Case Western Reserve University

Systems Biology and Bioinformatics

Graduate Program

Student Handbook

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Systems Biology and Bioinformatics
Graduate Program Handbook
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1. Preface

This Handbook provides an overview of the Systems Biology and Bioinformatics (SYBB) Graduate Program at Case Western Reserve University. The handbook describes the special features, requirements and expectations of the SYBB program. The policies described in this apply to incoming students for the 2015-2016 academic year and beyond. Students should be familiar with requirements and guidelines of the university, the School of Graduate Studies and the SYBB program. Many, but not all, of these requirements are described in this document. There are several other useful documents and websites that describe the opportunities and requirements associated with graduate study at CWRU.

Policies of the School of Graduate studies, along with links to important forms and "The Graduate Student Handbook" can be found at http://gradstudies.case.edu/index.html

School of Medicine resources and information can be found on the Office of Graduate Education web site. http://casemed.case.edu/gradprog/

The Graduate Student Senate (GSS) web site, http://gss.case.edu/, provides additional resources and information.

2. Program Overview

The Case Western Reserve University School of Medicine established the first Ph.D. and M.S. program in Systems Biology and Bioinformatics (SYBB) in the State of Ohio. Based in the School of Medicine, with the Center for Proteomics and Bioinformatics as its administrative home, the faculty cohort includes faculty from multiple departments and schools across the CWRU campus.

The Systems Biology and Bioinformatics program at CWRU offers trainees the opportunity to combine experimental with computational or mathematical disciplines to understand complex biological systems. The goal of this program is to produce scientists who are familiar with multiple disciplines and equipped to conduct interdisciplinary research.

The SYBB program trains scientists who are able to generate and analyze experimental data for biomedical research and to develop physical or computational models of the molecular components that drive the behavior of a biological system.

The specific academic requirements of the SYBB Program are intended to provide students with a required core curriculum in Systems Biology and Bioinformatics and a set of electives designed both to assure minimum competencies in three fundamental core competencies and equip them for their particular thesis research discipline. Each trainee will be guided in their course of study by a mentoring committee to ensure the

completion of training in the program competencies as well as maintenance of a focus on molecular systems theory.

Fundamental Core Competencies

- Genes and proteins
- Bioinformatics and Computational Biology
- Quantitative Analysis and Modeling

The SYBB program includes faculty and coursework from multiple departments and across the CWRU campus. Participating departments and centers include:

- Biology
- Biomedical Engineering
- Center for Proteomics and Bioinformatics
- Electrical Engineering and Computer Science
- Epidemiology and Biostatistics
- Genetics and Genome Sciences
- Mathematics
- Neurosciences
- Physiology and Biophysics
- Pharmacology

Program Tracks

The Case Western Reserve University (CWRU) graduate program in Systems Biology and Bioinformatics (SYBB) has 4 tracks:

- Translational Bioinformatics - Equips students to apply recent advances in genomics and proteomics to solve clinical problems in a cost-effective manner
- Clinical Research Informatics - Prepares students to analyze large clinical data repositories to derive new knowledge pertaining to health and disease
- Molecular and Computational Biology - Provides students the cutting edge tools to tackle a variety of biological problems using molecular and computational approaches
- Applied Health Informatics - Students learn methods and technology to translate data to information to knowledge in the healthcare ecosystem.

Program Administration and Coordination: The SYBB program is guided by a steering committee Chaired by Mark Chance, Vice Dean for Research, Professor of Basic Science,

Director, Center for Proteomics & Bioinformatics. Other Steering Committee members are: Jill-Barnholtz-Sloan, Associate Professor, Cancer Center (Primary) and Proteomics & Bioinformatics (Secondary); Thomas LaFramboise, Associate Professor of Genetics; Mehmet Koyuturk, Associate Professor of Electrical Engineering and Computer Science (Primary) and Proteomics & Bioinformatics (Secondary);David T. Lodowski. Assistant Professor of Nutrition (Primary), Center for Proteomics and Bioinformatics (Secondary) and Pharmacology (Secondary) Masaru Miyagi, Assistant Professor of Nutrition (Primary), Center for Proteomics and Bioinformatics (Secondary) and Pharmacology (Secondary); Jean-Eudes Dazard, Assistant Professor of Proteomics and Bioinformatics. The coordinator for the SYBB is Joan Schenkel, Instructor and Senior Administrator for the Center for Proteomics and Bioinformatics. Dr. Lodowski and Dr. Chance serve as Co-directors of the SYBB program.

Admission to SYBB program is through direct admission, or the School of Medicine's Biomedical Research Training Program (BSTP) or the Medical Science Training Program (MSTP).

3. Ph.D. Program

A. Academic Requirements for Ph.D.

All Ph.D. students in the Systems Biology and Bioinformatics program will fulfill the overall academic requirements for Ph.D. study at Case Western Reserve University, including the requirement of 24 coursework credits, at least 6 pre-dissertation research credits, the candidacy examination, and a minimum of 18 dissertation research credits. Students are required to register for the SYBB journal club (SYBB 501) every semester. Students are also required to attend works in progress presentations and Center for Proteomics and Bioinformatics Seminars on a regular basis. Upon completion of the first semester, students will be required to present a paper for the Journal Club or a works in progress presentation at least once per year.

B. Summary of Credit Requirements for Ph.D. program

The Systems Biology and Bioinformatics Ph.D. program includes a set of required core courses emphasizing molecular systems biology. For the Translational Bioinformatics and Molecular and Computational Biology tracks required courses include: Bioinformatics for Systems Biology (SYBB 459) and Current Proteomics (SYBB 555). For the Clinical Research Informatics and Applied Health Informatics Tracks the required courses are: Clinical Informatics at the Bedside and the Bench Part 1 and 2 (SYBB421 and SYBB422). Students are required to take at least six additional courses as outlined by the student's mentoring/dissertation committee (for at least 18 additional credits), a course in the Responsible Conduct of research (IBMS 500), a qualifier exam, a Ph.D. Thesis and an oral defense consistent with CWRU requirements.

C. Tuition and Stipend

Full time registered SYBB students are eligible for tuition and stipend support. Stipends and tuition are funded by NIH training grants, NIH individual research grants, NSF grants and university resources. Tuition and stipend support is the responsibility of the research mentor and his/her department upon identification of a research mentor. Students are highly encouraged to seek support through the submission of individual training grants.

Two potential funding opportunities are:

NSF GRFP http://www.nsfgrfp.org

Application opens in August and is due in November.

DOE CSGF http://www.krellinst.org/csgf/

Application opens in October and is due in January.

D. Mentoring Committee

Entering students will be assigned a mentoring committee by the SYBB steering committee of at least two faculty members to guide their matriculation during the first year. The student's overall planned program of study (PPOS) integrating these directives will be completed and approved by the SYBB steering committee by the end of the first year for Ph.D. students. The mentors will guide the coursework choices of the student such that they will have completed training in the three major areas required for their thesis research. Once the student has chosen a research mentor, the research mentor will become a member of the student's mentoring committee if he/she is not already a member of the committee. The research mentor will become the advisor of record in the Student Information System (SIS). Upon passing to PhD candidacy, the Student's Dissertation committee will replace the mentoring committee in this advisory capacity.

E. Planned Program of Study

An official Planned Program of Study (PPOS) is required to be submitted in SIS for each graduate student by the end of the second semester. **The PPOS must be submitted no later than the end of the second semester of graduate study to avoid a Registration Hold.** SYBB students will draft a PPOS during the second semester of their first year.

The Planned Program of Study which consists of the courses and other requirements for the Ph.D. degrees must be established in consultation with the student's mentoring committee and then must be approved by the SYBB steering committee.

After approval from the SYBB steering committee, the student should submit their PPOS via the Student Information System (SIS) for faculty/research advisor and School of Graduate Studies approval.

A revised program of study must also be submitted via SIS when any change in the original plan occurs.

Submission Process

Visit the Student Information System User Guides page to download a quick reference guide and a training manual on creating a planned program of study.
Submit your PPOS via the Student Information System.

Individual Development Plan
Students are required to submit and discuss an IDP with their mentor by the middle of the second semester of their first year in the program. The IDP will be reviewed by the mentor and student at least annually. An IDP must be submitted though the IDP portal provided by the school of graduate studies at http://casemed.case.edu/idp.

F. Laboratory Rotations for Undecided Direct Admit Students

Students will participate in 2-3, three month laboratory rotations. A student may request to be admitted to a laboratory at any time after matriculation. The student, the selected research mentor, the mentor's Department Chair and the SYBB steering committee must approve the laboratory selection in writing. Approval will be granted upon receipt of the Mentor Agreement Form (see appendix)

G. Biology and Bioinformatics Journal Club and Works in Progress presentations

The SYBB Journal Club is designed to assist SYBB students in the development of effective presentation skills. Each student is required to attend journal club and present one paper per semester after his/her initial semester in the program.

SYBB students are also required to attend and participate in Works in Progress events. Works in progress provide students an opportunity to share and discuss their research in order to gain feedback.

H. Dissertation Advisory Committee

Prior to the Qualifying Exam, the student will form a Dissertation Advisory Committee to conduct the qualifying exam and to guide the dissertation research plan. The committee must be chaired by a tenured or tenure-track faculty member with a primary or secondary appointment in the Center for Proteomics and Bioinformatics, and must include three other CWRU faculty members. The committee must include: the research mentor, at least one faculty member with expertise in relevant experimental work, at least one faculty member with expertise in relevant computational and mathematical analyses and one faculty member outside of the SYBB program. Members of the dissertation committee may fulfill more than one requirement so long as the committee has at least four members.

I. Qualifying Exam and Advancement to Candidacy

During the second semester of the student's second year, the student will generate and defend an NIH or NSF style proposal based on their proposed thesis research as their qualifier exam; successful oral defense of this proposal and completion of core

requirements will result in recommendation for formal Ph.D. candidacy. Candidates not successful at this stage may have a second opportunity to defend their proposal only at the discretion of the steering committee. Once a student advances to candidacy, both the student and the Dean of Graduate Studies must promptly be notified by completion of the Advancement to Candidacy form. At this point, the department must identify a university faculty member who will serve as the doctoral student's mentor and formally notify the Dean of Graduate Studies.

Qualifying Exam Guidelines

During the second semester of the student's first year he/she will be given the format of the qualifying exam through a presentation by members of the SYBB steering committee. Students will then work to develop an NIH style proposal. Proposals will follow format/requirements of a standard F31 proposal. The link to proposal requirements is: http://grants.nih.gov/grants/guide/pa-files/PA-11-111.html. The proposal needs to include: Abstract, Relevance, Specific Aims (1 page) and Research Strategy (6 pages). The SYBB program coordinator will schedule the Qualifying Exam. The Qualifying Exam will be conducted by the candidate's dissertation advisory committee without the student's advisor. The student's mentor and the mentoring committee may provide feedback to the student as he/she is developing the proposal, but it is expected that the proposal is the student's work.

Upon successful passage to candidacy, It is required that students will submit a fellowship proposal to the NIH for consideration. The Center for Proteomics and Bioinformatics will provide assistance with completion and submission of each application package. Students are encouraged to apply for fellowships through the NSF and DOE. See section 3C for more information regarding these opportunities.

Bi-annual Committee Meetings and Progress Reports

Upon advancement to candidacy, Students are expected to meet with their dissertation committees twice a year, informing the committee as to their progress and results. After these meetings, the Chair of the Dissertation Advisory Committee will report the student's research progress and dissertation progress via a one page written report. These reports are appended to the student's annual progress report, demonstrating that committee meetings have occurred and that progress toward the degree is occurring

J. **Annual report of student progress**

Students are expected to at the end of each school year submit a yearly progress report to the SYBB graduate director. This form will be sent out at the end of April, and will be due no later than May 15.

K. **Course 701 Requirements**

A student who has advanced to candidacy may begin 701 research credits. Students who have advanced to candidacy must register for 1-9 credits of course 701 each fall and spring semester (or up to 6 credits for the summer when needed). Students who have not advanced to candidacy, may begin registering for up to 6 credit hours of course 701 with departmental approval by completing the Predoctoral Standing form. ***No student should be given departmental or instructor permission to register for 701 unless proper Advancement or Predoctoral status has been approved by Graduate Studies.*** **Once a student begins registration of 701 credit hours, the student must register for at least one credit hour of 701 every semester until graduation.** A minimum of 18 credit hours of course 701 is required to graduate. Students have five years to complete their degree from the first registration of 701.

L. Dissertation Requirements

Ph.D. candidates must submit a written dissertation as evidence of their ability to conduct independent research at an advanced level. The dissertation must represent a significant contribution to existing knowledge in the student's field, and at least a portion of the content must be suitable for publication in a reputable professional journal or as a book or monograph. Students must prepare their own dissertations. Joint dissertations are not permitted. The written dissertation must conform to regulations concerning format, quality, and time of submission established by the Dean of Graduate Studies. Detailed instructions can be obtained from the School of Graduate Studies. **http://gradstudies.case.edu/current/etd/guidelines.html** Dissertations should not contain proprietary or classified material. When the research relates to proprietary material, the student and adviser are responsible for making preliminary disclosures to the sponsor in advance to permit timely release of the dissertation. These arrangements must be disclosed when the dissertation is submitted to the School of Graduate Studies

SYBB program guidelines for format and content of the dissertation

Research for the dissertation is to be carried out under the direct supervision of a university faculty member. See appendix (Below)) for a comprehensive guide to writing the dissertation.

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M. Final Oral Examination (Dissertation Defense)

Each doctoral candidate is required to pass a final oral examination in defense of the dissertation. A student passes the final oral examination if no more than one voting member dissents.

A SYBB policy is that you must have a pre-defense committee meeting no less than 30 days prior to your dissertation defense date, and no oral defense may be scheduled prior to this meeting. Only the majority of the members of your committee need be present for this pre-defense meeting. For PhD students, the Notification for Scheduling

the Final Oral Exam for the Ph.D. form (http://gradstudies.case.edu/webfm_send/316) may be filed only after this meeting. In addition, **students are required to submit the Notification for Scheduling the Final Oral Exam form at least three weeks prior to the scheduled defense date.** By signing this form, the adviser is indicating that the work is ready to defend. The defense must be published on the University Calendar and open to the campus community. The candidate must provide each committee member with a copy of the completed dissertation at least two weeks prior to the examination.

N. **Publication Requirements**

A minimum of two peer reviewed publications are required prior to the Dissertation Defense. At least one publication must be a first author publication.

O. **Graduation Instructions for Doctoral Candidates**

SYBB students need to prepare and apply well in advance for graduation. In order to graduate, students must complete the Application for Graduation process in the Student Information System (SIS) by the established deadline. Students who fail to meet the established deadlines must re-apply to graduate. The deadlines posted are firm.
Additionally, students must complete a PhD graduation packet. This packet contains all the necessary forms and instructions for graduation. Download PhD Graduation Packet

Students must be registered during the semester in which they graduate and candidates must meet all of the deadlines set forth in the Graduate Studies calendar. Students must satisfy all financial obligations to receive their degree.

P. **Suggested Timeline for Ph.D. Degree**

Year	Fall Semester	Spring Semester
1	-Establishment of mentoring committee -Laboratory Rotations(optional) -Identification of Research Mentor - Course Work	Laboratory Rotations Identification of Research Mentor/Advisor (beginning of semester) Development /submission/ of PPOS Course Work -Pre-Ph.D. Dissertation Research Qualification Exam Preparation Journal Club Presentation
2	-Qualify Exam Preparation -Pre-Ph.D. Dissertation Research -Course Work - Journal Club Presentation - Begin Identification of Dissertation Committee members	-Finalize Dissertation Committee membership -Qualifying Exam Presentation - -Ph.D. Dissertation Research -Course Work -Journal Club Presentation

3	-Ph.D. Dissertation Research -Journal Club Presentation	-Ph.D. Dissertation Research -Dissertation Committee Meeting -Works in Progress Presentation
4	-Ph.D. Dissertation Research -Journal Club Presentation	-Ph.D. Dissertation Research -Dissertation Committee Meeting -Works in Progress Presentation
5	-Ph.D. Dissertation Research -Journal Club Presentation	-Ph.D. Dissertation Research -Dissertation Committee Meeting -Works in Progress Presentation -Dissertation Defense -Graduation

4. **M.S. Degree**

A. **Academic Requirements for M.S.**

Case Western Reserve University's SYBB program offers two M.S. courses of study. Candidates for M.S. will complete 30 total credits and will fulfill the overall academic requirements for M.S. study at Case Western Reserve University. M.S. students will have the option to complete a course of study with thesis (Plan A) or without thesis (Plan B).

Master's Thesis (Plan A)

The minimum requirement to complete a Master's degree under Plan A is 30 hours. Of these, students must complete at least 21 hours of coursework and 9 hours of SYBB651 thesis registration. At least 18 semester hours of coursework, not including thesis, must be at the 400 level or higher. **Please note, once a student begins registration of 651, the student must register for at least one unit of 651 every semester until graduation.**

For completion of Master's degrees Plan A, an oral examination (defense) of the Master's thesis is required. The examinations are conducted by a committee of three University faculty members. The candidate's thesis adviser usually serves as the chair of the examining committee. The SYBB steering committee will identify the other two members of the examining committee. The examining committee must agree unanimously that the candidate has passed the thesis examination.

Master's Comprehensive (Plan B)

The minimum requirement to complete a Master's degree under Plan B is 30 hours. In addition to coursework, students must successfully complete a comprehensive examination. At least 18 semester hours of coursework must be at the 400 level or higher.

The comprehensive examinations are administered by a member of the SYBB steering committee. The examination may be written, oral, or both. A student must be registered during the semester in which any part of the comprehensive examination is taken. If not registered for other courses, the student will be required to register for one semester hour of EXAM 600, Comprehensive Examination, before taking the examination.

SYBB Requirements for M.S. program

The Systems Biology and Bioinformatics M.S. program includes a set of required core courses emphasizing molecular systems biology. For the Translational Bioinformatics and Molecular and Computational Biology tracks required courses include: Bioinformatics for Systems Biology (SYBB 459) and Current Proteomics (SYBB 555). For the Clinical Research Informatics and Applied Health Informatics Tracks the required course are: Clinical Informatics at the Bedside and the Bench Part 1 and 2 (SYBB421 and SYBB422). Students are required to complete at least 5 additional courses as outlined by the student's mentoring committee (for at least 15 additional credits), as well as a course in the Responsible Conduct of research (IBMS 500). Each semester enrolled

students are required to register for and participate in the SYBB journal Club (SYBB501). Students are also required to attend works in progress presentations and Center for Proteomics and Bioinformatics Seminars. Upon completion of the first semester, students will required to present for the Journal Club or works in progress presentations at least once per year.

B. Tuition

Students enrolled in the SYBB program are responsible for their own tuition. However, Ohio residents are eligible for a $5200 per year scholarship through the Ohio Board of Regents Choose Ohio First Scholarship program. This scholarship is administered by the Center for Proteomics and Bioinformatics.

C. Mentoring Committee

Entering students will be assigned a mentoring committee by the SYBB steering committee of at least two faculty members to guide their MS studies. The mentoring committee will recommend a course of study to be approved by the SYBB steering committee. The mentors will guide the coursework choices of the student such that they will have completed training in the three major areas required for the thesis research. Once the student has chosen a research mentor, the research mentor will become a member of the student's mentoring committee if he/she is not already a member of the committee. The research mentor will also become the advisor of record in SIS.

D. Planned Program of Study

An official Planned Program of Study (PPOS) is required for each graduate student by the end of the second semester. **The PPOS must be submitted no later than the end of the second semester of graduate study to avoid a Registration Hold.**

Entering students are assigned a mentoring committee of two faculty members to guide their first year. The mentoring committee will recommend a course of study to be approved by the steering committee. The student's overall study plan will be developed and approved by the end of the second semester for M.S. students. These mentors will guide the coursework choices for the student such that they include appropriate coverage of the core competencies in genes and proteins, bioinformatics and quantitative modeling and analysis such that the student will have completed training in the three major areas necessary for successful accomplishment of thesis research.

Upon approval of the steering committee, the student will submit their PPOS via the Student Information System (SIS) for major faculty/research advisor and School of Graduate Studies approval.
A revised program of study must also be submitted via SIS when any change in the original plan occurs.

Submission Process

Visit the Student Information System User Guides page to download a quick reference guide and a training manual on creating a planned program of study.
Submit your PPOS via the Student Information System.

Individual Development Plan
All graduate Students are required to submit and discuss an IDP with their mentor by the middle of the second semester of their first year in the program. The IDP will be reviewed by the mentor and student at least annually. An IDP must be submitted though the IDP portal provided by the school of graduate studies at http://casemed.case.edu/idp.

E. **Laboratory Rotations**
Students will also participate in two to three, three month laboratory rotations. A student may request to be admitted to a laboratory at any time after matriculation. The student, the research mentor, the Department Chair of the mentor, and the steering committee must approve the laboratory selection in writing.

F. **Final Oral Examination (Thesis Defense)**
Each Type A Master's candidate is required to pass a final oral defense of their thesis. All members of a student's thesis committee must approve the award of the M.S. degree based both upon this thesis defense and the content and format of the written M.S. thesis**.**
A SYBB policy is that you must have a pre-defense committee meeting no less than 30 days prior to your thesis defense date, and no oral defense may be scheduled prior to this meeting. Only the majority of the members of your committee need be present for this pre-defense meeting. The candidate must provide each committee member with a copy of the completed dissertation at least two weeks prior to the examination.

G. **Masters Graduation**
SYBB students need to prepare and apply well in advance for graduation. In order to graduate students must complete the Application for Graduation process in the Student Information System (SIS) by the established deadline. Students who fail to meet the established deadlines must reapply to graduate. The deadlines posted are firm.
Additionally students must complete appropriate MS graduation packet. This packet contains all the necessary forms and instructions for graduation. http://gradstudies.case.edu/current/graduation/masters.html
Students must be registered in the semester in which they graduate, and candidates must meet all of the deadlines set forth in the Graduate Studies calendar. Students must satisfy all financial obligations to receive the degree.

5. **Ethical Conduct of Research Requirement**
All SYBB students are required to take IBMS500 which is offered early in the spring semester. Ph.D. students must complete the course by the end of their fourth semester.

MS students are required complete the course the first spring they are enrolled in the SYBB program.

6. **Graduate School Calendar**
   http://gradstudies.case.edu/current/calendars/calendar.html

The School of Graduate Studies maintains a calendar of due dates for each academic year. Items included in the calendar include:

- Application for graduation
- Deadline to submit materials for graduation
- Registration information
- Graduate studies orientation
- University holidays
- Class schedule

7. **Commonly Used forms**

http://gradstudies.case.edu/current/forms.html
Advancement to Candidacy
Arrangement to Resolve an Incomplete
Drop/Add Form
Fellowship Course Application
Notification for Scheduling the Final Oral Exam
Petition for a Leave of Absence
Petition for an Extension
Petition for Course Repeat
Petition for Transfer of Credit
Petition for Transfer of Department
Predoctoral Standing
Waiver of Registration

8. **Electronic Thesis or Dissertation Guidelines**

ALL Ph.D. and Master's Plan A students are required to submit dissertations or theses electronically to the School of Graduate Studies via OhioLINK.
http://gradstudies.case.edu/current/etd/guidelines.html

Committee Approval Sheet
A Committee Approval Sheet must be included as the second page of your PDF document. This form should only have the typed names of your committee, not signatures. See the sample committee approval sheet.

Publishing
It is a requirement of Case Western Reserve University to publish all doctoral dissertations through UMI/ProQuest. Please note that electronic dissertations will be submitted to

UMI/ProQuest on behalf of CWRU by OhioLink. The doctoral graduation packet contains a form which contains detailed information about electronic publishing.

Copies

Although you will submit your thesis/dissertation electronically, you may need to make printed copies for the members of your defense committee. It is the student's responsibility to deliver to each committee member a copy of the thesis/dissertation at least ten days prior to the defense examination date. Some departments may also require a copy of the thesis/dissertation for deposit in the department. Students should consult their advisers or department chairs concerning departmental requirements.

Some students wish to have copies bound for their own use. Contact the University Bookstore in Thwing (368-1661) for information on its binding service.

SYBB M.S. Thesis and Ph.D. Dissertation guidelines

Your Master's thesis or PhD Dissertation provides both documentation of the experimental and theoretical aspects to your research project as well as serving as proof that you have gained expertise in the subject matter. The thesis demonstrates that you can apply what you have learned to the process of finding answers/providing analysis to clinical or biological problems. The graduate school has specific requirements for order and format of these documents. They can be found here: http://gradstudies.case.edu/current/etd/guidelines.html (much of the information on order/formatting are taken from here.

Preparation to write a Master's Thesis/ Ph.D. Dissertation:

1. Keep in mind that these documents are actually a publication and should be treated with the utmost seriousness; Master's students will work closely with their M.S. Thesis advisor to get a copy distributed to the rest of your committee prior to the thesis defense. This could take several months and several rounds of rough drafts and revision prior to being ready for dissemination to the rest of the committee.
2. A SYBB policy is that you must have a pre-defense committee meeting no less than 30 days prior to your dissertation defense date, and no oral defense may be scheduled prior to this meeting. Only the majority of the members of your committee need be present for this pre-defense meeting.
    1. For PhD students, the Notification for Scheduling the Final Oral Exam for the PhD form (http://gradstudies.case.edu/webfm_send/316) may be filed only after this meeting.
    2. For masters students, you may not "apply to graduate" in SIS prior to approval at this meeting.
3. A final draft of the thesis/Dissertation is to be provided to your committee no less than

ten (10) days prior to the oral defense.

4. Thesis will be written in grammatically correct English. Do not expect your committee to provide grammatical or spell-checking services; the role of the thesis committee is to provide **technical** and**/**or **scientific** guidance in the writing of the thesis and consequent defense. There are university services to assist with copyediting and writing; Educational Services for Students (ESS) works with non-native English speakers; GSS Peer Editing is available to all students.
5. Format:
    1. Typeface and Font
        1. Any standard type face is acceptable; font size should be 12. The font size may be reduced for captions on figures and tables.
    2. Margins
        1. The margins on the left side of all pages must be 1.5 inches. Top, bottom and right margins should be 1 inch. All photographs, charts, tables, graphs, drawings, etc. must fit within these specified margins. Double-check margins for accuracy.
    3. Spacing
        1. Double-space all text. Long quotations, captions, footnotes, and endnotes may be single-spaced.
    4. Pagination
        1. The numbering of pages should, at the very latest, begin with the Table of Contents. Roman numerals (iii, iv, v…) are acceptable for the front pages. However, Arabic numbers (3, 4, 5…) should begin no later than the first page of regular text. You should number consistently throughout the document (i.e. page numbers should be all at the top or all at the bottom).
    5. Proofing
        1. You must have the format of your thesis/dissertation checked and approved by the School of Graduate Studies before you upload to OhioLink. You can do this by emailing a copy of the entire PDF file to etdsubmit@case.edu. Include your department or program name and the words "format check" in the subject line. Notice of approval (or corrections) will be sent back via email. Any ETD uploaded to OhioLink without prior approval will be deleted.
    6. Copies of the final dissertation:
        1. Although you will submit your thesis/dissertation electronically, you may need to make printed copies for the members of your defense committee. It is the student's responsibility to deliver to each committee member a copy of the thesis/dissertation at least ten days prior to the defense examination date. Some departments may also require a copy of the thesis/dissertation for deposit in the department. Students should consult their advisers or department chairs concerning departmental requirements.
        2. Some students wish to have copies bound for their own use. Contact the University Bookstore (368-2650) for information on its binding service.

Thesis and dissertation outline

Before beginning to write it is a good idea to plan out an outline delineating chapters of the thesis. Required sections and a suggested order in the finished thesis are presented below. Your advisor or committee may have additional guidance for order or additional sections dependent upon your particular project.

The graduate school has mandated the following order for both master's theses and PhD dissertations:

1. Title page
    1. The title page must contain the following information: Title, Name, Degree, Department, University Name, Month and Year of Graduation. The month of graduation will either be January, May or August. See the sample title page.
2. Committee Approval Sheet
    1. A Committee Approval Sheet must be included as the second page of your PDF document. This form should only have the typed names of your committee, not signatures. See the sample committee approval sheet.
3. Copyright page (only if copyrighting)
    1. Authorship automatically and implicitly confers a copyright to the author, without any additional fee. However, a copyright can be registered with the U.S. Copyright Office, which will provide additional legal protections for your rights regarding your dissertation, for an additional fee. Graduate Studies is no longer processing these requests. If you do choose to copyright, please insert a "copyright page" into your document. If you are not copyrighting, then leave out this page.
4. Dedication page (optional)
5. Table of Contents -- Table of contents with chapters/sections and subsections of each chapter/section
6. List of Tables
    1. If you use tables, you must include an itemized/numbered list of each. Please separate these lists on different pages.
7. List of Figures
    1. If you use figures and/or illustrations, you must include an itemized/numbered list of each. Please separate these lists on different pages.
8. Preface (optional)
9. Acknowledgements (optional)
10. List of Abbreviations (optional)
11. Glossary (optional)

12. Abstract
    1. Dissertation abstracts must not exceed 350 words, thesis abstracts 150. See the sample abstract.
13. **Body Text**
    1. Introduction
        1. What is the problem addressed?
        2. What is the Hypothesis?
        3. What are your objectives in the study?
        4. Why is this research important / what is the expected impact?
        5. Summary of the approach (Experimental Design)
        6. What tools/methods will be employed?
    2. Background. (may possibly be part of the introduction section)
    3. Literature review on the problem you are addressing
        1. Describe previous approaches
            1. Attempts and methodology
            2. This includes a discussion as to shortcomings of previous attempts
            3. Reader should know alternate approaches to solving your problem and their shortcomings from reading this section
        2. This should make clear why your approach is better and different
    4. Theory necessary to understand experimental design and results
        1. This could include software algorithms, mathematical formula, etc.
            1. An explanation should accompany these (what variables mean, how derived, etc.)
    5. Methods
        1. Full methods such that a reader could replicate your results are required
    6. Results
        1. Here is where you list your measurements, describe any difficulties, errors and so on. From this section, the reader should know what worked, what didn't and what data you plan to use for the remainder of the thesis.
    7. Discussion and Analysis of results
        1. Based on the results, how did you examine the data and what did you gain from the analysis?
        2. This will tie in the computational/analytical results and their analysis with the underlying science/problem which was introduced in the introduction
        3. How do your findings fit with the previous work introduced in background/literature review?
        4. Does your work help interpret previous findings made by others?
    8. Conclusions
    9. Highlight major findings of your work,
        1. Applications
        2. Broader implications of your work
        3. Impact/future directions
14. Appendix/Appendices
    1. Class notes, unpublished work, etc. should be added as an appendix if cited in the

thesis.
2. Additional information that adds to the meaning of the dissertation can also be included
    1. (datasets)

15. Bibliography References
    1. Citation styles that are commonly used are acceptable, for instance the *APA citation style*. You must include a complete bibliography at the end of the ETD that includes all works cited. Please follow the format most commonly used by your department.
    2. Use of a reference manager is strongly encouraged; it will save you considerable time during revision and re-writing.

A note on Figures/Tables

Figures should have numbers referenced in the text, and it may be helpful to use a numbering scheme that consists of chapter and figure number (i.e. fig 2.1 would be the first figure in chapter 2.) to delineate figures. Figures should have a descriptive title as well as a caption describing what you want your reader to see/take away from the figure.

In the thesis/Dissertation, figures are to be presented on their own page with adequate resolution and size such that the figure spans the entire page width. The figure legend should either be on its own on the facing page, or just below the figure on the same page, provided there is room.

9. **Office of Graduate Studies Resources**

    Visit the Office of Graduate Studies website (**http://gradstudies.case.edu/**) for information on the following topics:

    University Guidelines on Authorship and Policy on Copyright
    Academic Integrity Standards
    Graduate Student Grievance Procedure
    Maintenance of Good Standing
    Maintenance of Quality Point Average
    Residency Requirement
    Time Limitation
    Leave of Absence from Graduate Study
    Withdrawal and Reinstatement
    Transfer of Credit
    Course Repeat Policy

Changes in Registration
Waiver of the Registration Requirement
Exceptions to Regulations
Graduate Studies Paperwork
Graduate Student Travel Award
V-Fund