims

Background and Significance

Preliminary Results

Research Plan

Bibliography

Figure legends must have captions that describe the contents of each figure

Oral Presentations – SPRING only for MCDB 485/486 students (April 17-24, 2020, at various times in YSB 352). These PowerPoint slides should be uploaded to the Canvas Assignment section at least 2 days before the scheduled presentation. Don't forget to include your 2-3 questions for the group.

Each student is required to give a formal seminar (PowerPoint slides) on their research progress at the end of the spring term (always held in multiple sessions spread out over the last week of classes). Each student seminar is capped at 15 minutes, with the slide presentation limited to 10-12 minutes, followed by 3-5 minutes for questions from peers and course instructors. Students should also prepare a final slide that includes 2-3 questions for the audience to discuss. All students are required to attend two full seminar sessions. This includes attending the session in which you are a presenter, and also attending a second full seminar session on a different day in which you are not presenting, but are an active member of the seminar audience. Students are expected to arrive promptly and to remain for the duration of each of their two required seminar sessions. Most sessions consist of 5-8 student seminar speakers. The actual time of each session varies from 1.5 – 2.5 hours depending on the number of speakers and the extent of questions from the audience. You will not be required to attend any sessions in the Fall term. A digital projector will be available; however, you should plan on bringing your own laptop to plug into the system.

After each talk, the audience will be allowed to ask questions, and then the speaker will be expected to ask 2 or 3 questions of the audience. A portion of your course grade will be based in part on participation in these sessions. Individual slides should be simple and not overloaded with text. Many skilled presenters find it effective to present only one key idea on each slide, as a general rule, and to provide a title on each slide. Your talk should include an introduction of the overarching biological question that you addressed, an explanation of the approach you took to tackle this question, your results, and the conclusions. Your objective should be to make your presentation clear and interesting to individuals who do not share your research background. It is extremely important to define any technical terms and to avoid acronyms. You should assume that the audience does not know the terminology or background of your field.

Practice your talk. Give a practice talk to the lab you are working in before you give it to the class. As noted in the Research Mentor's contract, their attendance at the session at which you are presenting is expected; if they cannot attend, you should arrange for someone else from your lab to attend. Mentor participation is a critical aspect of the course. Consequently, consult your research mentor at the beginning of the term to select a date that fits with her/his schedule.

Spring Poster Symposium: Due Date: **April 24, 2020 2:00-4:00pm in YSB Lobby**

The Poster Symposium is a **mandatory session** that will be held **April 24, 2020 from 2-4pm – YSB Lobby**. The purpose of the symposium is to share information and more specifically to highlight undergraduate research at Yale. Refreshments will be provided courtesy of the MCDB Dept. The symposium will be open to anyone wishing to attend, so please encourage friends, colleagues, family and other students to come. Your research mentor is strongly urged to attend.

Each student must prepare a poster. Posters can be as large as 3' X 5', but may be smaller. We will have poster boards and easels available to put your poster on. Posters may be printed professionally (**please note that there is no funding available for this expense from MCDB**), or the student may print them on a color printer and assemble individual sheets

onto the poster board at the poster session. DO NOT WAIT until the 11th hour to print your poster as the poster-printing service is always backlogged.

Posters should have a title, and the authors (including you and your research mentor) should be listed as well, usually in large letters at the top. Indicate which research course you are in (MCDB 485). The poster should include three sections: Introduction, Results, and Conclusions. The Introduction explains the purpose of your project; the Results section contains figures and/or tables showing your data, with legends or commentary; the Conclusion summarizes what you learned. Feel free also to include what you would do next were you to continue working on the project.

If you continue in research, the first presentation you are likely to give at a scientific meeting is a poster, so this will be good practice. The fewer words and the LARGER THEY ARE WRITTEN make it easier for people to notice and examine your poster. If a poster contains a great deal of text in small font, the audience may not read it. The same applies to data. Tables with large numbers of entries may be ignored. Simple figures with a concise conclusion for each are optimal. You should begin to organize your poster well in advance and you should allow at least one day for planning it and at least one day for producing the various parts of it. Bring it to the session ready to assemble. Please keep in mind that content should take precedence over form. It is much more important that your poster be clear, informative, and thoughtful than that it look highly professional. Aesthetic appeal is of course nice, but the science is paramount. Finally, **discuss your presentation with your colleagues and research mentor well before the session** and if you have any further questions/concerns bring the preliminary poster to show the instructor in charge.

Spring Report – Research Journal: Due date: **Friday, April 24, 2020 @ 4:00pm**

A 12-15 page double-spaced paper uploaded to the Canvas Assignment section, and a copy to your research mentor. Well in advance of this deadline, you should meet with your research mentor to plan a general outline for your paper. You and your mentor should engage in continued discussions throughout the writing process. The research mentor should grade the final version of the report and return it to us with comments electronically, along with a recommendation for an overall course grade. Your research mentor will be contacted directly with a form for grading near the end of the term. Consult your research mentor with any further questions that you might have. You should conform to any other specifics that your research mentor might expect in your write-up. (Please be sure to follow APA formatting – as well as follow the **Submission and Formatting Instructions for All Written Work**.)

The report should be written in a style similar to that of a paper in a typical **Research Journal** and should include the following sections:

- *Title Page:* Including title, the name and department of the faculty member in whose laboratory the project was performed, the name of the student, course number and date.
- *Abstract:* This is a brief summary of the project and the results obtained.
- *Introduction:* What is the biological problem, why is it important, and what's known about it already.
- *Experimental Procedures* (Material and Methods).
- *Results:* Describe what you have done. Include bar graphs, sketches, diagrams, tables, photographs etc. -- whatever is needed to represent your data.
- *Discussion:* If your project was successful, describe the significance of the results. If your project did not work, describe what you think went wrong, and what your expectations were. Regardless of outcome, describe what you would try next if you were to continue the project.
- *References:* References to previous work mentioned in your paper, as well as methods used, should be cited as in any other research paper. Each reference must be listed in the order of its appearance in the text and include title, authors, journal name, volume, year and page numbers.
- *Figure Legends:* Captions that describe the contents of each figure.

Grading:

The final grade will be based primarily on the recommendations from your research mentor on the level and quality of effort in the laboratory, and the quality of the final research reports. The MCDB research coordinator retains final grade determination if the recommended grade is at variance with the overall quality/scope of the performance of other course participants. A final grade deduction will be taken if a student fails to attend at least two MCDB Oral Presentation sessions. Failure to attend the two sessions will result in a loss of a half grade (e.g. a recommended A- will be lowered to a B+). Your mentor will be asked to recommend an interim grade of satisfactory (S) or unsatisfactory (U) at the end of the Fall term based on your laboratory effort and Fall research paper. Students receiving an unsatisfactory grade will be asked to meet with the instructor in charge and the mentor to identify problems and outline strategies for improvement. In the Spring semester, students will receive a letter grade that will be retroactively applied to the Fall term.