Master of Science Program
Biological Data Science

Program Handbook

Fall 2020
Updated July 2020
Welcome to Arizona State University’s Master of Science program in Biological Data Science (BDS). We have designed this program to give our students a strong, inquiry-based foundation in the key areas needed in data science and its biological applications. Our program emphasizes real-world training at the interface of the natural and mathematical sciences. Students learn to manipulate "Big Data", including the generation and analysis of data using statistical and computational toolsets. Students will use their analytical skills in ecological, environmental, toxicological and other biological applications. The program incorporates multiple levels of experiential learning to ensure students gain critical-thinking skills on top of core competencies. Students will be ready to enter one of the fastest-growing job markets, work with consulting firms and government agencies as well as non-governmental organizations, or go on to seek advanced professional or graduate degrees.

This is a two-year full-time program that requires 32 credit hours. During the first year, the cohort will take 2 biology classes, 2 statistics classes, 1 class in each of math, databases and programming, laboratory experience, and manuscript development. The second year will focus on electives further exploring one of the foundation areas and the completion of a thesis or applied project under the supervision of an interdisciplinary team of 2-3 faculty (the thesis is highly recommended for students seeking admission to a doctoral program). We also encourage our students to attend major conferences in their desired areas to present research findings.

Arizona State University comprises sixteen colleges and schools spread across four campuses in the Phoenix, Arizona metropolitan area. The MS program in Biological Data Science is offered by the School of Mathematical and Natural Sciences, which is part of the New College of Interdisciplinary Arts and Sciences, and is housed on ASU’s West Campus in Glendale, AZ.

If you have any questions about our program, feel free to contact Dr. Karen Watanabe, interim director, at karen.watanabe@asu.edu.
# Table of Contents

Admission ........................................................................................................................................................... 4  
Tuition Costs and Financial Aid ......................................................................................................................... 4  
  Tuition .............................................................................................................................................. 4  
  Financial Aid ..................................................................................................................................... 4  
Curriculum and Graduation Requirements ...................................................................................................... 5  
  General Curriculum ......................................................................................................................... 5  
  Additional Curriculum Information ................................................................................................. 5  
  Approval for Credit taken Outside the Program ............................................................................ 6  
  Culminating Experience ................................................................................................................... 6  
  Approval to Register for Research and Culminating Experience Courses ................................ 7  
  Plan of Study .................................................................................................................................... 7  
  Continuous Enrollment ................................................................................................................... 8  
  Maximum Time Limit ....................................................................................................................... 8  
  Transfer Credit ................................................................................................................................... 8  
ASU Graduate College Policies.......................................................................................................................... 9  
Satisfactory Academic Progress Policy............................................................................................................. 9  
Student Code of Conduct.................................................................................................................................. 9  
Academic Integrity ........................................................................................................................................... 9  
Professional Ethics........................................................................................................................................... 10  
Mentoring ........................................................................................................................................................ 10  
Funding for Travel and Research .................................................................................................................... 10  
My ASU portal .................................................................................................................................................. 12  
University Resources ....................................................................................................................................... 13  
  New College/West Campus - Academic ....................................................................................... 13  
  New College/West Campus - Amenities......................................................................................... 13  
  University Services ......................................................................................................................... 13  
MS Program Faculty ........................................................................................................................................ 14
Admission

Admission to the MS program is only offered for the Fall semester. The program uses a rolling admission deadline and reviews applications as they are received. Applications are accepted online through the ASU Graduate College admission system. The application fee is $70.

Applicants must fulfill the requirements of both the Graduate College and the New College of Interdisciplinary Arts and Sciences. Please visit ASU Degree Search for details on application requirements and admission deadlines.

Tuition Costs and Financial Aid

Tuition
Tuition is set by ASU and the Arizona Board of Regents every year. You can see the general tuition and fees chart by clicking here, or calculate your specific tuition costs by visiting ASU's tuition calculator.

Financial Aid
Financial aid is available through several different sources:

1) **Graduate College Fellowship**: Each year a small number of $10,000 Graduate College Fellowships (GCF) may be awarded to continuing students and first-year students upon their admission. Applicants who have a FAFSA on file are automatically considered for this award and do not need to apply for it. The GCF is a need-based award and students who receive one are notified before the beginning of the fall semester.

2) **Merit Scholarship**: Depending on program funds, a small number of $2,000 merit scholarships may be available. Applicants are automatically considered for this scholarship and do not need to apply for it. Students who receive the scholarships are notified before the beginning of their first semester.

3) **Traditional Financial Aid** (Loans & Grants): For information on general financial aid products, please visit ASU's Financial Aid office (https://students.asu.edu/financialaid)

4) **Course Assistant Positions**: The availability of these positions may vary each academic year. These positions typically assist with undergraduate courses offered in SMNS. Courses are typically a full semester (15 weeks at 8 hours per week), and CAs are paid a fixed $2,000 stipend for each course. Although these positions are not guaranteed, most students who desire to serve as a CA have done so in one or more classes per year.

5) **Research Assistant Funding**: On occasion, faculty may have funds to hire Master’s-level students as research workers. These would typically be advanced (second-year) students who are involved in grant-funded projects.
Curriculum and Graduation Requirements

The training students receive spans statistics, computing, mathematics, and biology. It is expected that the culminating experiences will be interdisciplinary involving biology and at least one of the other data science areas. Thus, students should choose a lead advisor and committee members with expertise that reflect the interdisciplinarity of the thesis or project.

32 credit hours and a culminating experience:
- an applied project with an appropriate 593 course (e.g., ACO 593, BIO 593 or MAT 593), or
- a research thesis and public oral defense with an appropriate 599 course (e.g., ACO 599, BIO 599, or MAT 599)

General Curriculum

Required Core (12 credit hours)
ACO 501 Database Systems and Problem Solving in Python (3)
BIO 614 Biometry (4)
LSC 519 Applied Learning Lab (1)
LSC 547 Wet Laboratory Experience (1)
STP 560 Experimental Statistics in Biology (3)

Other Requirements (9 credit hours)
LSC 555 Integrative Biology I (3)
LSC 556 Integrative Biology II (3)
LSC 562 Applied Mathematics Techniques in Biology (3)

Electives or Research (5 credit hours)

Culminating Experience (6 credit hours)
ACO 593 Applied Project (6)
BIO 593 Applied Project (6)
MAT 593 Applied Project (6)
ACO 599 Thesis (6)
BIO 599 Thesis (6)
MAT 599 Thesis (6)

Additional Curriculum Information
Other requirements as well as elective and research coursework must be approved by the program director. Students should consult their faculty advisor, also known as the supervisory committee chair, and the BDS graduate staff advisor (NCGradAdvising@asu.edu) for the approved electives and research course list.
Approval for Credit taken Outside the Program
Before taking courses outside the program the student should confer with the Director of BDS to determine if the course is appropriate for inclusion on the iPOS. This will involve sharing the following with the Director of BDS:

- a brief description of why the course is relevant to your iPOS
- the course prefix and number
- the course title
- the course catalog description

In instances where this information is not substantial enough to make a determination regarding the course, the student may be asked to solicit and provide a sample syllabus from the course. Once the Director of BDS has approved the course, the student may enroll and include it in the iPOS.

Culminating Experience
Students choose one culminating experience option (either a research thesis or applied project) based on their emphasis area in biological data science.

Master’s Thesis
A Master’s Thesis is a written report of an empirical research project. The content and scope of the thesis research is to be approved by the student’s supervisory committee chair. The final thesis document must then be defended before the supervisory committee chair and two additional committee members. While Master’s-level projects are not expected to be fully independent of an advisor’s research, it is expected that each student will have made a substantive contribution to all aspects of the thesis research, and will be the sole author of the thesis document submitted to the committee for defense.

The general format of the thesis document is set by ASU and is somewhat different than a typical research report or paper. Thesis documents must be reviewed and approved by the university prior to final submission. See https://graduate.asu.edu/current-students/completing-your-degree/formatting-your-thesis-or-dissertation for formatting details and a template. Aside from the requirements set forth in the format manual, the thesis document should use APA style or a discipline-specific style, and generally include an introduction, methods section, results section, and discussion. It is to your benefit to work closely with your supervisory committee chair while writing the thesis document.

Once the thesis document is complete, it must be “defended” before a committee consisting of the student’s supervisory committee chair and two additional committee members. The student may choose the other two members of the committee with the approval of the supervisory committee chair. It is best to approach prospective committee members early in the process. Members of the thesis committee should be identified by the end of the first year in the program and approved by submitting the iPOS.

Thesis projects are typically started in the Fall semester of a student’s second year in the MS program. Projects must be defended several weeks before the end of the student’s final semester. A thesis defense is typically 1-2 hours long and involves a presentation followed by questioning by the thesis committee (the specific format for the defense is up to the supervisory committee chair). Thesis defenses are required to be open to the public and the dates/times/locations of defenses are listed on the ASU website.
At the conclusion of the defense, students will be asked to leave the room while the thesis committee deliberates. The committee is given the option to pass the student, fail the student, or pass the student pending some revisions to the thesis document.

The timeline for completing and defending a Master’s thesis project is dictated by ASU’s Graduate College office (see https://graduate.asu.edu/current-students/policies-forms-and-deadlines/graduation-deadlines for specific deadlines).

**Failure to meet these deadlines will delay graduation.** Further details about ASU’s thesis rules can be found in the Graduate Policies and Procedures Handbook at https://graduate.asu.edu/current-students/policies-forms-and-deadlines/policy-manuals.

**Applied Project**
An “Applied Project” is an alternative to a Master’s thesis. There are no specific rules about the scope or content of applied projects. Typically, an applied project is a research proposal, literature review, program analysis, or some other scholarly work that is supervised by a student’s faculty advisor. Applied Projects must be approved by a student’s supervisory committee chair and one additional faculty member by the end of the final exam period that concludes a student’s final semester in the program. Students should plan to submit their applied project document to the supervisory committee chair well in advance of this deadline.

**Approval to Register for Research and Culminating Experience Courses**
To be eligible to enroll in Research (592), the student must have:
- completed the online individualized instruction form at https://newcollege.asu.edu/advising/graduate/iiform
- a course permission override granted by the graduate staff advisor

To be eligible to enroll in Applied Project (593) or Thesis (599) the student must have:
- an up-to-date and approved iPOS on file
- an approved applied project or thesis proposal in the BDS Canvas proposal organization
- a course permission override granted by the graduate staff advisor

**Plan of Study**
In a graduate program, the specific courses that will count toward a student’s degree must be approved by the student’s faculty advisor, also known as the supervisory committee chair, and the BDS Program Director. The list of these courses is called a Plan or Program of Study (POS). The POS is filed online through the Interactive Plan of Study (iPOS) available through the student’s My ASU portal (see section below). The iPOS must be **complete and approved by the end of your first year** of the program. This means that students should have conversations with their supervisory committee chair about what courses the student will take during the second year. The iPOS can always change if student’s plans change or a new course appears that the student would rather take.

For assistance with filing the iPOS, the student should contact the supervisory committee chair, the graduate staff advisor at negradvising@asu.edu, and/or download the iPOS instruction manual. After the initial iPOS is submitted, the supervisory committee chair and program director will approve it. You can track the approval process online through your My ASU account.
When the BDS director and supervisory committee chair evaluate an iPOS, the program requirements described above will be confirmed. In addition, the following rules below will be verified:

1. No more than 6 credits received from non-SMNS faculty may count toward the degree (including transfer credits)
   - Note that requests to take outside courses are evaluated on a case-by-case basis according to student/faculty research interests. Just because one student is allowed to take a course does not mean that all students may take it.
2. You must maintain a 3.0 GPA to progress in the program and graduate
3. You must be enrolled in at least one credit during the semester in which you defend your thesis/project

All courses that appear on the iPOS are applied toward the student’s MS degree and are ineligible to be applied toward a future graduate degree. As such, it is recommended that a student list only the 32 credits required for the MS degree on your iPOS.

**Continuous Enrollment**

Once admitted to a graduate degree program, students must be registered for a minimum of one graduate credit hour during all phases of their graduate education (excluding summer – unless they plan to graduate in the summer). Graduate students planning to discontinue registration for a semester or more must submit a petition for a leave of absence through the iPOS. This request must be submitted and approved before the anticipated semester of non-registration. Students should contact their faculty and staff advisors as soon as possible if they will not be able to meet continuous enrollment.

**Maximum Time Limit**

All work toward a Master’s degree must be completed within six consecutive years.

**Transfer Credit**

Students may transfer up to 6 credit hours of coursework taken before beginning the program (referred to as pre-admission credits). Pre-admission credit hours must be approved by the degree program and the Graduate College office. Students are responsible for alerting their faculty and staff advisors that they plan on transferring in credits.

To qualify for pre-admission credits, the courses must meet specific criteria:
- Be graduate-level
- Have been taken within three years of admission to the ASU degree program.
- A grade of “B” or better must have been earned
- Must not have been used towards a previous degree
- Completed at a regionally accredited US institution or international institution officially recognized by that country.

Certain types of graduate credits cannot be transferred to ASU, such as courses taken at a non-collegiate institution, institutions that lack regional accreditation, for life experience, continuing education programs, workshops, etc. Students must officially transfer in pre-admission credit hours through the iPOS system for approval by the staff advisor, supervisory committee chair, program director, and the Graduate College office. Official transcripts from where the pre-admission credits were earned must be sent to Graduate Admission Services.
ASU Graduate College Policies

Being a part of ASU means that all students, regardless of program, are held to the same high standards of academic integrity and excellence. It is important that all students familiarize themselves with these polices.
https://graduate.asu.edu/current-students/policies-forms-and-deadlines/policy-manual

Satisfactory Academic Progress Policy

All graduate students are expected to make systematic progress toward completion of their degree. Students are responsible for verifying and tracking satisfactory progress policies as required by their degree program and Graduate College. If a student fails to satisfy the requirements, the student may be dismissed from his/her program based on the academic unit’s recommendation to Graduate College. These policies are detailed in the Graduate College Policies and Procedures Handbook: https://graduate.asu.edu/current-students/policies-forms-and-deadlines/policy-manuals

The MS Program also follows the New College Graduate Satisfactory Academic Progress Policy available on the MS Biological Data Science website.

Student Code of Conduct

All students are expected to adhere to the Arizona Board of Regents Student Code of Conduct and university policies and procedures: https://eoss.asu.edu/dos/srr/codeofconduct

Students are expected to regularly check their ASU email accounts for messages from the university and New College. Students also are expected to regularly check their My ASU priority tasks for messages and holds from the university. Students are responsible for managing their tuition payments, finances and tracking university academic calendar deadlines.

Academic Integrity

New College and the MS Biological Data Science program has a zero tolerance policy toward academic dishonesty that is enforced within every course and educational activity offered or sanctioned by the school. Any allegation of academic dishonesty will be referred to the school’s Office of Student Rights and Responsibilities for review and recommendation to the Dean of the school. If any student is found to have engaged in academic dishonesty in any form – including but not limited to cheating, plagiarizing and fabricating data – that student shall receive a grade of XE for the class and will be dismissed from the school. There are no exceptions. Please refer to the University’s Academic Integrity Policy for the full policy.

International students who violate academic integrity policies may be dismissed immediately. Being withdrawn from a degree program can have immediate consequences regarding visa status, and dismissed students are required to leave the country immediately per immigration and visa rules.
At the beginning of every MS Biological Data Science class, each student will be given a copy of the full academic integrity policy, along with accompanying information on plagiarism in their course syllabus. More detailed guidance on how to avoid plagiarism and fabrication, can be found at: https://ori.hhs.gov/avoiding-plagiarism-self-plagiarism-and-other-questionable-writing-practices-guide-ethical-writing

Professional Ethics

In addition to academic integrity commitments, students in the Biological Data Science MS program must abide by the highest levels of ethics. This includes following the core principles of the APA Code of Ethics, including conducting research ethically and independently, privacy and confidentiality, and record keeping.

Mentoring

Given the training model of our Thesis and Applied Project tracks, graduate students in those tracks should take advantage of the mentoring provided by his/her supervisory committee chair. Mentoring involves many activities, ranging from development of a course plan to meet one’s career goals, development of skills related to teaching and research and the provision of constructive feedback related to these domains, and consultation on professional issues and career development.

At a minimum, a graduate student should expect the following from his/her supervisory committee chair:

- development of goals/objectives for a specified time period
- availability for periodic meetings
- provision of regular and constructive feedback regarding student progress
- any other responsibilities stipulated by program policy or the Graduate Handbook

However, it is important to keep in mind that mentoring involves a relationship; thus, it is the responsibility of the graduate student to seek out these mentoring activities and to follow through in a timely fashion with any activities on which he/she and his/her supervisory committee chair agree. If problems arise in a student’s mentoring relationship or with any other faculty member, the graduate student should arrange a time to discuss the problem with the Program Director.

Funding for Travel and Research

As research is a core component of this program, we encourage our students to conduct and present research at national and international academic conferences. As such a number of options exist for funding research (e.g., participant payment, supplies, equipment) and conference travel expenses.
1) **MS Biological Data Science Program Funding.** The MS program makes approximately $700 in travel/research funding available, to be used over the course of the two-year program. Students may choose to use that money in one year or split it over the two years in the program. Contact interim Program Director, Dr. Karen Watanabe (karen.watanabe@asu.edu), with questions. At the end of each fiscal year, if we have surplus funds, the maximum amounts on each award (and per student total) will be increased for the following fiscal year. Additionally, you may be able to apply any unused funds toward travel expenses for doctoral program interviews. However, please note, that the Biological Data Science faculty expect students to utilize the allotted funds for conference travel and research (as it is unlikely that students will be interviewed by doctoral programs if they have not conducted and presented their research). As with the other funding requests, your advisor and BDS Director must approve, and you must explain why you have remaining funds for this type of request.

2) **ASU Graduate College Travel Grants.** ASU’s Graduate College makes a limited number of travel grants available to students presenting at conferences. These grants typically cover airfare from Phoenix to the conference location and conference registration. This award has four application deadlines per year and must be applied for well in advance of the travel date. Applications must be submitted to the director of the graduate program. See [https://graduate.asu.edu/current-students/funding-opportunities/awards-and-fellowships/travel-awards](https://graduate.asu.edu/current-students/funding-opportunities/awards-and-fellowships/travel-awards) for more information and deadlines.

3) **Graduate and Professional Student Association (GPSA) Travel Grants.** ASU’s graduate student association offers a variety of travel awards available. Individual travel awards (to conferences) are up to $950 and have a monthly application deadline. Group travel grants are for teams of student researchers presenting a symposium or other group project. Interview travel grants are need-based grants made available to students who require funds in order to travel to an academic interview (e.g., at a PhD program). Details and application materials can be found at [http://gpsa.asu.edu/funding](http://gpsa.asu.edu/funding). Priority for funding is often given to those who volunteer for the GPSA. Please note: The deadlines for these are often several months prior to the conference or PhD interview (i.e., in October) – you can still apply even if you do not know about your acceptance to a conference or invitation to interview.

4) **External Student Travel Funding from professional societies.** Some professional societies have free or discounted student memberships, and travel grants to present research at their conferences. Two such societies and travel links are the Society for Industrial and Applied Mathematics: [https://www.siam.org/Conferences/Travel-Support/SIAM-Student-Travel-Awards](https://www.siam.org/Conferences/Travel-Support/SIAM-Student-Travel-Awards) and the Society for Mathematical Biology: [https://www.smb.org/travel-grants/](https://www.smb.org/travel-grants/). Please consult your advisor to see if other professional societies might be more appropriate for your particular research area.

**Funding Priorities for Biological Data Science Program Fee Monies**  
*(not rank ordered)*

- Presenter at a professional conference
- Co-authorship on a conference presentation
- Thesis/Applied Project research expenses
- Doctoral program interview expenses (only if monies remaining after prior travel/research expense requests)
- Professional conference attendance only – not presenting *(no funding)*
My ASU portal

On your My ASU portal (my.asu.edu) you will find information about your courses, transcripts, transportation, student success and support, finances, university policies and the academic calendar. Please take time to familiarize yourself with these areas:

**Profile:** Update your address, phone number, email information, or add guests, such as a parent, so they can look FERPA-protected information including grades.

**My Classes:** Click on the name of each course to access the corresponding Canvas content. This is where you will see the syllabus, find links to readings and submit assignments. Take a few minutes to familiarize yourself with the structure of each course.

**Final Transcript:** If you sent in a transcript for admission to the program before you graduated, send your final transcript with your degree posted.

**Academic Integrity Module:** ASU Graduate College module reviewing academic integrity expectations. Please complete as soon as possible. Please note, this module explains the university-wide policy. The New College academic integrity policy includes additions specific to our students. Please be familiar with both policies.

**Academic Calendar:** This has important dates you need to monitor, including when classes begin, last day to register or drop/add classes, tuition and fee payment deadlines, holidays, withdrawal deadlines, schedule of classes available and when to enroll.

**Campus Services:** This includes Health and Wellness Resources, such as health insurance, counseling, disability services; Transportation, such as parking permits, METRO Light Rail, U-Pass and campus shuttles; Student Success and Support, such as disability services, tutoring and student success centers; and Job & Career Services. Please note these job resources are university-wide and not specific to the Biological Data Science MS program.
University Resources

There are a number of resources available in the program and through the university.

New College/West Campus - Academic
- Fletcher Library
- ASU Library
  - ASU Library now has an online tutorial version of "Library 501: What Grad Students Need to Know about the Library" workshop available for online students and anyone else for whom it might be useful. The Library 501 tutorial can be found on our tutorials page: https://lib.asu.edu/tutorials or at bit.ly/Library501Tutorial
  - Students can see the full slate of workshop offerings here: libguides.asu.edu/grad/workshops
- Graduate Academic Support Services – enrollment in-person (all campuses) and online includes no-cost writing assistance and statistics tutoring (most services free except for special sessions, refer to website for more details)
- Career & Professional Development Services – resource for finding jobs and internships, career advising, and more; online services available

New College/West Campus - Amenities
- Dining Options
- Banks
- Parking & Transit

University Services
- Student support:
  - International Student Services
  - Housing
  - Health Services
  - Counseling
    - Graduate Wellness Resources
    - 10 Best Practices in Graduate Student Wellbeing
  - Disability Resources
  - Veterans
  - Graduate and Professional Student Association (GPSA)
  - Educational Outreach & Student Services (Dean of Students Office)
  - Student Rights and Responsibilities
  - Graduate Student Diversity Resources
- Business and Finance services (e.g., parking and transit, student accounts, ID cards).
- Contact information
  - Provost’s Office
  - Graduate College
  - GPSA Outreach
  - IT Help Office
  - Emergency Services
MS Program Faculty

The MNS faculty listed at the BDS New College Graduate Advising website have projects with opportunities for BDS students. If you are interested in working with faculty member who is not listed here, send them an email inquiry about conducting research with them. You may also ask the BDS director to help with an introduction.