Biomedical Informatics and Computational Biology Program

2015-16 Program Orientation
University of Minnesota Rochester

• Established in 2006
  – RHEDC

• Focus on health sciences and biotechnology

• Programs
  – B.S. in Health Sciences (BSHS, Fall 09)
  – B.S. in Health Professions (BSHP, Fall 11)
  – M.S. and Ph.D. graduate programs in Biomedical Informatics and Computational Biology (BICB, Fall 08)
  – (Partnership programs)

• Center for Learning Innovation
  – Academic unit for faculty teaching in the BSHS
Building Partnerships
Overview: Biomedical Informatics and Computational Biology (BICB)

- Interdisciplinary, all-University graduate program
  - University of Minnesota Twin Cities
  - University of Minnesota Rochester (administrative home)
- Ph.D. and Master of Science (M.S. Plan A and Plan B) degrees and a Minor
- The program is suitable for full-time and part-time students.
- Graduate faculty are from
  - University of Minnesota Twin Cities
  - University of Minnesota Rochester
  - Hormel Institute
  - Mayo Clinic
  - IBM
  - National Marrow Donor Program
  - Brain Sciences Center (VA)
  - Medtronic
- Students are in residence on either the Rochester or Twin Cities campus.
- Research can be conducted on any of the participating sites.
BICB by the Numbers

Faculty (Summer 2015)

<table>
<thead>
<tr>
<th>Institution</th>
<th>Count</th>
</tr>
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<tbody>
<tr>
<td>UMTC</td>
<td>39</td>
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<tr>
<td>UMN-Hormel</td>
<td>5</td>
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<tr>
<td>Mayo</td>
<td>26</td>
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<tr>
<td>NMDP</td>
<td>6</td>
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<tr>
<td>IBM</td>
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</tr>
<tr>
<td>Medtronic</td>
<td>1</td>
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<td>Ambient CA</td>
<td>1</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>80</strong></td>
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</tbody>
</table>

Graduates (Fall 14-Summer 15)
- 2 Ph.D.
- 6 M.S.

New Students Fall 15
- 10 M.S.
- 8 Ph.D.

40% of students work full-time
How to find BICB...

http://twin-cities.umn.edu/
At the Bottom of the Web Page:

http://r.umn.edu/
Academics & Research

Academics: Preparing Leaders and Entrepreneurs

Enriched by the Rochester region's internationally-renowned biomedical and technology enterprises, UMR's educational programs provide world-class instruction in a vibrant and friendly urban setting. Novel delivery systems, collaborations, and experience-based learning create an intellectual environment second to none.

Research: Interdisciplinary Inquiry in an Exceptional Environment

Hope for tomorrow is being shaped today by the innovative research led by faculty in UMR's Center for Learning Innovation (CLI) and Biomedical Informatics and Computational Biology (BICB) program. CLI develops and tests novel learner-centered, technology-enhanced, competency-based, and community-integrated approaches to undergraduate pedagogy in the living laboratory setting offered by UMR's B.S. in Health Sciences program. The BICB program advances knowledge related to biomedical informatics and computational biology in the context of five-way collaboration among UMR, the University of Minnesota Twin Cities, Mayo Clinic, IBM, and the Hormel Institute.

B.S. in Health Sciences (BSHS)
Biomedical Informatics and Computational Biology

World-Class Resources, World-Changing Programs

Computation is the vanguard of today’s biomedical research. UMR’s Biomedical Informatics and Computational Biology (BICB) program is the vanguard of biomedical computation. We combine the strengths and skills of eight internationally renowned partners - University of Minnesota Rochester, University of Minnesota Twin Cities, Mayo Clinic, IBM, The Hormel Institute, Cray, Inc., National Marrow Donor Program (NMDP), and the Brain Sciences Center - to create a one-of-a-kind opportunity for research and graduate education at the intersection of quantitative sciences, biology, and medicine.

More about BICB >>

News & Announcements

click here for more information on the 2nd Annual BICB Industry Symposium to be held on August 21, 2014.

Awards

Scott Simpkins, BICB Ph.D. student, receives National Science Foundation (NSF) Fellowship Honor. Read more >>

Dr. Claudia Neuhauser, named to Fellows of the American Mathematical Society (AMS) for 2013. Read more >>

Susan Van Riper, BICB Ph.D. student, receives Doctoral Dissertation Fellowship from the University’s Graduate School.

Dr. Claudia Neuhauser, Vice Chancellor for Academic Affairs at the University of
Graduate Program

The Biomedical Informatics and Computational Biology M.S. and Ph.D. graduate programs offer a full suite of academic offerings and research opportunities in this fast-growing field to give you the skills and knowledge needed to lead the way to tomorrow's tools for the quantitative analysis of biological and clinical data.

- top-ranked faculty from eight world-class institutions
- state-of-the-art knowledge in a fast-growing field
- integrated education in the life and computational/mathematical sciences
- collaborative research opportunities
- professional development
- world-class supercomputing resources
- semiannual research symposia
Student Handbook

The BICB graduate program is an all-University, interdisciplinary graduate program. The administrative home is at the University of Minnesota Rochester. Faculty come from the University of Minnesota Twin Cities, the University of Minnesota Rochester, the Mayo Clinic, IBM, Hormel Institute, National Marrow Donor Program (NMDP), and the Brain Sciences Center. A Director of Graduate Studies (DGS) and an Associate Director of Graduate Studies (A-DGS) are the liaison with departments and partnering institutions.

Graduate students are admitted to the University of Minnesota after review of applications by the faculty of the program for which the student applied. The Biomedical Informatics and Computational Biology (BICB) graduate program is one of many graduate programs offered by the University of Minnesota. A list of all majors and degrees offered by the University of Minnesota, the faculty members, requirements, and courses can be found in the Graduate School Catalog.

Specific information about the BICB graduate program and the Student Handbook for this program can be found through the links on the right-hand side. General information about graduate programs at the University of Minnesota can be found at the web page of the Graduate School. The Graduate School has also issued a Graduate Student Handbook with useful information about policies and procedures that are relevant to all University of Minnesota graduate students.

The information in this handbook and other University catalogs, publications, or announcements is subject to change without notice. University offices can provide current information about possible changes.
Graduate Faculty

• To identify advisors and committee members go to [Graduate Faculty](http://r.umn.edu/academics-research/biomedical-informatics-and-computational-biology/graduate-program/student-handbook/faculty) on the Graduate Program Home Page

• [http://r.umn.edu/academics-research/biomedical-informatics-and-computational-biology/graduate-program/student-handbook/faculty](http://r.umn.edu/academics-research/biomedical-informatics-and-computational-biology/graduate-program/student-handbook/faculty)
Graduate Faculty

The graduate faculty of the BICB graduate program comes from eight institutions (University of Minnesota including Hormel Institute; Cray Inc.; IBM; Mayo Clinic; National Marrow Donor Program; Brain Sciences Center).

- University of Minnesota Faculty
- Mayo Clinic Faculty
- IBM Faculty
- National Marrow Donor Program (NMDP) Faculty
- Brain Sciences Center
- Other Affiliated Faculty

University of Minnesota

Dr. Elizabeth Amin (Associate Professor, College of Pharmacy)

The Amin laboratory’s NIH/NIAID-funded research program focu (chemical, biological, radiological, nuclear and explosive) agents, Bacillus anthracis (the causative agent of anthrax), the ricin toxin organophosphate nerve gases such as sarin, soman, and VX. We use biochemistry and microbiology with computational sciences. Our design and optimization of small-molecule anthrax toxin lethal inhibitors, and ricin toxin A (RTA) inhibitors, to be used as emerging bioterror agents, and engineering enzyme active sites. Effectively hydrolyze fast-acting nerve agents.

Dr. Massoud Amin (Professor, Electrical and Computer Engineering)

Dr. Massoud Amin's research focuses on two areas: 1) Global transition dynamics to enhance resilience, security and efficiency of complex dynamic systems. 2) Science and Technology scanning, mapping, assessment and valuation to identify new science and technology-based opportunities that meet the needs and aspirations of today's companies, companies and the broader society. This thrust builds partnerships between
Roles and Responsibilities of Graduate Faculty

• To read about roles and responsibilities of graduate faculty, go to Roles and Responsibilities of Graduate Faculty
REGISTRATION
Full-time and Part-time

• Full-time students: 6 or more credits
  – Banded tuition: same tuition for 6-14 credits
  – Proof of health insurance required at registration
• Part-time students: 0-5 credits
  – Tuition: pay per credit
• Fees vary by credit
• Credits listed on class schedule
  – Auditing a course costs tuition
• All completion times in the Handbook are listed for full-time students
  – Adjust times if you are a part-time student
Registration

- Students need to register every fall and spring
  - All registration through MyU
- Register BEFORE classes start to avoid late fees
- GRAD 999 (0 credits, no tuition)—not for students who need to be full time students, but especially for part-time students who need to take off a semester
- Advanced students (after completion of ALL requirements)
  - M.S. Students: BICB 8333 (1 credit, reduced tuition)
    - Special form; requires approval
  - Ph.D. Students: BICB 8444 (1 credit, reduced tuition)
BICB

PROGRAM PROCEDURES
Degree Programs

- Ph.D.
  - Individualized
  - Research focus
  - Preliminary written and preliminary oral exam
  - Thesis defense
  - Time limit: 8 years

- M.S. (30 credits)
  - Individualized
  - Plan A
    - Research thesis (10 credits)
  - Plan B
    - Synthesis paper or short project
  - Decision on plan after completion of about 10-15 credits
  - Final oral exam
  - Time limit: 5 years
Your Advisor(s) and Examining Committee

- Temporary advisor at arrival (DGS is default for M.S.)
- Degree advisor by the end of first year
  - Co-advising is encouraged for Ph.D. and M.S. (Plan A)
- Examining Committee
  - Ph.D.
    - Adviser and three additional members
      - At least three members, including the adviser, from the BICB program
    - Find committee members one semester prior to taking preliminary written exam
    - Meet regularly
  - M.S.
    - Adviser and two additional members
      - At least two members, including the adviser, from the BICB program
    - Plan A: Find committee members by the end of second semester
    - Plan B: Find committee members one semester prior to graduation
    - Meet regularly
  - One external member permitted
Graduate Student Services and Progress Office (GSSP)

http://www.grad.umn.edu/current-students/gssp
DEGREE COMPLETION STEPS

Doctor of Philosophy
Doctor of Education

1. Complete Graduate Degree Plan
   Submit at least one semester prior to your preliminary oral exam

2. Assign members to preliminary oral exam committee
   Complete at least one month prior to exam via www.grad.umn.edu/students/forms/doctrinal/index.html

3. Complete Preliminary Written Exam Report
   Must be on file to be authorized to take preliminary oral exam

4. Schedule preliminary oral exam
   Notify GSSP of scheduled exam at least one week in advance

5. Submit Preliminary Oral Report
   Submit for your record to reflect doctoral candidacy

6. Assign members to doctoral final exam committee
   Complete at least one month prior to exam via www.grad.umn.edu/students/forms/doctrinal/index.html

7. Request Graduation Packet
   Packet will include the Graduate Application for Degree form and Reviewers' Report form. You can request it in person or online up to one semester before your doctoral final exam.

8. Schedule doctoral final exam
   Notify GSSP of scheduled exam at least one week in advance

9. Submit Graduate Application for Degree
   Submit to One Stop by the first business day of anticipated month of graduation

10. Submit Reviewers' Report
    Submit prior to your defense

11. Submit Doctoral Final Exam Report
    Submit no later than the last business day of anticipated month of graduation

12. Submit dissertation/project
    Submit by the last business day of anticipated month of graduation. Consult Graduation Packet for formatting guidelines.

Questions?
Renee Faunce
Graduate Degree Plans & Committee Assignments
gscont@umn.edu
612-625-5833

Amber Cellotti
Degree Progress & Completion
gscmst@umn.edu
612-625-4019

DEGREE COMPLETION STEPS

Master's Plan A

1. Complete Graduate Degree Program
   Submit at least one semester prior to anticipated month of graduation

2. Assign members to preliminary oral exam committee
   Complete at least one month prior to exam via www.grad.umn.edu/students/forms/doctrinal/index.html

3. Complete Preliminary Written Exam Report
   Must be on file to be authorized to take preliminary oral exam

4. Schedule preliminary oral exam
   Notify GSSP of scheduled exam at least one week in advance

5. Submit Preliminary Oral Report
   Submit for your record to reflect doctoral candidacy

6. Assign members to doctoral final exam committee
   Complete at least one month prior to exam via www.grad.umn.edu/students/forms/doctrinal/index.html

7. Request Graduation Packet
   Packet will include the Graduate Application for Degree form and Reviewers' Report form. You can request it in person or online up to one semester before your doctoral final exam.

8. Schedule doctoral final exam
   Notify GSSP of scheduled exam at least one week in advance

9. Submit Graduate Application for Degree
   Submit to One Stop by the first business day of anticipated month of graduation

10. Submit Reviewers' Report
    Submit prior to your defense

11. Submit Doctoral Final Exam Report
    Submit no later than the last business day of anticipated month of graduation

12. Submit dissertation/project
    Submit by the last business day of anticipated month of graduation. Consult Graduation Packet for formatting guidelines.

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DEGREE COMPLETION STEPS

Master's Plan B
Master's Plan C

following procedures must be completed. You must maintain active very fall and spring semester until your degree is awarded. All forms must be draft Services and Progress (GSSP) office unless otherwise noted. Contact program-specific requirements and deadlines.

5. Submit Graduation Application for Degree
   Submit prior to master's final exam to obtain the Final Examination Report form.

6. Submit Final Examination Report
   Must be submitted no later than the last business day of anticipated month of graduation.

7. Submit Thesis
   Submit by the last business day of anticipated month of graduation. Consult Graduation Packet for formatting guidelines.

8. Submit Reviewers' Report
   Submit Reviewers' Report form. You can request it in person or online up to one semester before your doctoral final exam.

9. Submit Doctoral Final Exam Report
   Submit no later than the last business day of anticipated month of graduation.

10. Submit dissertation/project
    Submit by the last business day of anticipated month of graduation. Consult Graduation Packet for formatting guidelines.

11. Submit Graduation Packet
    Submit to One Stop by the first business day of anticipated month of graduation

12. Submit Graduation Application for Degree
    Complete at least one prior to exam via www.grad.umn.edu/students/doctrinal/index.html

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612-625-4019
The First Steps

• Program assigns adviser
• Program submits degree plan
  – Degree plan discussed in annual review meetings
  – DGS prepares degree plan
  – DGS submits degree plan to GSSP
• You assign committee members online
  – Adviser and program approval
Student Handbook

The BICB graduate program is an all-University, interdisciplinary graduate program. The administrative home is at the University of Minnesota Rochester. Faculty come from the University of Minnesota Twin Cities, the University of Minnesota Rochester, the Mayo Clinic, IBM, Hormel Institute, National Marrow Donor Program (NMDP), and the Brain Sciences Center. A Director of Graduate Studies (DGS) and an Associate Director of Graduate Studies (A-DGS) are the liaison with departments and partnering institutions.

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Courses

• Core Areas
  1. Biochemistry, molecular and cell biology
  2. Database, data mining, and computing
  3. Informatics, analysis, and machine learning
  4. Mathematics, biostatistics, and statistics
  5. Computational and systems biology

• Elective Courses
  1. Biochemistry, molecular and cell biology
  2. Informatics, database, data mining, and computing
  3. Mathematics, biostatistics, statistics
  4. Chemistry, chemical engineering, and physics
  5. Biophysics and structural biology
  6. Imaging, information theory, and signal processing
  7. Computational chemistry, medicinal chemistry, and drug design
  8. Clinical and translational sciences
Courses

• BICB Courses
  – Offered via ITV on both campuses

• UMTC courses
  – All are offered at UMTC
  – Some are offered through UNITE for Rochester students
    • INFORM DGS BEFORE YOU SIGN UP FOR A UNITE COURSE BECAUSE OF FEE AGREEMENT

• Mayo Clinic Courses
  – Inform DGS which ones you’d like to take
  – DGS will help you register at Mayo Clinic
  – You register for appropriate section in BICB 5620 or 8620
  – If you work at Mayo, enroll as a non-degree student at Mayo (saves tuition)
# Courses

### INFORMATICS, ANALYSIS, AND MACHINE LEARNING

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<tr>
<th>Fall 2013</th>
<th>Spring 2014</th>
<th>UMN Courses</th>
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<tr>
<td></td>
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<td>CSci 5109 Visualization</td>
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<td>CSci 5121 Advanced Internet Programming</td>
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<td>CSci 5481* Computational Techniques for Genomics I</td>
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<td>x</td>
<td>CSci 5461* Functional Genomics, Systems Biology, and Bioinformatics</td>
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<td>CSci 5511* Artificial Intelligence I</td>
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<td>CSci 5521* Pattern Recognition</td>
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<td>CSci 5525 Machine Learning</td>
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<td>CSci 5541 Natural Language Processing</td>
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<td></td>
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<td>EE 8591* Predictive Learning from Data</td>
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### Mayo Clinic Courses

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<th>F13</th>
<th>W14</th>
<th>S14</th>
<th>Su14</th>
<th>Mayo Clinic Courses</th>
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<td>BMB 8350f GENOMIC AND PROTEOMIC ANALYSIS USING BIOINFORMATICS TECHNIQUES</td>
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</table>
Finding Courses

• BICB courses are listed under Class Search on the UMR website
• Other University of Minnesota courses are listed on the UMTC website under Class Search or Class Schedule
• Permission numbers are required for many graduate courses
  – BICB: DGS
  – Other courses: [http://www.r.umn.edu/academics-research/biomedical-informatics-and-computational-biology/graduate-program/student-18](http://www.r.umn.edu/academics-research/biomedical-informatics-and-computational-biology/graduate-program/student-18)
Career Development

• Ethics
  – BICB 8401: Ethical Issues in Bioinformatics (Fall Semester)
  – Public Health courses
    • PUBH 6741
    • PUBH 6742

• Leadership and management
  – BICB 8970 (Spring semester)
  – PA 4190 Topics in Public and Nonprofit Leadership and Management (Fall semester)
Master’s Degree (Plan A and B)

- 30 credits
- Core 1 and one of Cores 2-5: at least 9 credits
- Electives: at least 5 credits
- Journal Club (BICB 8930, 2 sem), Colloquium (BICB 8920, 1 sem), Ethics (1 credit), Leadership (1 credit)
- Limit of one 4xxx level course
- Degree plan submitted prior to decision about Plan
  - Adviser required for submission
  - Plan A: 10 thesis credits (BICB 8777)
  - Plan B: additional courses, capstone
- Examining committee
  - One semester prior to intended graduation
  - Student initiates workflow
  - Approval by program
• Plan A:
  – Start research during first year
  – Pre-thesis seminar during second year
  – Finish thesis by the end of second year or middle of third year
  – Take final oral examination

• Plan B:
  – Write one to three synthesis papers or do small project with project report
  – Finish coursework and reports by end of second year
  – Take final oral examination
Ph.D. Degree

• 1st year students: Meet with DGS and temporary advisor before first term starts to determine coursework (prerequisites and graduate courses)
• Degree advisor by end of first year
• Regular meetings with examining committee
• Degree program submitted prior to preliminary written exam
  – Adviser
  – 24 course credits
  – 24 thesis credits: can be taken prior to preliminary oral exam with permission of adviser
  – Other requirements
• Form examining committee prior to preliminary written exam
• Course Credits: 24 credits
  – 12 credits in Core (Core Area 1 and at least two of the Core Areas 2-5); BICB is Core
  – Core courses are also elective courses
  – Limit of one 4xxx level course
  – We are open to suggestions of additional courses
• 24 thesis credits
• Minor in another field is possible
• BICB 8510
  – Two semesters
• BICB 8920 BICB Colloquium
  – Two semesters
  – Do not count as Core or Elective courses
• BICB 8930 Journal Club
  – Four semesters
  – Do not count as Core or Elective courses
• Proposal Writing Seminar (1 cr)
  – 4th semester
  – Proposal (preliminary written examination) due by the end of 4th semester
  – Does not count as Core or Elective course
• Ethics (1 cr) and Leadership/Management (1 cr)
  – Count as Elective courses
• Internship/Lab rotation
  – Completed within the first 2-3 years
  – Equivalent to about 120 hours of industrial or clinical internships or lab rotations
  – Prior experience can be applied
• Pre-thesis seminar before preliminary oral examination
• Preliminary Oral Examination by the end of 5th semester
Preliminary Written Examination

- BICB 8932 Proposal Writing Seminar (unless submitted earlier)
- Due by the end of 2nd year
- Written as a thesis proposal (about 12 pages)
- Significant step in formulating student’s research questions and developing methods
- Early deadline will ensure feedback
- Evaluated by at least 3 BICB Grad Faculty, approved by BICB Grad Faculty
  - 2 examiners are from the examining committee
UMR MyU and One Stop

The University of Minnesota Rochester offers students an unparalleled education, including an integrated, hands-on health sciences curriculum, personalized attention, and a learning experience that is truly one-of-a-kind. Immersed in the heart of one of the nation's most health-focused communities, students engage with medical professionals on a daily basis and graduate prepared to transform knowledge into discovery in the ever-changing world of health care.
Administrative Contact

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