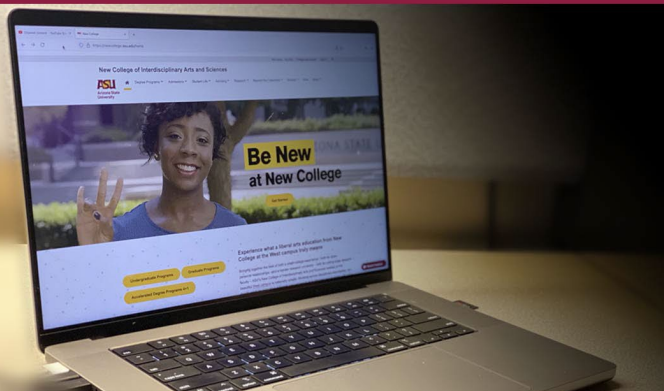




# Online Handbook Biological Data Science, MS



**ASU** New College  
of Interdisciplinary Arts and Sciences  
Arizona State University





Greetings!

Welcome to the New College of Interdisciplinary Arts and Sciences at Arizona State University.

Your acceptance into our graduate degree program is evidence of your past academic accomplishments and your future potential. It is both an honor and an indication of the hard work and dedication you have invested into your education. Congratulations! Chances are you probably have questions, answers for most of which you will find throughout this handbook. But there are at least two questions I want to address here. First, “for how long will New College be new?” New College will always be New! That’s because New is not measured on a stopwatch or even a calendar. New is a mindset to never settle for the status quo, but instead continue to push the bounds of knowledge and understanding.

The next most-often question I receive is, “what is Interdisciplinary?” The dictionary tells us interdisciplinary involves two or more disciplines. We put that in practice in New College by building degree programs that break down the silos between traditional academic disciplines. Your studies will likely include courses offered across our four unique schools.

Please know, starting a graduate degree program is a huge next step in your life – and I want you to know that throughout your journey with New College, all of us are ready to help you through every phase. If your schedule allows, I invite you to visit our beautiful campus at any point during your studies. Come meet your faculty and advisors. I would sincerely appreciate meeting you as well. Looking ahead, when you graduate, please consider joining us in person for commencement, convocation, and our special New College reception just for online students.

We are thrilled you have chosen New College to pursue your graduate degree and we commit to being here with you every step of the way.

Sincerely,

A handwritten signature in blue ink that reads "Todd R. Sandrin". The signature is fluid and cursive, with the first name being the most prominent.

Todd R. Sandrin, Ph.D.

Dean, [New College of Interdisciplinary Arts and Sciences](#)

Vice Provost, [West Valley campus](#)

Professor, [School of Mathematical and Natural Sciences](#)

Senior Global Futures Scientist - [Julie Ann Wrigley Global Futures Laboratory](#)



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# Overview

## ASU Charter

ASU is a comprehensive public research university, measured not by whom we exclude, but rather by whom we include and how they succeed; advancing research and discovery of public value; and assuming fundamental responsibility for the economic, social, cultural and overall health of the communities it serves.

Visit [ASU Charter, Mission and Goals](#) for more information.

## Diversity, Equity, and Inclusion

The New College of Interdisciplinary Arts and Sciences is guided by our commitment to fulfilling ASU's Charter. As a comprehensive public research university that measures itself not by whom it excludes, but by whom it includes and how they succeed; advancing research and discovery of public value; and assuming fundamental responsibility for the economic, social, cultural and overall health of the communities it serves, New College supports inclusive excellence in all forms and aims to foster a sense of belonging for all its students, staff and faculty. In New College, our commitment to access means that we strive to create an educational and work environment that is free from discrimination. Our unit and the University are deeply committed to building excellence, enhancing access, and having an impact on our communities, state, nation, and the world. This is actualized by our faculty and staff who engage in the advancement of knowledge with the most inclusive understanding possible of the issues that are addressed through our scholarly activities..

Find more information at [Graduate Student Diversity Resources](#); [Center for the Study of Race and Democracy](#)

## Welcome

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 21-month program that requires 32 credit hours. Upon completion of your coursework, you will complete two Capstone courses (6 hours total).

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 Valley Campus](#) in Phoenix, AZ and Online.

If you have any questions about our program, feel free to contact Dr. Jennifer Broatch, Director, at [jennifer.broatch@asu.edu](mailto:jennifer.broatch@asu.edu).

## Quick Facts

Program location: Online

Start terms (online): Fall A, Spring A

Time to completion: 21 Months

Schedule: Asynchronous

## Student Support & Academic Advising

The New College of Interdisciplinary Arts and Sciences has a team of Academic Success Advisors available to support you throughout your graduate career. Academic Success Advisors are available weekdays from 8 am - 5 pm MST. Contact us at 602-543-3000 or email [NCGradOnline@asu.edu](mailto:NCGradOnline@asu.edu).

Current students can schedule an appointment [here](#).

Although we typically provide same day responses, please allow up to 2 business days for an email response. If you have questions that are better suited for a verbal conversation please schedule an appointment with an Academic Success Advisor via your My ASU page.

## Program Handbook Archives

To review archived handbooks, please visit [New College Graduate Handbook Archives](#)

## My ASU Portal

On your My ASU portal you will find information about your courses, transcripts, transportation, student success and support, finances, university policies and the academic calendar. You can familiarize yourself [with these resources](#).

# Student Responsibility

As a graduate student, you're responsible for reviewing and adhering to all university, college, and graduate college policies and procedures.

- Review this program handbook and communicate with your academic success team about any questions.
- Review your [program website](#) to ensure you have information related to course registration and course sequencing.
- Check your ASU email daily and review all messages from your New College Graduate Student Services team.
- Monitor your My ASU account regarding your status, holds, action items and other important information to ensure you're on track for your degree.

# Admissions

## Application Requirements & Deadlines

Admissions to the MS Biological Data Science – Online is offered for the Fall A (August) and Spring A (January). Completed admission files are reviewed on a rolling basis. Admission decisions are typically made within five business days. Applicants are encouraged to apply early and have all application materials on file with ASU on or before any posted deadlines.

The Graduate College at ASU maintains a minimum requirement of admission to master's, certificate and doctoral programs. These minimum requirements can be reviewed on the [ASU Graduate Admission](#) site. Each degree program also establishes specific admission requirements. Please visit [ASU Degree Search](#) for details on application requirements. Applicants must fulfill the requirements of both the Graduate College and the New College of Interdisciplinary Arts and Sciences.

Application deadlines for online New College graduate degree programs can be found online [here](#).

Admissions Contact Information:

Future Students: [EnrollmentOnline@asu.edu](mailto:EnrollmentOnline@asu.edu)

Current Applicants: [ncgradadmissions.online@asu.edu](mailto:ncgradadmissions.online@asu.edu)

# Investment and Funding

## Tuition and Fees

All amounts shown in the Tuition and Fees Schedules or in other University publications or web pages represent tuition and fees as currently approved. However, Arizona State University reserves the right to increase or modify tuition and fees without prior notice, upon approval by the Arizona Board of Regents or as otherwise consistent with Board policy and to make such modifications applicable to students enrolled at ASU at that time as well as to incoming students.

To view current year tuition, program fees, other fees, please visit the [Tuition and Cost Calculator](#).

To view historical information about tuition and fees, please visit [Tuition and Fees Schedule](#).

## Financial Aid and Scholarship Services

For information on investing in your graduate degree visit [Financial Aid and Scholarship Services](#) online.

Current or incoming ASU Online students can call 24/7 at 855-278-5080.



# Program Requirements

## Degree Requirements

The MS Biological Data Science – Online requires 32 credit hours including 6 credit hours of culminating experience.

Visit [ASU Degree Search](#) for more information.

## Course Descriptions

### Required Core (12 credit hours):

**ACO 501: Database Systems and Problem Solving in Python (3):** Design and implementation of databases for scientific applications. Defining and querying database systems using the SQL industry standard language. Data exchange using XML. Programming in Python to solve realistic problems using scientific data.

**LSC 555: Integrative Biology I (3):** Provides a comprehensive understanding of the human genome, recent developments, next generation sequencing techniques including the preparation of DNA samples as well as principles of the new generation sequencing assay formats. Describes, critically evaluates and applies theoretical perspectives within genetic/genomic studies, develops and uses computational and mathematical tools and of the invaluable lines of inquiry these biomedical investigations may portend.

**LSC 556: Integrative Biology II (3):** Provides a survey of fundamental issues in organismal biology. Covers biological diversity, relationships between form and function, processes of growth and development in individuals and populations, biomes and organism-environment relationships, populations and ecosystem function. Weaves components of previous course work throughout this course where possible.

**LSC 562 Applied Mathematics Techniques in Biology (3):** Population dynamics, molecular interactions, population genetics, and other biological applications motivate the discrete and continuous mathematics. Studies mathematical techniques and applications representative of a range of applied mathematics topics. Incorporates computer software to help with visualization and numerical solutions of some of the problems.

### Other Requirements (11 credit hours):

**ACO 580: Intro to Python Programming for Problem Solving (pre-req for ACO 501) (3):** Structured practical experience in a professional program, supervised by a practitioner and/or faculty member with whom the student works closely.

**LSC 519: Applied Learning Lab (2):** Workshop-style course where students learn to use ASU's high-performance computing cluster, manipulate files from the Unix command line, and write scripts for the Unix shell and in R for data analysis. Students will be introduced to a variety of research areas in Biological Data Science and will review the requirements for their culminating experience. Additional topics include best practices for written and oral scientific communication.

**LSC 540: Statistics for Biological Data Science I (3):** Statistical concepts and fundamental methods applicable to biological data science. Emphasis is placed on the practical application to biological contexts and communication of results, using data science software such as R and/or Python. Statistical concepts and methodologies including hypothesis testing, confidence intervals, correlation, probability, analysis of variance, chi-squared tests and linear regression will be explored within biological and life science contexts.

**LSC 541: Statistics for Biological Data Science II (3):** This second course in statistics covers both classical and modern statistical tools for biological data analyses. The course is divided into five modules: (1) one and two-variable analysis; (2) multivariate analysis; (3) design of experiments (4) introduction of longitudinal and survival analysis.; (5) modern computer intensive analysis methods. For each statistical method, students will learn the rationale behind the method and how to implement the method using statistical software (primarily R and/or Python).

**Electives (3 credit hours – Select One Course):**

**FOR 540: Advanced Topics in Human Forensic DNA (3):** Examines the science of current forensic DNA typing methods by focusing on the technology behind STR, Y-STR and mtDNA typing, real-time PCR, serology tests, capillary electrophoresis, expert systems and statistics.

**LSC 598: Computational Toxicology (3):** This course provides instruction and hands-on experience with computational methods and tools that are needed for Toxicology in the 21st century. Topics include, but are not limited to (i) biologically based modeling such as quantitative adverse outcome pathways that span multiple scales of biological organization, and extrapolation of in vitro assay data from US EPA's Toxcast program to predict in vivo effects; (ii) probabilistic approaches in risk assessment, and (iii) model and data sharing.

**Culminating Experience (6 credit hours):**

**LSC 585: Capstone I in Biological Data Science (3):** Students bring together knowledge learned in required degree courses via a digital portfolio in a way that is meaningful and relevant to their professional goals. Each student must summarize current knowledge as it relates to a specific group project in the biological data sciences.

**LSC 586: Capstone II in Biological Data Science (3):** Students use their previously developed digital portfolio and apply this acquired knowledge in a culminating group project.

# Culminating Experience

## Summary of Culminating Experience

The MS Biological Data Science (Online) requires LSC 585 & LSC 586 Capstone I & II in Biological Data Science, 6 credit hours to satisfy the culminating experience requirement. The capstone will focus on work-based learning and projects that allow students to apply what they learned in classes to real-world problems.

## Capstone Course Eligibility and Registration

The capstone course is completed in a student's final semester of study. To be eligible for an override to enroll in the culminating experience a student must:

- Have an approved iPOS with no course errors
- Resolve all items listed under Priority Tasks affecting registration in the My ASU Portal
- Meet the minimum 3.00 GPA in each Plan of Study GPA, Overall Graduate GPA, Cumulative GPA.
  - If one or more of the GPAs is below the required minimum and can increase to a 3.00 with successful completion of the capstone, registration will be permitted.
- If a student becomes ineligible before the start of the culminating experience they will be removed from the course by New College Graduate Student Services.

Prior to registration a student who is issued an override will receive an email with the appropriate section line number. If a student does not meet eligibility requirements as outlined above they will need to contact [NCGradOnline@asu.edu](mailto:NCGradOnline@asu.edu).

## Capstone Course Completion

All MS Biological Data Science students must earn a "B" or better in each 3 credit hour section of LSC 585 & LSC 586 Capstone I & II in Biological Data Science.

The MS Biological Data Science program allows students a maximum of two graded attempts per course (letter grade A-E). Students who do not achieve a "B" or better in the second attempt of LSC 585 will not be allowed to register in LSC 586 and will be recommended for dismissal. If a student earns the required "B" in LSC 585 and does not earn a "B" or higher in the LSC 586 after two attempts they will be recommended for dismissal from the program.

Grades of Incomplete "I" or Withdrawal "W" in LSC 585 & LSC 586 do not indicate satisfactory academic progress. A student with three or more earned "I" or "W" grades (or a combination of "I" and "W" grades) may be recommended for dismissal.



# Graduation Requirements

Congratulations on nearing the completion of your master's degree. There are a few administrative items that need your attention:

- 1) Ensure you have an approved and up-to-date iPOS on file.
- 2) [Apply for graduation](#) via My ASU

**Applying for graduation and registering to attend in-person graduation ceremonies are separate but related issues.** Applying and paying your graduation fee ensures that your degree will be processed after coursework is complete and certification of your degree is issued. Registering for attendance at ceremonies ensures that seating will be made available for you and your guests for the event(s) you will attend. It also ensures tickets will be reserved for those events that require tickets.

## Ceremonies

There are a variety of opportunities to celebrate this milestone. Two of the most popular ceremonies are Commencement (ASU ceremony) and Convocation (College ceremony).

**Commencement:** Commencement ceremonies are the official graduation events for the university. During the university's graduate Commencement, President Crow confers degrees on all ASU graduate students (master's and doctoral candidates).

- **Master's degree candidates** will be hooded at Graduate Commencement, but will **NOT** be called individually to cross the stage.
- **Doctoral candidates** will be hooded at Graduate Commencement, have their names called and cross the stage individually to receive congratulations.

**Convocation:** Convocation ceremonies celebrate graduating New College of Interdisciplinary Arts and Sciences students and their achievements. During Convocation, New College of Interdisciplinary Arts and Sciences **graduates are individually recognized** for their academic achievement, including crossing the stage while their name is read.

## Register to Attend an Event

All ASU graduation ceremonies require reservations (RSVPs) from graduating students who wish to participate. Attendance is not mandatory or you may elect to attend one or more ceremonies.

[Register to Attend Commencement](#)

[Register to Attend New College Convocation](#)

Summer graduates completing coursework in August may opt to participate in ceremonies the May prior to course completion or the December following course completion.

# Program Leadership & Faculty

## Program Director



Dr. Jennifer Broatch is the Program Director for the West Valley campus and online MS in Biological Data Science programs. More information on Dr. Broatch is [available here](#).

## Program Faculty

The Arizona State University faculty is at the forefront nationally in advancing research and discovery. Our more than 4,700 faculty members inspire new ways of thinking, innovating and solving problems socially, culturally and economically in our region and in the international community.

We aspire to create an accessible academic experience and attract faculty not bound by traditional disciplinary distinctions, but who embrace an inclusive, collaborative and entrepreneurial environment defined by excellence and impact.

Mathematical and Natural Sciences Faculty information can be found [here](#).

# Degree Progress

## Registration and Course Selection

Students will register for classes each semester via My ASU and use their course sequence or approved iPOS as a guide for registration. The schedule of classes is available [here](#).

The recommended course sequence varies slightly for each admit term and can be viewed online at the MS Biological Data Science (Online) [advising website](#). It is important to consider your personal and professional commitments when you select a completion timeline. Summer registration may be required for students based on the required course sequence.

## Continuous Enrollment Policy

To remain active at ASU graduate students must be continuously registered for a minimum of 1 graduate credit hour in every fall and spring semester.

Students who fail to enroll in any semester (not including summer) will be dropped automatically by the ASU Graduate College and have to re-apply and be re-admitted to continue working towards the degree.

Please review the Registration and Course Selection above. Depending on course availability, some programs may require summer registration.

## Drop/Add Withdrawal

The [ASU Academic Calendar](#) lists specific dates and deadlines for each semester. Exceptions to published dates are rare and made on a case-by-case basis.

## Request Leave of Absence

Students can apply for a formal waiver of the continuous enrollment requirement or a leave of absence (up to 2 semesters). These must be submitted via the iPOS in My ASU and approved by the student success team, program director, and the Graduate College prior to the semester for which the waiver or leave is requested.

## Medical or Compassionate Withdrawal

A [medical or compassionate withdrawal request](#) may be made in extraordinary cases in which serious illness or injury (medical) or another extraordinary personal situation such as a death in the family (compassionate) prevents a student from continuing their classes and incompletes or other arrangements with the instructors are not possible.

For information on the New College Medical/Compassionate Withdrawal policy and procedures, students should visit <https://newcollege.asu.edu/advising/medical-compassionate-withdrawal>.



# Interactive Plan of Study (iPOS)

## What is the Interactive Plan of Study (iPOS)?

The Interactive Plan of Study (iPOS) functions as an agreement between the student, the academic unit, and the ASU Graduate College. It will support you as you make progress toward your degree requirements. ([Learn More](#))

The iPOS allows you to plan for your course load, can guide registration each term, and provides an anticipated timeline for degree completion.

## How do I select courses for my iPOS?

At the time of admission students in the MS Biological Data Science (Online) program are provided with a recommended sequence of courses that can be completed within 21 months. It is expected that students take coursework in Fall, Spring, and Summer.

The recommended course sequence varies slightly for each admit term and can be viewed online at the MS Biological Data Science (Online) [advising website](#). It is important to consider your personal and professional commitments when you select a completion timeline.

Failure to follow the provided course sequence may delay time to degree completion. It is the responsibility of the student to communicate with the academic success team at [ncgradonline@asu.edu](mailto:ncgradonline@asu.edu) if there are any challenges with the assigned course sequence.

## How to create an iPOS

To access the iPOS: Login to [My ASU](#). From the My Programs box, under the Programs tab, select iPOS. Select Graduate Interactive Plan of Study (iPOS). Note: Pop up blockers may need to be turned off.

You will find instructions for submitting the iPOS in the downloadable [how-to guide](#).

All of the information you need to submit your iPOS including course requirements by semester, faculty advisor, and anticipated graduation term are available on the course sequence on [advising website](#).

## When do I file my iPOS?

We encourage students to file their iPOS as soon as possible (the iPOS is available to students 30 days prior to the start of their first semester). It helps our team to monitor progress and provides you with the information you need for registration each term.

An advising hold will be placed on your account if you do not have your iPOS filed by the end of your first semester.

## Can I update my iPOS?

Yes! Once approved, the iPOS can be updated to accommodate changings in your course selection.

# Academic Progress

## Satisfactory Academic Progress

This policy applies to all graduate students in the New College of Interdisciplinary Arts & Sciences. All graduate students are expected to make systematic progress toward the completion of their degree. In order to remain in good standing in the New College of Interdisciplinary Arts & Sciences (NCIAS), students must maintain satisfactory academic progress. This document sets forth the standards for “satisfactory academic progress” and “good standing” and explains the consequences of not meeting these standards.

Review the complete policy and performance requirements [here](#).

## Academic (grade) Grievance Policy

The New College of Interdisciplinary Arts & Sciences requires that any student seeking to appeal a grade must follow the Academic (grade) Grievance Policy.

Review the complete policy and steps located in the “Graduate policies” section of the New College Academic Catalog policies located [here](#).

# Student Code of Conduct and Academic Integrity

## Student Code of Conduct

All students are expected to adhere to the [Arizona Board of Regents Student Code of Conduct](#).

## Academic Integrity

The highest standards of [academic integrity](#) and compliance with the university’s [Student Code of Conduct](#) and [Academic Integrity Student Policy](#) are expected of all graduate students in academic coursework and research activities. The failure of any graduate student to uphold these standards may result in serious consequences including suspension or expulsion from the university and/or other sanctions as specified in the academic integrity policies of individual colleges as well as the university.

For more information please visit: the [Graduate College’s Policies, Forms, and Deadlines](#) and [Maintaining Academic and Research Integrity](#).

# Resources

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

## Academic and Professional Services

- [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 the tutorials page under "[Other Tutorials](#)".
- [Career & Professional Development Services](#) – resource for finding jobs and internships, career advising, and more; online services available.
- Resources for ASU Online students through the ASU Library are available [here](#).

## Student Support Services

- [Counseling](#)
  - [Graduate Student Wellness Resources](#)
  - [Graduate Student Wellbeing](#)
  - [360 Life Services](#): This resource gives students access to experts who can answer financial questions, provide legal advice, offer clinical or personal care, and provide career advice 24/7
- [Educational Outreach & Student Services \(Dean of Students Office\)](#)
- [Graduate Student Diversity Resources](#)
- [Graduate Academic Support Services](#) – in-person (all campuses) and online, no-cost writing and statistics tutoring (most services are free except for special sessions, refer to the website for more details).
- [Health](#)
- [ID Cards](#)
- [International Student Services Center \(ISSC\)](#)
- [Sexual Violence Awareness, Prevention and Response \(Title IX\)](#)
- [Statistics and Methods \(SAM\) Lab](#)
- [Student Accessibility and Inclusive Learning Services \(SAILS\)](#)
- [Student Rights and Responsibilities](#)
- [Veterans](#)

## University Contact Information

- [Emergency Services](#)
- [Graduate College](#)
- [GPSA Outreach](#)
- [Provost's Office](#)
- [Student Business Services](#)
- [University Technology Office/IT Help](#)





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