The current explosion of biomedical data provides an awesome opportunity to improve understanding of the mechanisms of disease and ultimately to improve human health care. However, fully harnessing the power of high-dimensional, heterogeneous data requires a new blend of skills including programming, data management, data analysis, and machine learning.

The MS degree program in biomedical data science covers core concepts and allows for concentrated coursework, in both methodology and application.

**ADMISSIONS**

Please consult the table below for key information about this degree program’s admissions requirements. The program may have more detailed admissions requirements, which can be found below the table or on the program’s website.

Graduate admissions is a two-step process between academic programs and the Graduate School. **Applicants must meet the minimum requirements** (https://grad.wisc.edu/apply/requirements/) of the Graduate School as well as the program(s). Once you have researched the graduate program(s) you are interested in, apply online (https://grad.wisc.edu/apply/).

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall Deadline</td>
<td>December 15</td>
</tr>
<tr>
<td>Spring Deadline</td>
<td>The program does not admit in the spring.</td>
</tr>
<tr>
<td>Summer Deadline</td>
<td>The program does not admit in the summer.</td>
</tr>
<tr>
<td>GRE (Graduate Record Examinations)</td>
<td>Not required.</td>
</tr>
<tr>
<td>English Proficiency Test</td>
<td>Every applicant whose native language is not English, or whose undergraduate instruction was not exclusively in English, must provide an English proficiency test score earned within two years of the anticipated term of enrollment. Refer to the Graduate School: Minimum Requirements for Admission policy: <a href="https://policy.wisc.edu/library/UW-1241">https://policy.wisc.edu/library/UW-1241</a> (<a href="https://policy.wisc.edu/library/UW-1241/">https://policy.wisc.edu/library/UW-1241/</a>).</td>
</tr>
<tr>
<td>Other Test(s) (e.g., GMAT, MCAT)</td>
<td>n/a</td>
</tr>
<tr>
<td>Letters of Recommendation</td>
<td>Required</td>
</tr>
</tbody>
</table>

For additional information about admission to the program, see MS Program in Biomedical Data Science (https://biostat.wiscweb.wisc.edu/education/prospective-students/) on the department website.

**FUNDING**

Resources to help you afford graduate study might include assistantships, fellowships, traineeships, and financial aid. Further funding information (https://grad.wisc.edu/funding/) is available from the Graduate School. Be sure to check with your program for individual policies and restrictions related to funding.

**PROGRAM RESOURCES**

Funding guarantees are not provided for students in this program. Students are encouraged to explore funding options available across campus.

**REQUIREMENTS**

**MINIMUM GRADUATE SCHOOL REQUIREMENTS**

Review the Graduate School minimum academic progress and degree requirements (http://guide.wisc.edu/graduate/#policiesandrequirementstext), in addition to the program requirements listed below.

**MAJOR REQUIREMENTS**

**MODE OF INSTRUCTION**

<table>
<thead>
<tr>
<th>Mode of Instruction</th>
<th>Face to Face</th>
<th>Evening/Weekend</th>
<th>Online</th>
<th>Hybrid</th>
<th>Accelerated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

**Mode of Instruction Definitions**

**Accelerated:** Accelerated programs are offered at a fast pace that condenses the time to completion. Students typically take enough credits aimed at completing the program in a year or two.

**Evening/Weekend:** Courses meet on the UW–Madison campus only in evenings and/or on weekends to accommodate typical business backgrounds; providing opportunities to develop necessary skills immediately upon entering the program.
schedules. Students have the advantages of face-to-face courses with the flexibility to keep work and other life commitments.

**Face-to-Face:** Courses typically meet during weekdays on the UW-Madison Campus.

**Hybrid:** These programs combine face-to-face and online learning formats. Contact the program for more specific information.

**Online:** These programs are offered 100% online. Some programs may require an on-campus orientation or residency experience, but the courses will be facilitated in an online format.

### CURRICULAR REQUIREMENTS

**Requirement Detail**

<table>
<thead>
<tr>
<th>Minimum Credit Requirement</th>
<th>30 credits</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Minimum Residence Credit Requirement</th>
<th>16 credits</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Minimum Graduate Coursework Requirement</th>
<th>15 credits must be graduate-level coursework. Refer to the Graduate School: Minimum Graduate Coursework (50%) Requirement policy: <a href="https://policy.wisc.edu/library/UW-1244/">https://policy.wisc.edu/library/UW-1244/</a>.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Overall Graduate GPA Requirement</th>
<th>3.00 GPA required. Refer to the Graduate School: Grade Point Average (GPA) Requirement policy: <a href="https://policy.wisc.edu/library/UW-1203/">https://policy.wisc.edu/library/UW-1203/</a>.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Other Grade Requirements</th>
<th>Students must earn a B or above in all core curriculum coursework.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Assessments and Examinations</th>
<th>No formal examination required.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language Requirements</td>
<td>No language requirements.</td>
</tr>
</tbody>
</table>

### REQUIRED COURSES

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Concentration Electives</strong></td>
<td></td>
<td>12</td>
</tr>
</tbody>
</table>

In consultation with their faculty advisor, students will select electives in an area of concentration within biomedical data science. Examples include but are not limited to:

- I SY E 517 Decision Making in Health Care
- B M I/STAT 541 or B M I/POPLTH 551 or STAT/F&W ECOL/HORT 571 Introduction to Biostatistics
- B M I/POPLTH 552 Regression Methods for Population Health
- B M I/COMP SCI 567 Medical Image Analysis
- B M I/STAT 641 Statistical Methods for Clinical Trials
- B M I/STAT 642 Statistical Methods for Epidemiology
- B M I/POP HLTH 651 Advanced Regression Methods for Population Health
- B M I/STAT 741 Survival Analysis Theory and Methods
- B M I/COMP SCI 767 Computational Methods for Medical Image Analysis
- B M I/STAT 768 Statistical Methods for Medical Image Analysis
- B M I 773 Clinical Research Informatics
- B M I/COMP SCI 775 Computational Network Biology
- B M I/COMP SCI 776 Advanced Bioinformatics
- B M I/STAT 877 Statistical Methods for Molecular Biology

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data Science Electives</strong></td>
<td></td>
<td>12</td>
</tr>
</tbody>
</table>

In consultation with their faculty advisor, students will select electives in computer science and/or statistics. Examples include but are not limited to:

- STAT 609 Mathematical Statistics I
- STAT 610 Introduction to Statistical Inference
- STAT 627 Professional Skills in Data Science
- STAT 771 Statistical Computing
- STAT 849 Theory and Application of Regression and Analysis of Variance I
- STAT 850 Theory and Application of Regression and Analysis of Variance II
- COMP SCI/E CE 766 Computer Vision
- COMP SCI/E CE/ISY E 524 Introduction to Optimization
- COMP SCI/E CE/M.E 532 Matrix Methods in Machine Learning
- COMP SCI 571 Building User Interfaces
- COMP SCI/ISY E/STAT 726 Nonlinear Optimization I
- COMP SCI 744 Big Data Systems
- COMP SCI 762 Advanced Deep Learning
- COMP SCI 765 Data Visualization
- COMP SCI 784 Foundations of Data Management
- COMP SCI 564 Database Management Systems: Design and Implementation

| Code         | Title                                           |
|--------------|-------------------------------------------------|---------|
| B M I 573    | Foundations of Data-Driven Healthcare           |
| B M I/COMP SCI 576 | Introduction to Bioinformatics                 |
| B M I/BIOCHEM/ BMOLCHEM/ MATH 609 | Mathematical Methods for Systems Biology |
| I SY E/B M I 617 | Health Information Systems                   |
| B M I/STAT 641 | Statistical Methods for Clinical Trials       |
| B M I/STAT 642 | Statistical Methods for Epidemiology          |
| B M I/POP HLTH 651 | Advanced Regression Methods for Population Health |
| B M I/STAT 741 | Survival Analysis Theory and Methods          |
| B M I/COMP SCI 767 | Computational Methods for Medical Image Analysis |
| B M I/STAT 768 | Statistical Methods for Medical Image Analysis |
| B M I 773    | Clinical Research Informatics                  |
| B M I/COMP SCI 775 | Computational Network Biology                |
| B M I/COMP SCI 776 | Advanced Bioinformatics                        |
| B M I/STAT 877 | Statistical Methods for Molecular Biology     |
| COMP SCI/E CE 766 | Computer Vision                               |
| COMP SCI/E CE/ISY E 524 | Introduction to Optimization            |
| COMP SCI/E CE/M.E 532 | Matrix Methods in Machine Learning        |
| COMP SCI 571 | Building User Interfaces                      |
| COMP SCI/ISY E/STAT 726 | Nonlinear Optimization I               |
| COMP SCI 744 | Big Data Systems                              |
| COMP SCI 762 | Advanced Deep Learning                        |
| COMP SCI 765 | Data Visualization                            |
| COMP SCI 784 | Foundations of Data Management                |
| COMP SCI 564 | Database Management Systems: Design and Implementation |
COMP SCI 764  Topics in Database Management Systems
COMP SCI 570  Introduction to Human-Computer Interaction
COMP SCI/ED PSYCH/PSYCH 770  Human-Computer Interaction
COMP SCI 540  Introduction to Artificial Intelligence
COMP SCI/ECE 760  Machine Learning
COMP SCI/ECE 761  Mathematical Foundations of Machine Learning
COMP SCI 769  Advanced Natural Language Processing
COMP SCI/I SYE/ECE 425  Introduction to Combinatorial Optimization
COMP SCI/I SYE/ECE 525  Linear Optimization
COMP SCI 642  Introduction to Information Security

Research Ethics Course 1-2
B M I 738  Ethics for Data Scientists
B M I 738 is recommended. If a student is unable to take B M I 738, one of the following courses may be substituted.
ONCOLOGY 715  Ethics in Science
BIOCHEM 729  Advanced Topics (Topic: Responsible Conduct of Research)
NURSING 802  Ethics and the Responsible Conduct of Research
SURG SCI 812  Research Ethics and Career Development
OBS&GYN 955  Responsible Conduct of Research for Biomedical Graduate Students
OBS&GYN 956  Advanced Responsible Conduct of Research for Biomedical Students

Professional Development Elective 1
B M I 800  Becoming a Biomedical Data Scientist

Research 4
B M I 699  Independent Study

Total Credits 30

Electives
Between the Concentration Electives and Data Science Electives, students must complete at least 6 credits of computer sciences-oriented courses and 6 credits of statistics-oriented courses. Computer sciences-oriented courses include those in the Department of Computer Sciences course listing (COMP SCI (http://guide.wisc.edu/courses/comp_sci/)). Statistics-oriented courses include those in the Department of Statistics course listing (STAT (http://guide.wisc.edu/courses/stat/)), in addition to B M I/POP HLTH 552 Regression Methods for Population Health and B M I/POP HLTH 651 Advanced Regression Methods for Population Health. A specific section of B M I 826 Special Topics in Biostatistics and Biomedical Informatics can satisfy as either a computer sciences-oriented course or a statistics-oriented course at the discretion of the MS Program Steering Committee.

POLICIES

GRADUATE SCHOOL POLICIES
The Graduate School’s Academic Policies and Procedures (https://grad.wisc.edu/acadpolicy/) provide essential information regarding general university policies. Program authority to set degree policies beyond the minimum required by the Graduate School lies with the degree program faculty. Policies set by the academic degree program can be found below.

MAJOR-SPECIFIC POLICIES

PRIOR COURSEWORK
Graduate Credits Earned at Other Institutions
With program approval, students are allowed to transfer no more than 9 credits of graduate coursework from other institutions. Coursework earned ten or more years prior to admission to a master’s degree is not allowed to satisfy requirements.

Undergraduate Credits Earned at Other Institutions or UW–Madison
Refer to the Graduate School: Transfer Credits for Prior Coursework (https://policy.wisc.edu/library/UW-1216/) policy.

Credits Earned as a Professional Student at UW–Madison (Law, Medicine, Pharmacy, and Veterinary careers)
Refer to the Graduate School: Transfer Credits for Prior Coursework (https://policy.wisc.edu/library/UW-1216/) policy.

Credits Earned as a University Special Student at UW–Madison
With program approval, students are allowed to transfer no more than 9 credits of course work numbered 300 or above taken as a UW–Madison University Special student. Coursework earned ten or more years prior to admission to a master’s degree is not allowed to satisfy requirements.

PROBATION
Refer to the Graduate School: Probation (https://policy.wisc.edu/library/UW-1217/) policy.

ADVISOR / COMMITTEE
All students are required to conduct a yearly progress report meeting with their advisor, scheduled by December 17 and completed by April 30.

CREDITS PER TERM ALLOWED
15 credits

TIME LIMITS
Refer to the Graduate School: Time Limits (https://policy.wisc.edu/library/UW-1221/) policy.

GRIEVANCES AND APPEALS
These resources may be helpful in addressing your concerns:
  • Bias or Hate Reporting (https://doso.students.wisc.edu/bias-or-hate-reporting/)
  • Graduate Assistantship Policies and Procedures (https://hr.wisc.edu/policies/gapp/#grievance-procedure)
biennially. It is the responsibility of each program to report research misconduct. For such reports refer to the hr.wisc.edu/policies/gapp/.

Biotechnology and Graduate Studies requires that each graduate program utilize the Assistants in TA, PA and/or RA appointments. Graduate Assistants will this policy does not apply to employment-related issues for Graduate "Research" tab of the SMPH because of such activity. Each program's grievance advisor is listed on the openly and shall not be subject to intimidation, discipline, or retaliation following these grievance procedures. Any student who discusses, about the treatment and to receive a prompt hearing of the grievance member, staff member, postdoc, or student has the right to complain because of such activity. Each program's grievance advisor is listed on the “Research” tab of the SMPH intranet (https://intranet.med.wisc.edu/).

Exclusions
This policy does not apply to employment-related issues for Graduate Assistants in TA, PA and/or RA appointments. Graduate Assistants will utilize the Graduate Assistantship Policies and Procedures (https://hr.wisc.edu/policies/gapp/) (GAPP) grievance process to resolve employment-related issues.

This policy does not apply to instances when a graduate student wishes to report research misconduct. For such reports refer to the UW-Madison Policy for Reporting Research Misconduct for Graduate Students and Postdoctoral Research Associates (https://research.wisc.edu/kb-article/?id=84924).

Requirements for Programs
The School of Medicine and Public Health Office of Basic Research, Biotechnology and Graduate Studies requires that each graduate program designate a grievance advisor, who should be a tenured faculty member, and will request the name of the grievance advisor annually. The program director will serve as the alternate grievance advisor in the event that the grievance advisor is named in the grievance. The program must notify students of the grievance advisor, including posting the grievance advisor’s name on the program's Guide page and handbook.

The grievance advisor or program director may be approached for possible grievances of all types. They will spearhead the grievance response process described below for issues specific to the graduate program, including but not limited to academic standing, progress to degree, professional activities, appropriate advising, and a program’s community standards. They will ensure students are advised on reporting procedures for other types of possible grievances and are supported throughout the reporting process. Resources (https://grad.wisc.edu/current-students/#reporting-incidents) on identifying and reporting other issues have been compiled by the Graduate School.

Procedures

1. The student is advised to initiate a written record containing dates, times, persons, and description of activities, and to update this record while completing the procedures described below.

2. If the student is comfortable doing so, efforts should be made to resolve complaints informally between individuals before pursuing a formal grievance.

3. Should a satisfactory resolution not be achieved, the student should contact the program’s grievance advisor or program director to discuss the complaint. The student may approach the grievance advisor or program director alone or with a UW-Madison faculty or staff member. The grievance advisor or program director should keep a record of contacts with regards to possible grievances. The first attempt is to help the student informally address the complaint prior to pursuing a formal grievance. The student is also encouraged to talk with their faculty advisor regarding concerns or difficulties.

4. If the issue is not resolved to the student’s satisfaction, the student may submit a formal grievance to the grievance advisor or program director in writing, within 60 calendar days from the date the grievant first became aware of, or should have become aware of with the exercise of reasonable diligence, the cause of the grievance. To the fullest extent possible, a grievance shall contain a clear and concise statement of the grievance and indicate the issue(s) involved, the relief sought, the date(s) the incident or violation took place, and any specific policy involved.

5. On receipt of a written grievance, the following steps will occur. The final step must be completed within 30 business days from the date the grievance was received. The program must store documentation of the grievance for seven years. Significant grievances that set a precedent may be stored indefinitely.

   a. The grievance advisor or program director will convene a faculty committee composed of at least three members to manage the grievance. Any faculty member involved in the grievance or who feels that they cannot be impartial may not participate in the committee. Committee composition should reflect diverse viewpoints within the program.

   b. The faculty committee, through the grievance advisor or program director, will obtain a written response from the person or persons toward whom the grievance is directed. The grievance advisor or program director will
inform this person that their response will be shared with the student filing the grievance.

c. The grievance advisor or program director will share the response with the student filing the grievance.

d. The faculty committee will make a decision regarding the grievance. The committee’s review shall be fair, impartial, and timely. The grievance advisor or program director will report on the action taken by the committee in writing to both the student and the person toward whom the grievance was directed.

6. If either party (the student or the person or persons toward whom the grievance is directed) is unsatisfied with the decision of the program’s faculty committee, the party may file a written appeal to the SMPH senior associate dean for basic research, biotechnology and graduate studies within 10 business days from the date of notification of the program’s faculty committee. The following steps will occur:

   a. The grievant will be notified in writing, within 5 business days of the written appeal, acknowledging receipt of the formal appeal and establishing a timeline for the review to be completed.

   b. The senior associate dean or their designee may request additional materials and/or arrange meetings with the grievant and/or others. If meetings occur, the senior associate dean or their designee will meet with both the grievant and the person or persons toward whom the grievance is directed.

   c. The senior associate dean or their designee will assemble an ad hoc committee of faculty from outside of the student’s graduate program and ask them to prepare a written recommendation on whether to uphold or reverse the decision of the program on the student’s initial grievance. The committee may request additional materials and/or arrange meetings with the grievant and/or others. If meetings occur, the committee will meet with both the grievant and the person or persons toward whom the grievance is directed.

   d. The senior associate dean or their designee will make a final decision within 20 business days of receipt of the committee’s recommendation.

   e. The SMPH Office of Basic Research, Biotechnology, and Graduate Studies must store documentation of the grievance for seven years. Grievances that set a precedent may be stored indefinitely.

7. The student may file an appeal of the School of Medicine and Public Health decision with the Graduate School. See the Grievances and Appeals section of the Graduate School’s Academic Policies and Procedures (https://grad.wisc.edu/documents/grievances-and-appeals/).

**Time Limits**

Steps in the grievance procedures must be initiated and completed within the designated time periods except when modified by mutual consent. If the student fails to initiate the next step in the grievance procedure within the designated time period, the grievance will be considered resolved by the decision at the last completed step.

**OTHER**

Funding guarantees are not provided for students in this program. Students are encouraged to explore funding options available across campus.

**PROFESSIONAL DEVELOPMENT**

**GRADUATE SCHOOL RESOURCES**

Take advantage of the Graduate School’s professional development resources (https://grad.wisc.edu/pd/) to build skills, thrive academically, and launch your career.

**LEARNING OUTCOMES**

1. Understand, apply, and evaluate common informatics theories, methods, and tools related to biological and biomedical problems, health care and public health.

2. Apply, adapt, and validate an existing approach to a specific biomedical and health problem.

3. Produce solutions that address academic or industrial needs using informatics tools and knowledge.

4. Evaluate the impact of biomedical informatics applications and interventions.

5. Understand the challenges and limitations of technological solutions.

6. Demonstrate scholarly oral and written presentations.

7. Adhere to the professional and legal standards of conduct in Biomedical Data Science.

**PEOPLE**

**Faculty:** Broman, Buchanan, Burnside, Chappell, Chen, Chung, Craven, Dewey, Doan, Dyer, Elwert, Gangnon, Gianola, Gitter, Keles, Kendziorski, Kim, Lu, Mao, Mumford, Newton (chair), Ong, Palta, Patel, Peissig, Rosa, Rosenberg, Roy, Singh, Sorkness, Tang, Yandell, Velten, Wang, Yu, Zhang, Zhu