

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 495 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: WEDNESDAY, SEPTEMBER 7, 2016

Spring Oral Presentations: TBD Oral Presentations meet in KBT 1202 typically from 4:00 – 6:00 pm or 6:00 – 8:00 pm over several evenings in mid-late March and early April

Final Report Due:

Fall: FRIDAY, DECEMBER 9, 2016

Spring: FRIDAY, APRIL 28, 2017

Poster Symposium: Mid April (2-4pm) (Location TBD)

MCDB 485 – Senior Research

To: Prospective MCDB 485 students

From: Independent Research Courses Coordinator: John Carlson, Joseph Wolenski

Below is an introduction and guidelines to the MCDB 485 course. Students should always check the Canvas course site for additional information.

Course Overview:

The main purpose of this course is to enable you to obtain hands on experience with basic research as part of your education at Yale. The course entails two semesters of experimental work (the minimum time expectation is 10-12 hr/week in the lab) aimed at generating data using experimental strategies designed to test an interesting research problem. In most cases the project will test a specific hypothesis. Only MCDB seniors may take this course, and only to fulfill the Senior Requirement for the MCDB BS degree.

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:** include a title page with the following information: (a) Title of Research, (b) Student Name, (c) Course & Term, and (e) PI Name. Make sure to include a header on pages 2 through end 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*. **Do 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: (1 week after start of classes).

These should be uploaded to the Canvas Assignment section. Contracts are attached to these guidelines.

Summary Proposal: Due date: (1 week after start of classes)

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 her/his NIH or NSF grants. This summary is due **one week after start of classes**.

The types of proposal that are inappropriate 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: (last day of classes)

A 5 page (double spaced) **Grant Proposal** is due on the ***last day of classes***. Make sure you have the following sections, which are patterned after the format of an NIH or NSF Grant:

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 students These 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 will make an oral presentation to a small group of students. Following a 10 minute presentation, students are expected to pose 2 or 3 questions to the group for discussion. There will be approximately 6 students presenting at each of the sessions. Students must present at one session and attend one additional small group session as a member of the audience.

Attendance will be taken. Failure to attend the 2 sessions will result in a loss of a half grade (e.g. a recommended A- will be lowered to a B+). All presentations will be held in KBT 1202; typically, from 4:00 – 6:00 pm or 6:00 -8:00 pm over several evenings. Spring: March/ April (TBD).

All students in the MCDB 485/486 courses are expected to attend a minimum of 2 MCDB Oral Presentation sessions in the Spring term, (*i.e., you will present at one session and attend 1 additional session for a total of 2 sessions*). Signups will be handled through the Canvas site. All students should try to find a mutually agreeable time with their Research Mentors for their MCDB Oral Presentations. We have tried to be as flexible as possible in making these arrangements. Students will be expected to adhere to the time schedule as noted on Canvas. Each student must have a verified time slot for his/her presentation. Failure to attend both sessions will result in a loss of a half grade (e.g. a recommended A- will be lowered to a B+). **You will not be required to attend any sessions in the Fall term.**

These presentations should be made using Powerpoint. We will have a digital projector available; however, you should plan on bringing your own laptop to plug into the system. Talks are 10 minutes followed by 3-5 minutes for discussion/questions. Time and presentation order will be enforced.

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, his/her attendance at the session at which you are presenting is expected; if she/he 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: Mid April

The Poster Symposium will be held Mid April from 2-4pm – location to be determined. 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 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.

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 495). 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: Last Day of Classes

A 12-15 page double-spaced paper is due on the last day of classes 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.

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.