



## **Undergraduate and Graduate Advising Handbook**

### **Bioinformatics Programs Rochester Institute of Technology**



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**Disclaimer: this is only a guide. Official policies and procedures are in the undergraduate and graduate bulletins.**

## **Bioinformatics@ RIT**

Bioinformatics is a field that has been developing over the last 20 years. It is a discipline that represents a marriage between biotechnology and computer technologies and has evolved through the convergence of advances in each of these fields. Today bioinformatics is a field that encompasses all aspects of the application of computer technologies to biological data. Computers are used to organize, link, analyze and visualize complex sets of biological data.

In order to address the need for highly trained individuals in this exciting field, RIT has established new degree programs in Bioinformatics at both the baccalaureate and masters levels. Already a national leader in biotechnology education, we are now offering curricula which lead to the BS and MS degrees in Bioinformatics. The latter is comprised of two tracks of core courses, a choice of electives, and a required research thesis. In addition, we offer a combined BS/MS program which can be completed in a total of five years.

An integral component of our program is goal of familiarizing our students with the algorithms and techniques used in and appropriate for bioinformatics. While many of the courses in our programs are already offered, albeit across colleges and departments, we have developed more than 15 new courses for the bioinformatics programs which specifically address the symbiosis between the disciplines within biotechnology and the computing sciences. The interdisciplinary nature of bioinformatics requires close work with departments outside of Life Sciences. In this light, our programs have been developed in collaboration with the faculty of the departments of Life Sciences, Computer Science, Information Technology, Mathematics and Statistics and Chemistry.

Faculty within the School of Life Sciences dedicated to the Bioinformatics programs include:

### **Michael V. Osier, Ph.D.**

Director of Bioinformatics and Associate Professor of Life Sciences  
B.S., Biochemical Science, University of Vermont, 1995  
Ph.D., Genetics, Yale University, 2002  
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### **Gary R. Skuse, Ph.D.**

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### **Vicente Reyes, Ph.D.**

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## **Undergraduate Studies:**

Three undergraduate degree opportunities are available for studies in Bioinformatics at RIT.

### *Bachelor of Science in Bioinformatics*

The School of Life Sciences BS program in Bioinformatics represents a truly interdisciplinary degree. The Bioinformatics curriculum was developed by faculty in the Departments of Life Sciences, Chemistry, Computer Science, Mathematics and Statistics and Information Technology with the guidance of individuals in the bioinformatics and biotechnology industries throughout the country. This curriculum was designed with the needs of the prospective employer in mind, specifically for this challenging and rapidly changing field. Bioinformatics represents the wedding of biotechnology and the computing sciences. Bioinformaticists use computers to analyze, organize and visualize biological data in ways which increase our understanding of those data and lead to new discoveries.

The bioinformatics degree curriculum requires the completion of one cooperative education experience. This experience permits the student to witness the state-of-the-art in bioinformatics from a practical perspective. More than 65 organizations in industry, government and academia employ our students in short-term (10-12 weeks) full-time, paid positions. Co-op positions can be held during the summer and/or the regular academic year. No tuition is charged for any co-op participation. If a student elects to pursue a co-op during the regular academic year, he or she will take the same number of academic class terms, but may need to extend the date of graduation beyond the normal four years.

### *BS/MS in Bioinformatics*

The existing BS program may be combined with the MS program in Bioinformatics, allowing undergraduate majors to acquire both degrees in as few as five years. Undergraduate students with an overall GPA of 3.2 and a GPA in their professional field of study of 3.4 may apply to the bioinformatics committee for entry before the completion of their third year of study. Students in the combined program will be required to take graduate level courses during their fourth year and complete an approved MS thesis during their final year of study. Those who select this program will complete the undergraduate degree requirements and 45 quarter credit hours toward the Bioinformatics MS degree.

### *Bachelor of Science in Molecular Bioscience and Biotechnology with a Bioinformatics Option*

Students may choose to take a different approach to their education in Bioinformatics by pursuing a major in Molecular Bioscience and Biotechnology with a Bioinformatics option. This degree is based on the Molecular Bioscience and Biotechnology degree and includes key course in computer programming and bioinformatics.

**Course Information:**

Detailed course listings can be found through the Registrar's Web site, specifically on "<https://sis.rit.edu/>". This site provides course descriptions, pre-requisites, days/times offered, which are open/closed for registration, and exam schedules. We strongly recommend checking the information offered from this site periodically.

**Graduate Merit Scholarships:**

Starting with the class matriculating in the 2011-2012 Academic Year, Merit Scholarships will be adjusted to encourage strong student performance in course work. Students with Merit Scholarships who perform well during their first year will see an increase in their Merit Scholarships for the subsequent years. Students with higher GPA's will receive larger increases.

Starting with the class matriculating in the 2012-2013 Academic Year, students with Merit Scholarships who receive multiple probations or otherwise perform poorly will receive a decrease in their Merit Scholarships.

Note that the decreases are distinct from the Merit Scholarship increases, and additive. Additionally, decreases will happen in the quarter immediately following the cause. For example, a student finishing their first year with a GPA of < 3.0 who receives two probations in the second year will see a total decrease of 10%. At the Program Director's discretion, if a student performs sufficiently well in subsequent quarters, decreases may be removed, restoring the student to previous Merit Scholarship levels.

<b>Performance Metric</b>	<b>Merit Scholarship Change</b>
First year GPA of > 3.7	+5%
First year GPA of 4.0	Additional +5% (total of +10%)
Two Probations or a First year GPA of < 3.0	-5%

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## Bioinformatics MS Thesis

To graduate with a Master of Science degree from the Bioinformatics Program, all students must complete a series of milestones. Below is a sample signature sheet to record your progress. An official signature sheet will be kept in the School of Life Sciences.

### Milestones:

- If you have acceptance contingencies, they must be completed

Date \_\_\_\_\_ Program Director signature: \_\_\_\_\_

- Complete required coursework and credit hours

Date \_\_\_\_\_ Official signature: \_\_\_\_\_  
(must be the Bioinformatics Program Director or Administrative Assistant)

- Identify a thesis advisor and thesis committee
- With your advisor, prepare a thesis proposal (policies below)
- Defend the thesis proposal

Date \_\_\_\_\_ Thesis Advisor signature: \_\_\_\_\_

- With your advisor, write a thesis (formatting guidelines below)
- Defend your thesis in an *advertised public presentation*

Signature sheet available from School of Life Sciences staff

- Bind your thesis at the Wallace Center (guidelines below)

Date \_\_\_\_\_ Official signature: \_\_\_\_\_  
(must be the Bioinformatics Program Director or Administrative Assistant)

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All requirements of graduation have been met:

Date \_\_\_\_\_ Program Director signature: \_\_\_\_\_

Date \_\_\_\_\_ School Head signature: \_\_\_\_\_

## **Identification of a Thesis Advisor and the Thesis Proposal**

1. The Director of Bioinformatics will initially assume primary advising responsibility for each MS. He will assist each student in identifying a suitable research project and research advisor. The student will select a research advisor on the basis of common interests shared between the advisor and the student. Full time faculty, adjunct faculty and professionals outside of RIT may serve as research advisors. In every case, the Director of Bioinformatics must approve the selection of a research advisor.

2. The student will prepare a research proposal, working in consultation with his or her research advisor. The proposal should be no longer than 15 pages and include the following sections.

A. Introduction This section should describe, in detail, the background and rationale for the proposed project. This section must conclude with a succinct statement of the problem to be addressed by the proposed project.

B. Materials and Methods This section should describe the project to be undertaken. Sufficient detail should be provided so that the student's thesis advisory committee can determine whether the proposed work represents a satisfactory thesis project in terms of scope and value.

C. Literature Cited This should reflect a thorough search of relevant literature needed to support the proposed project. A comprehensive list of relevant literature will assist the student in assessing the relevance and potential impact of the proposed project.

3. The student will select a Thesis Advisory Committee composed of his or her advisor and 2-3 additional members. Members should be selected based on their potential to provide guidance for the proposed thesis project.

4. Two weeks prior to an initial Thesis Advisory Committee meeting, the student will distribute printed copies of his or her research proposal. At the initial committee meeting the student will present the proposal orally to her or her committee and be prepared to discuss and defend the proposal. By the end of that meeting, the committee will either approve the proposal as written or recommend changes. Any such changes will be incorporated by the student and the revised proposal distributed for committee approval. There is no need for a second committee meeting unless the committee deems it necessary.

5. Identification of a thesis advisor and approval of a thesis project must occur before the student enters his or her second year of graduate study. Once the committee approves the project as suitable for a MS thesis in Bioinformatics the student may commence work on the proposed project.

## **The Written Thesis**

1. Upon completion of the approved thesis project, a written report of the work performed will be submitted to the student's thesis advisory committee. The final report will contain all of the sections described above for the research proposal with the addition of a results and discussion section detailing the findings of the student's thesis research and include a scholarly review of the implications of the student's work.

2. The student is required to summarize his or her work in a public seminar wherein he or she will present the thesis research and present it in its contemporary context. That seminar will be immediately followed by a private defense attended only by the student and his or her thesis advisory committee. In some instances, particularly when additional expertise is needed, a fourth committee member may be invited to the student's thesis defense. If this is necessary, the student will be so informed at least one week prior to the thesis defense.

Two weeks prior to the defense, the student will distribute printed copies of his or her written thesis to the thesis advisory committee. At the defense, which will last no less than 50 minutes, the student will present the research work and be prepared to discuss and defend that work. By the end of that meeting, the thesis advisory committee will either approve the thesis as written or recommend changes. Any changes will be completed in a timely fashion, as specified by the thesis advisory committee, and approved before the student's research is considered complete.

3. Four corrected and committee approved copies of the final written thesis must be prepared. One copy is returned to the student after approval signatures have been affixed. The student's research advisor keeps a second copy, and the Bioinformatics Program retains the third copy. The fourth copy is sent to the RIT library for holding and future reference. While only four copies are required, it is highly recommended that the student make several extra copies for himself or herself.

4. When final approval has been received from the Thesis Advisory Committee, and all other requirements have been met, the Director of Bioinformatics will certify the student for graduation.

## Format of the Thesis

Formal requirements for the format of the written thesis are outlined by the RIT Library. As of September, 2011, this information is located at "<http://library.rit.edu/graduate-student-support>". In the future, this information may move, but should be easily found from the Wallace Center's Home Page.

The below are recommendations, and can be superseded by the RIT thesis requirements as noted above.

The key to good thesis writing is organization and planning. Students are encouraged to read the following guidelines carefully.

Contents: In keeping with the convention in the scientific literature, as appropriate, the thesis should contain the following sections. Sections indicated as optional are not required.

1	Title Page	8	Introduction
2	Copyright Release Form	9	Experimental or Methods
3	Abstract	10	Results
4	List of Figures (optional)	11	Discussion
5	List of Tables (optional)	12	Conclusions
6	Acknowledgments (optional)	13	References
7	Table of Contents	14	Appendices (optional)

*Title page* should include the following statement. "Submitted in partial fulfillment of the requirements for the Master of Science degree in Bioinformatics at Rochester Institute of Technology."

Following the title page should be a list of the thesis committee members with their departmental and institutional affiliations.

*Copyright Release Form:* Occasionally RIT receives requests for copies of a thesis. You may or may not wish to grant Wallace Memorial Library the right to make a copy of your thesis when a request is received. Your choice is implemented by signing the appropriate permission or deny-permission Copyright Release Form.

*Abstract:* The abstract is a brief summary of your thesis. See any abstract in the scientific literature as an example. The length should be approximately 100 to 200 words.

*References:* References are a list of scientific literature cited in the thesis. These should follow one of two formats: listing by number or listing by author's name and date. For example:

Both algorithms set equal to zero any data point with a value less than an arbitrary noise figure as defined previously.<sup>13</sup>

Both algorithms set equal to zero any data point with a value less than an arbitrary noise figure as defined previously (13).

Both algorithms set equal to zero any data point with a value less than an arbitrary noise figure as defined previously Ludlow and Skuse 1995).

Collate all references at the end of the manuscript in numerical order of citation if listed by number and in alphabetical order if cited by author.

The exact format of the reference may vary slightly between the subdisciplines of chemistry. You should use the format acceptable in your subdiscipline. References to journal articles should contain authors, title of article, journal name in italics, volume (bold), pages, and year as presented in the following examples. Refer to *The ACS Style Guide* or CASSI for abbreviations of journals.

13. Ludlow, J.W. and Skuse, G.R. (1995) Viral oncoprotein binding to pRB, p130, and p300. *Virus Research*, 35:113-121.

An alternative format for some professional journals:

13. Ludlow, J.W. and Skuse, G.R. Viral oncoprotein binding to pRB, p130, and p300. *Virus Research*, 35: 113-121 (1995).

References to books should contain the author(s), title in italics, publisher, city, and year. You may also wish to include the *ISBN* number.

3. J.W. Ludlow and G.R. Skuse *Tumor Suppressors: Involvement in Human Diseases, Viral Protein Interactions, and Growth Regulation*; The R.G. Landes Company, Georgetown, TX 1994.

References to book chapters in an edited book should contain authors, title of chapter, title of book in italics, editor, publisher, city, year, page or chapter.

25. G.R. Skuse and P.T. Rowley "Tumor Suppressor Genes and Human Neoplasia" in *Biochemical and Molecular Aspects of Selected Tumors*; T.P. Pretlow and T.G. Pretlow eds.; Academic Press, Orlando, FL, 1991; chapter 1.

Additional formats may be used as long as the format of all references is consistent within the thesis.

*Appendices:* Appendices should, if necessary, have their own table of contents. The individual pages of an appendix should be numbered with the letter of the appendix and ascending page numbers (*i.e.*, A1, A2, A3....).

## **Thesis and Dissertation Binding**

Formal requirements for the format of the written thesis are outlined by the RIT Library. As of September, 2011, this information is located at "<http://library.rit.edu/graduate-student-support>". In the future, this information may move, but should be easily found from the Wallace Center's Home Page.