

# STUDENT HANDBOOK

Biostatistics

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Department of Biostatistics, Health  
Informatics & Data Sciences

University of Cincinnati  
College of Medicine  
2025-2026

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## Introduction

*Biostatistics* is a data science field concerned with the application of statistical reasoning in biomedical and public health research. Biostatisticians develop statistical methodologies that are tailored to address specific biomedical data analysis problems. Biostatisticians are also members of interdisciplinary biomedical research teams whose role is to ensure the optimal use of data to answer specific biomedical research questions.

*Bioinformatics* is an interdisciplinary field that develops methods and computational tools for understanding high-dimensional biomedical data. Bioinformatics combines computer science, statistics, mathematics, and engineering to manage, process, and analyze biomedical data. There are many overlaps between Biostatistics and Bioinformatics in terms of methodologies utilized and domains of application in biomedical research. However, Bioinformatics tends to be more focused on the analysis and interpretation of high-dimensional datasets such as genomics, proteomics, and metabolomics. Furthermore, Bioinformatics research objectives often involve the development of software tools that facilitate the management and analysis of large and complex datasets.

Both Biostatistics and Bioinformatics are integral parts of the new emerging field of Biomedical Data Sciences. Data Sciences in general is a field dedicated to the extraction of knowledge from data. In the context of biomedical and public health research, data sciences integrate traditional statistical reasoning with the technological and computational solutions needed to organize, integrate, and analyze relevant data. The research of biomedical and public health is increasingly becoming data-intensive and data-driven. The challenges and opportunities offered by accessing, managing, analyzing, and integrating datasets of diverse data types (exposure, health, behavioral, genomics, genetics, etc.) are captured by the term "Big Data". The graduate programs and research within our department reflect the rapidly increasing role that data sciences play in contemporary biomedical and public health research.

Current methodological research undertaken by Department faculty includes statistical methods for multiple hypothesis testing, statistical genetics, supervised and unsupervised Bayesian and machine learning methods for genomics data analysis, methods for disease early detection and biomarkers discovery, methods for next-generation sequencing data analysis, statistical geospatial modeling, integrative statistical models for Big Data, computational drug screening, and protein structure modeling. A few examples of interdisciplinary biomedical research projects that involve Department faculty are the study of predictive transcriptional signature for juvenile idiopathic arthritis, genomic determinants of kidney cancer, cancer treatment clinical trials, and numerous biomedical projects investigating gene-environment interactions.

This handbook serves as a supplement to the University of Cincinnati Graduate College Handbook. Students in the program are expected to reference both handbooks regularly.

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## Graduate College Policies (See more at [UC Graduate College Student Handbook](#))

### Time Limitations

The Board of Trustees stipulates that all degree requirements must be completed within a defined span of years starting from the date of matriculation into the degree program, regardless of whether students are full-time or part-time. **This time span is 5 years for Master's students and 9 years for PhD students.**

Under extenuating circumstances, a program may petition, on behalf of the student, for **extension of the time limit for attaining his or her degree**. Prior to the program petitioning the Graduate College for an extension, the student must communicate with the student's program advisor and/or director to review the student's degree completion to date and form a plan for degree completion. All this information should be included in a petition submitted to the Graduate College, which will review this petition and make a final decision.

Students who have not completed degree requirements by their time-to-degree limit are on inactive status regardless of course registration in each academic year. Such students are required to apply for an extension of their time-to-degree.

### Academic Misconduct

Academic misconduct or dishonesty is defined in the University of Cincinnati, Student Code of Conduct, and includes, but is not limited to, acts of cheating, plagiarism, falsification, and misappropriation of credit.

The [Student Code of Conduct](#) defines the behavior expected of all University of Cincinnati students. It is each student's responsibility to know and comply with the University's Student Code of Conduct. Disciplinary procedures are explained in a step-by-step manner, and the procedures for appeal of decisions are stated. Students within the Department of Biostatistics, Health Informatics and Data Sciences are required to adhere to this code.

### Minimum Academic Performance

Full-time graduate students will be registered for at least 10 graduate credits per semester. Students receiving a University Graduate Scholarship (UGS) must be registered for 12 graduate credit hours for each semester for which they are receiving support. **If a student is registered for at least one (1) graduate credit, he or she will maintain graduate student status throughout the entire academic year, fall through summer.** The Graduate College requires that a student must have an **aggregate grade point average (GPA) of at least 3.0** to obtain a graduate certificate or degree at the University of Cincinnati.

### Advanced Standing for Graduate Courses Taken Outside of UC

1. Programs are permitted to award up to one-third (1/3) of the credits of a UC graduate program through advanced standing (e.g. 10 credits are eligible in a 30-credit program or 13 credits in a 40-credit hour program). The relevant number of credits is based on the minimum credits required to earn the advanced degree starting from the minimum degree qualification (usually a baccalaureate degree). Note that for doctoral students the advanced standing credit total will include any use of the Ohio Department of Higher Education (ODHE) allowance of up to 30 credits for a prior master's degree.
2. Any graduate course credits, including those earned from previously earned graduate or undergraduate degrees, are eligible as advanced standing credits.
3. Advanced standing can only be offered for courses (including electives) entered in eCurriculum for the UC program.
4. Program faculty must evaluate courses for equivalence or comparability prior to granting students Advanced Standing credit for courses taken at another institution, meeting all the following criteria;
  - a. Courses taken at a recognized University or College

- b. Courses taken at the graduate level
  - c. Requested advanced standing credits must be the lower of the following two choices
    - i. Credits originally earned for the course
    - ii. Credits available in the UC course listed in e-curriculum
  - d. For 1:1 course equivalency, one or more of the following criteria must be met when compared to the University of Cincinnati course for which Advanced Standing credit is sought:
    - i. Course was taken in the same field with the same title
    - ii. Course had similar topics
    - iii. Course had similar learning outcomes
    - iv. Course assignment and assessment requirements were similar
    - v. Course readings requirements are similar
  - e. This evaluation process should be documented for each case in which it is applied
5. The one-third rule doesn't apply to dual degrees, sequential Masters to doctorate programs, or others with shared content that have received approval from the Graduate College.
  6. Advanced standing credit recommended by program faculty must first be approved by the graduate program director and then submitted for final review by the Graduate College to assure the request complies with the criteria above.

### **Transfer Credit for Graduate Courses Taken at UC**

1. When leaving one graduate degree program to join another at UC, all UC graduate credits taken as part of the incomplete degree are eligible for transfer to fulfill requirements in the new degree program, based on faculty evaluation of the equivalence to courses in the new curriculum and program approval. This same policy will also apply when a student who matriculated in an incomplete UC graduate certificate program matriculates into a graduate degree program.
2. When a non-matriculated student enters a graduate degree program at UC, non-matric UC graduate credits are eligible to be transferred toward obtaining the new degree, if the coursework is listed in the e-curriculum as part of the degree requirements. Subject to program approval, students may transfer up to 12 credits or one-third (1/3) of the credits required to earn their UC graduate degree (whichever is greater).

### **Minimum Registration**

To maintain graduate status at the University of Cincinnati, students must register at UC for **at least one graduate credit that contributes to degree requirements** (as determined by the graduate program) **in an academic year**. If the student is registered for at least one graduate credit, he/she will maintain graduate student status throughout the entire academic year, fall through summer. (Credits that are audited or in which a student receives a W or UW do not count toward the minimum credit requirement). A student whose status has automatically terminated because of failure to register during an academic year will no longer be considered a graduate student but may seek reinstatement (see Reinstatements). Also note that students must register for at least one graduate credit hour during each semester (excluding the summer semester) if they are using university resources such as libraries, university housing, campus laboratories, office space, equipment, recreational or computer facilities.

### **Full-Time Course Load**

Students must be registered for 10 or more graduate credits each semester to be considered full-time students, 12 if holding a university sponsored graduate assistantship or fellowship. Audit or undergraduate credits do not count toward full-time status and cannot be supported by a University Graduate Award.

### **Part-Time Course Load**

Students who can devote less than full time to graduate study may register for the number of graduate credits judged by their program advisors to represent the appropriate fraction of a fulltime load. However, doctoral students must satisfy the Board of Trustees residency requirement, which requires that they have one year of full-time study, which is defined as being enrolled for at least 10 graduate credits in their program in each of two semesters (including summer semester) during a span of three consecutive semesters. Full-time UC employees using their tuition remission benefit to complete a part-time doctoral program may request a waiver of this requirement from the Associate Dean of the Graduate College.

### **Reduced Course Load (International Students)**

Once an international student has finished all required course work and will no longer be enrolling full time, she/he may choose to enroll with a reduced course load. Visit the [F-1 Students page on the UC International Services website](#), referring to the “Enrolling part-time as a graduate student who has finished all course requirements” section for the link to the form and more information.

### **Grade Changes**

A change of grade is only appropriate for an I, an NG, an SP/UP, or an error made by the instructor. SP/UP grades must be converted to a final grade by the end of the following semester. Instructors may change an I or NG grade online in Catalyst for approximately one year (the interval extends from the initial grading semester to the last working day of the same term the following year). To request a change of grade for a non-research course for graduate credit after this period, or an F grade at any time, the instructor must do an official, paper change of grade form and forward it to the Director of the Graduate College along with a reason for requesting the grade change. The Director will approve or deny the request after consideration of the reason for the change.

Previously recorded grades may not be changed to W or I after the close of the term. Both I and W grades must be awarded while the course and semester are still in progress, and cannot be awarded retroactively. W reflects an official withdrawal that took place by the 58th calendar day of classes, and I indicates work remains to be completed and the student did not earn a final grade. Students cannot withdraw from a class retroactively or be given additional opportunities to seek a different final grade retroactively. If an F is in a non-required course or the required course has since been retaken for a passing grade, the Program Director at certification may request a waiver of the F grade from the Associate University Dean of the Graduate College.

Graduate students are not allowed to add or drop courses, credit hours, or change the level or grading type of a course (e.g. undergraduate to graduate course, audit to pass/fail, etc.) after students are no longer able to perform these actions themselves using the 35 Catalyst self-service tool. Deadline dates describing each term’s final opportunity for Catalyst self-service actions can be found on the Registrar’s website.

### **Leave of Absence**

Under special circumstances, graduate students may apply for a leave of absence from full-time study at the university for a specific period of up to one academic year. Assuming appropriate documentation is provided, the circumstances justifying a leave include but are not limited to personal or family medical conditions, call to active military duty, maternity leave, or death in the immediate family. The rationale must be documented by the applicant.

An approved leave of absence preserves the student’s status in his or her degree program, and the time off will not be counted against the time limits for awarding degrees. Consequently, registration is not required during the leave period. A leave may be renewed for up to one additional year. Renewal of a leave is subject to the approval of the program, college, and the Graduate College.

To apply for a leave of absence, a student must complete the [Request for Leave of Absence Form](#) and upload the appropriate documentation (e.g. doctor’s letter or military orders) through [GradTracker](#). The program will approve through [GradTracker](#) as well. Once the program has approved the request, the Director of the Graduate College will review the petition and if approved, the student and program will receive an email notification

through their UC email

Note: Students with financial aid or student loans should confer with the Financial Aid Office prior to requesting a leave of absence to ascertain the consequences of a leave on their loan status. Students should also be aware that any scholarships or assistantships are not guaranteed to be available when a student returns from a leave of absence.

### **Withdrawal from the Program**

Students must notify the department graduate program office in writing regarding their intent to withdraw from their programs.

### **Dismissal from Program**

Students must consult with individual programs concerning dismissal policies. If a program dismisses a student, the program must copy the Graduate Admissions Program Manager on the notification to the student.

### **Residency (PhD students only)**

**Prior to admission to doctoral candidacy**, all doctoral students shall complete a residency requirement by enrolling in **10 graduate credit hours (12 if funded by a Graduate Assistantship)** per semester **for TWO out of three consecutive semesters of study (including summer)**. Part-time students are not exempt from enrollment requirements to achieve residency. However, full-time UC employees using their tuition remission benefit to complete a part-time doctoral program may request a waiver of this requirement from the Associate Dean of the Graduate College.

### **174 Graduate Credit Rule**

**Students receiving any university award (e.g. UGA stipend, GS tuition scholarship) and students who receive funds from the State of Ohio are governed by the requirements and limitations described in the following paragraphs.** Any student who becomes ineligible to receive state subsidy is not eligible to receive general funds financial aid (i.e., a university stipend and/or tuition). Since this policy is due to regulations governing state support of the university, exceptions to the policy are not considered. Graduate students who have attempted 174 graduate credit hours at the University of Cincinnati are not eligible for a university award for enrollment at or beyond the 174 hours. Hours attempted include hours for which credit has been awarded, as well as withdrawn courses, audited courses, and hours in progress or incomplete (these graduate credit hours include all courses with grades F, I, UW, SP, IP, UP, W, etc.). All graduate hours attempted at the University of Cincinnati, regardless of program or student status, count toward the 174 total. A student is not eligible for funding beginning with the semester in which said student will reach the 174 attempted hours. For example, if a student has earned 167 graduate credit hours at the University of Cincinnati by the close of summer sessions and registers for (i.e., attempts) 12 credit hours for fall semester, they are ineligible for a university graduate scholarship or fellowship in the fall semester.

If a student earned master's credits at the University of Cincinnati (for either a partial or a full degree), the exact number of these credits are deducted from the 174 credit hour total for which they can receive funding. This is true if the credits are earned at an earlier time and the student returns to the University of Cincinnati to continue graduate education, and it is true regardless of the discipline in which those credits were earned. For example, if a student has earned a master's degree in engineering and then chooses to pursue a master's and a doctoral degree in math, the credits earned to get the engineering degree are deducted from the 174 credit hours for which the student can receive state financial support (e.g., fellowships, assistantships, and scholarships).

Graduate students who have earned a master's degree or other equivalent or higher advanced degree at another institution are not eligible for a university scholarship or fellowship once they have attempted 140 graduate credit hours at the University of Cincinnati. If a student enters the University of Cincinnati with a master's degree from any institution other than the University of Cincinnati, they are credited with 34 graduate credit hours toward the 174 credit hour limit for state funding eligibility. Per Ohio Department of Higher Education policy,

Ohio can subsidize up to the remaining 140 credit hours. The 34 credit hours are deducted from the 174, regardless of the discipline and regardless of the graduate level at which the student enters the University of Cincinnati. For example, if a student has earned a master's degree in engineering at The Ohio State University and then chooses to pursue a master's and a doctoral degree in math at UC, the credits they earned to get their engineering degree are deducted from the 174 credit hours for which they can receive state financial support in the math program. Note that professional degrees, like a juris doctorate or medical doctorate, do not count as a master's or higher equivalent for the purpose of comparative funding. Students who enter graduate education at the University of Cincinnati with a professional degree and no other advanced degrees are still eligible to receive up to the 174 credit hours of funding. If a student enters the University of Cincinnati with only partial credit toward a degree from another institution, those credits are not deducted from the 174 total—even if the program they enter at the University of Cincinnati agrees to accept transfer of those credits toward the student's degree requirements at the University of Cincinnati. The student can still receive state subsidy for up to 174 credit hours earned at the University of Cincinnati beyond those transferred in.

**Note:** For the purposes of this policy, a master's degree is one awarded by an American institution or a degree of equivalent value from a foreign institution. Students holding a master's degree from a foreign institution that is the equivalent of a bachelor's degree in the U.S. will have the higher limit (174). The higher limit will not be affected by a student's completion of course work short of a master's degree at another institution.

## Department Policies (for MS and PhD)

### Language Requirement

This requirement is for PhD students and those who are going to be **Teaching Assistants**. All students who do not have English as a first language must take the English proficiency examination administered by the University by the end of their first academic semester ([OEPT Requirements](#)) or in the case of Teaching Assistants, before their assistantship starts. In case of failure, the student may take the examination again after an academic semester has elapsed, for a total of two (2) attempts per year. In any case, the student will not be awarded a degree until the examination is passed. The Department policy on language holds that all students speak English when communicating with faculty, staff, and other students. The overwhelming majority of scientific literature is communicated in English, so it is to the individual's benefit to become well-equipped to convey scientific studies by speaking and writing in the English language.

### Course Waiver

Course waivers do not reduce the total number of credit hours required for your program. You must still fulfill the full credit hour requirement as specified in your curriculum guide in order to graduate.

**If a course is waived, it must be replaced with an alternative didactic course, not with research credits.**

**Requests to waive core required courses must include a completed course waiver form and be supported by clear justification along with appropriate documentation (e.g., official transcripts, course descriptions). Approved waivers must be substituted with a course at an equivalent or higher level within the same field of study.**

### University of Cincinnati Institutional Review Board (IRB)

All human research projects must be submitted to and approved by the University of Cincinnati Institutional Review Board (IRB). Projects originating in and/or involving other institutions (e.g., Children's Hospital) must also have approval of that IRB. Other permissions may apply (e.g., animal care, radiation safety).

## Master of Science - Biostatistics

The Master of Science (M.S.) in Biostatistics degree is designed to provide graduate-level training in the application and theory of biostatistics. The target audiences for this program include individuals who desire careers as collaborative biostatisticians in the basic, clinical, translational, or population sciences. MS students will have opportunities to work with real-world applications under the supervision of experienced faculty.

### Advisor and Course of Study

Students will first work with the Program Director for their course of study. If appropriate, a different advisor may be requested at a later date. In the event of a change in advisor, the student shall send a communication to the Graduate Program Office (GPO) that includes the signatures of the assigned and proposed advisor and the Program Director indicating concurrence. The course of study for the M.S. degree will be planned in consultation with the student's advisor. The student's program is subject to approval by the program faculty and must show a reasonable degree of concentration on interrelated subjects.

### Credit Hours

To graduate with a M.S. Degree from the Department, students must complete a minimum of **30 graduate credit hours (including Thesis research)**. In addition to the successful completion of coursework, a thesis based on laboratory, field, or clinical research is required for the M.S. degree. Students must complete **a minimum of 2 thesis credit hours (BDS-7091 or previously ENV-7091)**.

### Research Credit

**Students registering for research credits must obtain approval from their research mentor and Program Director prior to registering for research credits.** The Research Credit Pre-Approval Form (available on Canvas: Biostatistics Student Community) must be filed in the Graduate Program Office (GPO), before registration.

***Students are responsible*** for documenting their work during the semester in which they are registered for research credits. Before a grade can be assigned, a progress report and/or other meaningful products resulting from the student's work must be presented to the research mentor (e.g., meeting abstract, poster, manuscript). Students must also submit a **Research Credit Verification form** (available on Canvas: Biostatistics Student Community), signed by their research mentor and Program Director before the end of the semester in order to receive a passing grade. Verification forms can also be submitted in the GPO. ***The research mentor is responsible*** for evaluating the student's work and providing an appropriate grade at the conclusion of the academic semester.

### Thesis Advisor Committee

Students must fill out the departmental **Proposed Thesis/Dissertation Committee Request form** to the Office of Graduate Program before their first Thesis Committee meeting. Students must select their Thesis Advisory Committee according to the Graduate College. They are to be composed of **at least two full-time faculty members with professorial rank, at least one of whom is a member of the All-University Graduate Faculty**. In addition, the Chair of the committee must be part of the Biostatistics and Bioinformatics Division. Typically, the Thesis advisor is the Chair of the Thesis Advisory Committee. The advisor may act as chair, convener, and voting member of the Thesis Advisory Committee. The final judgment on the acceptability of the Thesis will be made by this Committee, by a unanimous vote if there are only two members, or else with no more than one dissenting vote.

## M.S. Thesis

The M.S. Thesis is intended to demonstrate the student's ability to communicate and evaluate critically. The Thesis needs to be the result of independent research. Information concerning the Thesis form, submission deadline dates, and the mechanics of preparing the final draft and abstract can be located at the [ETD website](#)

### 1. Thesis Research

- a. Thesis research may be part of the ongoing work of the Thesis laboratory but must be separately identifiable. The Thesis research should reflect advisor guidance but mainly be the independent work of the student.
- b. It is the responsibility of the student and the faculty advisor to see that a Thesis Committee is formed and that the research plan is finalized. The Thesis Committee must confirm that the student's work is not, to a large extent, carried out by technical assistants or other personnel.
- c. **A Thesis may be written in the form of a publishable research paper**, conforming to the publication guidelines of the student's journal of choice (e.g., *JASA*, *Biometrics*, *JAMA*, *Pediatrics*, *AJE*, etc.). This option must be approved by the student's Thesis Advisor and Thesis Committee. The research must be conducted while the student is enrolled in the program and **the student must be the first author of the manuscript. The manuscript should not be submitted for publication until approval by the Thesis Committee.** The student must place an embargo on the Thesis prior to submission of his or her manuscript for publication (see section 5 for further instructions).
- d. In agreement with the function of the Thesis Committee, as specified by the rules of the University of Cincinnati Graduate College, any decisions about the quantity and quality of the work done are the responsibility of the Thesis Committee.
- e. After the student leaves the University the Thesis research results may be used as the basis for continuing investigations by the student and/or by the laboratory in which the Thesis research was done. The student and the laboratory are entitled to retain copies of the data and analyses for their use.

### 2. Policy for External Thesis Research for Master's Degree Program.

Thesis research outside the department requires careful coordination between the department and the collaborating institution. There are circumstances where it is in the interest of the student, the department, and an outside laboratory of academic stature, such as elsewhere in the University, or at a Federal Agency, to permit the pursuit of graduate Thesis research outside the department. The requirements of external Thesis research are:

- a. A departmental faculty advisor who has expertise in the field of Thesis research;
- b. Appointment of the external supervisor to the Thesis Committee;
- c. An explicit understanding that, as in the case for Thesis research carried out within the department, every effort will be made to ensure that the Thesis research, when initiated, will be supported to its conclusion;
- d. Adherence to the same rules and governance procedures used for Thesis research within the department. These include the clear understanding that the results are available for publication as a Thesis and in the open literature, and it is the responsibility of the Thesis Advisory Committee to make final decisions about the direction and extent of work. Attention is also drawn to the requirement that the Thesis Advisory Committee meet at least twice each year;

### 3. **Guidance on UC Medical IRB Review of Graduate Student Activities that involve Human Subjects Research.**

- a. Refer to the [Office of Research Human Research Protection Program](#) website for information regarding IRB Review.

### 4. **Embargo of Thesis**

You can request an embargo be placed on your thesis for two years initially, with the option of extending the embargo for a third year. An embargo is simply a hold on publishing your thesis in OhioLINK. If you plan to submit your thesis in part or whole for publication it is vital that you embargo your work for a period of time. Some journals still consider a thesis that is published on the internet a “publication.” To avoid the fact or appearance of a “duplicate” publication it is important to embargo your document. You request an embargo electronically when you upload your thesis for final approval by your chairperson. As a further protection, you should acknowledge in any submitted manuscripts based upon your graduate research that the work was completed in partial fulfillment of the requirements for the MS in biostatistics. See your advisor if you have any questions regarding the embargo of your work.

### 5. **Submitting your Thesis**

The University of Cincinnati Electronic Thesis or Dissertation ([ETD website](#)) has all the details you need to submit your final thesis. In short, you will need to submit your full thesis in PDF form to OhioLINK following the directions on the ETD website, along with a scanned PDF of your fully signed Committee Approval form. If you publish part or all of your thesis, you should add the following acknowledgment to your publication: **“This work was completed in partial fulfillment of the Master of Science degree in Biostatistics in the Department of Biostatistics, Health Informatics & Data Sciences, University of Cincinnati College of Medicine”**. The advisor must approve a thesis after it is uploaded to ETD, so the student should submit early to allow the advisor time to submit approval.

## Master of Science Biostatistics Curriculum

(Course descriptions available on the [Course Catalog](#))

Course Number	Course Title	Credits	Required or Elective	Semester Offered
<b>MS Biostatistics Core Courses: 18 credit hours</b>		<i>ALL semester course offerings are subject to change</i>		
BDS 7024	Computational Statistics	3	Required	Spring
BDS 7088	Regression Analysis	3	Required	Spring
BDS 7089	Experimental Design	3	Required	Fall
BDS 8029	Biostatistics Seminar <b>(2 semesters)</b>	2	Required	Fall/Spring
GNTD 7003	Ethics in Research	1	Required	Spring
STAT 6021	Mathematical Statistics I	3	Required	Fall
STAT 6022	Mathematical Statistics II	3	Required	Spring
<b>Biostatistics Credits: 3 credit hours</b>			Required	
<b>Select one course from the list below</b>				
BDS 7026	General Linear Models	3		Spring (varies)
BDS 7090C	Applied Survival Analysis	3		Spring (Odd year)
BDS 7091	Applied Multivariate Analysis	3		Spring (Even year)
<b>Biomedical Credits: 3 credit hours</b>			Required	
<b>Select a minimum of 3 credit hours from the list below</b>				
BE 7076	Introduction to Epidemiology	3		Fall/Spring
CB 8080	Cancer Biology & Therapeutics	4		Spring
GNTD 7001	Principles of Molecular and Cellular Biology	1-4		Fall
GNTD 8001C	Introduction to Functional Genomics	3		Fall
MCP 6031C	Computational Systems Biology	2		Spring
TOX 7082	Survey of Toxicology	2		Spring
<b>Research Credits: 2 credit hours - Research Pre-Approval Form &amp; Advisor Meeting Required for Permission to Enroll</b>				
BDS 7091	Master's Thesis Research	2	Required	Fall/Spring/Summer
<b>Free Electives: ≥ 4 credit hours - Select remaining credits from Course Catalog List</b>				
BDS6XXX+; BE6XXX+; BMIN6XXX+; CB6XXX+; CS6XXX+; EECE6XXX+; ENV6XXX+; GNTD6XXX+; MATH6XXX+; STAT6XXX+; MCP6XXX+; TOX6XXX+  Students are required to complete 4 credit hours or more of Free Electives from the Course Catalog List with assistance from their advisor.		4	Elective	
			Elective	
			Elective	
			Elective	
			Elective	
			Elective	
<b>Total Credits</b>		<b>30</b>		
<ul style="list-style-type: none"> <li>▪ <b>3.0 GPA (B average) or higher required for graduation.</b></li> <li>▪ <b>All required courses must be completed with a B- or higher.</b></li> <li>▪ "I" (Incomplete) or "NG" (Not Graded) grades must be removed from academic record prior to applying for graduation.</li> <li>▪ Students must take a minimum of one graduate credit that contributes to degree requirements per academic year (fall-summer) to maintain active status.</li> <li>▪ All requirements for the master's degree must be completed within five consecutive academic years of the date of matriculation into the program.</li> <li>▪ Students are expected to meet with their advisor at least once a semester to discuss their academic progress.</li> <li>▪ Electives must be determined with a consultation from your advisor.</li> </ul>				

## M.S. Degree Graduation Checklist

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- English Proficiency requirement met for international students (OEPT must be taken by the end of your first academic year). Letter attesting to satisfactorily completed OEPT submitted by examiner to program director and Graduate Program Office (GPO).
  
- Coursework required for M.S. Degree completed satisfactorily, and all grades from previous terms have been confirmed (no outstanding "I" or "NG" grades). Academic status confirmed with the program director or program office.
  
- If applicable, all necessary IRB approvals have been obtained.
  
- Propose M.S. Thesis committee members submitted to Graduate Program Office.
  
- After M.S. Thesis committee is formed, you should meet regularly with your Committee members to discuss progress, questions, and keep on a timeline for completion.
  - Enroll in the MS Thesis Research Credit (at least 2 credit hours)
  
- Complete "On-Line Graduation Application" on the [Graduate College](#) page. Graduation paperwork filed with GPO and University Officials (see official dates in GPO).
  
- Thesis preparation: You should give the draft to your Thesis committee members **at least one month** and your final Thesis to committee members **at least two weeks** before the deadline on the [Graduate College](#) page to give them ample time to review and send back comments.
  - Committee members have approved it and signed the **Committee Approval form (You will create this form** on the [Graduate College](#) page). More details, see [View Thesis Checklist Guide](#) (PDF).
  
- Thesis uploaded submitted electronically following the instructions found at the [ETD Formatting Guidelines](#) page. Current information regarding Thesis and electronic submission can be obtained on the [Graduate College](#) page.

## Doctor of Philosophy Biostatistics

### Advisor and Course of Study

The **Doctor of Philosophy (PhD) in Biostatistics** prepares students for advanced study and research in biostatistics and bioinformatics. The program targets students with strong skills and training in mathematics and statistics who are interested in applications in biomedical research, public health and health care. The PhD program aims to train independent researchers in biostatistics and bioinformatics applications and methodology. An applicant to the Departmental Doctoral Program is admitted as a Doctoral degree student upon recommendation of the Director of Graduate Program and the program Admissions Committee, following faculty evaluation. An initial advisor is assigned by the Associate Director of the Department in consultation with the program directors. If appropriate, a different advisor may be requested at a later date. In the event of a change in advisor, the student shall send a communication to the Graduate Program Office that includes the signatures of the Program Director and both the assigned and proposed advisor indicating their concurrence.

The course of study to be pursued for the Doctoral degree will be arranged with each student by his/her advisor following the guidelines specific to the program. Coursework in other departments may be scheduled according to the needs of the individual student. In all cases, the aim of the Doctoral program will be a reasonable concentration and a breadth of study, designed to develop competence in research, scholarship, teaching, and professional performance in general.

**Full-time first-year PhD students receiving Graduate Assistantships are expected to participate in research activities in their advisor's laboratory for an average of 12 hours per week during the academic year.** Exact hours and research activities will be planned with the advisor.

### Big Data Track

The biomedical research enterprise is increasingly becoming data-intensive and data-driven. Massive streams of data are being generated to interrogate biological systems and improve health care. Biomedical Big Data (BBD) is characterized by high dimensionality, complexity and diversity. It has become abundantly clear that effective statistical methodologies are essential for processing, analyzing, and mining BBD. The Big Data Biostatistics program aims to train the next generation of data scientists, addressing regional and national demands for experts in statistical methods for BBD analysis.

The new track provides rigorous foundations in probability theory, statistics and computational sciences, combined with a broad knowledge of applications to biomedical research. The core curriculum consists of traditional Biostatistics coursework such as: Probability Theory, Mathematical Statistics, Linear Models, and Multivariate Analysis; core computational competency coursework such as Design and Analysis of Algorithms, Database Design, and Programming; and biomedical research-oriented coursework such as: Functional Genomics, Bioinformatics, and Medical Informatics.

Consistent with the overall goals of the PhD program in Biostatistics, the Big Data track has been designed to provide rigorous foundations in statistics and computational sciences, combined with a broad knowledge of applications to biomedical research. This is achieved by a mixture of both foundational courses in statistics, mathematics, and biostatistics from the existing curriculum, as well as additional computer science, and application-oriented core courses and electives included in the proposed curriculum. This will enable graduates of the Big Data Biostatistics Track of the PhD Program to take a full advantage of data-driven revolution in biomedical sciences and the society at large.

## Credit Hours

To graduate with a Doctor of Philosophy Degree from the Department, students must complete a **minimum of 90 graduate credit hours of which 60 must come from didactic coursework**. The last 30 credits, exclusive of research credits, must be completed at the University of Cincinnati or under its direction. **Students must register for at least 7 PhD Dissertation research credits (BDS-9091), but they may not do so before passing the Qualifying Exam.**

Students matriculating into **the traditional track** with a confirmed master's degree are required to take **34** didactic credit hours, **7** dissertation research credit hours, and **19** free elective credit hours.

Students matriculating into **the Big Data track** with a confirmed master's degree are required to take **40** didactic credit hours, **7** dissertation research credit hours, and **13** free elective credit hours.

In no case, however, will a degree be granted solely on the basis of accumulation of the required number of credits. The Department will recommend students for a degree only after they have developed the necessary intellectual abilities and have fulfilled all the requirements of the program and the Department.

Doctoral degrees are conferred on the basis of sustained study and high scholarly attainment in a special field of learning. In no case will the degree be granted for less than 3 years of full-time graduate study or its equivalent, of which the last year must be in residence in the University of Cincinnati or under the University's direction.

## Qualifying Examinations

Before a Doctoral student becomes a candidate for a Doctoral degree, he/she is required to take an examination for candidacy, i.e., the Qualifying Examination. The purpose of the examination as a whole is that determine the candidate's potential for PhD work. Prior to the Qualifying Exam, the student must have completed essentially all required coursework in his/her respective program and maintained a grade point average of B (3.0) or better in all Doctoral course work. Students who enrolled in the program after Fall of 2014 will follow the instructions, topics, and format of the revised Qualifying Exam listed below.

### Qualifying Exam: Part 1 + Part 2 Format

#### Part 1: Testing Core Knowledge

**Component 1:** A three-hour written exam, testing competency in **Biostatistics, Mathematical Statistics, Design of Experiments, and Regression**

**Component 2:** A three-hour written exam, testing computational skills covering **Biostatistics, Mathematical Statistics, Design of Experiments, and Regression**

**Component 3:** A weekend project assignment testing data analysis and reporting skills

- **Part 1 is conducted before the start of Fall semester (August).**
- Components 1 and 2 each have four sections (**Biostatistics, Mathematical Statistics, Design of Experiments, and Regression**).
- If a candidate **fails in two or more sections in a component**, he/she has to retake all four sections. Otherwise, he/she takes only the section he/she failed. **All re-takes should be completed within one year.**
- **No more than two attempts** are allowed in each component of Part 1.
- **Failure to pass a component after the second attempt will result in academic dismissal from the program.**

#### Part 2: Dissertation Proposal defense

Students who pass Part 1 proceed to Part 2. The eligible student chooses a research topic and should have completed preliminary research to show feasibility before proceeding to defense. Typically, the student chooses a PhD dissertation advisor for guidance. The advisor advises the student whether or not the student has accomplished enough research before proceeding towards defense. The steps outlined below have to be followed.

**Step 1:** Compose a dissertation committee (within 12 months after passing Part 1). The dissertation committee includes, at a minimum, the **dissertation advisor** (typically the chair) and **at least two other research faculty members**. **At least one committee member must be from outside the Department**. The chair should be primary faculty from our department and part of the graduate faculty. See more details in the section of “Dissertation Advisor and Committee”. The dissertation advisor could be anyone from our department or one of the secondary faculty. Students wanting their chair to come from secondary faculty need approval from the Program Director.

After the committee is formed, **the student is advised to meet with the Dissertation Committee periodically and complete Advising Meeting Form once per semester to make sure he/she is making progress toward proposal defense.**

**Step 2: Develop and prepare a complete research proposal in either the NIH F31 format (maximum of 5 pages, excluding references) or in the format of a publishable manuscript. The specific format should be determined in consultation with your dissertation advisor. Submit the document to your Dissertation Committee for review.**

**Step 3:** Schedule **the dissertation proposal defense** with the approval of the Dissertation Committee. Announce publicly the date of defense.

**Step 4:** Defend the proposal. All faculty members are welcome. All students are welcome. Questions and comments are solicited from the audience.

**Step 5:** The Dissertation Committee deliberates whether the student has passed the Part 2 PhD qualifying exam **unconditionally** or **conditionally subject to modifications** in the proposal/manuscript, or **failed**. If the student fails, the Committee gives in writing why he/she failed.

**Step 6:** If the student fails, he/she is given another chance to defend his/her revamped proposal or a different proposal, possibly under a new Dissertation Committee. If there are any changes to your Committee due to a change in topic or recommendation, please resubmit your **Dissertation Committee Request Form** to the Graduate Program Office (refer to steps 1 & 2).

**NOTE: A majority of your Committee members have to approve your defense with a minimum of 3 signatures to move forward to candidacy. If the student is unable to successfully defend their proposal a second time they will be dismissed from the program.**

**Step 7:** If the student successfully defends his proposal, he/she will be admitted to the candidacy.

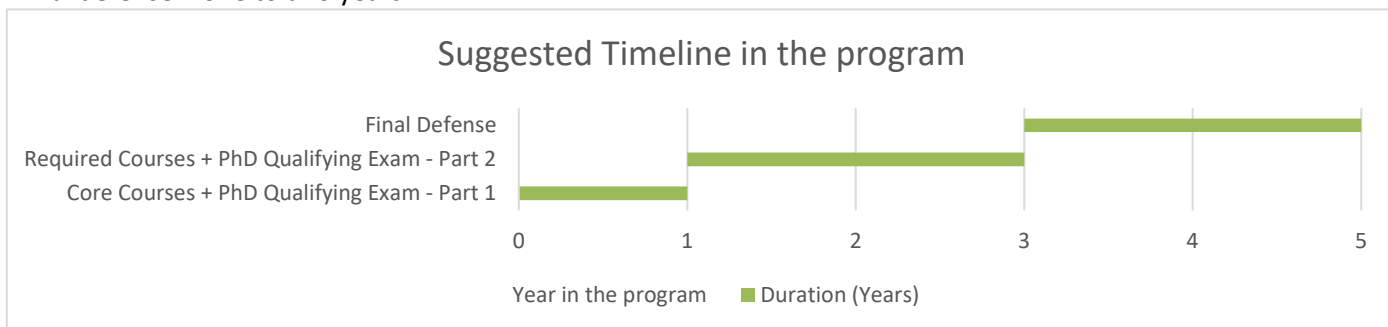
**NOTE: Once the student is in the ‘candidacy’ mode, he/she should strive to complete his/her research for the final defense. The student is advised to meet with the Dissertation Committee periodically and complete Advising Meeting Form once per semester to make sure he/she is making progress toward completion and final defense.**

### Suggested Timeline in the program

Completion of Part 1 – one year

Completion of Part 2 – one to two years

Final defense – one to two years



## Topics/Sections for the three-hour exams (PhD Qualifying Exam - Part 1)

### 1. Biostatistics:

Prospective and Retrospective studies; Observational studies; Laboratory experiments; Comparative studies; Cross-over experiments; Clinical trials; Cohorts; Case-control studies; Longitudinal studies; Discrete probability; Elementary distributions; Rudiments inference – estimation, testing of hypotheses; confidence intervals, p-values, and standard errors; Contingency tables and chi-squared test of independence; McNemar test; The kappa of concurrence; Log-linear models; Odds ratio; Rudiments of non-parametric tests; Simple Linear Regression; Logistic regression; Correlation; Analysis of Variance; Basics of Multiple comparisons; Rates and Proportions

#### *References:*

Lloyd Fisher and Gerald van Belle – Biostatistics, Wiley Interscience, New York

Bernard Rosner – FUNDAMENTALS OF BIOSTATISTICS, Cengage Learning, Boston, MA

### 2. Mathematical Statistics:

Probability; Conditional Probability and Independence; Random variables and their properties; Probability inequalities; Special distributions; Functions of random variables; Moment generating functions; Sampling distributions; Convergence in distribution; Convergence in probability; The Central Limit theorem; Point Estimation and Confidence intervals; Sufficiency and completeness; Variance bounds; Fisher information; Cramer-Rao bound; Rao-Blackwell theorem; Testing of hypotheses – UMP tests; Likelihood tests and asymptotics; Nonparametric methods; Multivariate normal distribution; Distribution of quadratic forms; The Bayesian paradigm; Sequential probability ratio test.

#### *References:*

Robert Hogg, Joseph McKean, and Allen Craig – Introduction to Mathematical Statistics, Pearson Education, Harlow, U.K.

Peter Bickel and Doksum Kjell - Mathematical Statistics: Basic Ideas and Selected Topics, Chapman and Hall / CRC

### 3. Design of Experiments

Basic principles of design, randomization, treatment comparisons, family-wise Error rate, Tukey's method, Dunnett's method, analysis of variance table, random effects, fixed effects, mixed model, estimation of variance components, intraclass correlation coefficient (ICC), factorial design, block design, Latin square, split-plot experiments, randomization and blinding in clinical trial, parallel group design, cluster randomized design, crossover design, group sequential design.

#### *Reference:*

Robert O Kuehl - Design of Experiments: Statistical Principles of Research Design and Analysis, 2nd Edition, Cengage Learning, 1999.

Shein-Chung Chow and Jen-Pei Liu - Design and Analysis of Clinical Trials, 3rd Edition, Chapter 4 and 5, Wiley, New York, 2013

### 4. Regression

Simple Linear Regression model; Least squares method; Slope and intercept and their interpretation; Prediction, ANOVA table; Coefficient of determination; Correlation coefficient; Model assumptions; Residuals; Multiple linear regression, Partial correlation; Model selection; Polynomial regression; Dummy/indicator variables; Random and mixed effect models; Logistic regression models and odds ratios, Generalized linear models and link function; Multicollinearity; Leverage and influence; Ridge regression; Robust regression; Testing general linear hypothesis

#### *Reference:*

Douglas Montgomery, Elizabeth Peck, and Geoffrey Vining – Introduction to Linear Regression Analysis, John Wiley, New York

William Mendenhall and Terry T Sincich – A Second Course in Statistics: Regression Analysis, Pearson

## PhD Candidacy

### 1. Registration Requirements

After the student has completed the required course work, the language requirements, and the Qualifying Examination (Part 1 + Part 2), he/she is considered a candidate for the PhD degree. After admission into candidacy for the Doctoral degree, registration and fee payment for **at least one semester credit hour in the fall semester of each year is required** for each student if his/her candidacy is not to lapse. In addition, **students are required to register for at least one (1) credit during each semester** that they wish to use University resources, excluding summer.

### 2. Time Limitations

- a. The Doctoral degree will be granted for **no less than the equivalent of three (3) years** of full-time graduate study.
- b. All requirements for the doctoral degree must be completed **within nine (9) consecutive academic years of the date of matriculation into the program**.
- c. **Students are advised to complete the Qualifying Examination (Part 1 + Part 2) within three (3) years after the initial enrollment in the program**.
- d. Students should form their PhD Dissertation Committee **within 12 months after passing the Qualifying Exam - Part 1**.
- e. **A period of at least seven (7) months must elapse between admission to Doctoral candidacy and receipt of the degree**.
- f. Students who have not been enrolled in courses for more than three years are **not eligible for reinstatement** and must reapply for admission to the University.

### 3. Dissertation Advisor and Committee

When the student is ready (after passing Qualifying Exam – Part 1) to begin the Dissertation research, the student, through the advisor, should submit to the Graduate Program Office a list of faculty members considered appropriate for membership on the student’s Dissertation Committee using the **Dissertation Committee Request Form**.

Rules of the Graduate College require that **at least the advisor or otherwise two other members of the committee be from the Graduate Faculty of the University**. The Dissertation Committee, of **at least three full-time faculty members** of professional rank (including full-tenured, research, field service or clinical track, assistant, and associate professors; not adjunct, visiting, retired, or emeriti), should be appointed as soon as possible after a student has passed Qualifying Exam – Part 1. **At least one committee member must be from outside the Department. The committee should be formed within 12 months after passing the Qualifying Exam - Part 1.**

Where special expertise on, or familiarity with, the Dissertation topic is available in the person of a **former faculty member or appropriate external professional**, such a person should be included in the basic Dissertation Committee if he/she is nominated by the student and dissertation advisor, and approved by the Graduate College by submitting an External Committee Member Form to the Graduate Program Office. Such persons should be voting members of the Dissertation Committee and be appointed to the Committee along with the initial appointment of the other members. Such persons serve without compensation from either the University or the student.

**The student must meet with the Dissertation Committee periodically and complete Advising Meeting Form once per semester.** In some cases, more frequent progress reports and presentations to the Dissertation Committee can be very helpful for the candidate.

When the Dissertation is completed, a copy is submitted to each Committee member for critical evaluation. If it is considered to be satisfactory with respect to form and content by the Committee, a final, public Defense of

Dissertation should be scheduled through the University's and Department's Graduate Program Office. **Before the defense, a final draft of the Dissertation must be in the hands of each member of the Dissertation Committee in acceptable form and public announcements must be posted at least two weeks before the scheduled Defense.**

#### 4. Research Credit

**Students registering for research credits must obtain approval from their research mentor (or dissertation advisor) and Program Director prior to registering for research credits.** The Research Credit Pre-Approval Form (available on Canvas: Biostatistics Student Community) must be filed in the Graduate Program Office (GPO), before registration.

**Students are responsible** for documenting their work during the semester in which they are registered for research credits. Before a grade can be assigned, a progress report and/or other meaningful products resulting from the student's work must be presented to the research mentor (e.g., meeting abstract, poster, manuscript). Students must also submit a **Research Credit Verification form** (available on Canvas: Biostatistics Student Community), signed by their research mentor and Program Director before the end of the semester in order to receive a passing grade. Verification forms can also be submitted in the GPO. **The research mentor (or dissertation advisor) is responsible** for evaluating the student's work and providing an appropriate grade at the conclusion of the academic semester.

#### **Publication in a Peer-Reviewed Journal**

In addition to submitting the final approved dissertation, PhD students are **required** to conduct research that results in at least one high-quality publishable manuscript based on the PhD dissertation submitted to a peer-reviewed journal. **It is strongly encouraged that all doctoral students have at least one article published or accepted for publication as the first author, prior to the dissertation defense date. The submission of the manuscript must be first approved by the dissertation advisor and all collaborators involved in the manuscript. An official confirmation letter of submission (i.e., the letter sent by the journal to the corresponding author to confirm the submission) can be used to fulfill this requirement.**

#### **Dissertation Research**

- a. Dissertation research should be part of the ongoing research affiliated with the department but must be separately identifiable. The Dissertation research should reflect advisor guidance, but mainly be the independent work of the student. The Dissertation advisor must have expertise in the field of research.
- b. It is the responsibility of the student and the Dissertation advisor to see that a Dissertation Committee is formed within 12 months after passing the Qualifying Examination (Part 1). The Dissertation Committee then should assure itself that **the student's work is not, to a large extent, carried out by technical assistants or other personnel**.
- c. In agreement with the function of the Dissertation Committee, as specified by the rules of the University of Cincinnati Graduate College, any decisions about the quantity and quality of the work done are the responsibility of the Dissertation Committee. Dissertation research should be published with the student as first author.
- d. After the departure of the student, the dissertation research results may be used as the basis for continuing investigations by the student or by the laboratory in which the research was done. The student and the laboratory are entitled to retain copies of the data and analyses for use.

#### **Policy for External Dissertation Research**

Dissertation research outside the department requires careful coordination between the department and the collaborating institution. There are circumstances where it is in the interest of the student, the department, and

an outside laboratory of academic stature, such as elsewhere in the University, or at a Federal Agency in Cincinnati, or other domestic or foreign institution to permit pursuit of graduate research outside the department. The policy outlined below represents a restatement and elaboration on the previous policy on external dissertation work, adopted by faculty on 10/1/79. The requirements of external Dissertation research are:

- a. A departmental faculty advisor who has expertise in the field of research;
- b. Appointment of the external supervisor to the Dissertation Committee;
- c. An explicit understanding that, as in the case for research carried out within the department, every effort will be made to ensure that the research, when initiated, will be supported to its conclusion;
- d. Adherence to the same rules and governance procedures used for Dissertation research within the department. These include the clear understanding that the results are available for publication as a Dissertation and in the open literature, and it is the responsibility of the Dissertation Committee to make final decisions about the direction and extent of work. Attention is also drawn to the requirement that the Dissertation Advisory Committee meet at least twice each year;

### **Final Defense of Dissertation**

The student's final Defense of the Dissertation will be open to the public and all members of the academic community and posted on bulletin boards **at least two weeks** before the defense. **The Office of the University Dean must have two weeks' notice to make notification of defense on the University website.**

Under the standard procedure, the candidate will answer pertinent questions put by other people present following an oral presentation of the Dissertation. After the general audience has completed its questioning and is excused from the room, members of the Dissertation Committee will pose questions or provide comments. At the conclusion of the Defense, the Committee will withdraw, make a decision forthwith about the acceptability of the Dissertation and its defense, and report to the candidate. If the decision is favorable, the approval form will be signed by the Committee members and transmitted to the Office of the Graduate Department. **At least 80% of the voting members of the Dissertation Committee must approve the Dissertation.**

### **Submission of Electronic Dissertation to UC**

All Dissertations must be submitted to the University in electronic form. All Dissertations approved for the doctorate will be published through Bell & Howell (formerly UMI University Microfilms International). Students submitting documents to Bell & Howell (required for Dissertations, optional for Theses) must download, print, complete, and submit the Bell & Howell Agreement Forms to the Graduate College. These documents must be submitted to the Office of the Graduate College along with the rest of the required graduation materials before the document submission deadline. Most current and complete instructions are available online on the [Graduate College](#) page. If you publish your Dissertation in a journal, you should acknowledge in any submitted manuscripts based upon your graduate research that the work was completed in partial fulfillment of the requirements for the PhD in biostatistics. The University of Cincinnati Electronic Thesis or Dissertation ([ETD website](#)) has all the details you need to submit your final dissertation. In short, you will need to submit your full dissertation in PDF form to OhioLINK following the directions on the ETD website, along with a scanned PDF of your fully signed Committee Approval form.

If you publish part or all of your dissertation, you should add the following acknowledgment to your publication: **"This work was completed in partial fulfillment of the Doctor of Philosophy degree in Biostatistics in the Department of Biostatistics, Health Informatics and Data Sciences, Division of Biostatistics & Bioinformatics, University of Cincinnati College of Medicine."** The advisor must approve a dissertation after it is uploaded to ETD, so the student should submit it early to allow the advisor time to submit approval.

If you publish part or all of your Dissertation, you should add the following acknowledgment to your publication: **"This work was completed in partial fulfillment of the Doctor of Philosophy degree in the Department of Biostatistics, Health Informatics and Data Sciences, Division of Biostatistics & Bioinformatics, University of Cincinnati College of Medicine."** Also, acknowledge any grant support you received as you completed your

project.

### **Embargo of Dissertation**

If you plan to submit your Dissertation in part or whole for publication it is vital that you embargo your work for a period of time after electronic submission to the Office of Graduate Studies and [ETD website](#). Some journals consider a Dissertation that is published electronically a “publication.” In order to avoid the fact or appearance of a “duplicate” publication it is important to embargo your document. You can embargo your work for a period of up to three years. You request an embargo electronically when you upload your Dissertation for final approval by your Dissertation Committee chairperson. You must also provide a reason for the embargo such as patent pending or publisher restrictions. See your advisor if you have any questions regarding the embargo of your work.

## Doctor of Philosophy Biostatistics Traditional Track Curriculum

(Course descriptions available on the Course Catalog)

Course Number	Course Title	Credits	Required or Elective	Semester
<b>PhD Biostatistics Core Courses: 31 credit hours</b>		<i>ALL semester course offerings are subject to change</i>		
BDS 7024	Computational Statistics	3	Required	Spring
BDS 7088	Regression Analysis	3	Required	Spring
BDS 7089	Experimental Design	3	Required	Fall
BDS 8029	Biostatistics Seminar ( <b>4 semesters</b> )	4	Required	Fall/Spring
ENV 7001 or BMIN 7003	Environmental Health Seminar or Biomedical Informatics Seminar	<b>4 (4 semesters)</b>	Required	Fall/Spring
GNTD 7003	Ethics in Research	1	Required	Spring
STAT 6021	Mathematical Statistics I	3	Required	Fall
STAT 6022	Mathematical Statistics II	3	Required	Spring
BDS 9091	Dissertation Research ( <i>After Statement of Intent Approved</i> )	7	Required	Fall/Spring/Summer
<b>Biomedical Credits: 4 credit hours</b>			Required	
<b>Select a minimum of 4 credit hours from the list below</b>				
BE 7076	Introduction to Epidemiology	3		Fall/Spring
CB 8080	Cancer Biology & Therapeutics	4		Spring
GNTD 7001	Molecular and Cellular Biology	1-4		Fall
MCP 6031C	Computational Systems Biology	2		Spring
TOX 7082	Survey of Toxicology	2		Spring
<b>Traditional Track Specific: 6 credits</b>			Required	
<b>Select a minimum of 6 credit hours from the list below</b>				
BDS 7026	General Linear Models	3		Spring (varies)
BDS 7090C	Applied Survival Analysis	3		Spring (odd year)
BDS 7091	Applied Multivariate Analysis	3		Spring (even year)
<b>Free Electives: ≥ 19 credit hours, Select remaining credits from Course Catalog List</b>				
BDS6XXX+; BE6XXX+; BME6XXX+; BMIN6XXX+; CB6XXX+; CS6XXX+; ENV6XXX+; GNTD6XXX+; MATH6XXX+; MCBP6XXX+; PH6XXX+; STAT6XXX+;				
Students are required to complete <b>19 credit hours or more</b> of Free Electives from the Course Catalog List with assistance from their advisor.				
			Elective	
			Elective	
			Elective	
			Elective	
			Elective	
			Elective	
<b>Total Credits Post-Masters (≥ 19 credit hours Free Electives)</b>		<b>60</b>		
<b>Total Credits Post-Bacc (≥ 49 credit hours Free Electives)</b>		<b>90</b>		
<ul style="list-style-type: none"> <li>▪ 3.0 GPA (B average) or higher required for graduation.</li> <li>▪ All required courses must be completed with a B- or higher.</li> <li>▪ "I" (Incomplete) or "NG" (Not Graded) grades must be removed from academic record prior to applying for graduation.</li> <li>▪ The doctoral degree will be granted for no less than the equivalent of three years of full-time graduate study.</li> <li>▪ All requirements for the doctoral degree must be completed within nine consecutive academic years of the date of matriculation into the program.</li> <li>▪ Students must take a minimum of one graduate credit that contributes to degree requirements per academic year (fall-summer) to maintain active status.</li> <li>▪ A doctoral student must be enrolled for at least 10 graduate credits in his/her program in each of two semesters (including summer semester) during a span of three consecutive semesters.</li> <li>▪ Students are expected to meet with their advisor at least once a semester to discuss their academic progress.</li> <li>▪ Electives must be determined with a consultation from your advisor.</li> </ul>				

## Doctor of Philosophy Biostatistics Big Data Track Curriculum

(Course descriptions available on the [Course Catalog](#))

Course Number	Course Title	Credits	Required or Elective	Semester
<b>PhD Biostatistics Core Courses: 31 credit hours</b>		<i>ALL semester course offerings are subject to change</i>		
BDS 7024	Computational Statistics	3	Required	Spring
BDS 7088	Regression Analysis	3	Required	Spring
BDS 7089	Experimental Design	3	Required	Fall
BDS 8029	Biostatistics Seminar ( <b>4 semesters</b> )	4	Required	Fall/Spring
ENV 7001 or BMIN 7003	Environmental Health Seminar or Biomedical Informatics Seminar	4 (4 semesters)	Required	Fall/Spring
GNTD 7003	Ethics in Research	1	Required	Spring
STAT 6021	Mathematical Statistics I	3	Required	Fall
STAT 6022	Mathematical Statistics II	3	Required	Spring
BDS 9091	Dissertation Research ( <i>After Statement of Intent</i> )	7	Required	Fall/Spring/Summer
<b>Biomedical Credits: 4 credit hours</b>			Required	
BE 7076	Introduction to Epidemiology	3		Fall/Spring
CB 8080	Cancer Biology & Therapeutics	4		Spring
GNTD 7001	Molecular and Cellular Biology	1-4		Fall
MCP 6031C	Computational Systems Biology	2		Spring
TOX 7082	Survey of Toxicology	2		Spring
<b>PhD Biostatistics Big Data Track Courses: 12 credit hours</b>			Required	
BDS 8093	Intro to Database Systems and Applications	3	Required	Spring
BMIN 7099	Introduction to Bioinformatics	3	Required	Spring
GNTD 8001C	Introduction to Functional Genomics	3	Required	Fall
<b>Select <u>one</u> course from the list below.</b>				
BDS 7082	Intro to Data Science	3		Fall (even years)
CS 6037	Machine Learning	3		Fall
<b>Free Electives: Select remaining credits from Course Catalog List (fill-in with advisor)</b>				
BDS6XXX+; BE6XXX+; BME6XXX+; BMIN6XXX+; CB6XXX+; CS6XXX+; ENV6XXX+; GNTD6XXX+; MATH6XXX+; MCBP6XXX+; PH6XXX+; STAT6XXX+				
Students are required to complete a minimum of <b>43 credits (post-bacc)</b> or <b>13 credits (post-Masters)</b> of free electives. Electives must be determined with a consultation from an advisor.				
			Elective	
			Elective	
			Elective	
			Elective	
			Elective	
			Elective	
			Elective	
			Elective	
<b>Total Credits Post-Masters (≥ 13 credit hours Free Electives)</b>		<b>60</b>		
<b>Total Credits Post-Bacc (≥ 43 credit hours Free Electives)</b>		<b>90</b>		
<ul style="list-style-type: none"> <li>▪ 3.0 GPA (B average) or higher required for graduation.</li> <li>▪ All required courses must be completed with a B- or higher.</li> <li>▪ "I" (Incomplete) or "NG" (Not Graded) grades must be removed from academic record prior to applying for graduation.</li> <li>▪ The doctoral degree will be granted for no less than the equivalent of three years of full-time graduate study.</li> <li>▪ All requirements for the doctoral degree must be completed within nine consecutive academic years of the date of matriculation into the program.</li> <li>▪ Students must take a minimum of one graduate credit that contributes to degree requirements per academic year (fall-summer) to maintain active status.</li> <li>▪ A doctoral student must be enrolled for at least 10 graduate credits in his/her program in each of two semesters (including summer semester) during a span of three consecutive semesters.</li> <li>▪ Students are expected to meet with their advisor at least once a semester to discuss their academic progress.</li> <li>▪ Electives must be determined with a consultation from your advisor.</li> </ul>				

## Doctor of Philosophy Degree Checklist

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- Coursework required for the PhD Degree completed satisfactorily.  
Oral English Proficiency Test (OEPT) requirement is met for international students (OEPT must be taken by the end of your first academic year). Letter attesting to satisfactorily completed OEPT submitted by the examiner to the program director, and Graduate Program Office (GPO).
- Qualifying Examination - Part 1 (written exam) passed.  
Dissertation Committee **within 12 months** after passing the qualifying exam – Part 1).
- The student is advised to meet with the Dissertation Committee periodically and complete Advising Meeting Form once per semester to make sure he/she is making progress toward proposal defense.**
- The Residency Requirement is fulfilled before PhD candidacy.
- Dissertation Proposal is completed and approved by Dissertation Committee.
  - Qualifying Examination - Part 2 (Proposal defense) passed.
- Form (obtained from Graduate Program Office) attesting that Qualifying Exam was passed submitted by Dissertation Committee Chair to Graduate Program Office.  
**The student is advised to meet with the Dissertation Committee periodically and complete Advising Meeting Form once per semester to make sure he/she is making progress toward the dissertation and final defense.**
- Dissertation written.
- Submission to a peer-reviewed journal (at least one publishable manuscript; Require the approval of dissertation advisor and confirmation letter(s) of submission from the journal(s)).**
- Successful defense of Dissertation and signed by Dissertation Committee members.
  - Complete “On-Line Graduation Application” on the [Graduate College](#) page at the Main Menu sidebar and select “Graduation.”
  - Committee members have approved it and signed the **Committee Approval form (You will create this form** on the [Graduate College](#) page). More details, see [View Dissertation Checklist Guide](#) (PDF).
  - Graduation paperwork is filed with GPO and University Officials. (See official dates on the Graduate College website.)
- Electronic Dissertation. Current information regarding dissertation and electronic submission can be obtained on the [Graduate College](#) page.

## Graduation

### One semester prior to anticipated graduation, the student should:

1. Run a degree audit using the [Get My Degree Audit](#) page to receive your grade report and an estimation of your degree progress.
2. **Schedule a meeting with the Program Director to verify all coursework is complete.**
3. Consult the Graduate College's website for the [Graduation Deadlines](#) dates; including the last day to register for graduation and **the last day to electronically submit the thesis or dissertation.**
4. Apply for graduation after you have verified all of your coursework and degree requirements; please note the importance of verifying your coursework before you apply to graduate as there will be a fee for the graduation application and this will need to be resubmitted each time you apply to graduate. Information on how to apply can be found on the [Graduation Application Information](#) page.

### Student Graduation Checklist:

- Cap and Gown - may be purchased or rented at the University Bookstore.
- Removal of I and NG Grades - Notification of removal of all I and NG grades must be submitted prior to the student's graduation.
- Credit Hours - Completion of the required semester credit hours for the degree.
- Departmental Requirements – Students must complete all departmental requirements for the degree. Any graduate student who expects to receive a degree at any of the three (3) University commencements must make a formal application for the degree. As a general rule, the On-Line Graduation Application is accessible only for approximately four (4) weeks prior to the end of each semester and steps on the application itself may be read and completed only incrementally upon completion of each preceding step. The GPO will complete and submit a Certification form electronically to the Graduate College.

### Application to Graduate:

Students must: 1) complete academic requirements, 2) complete the official online Application to Graduate by the deadline for the semester in which they expect to graduate. Deadlines are firm and failure to meet them will delay students' graduation until the following semester, when they must then submit a new application for their revised graduation date.

## Dismissal from Program

Students will be dismissed from the program if: 1) involved academic dishonesty or misconduct in any form, including cheating, plagiarism, and deception of effort, 2) failed to pass a component in Part 1 Qualifying Exam after the second attempt, 3) failed to defend their proposal (Part 2 Qualifying Exam) a second time, and 4) no progress toward the PhD research work and obtained "C" or "Fail" for the dissertation research credits more than two times.

## Student Resources

### International Students

All of the necessary information required by international students can be located on the [UC international Services](#) webpage.

#### OneStop:

One Stop Student Service is the UC Web site where you are able to accept your aid award, pay your bill, check your grades, request a transcript, and more. The One Stop Student Service Center is located on the second floor of the University Pavilion.

Phone: 513-556-1000

Office hours: Monday - Thursday, 8-5 and Friday 9-5

#### Catalyst:

Catalyst is the University of Cincinnati's new student portal, Catalyst will change how you take care of your student-related services, from class registration to paying your bill. WHAT IS A STUDENT PORTAL? Picture the Catalyst portal like a house. Unlock the front door with your 6+2 and password, and inside you'll find rooms filled with many of the student functions found on the One Stop website, including: View Class Offerings, Add/Drop Classes, Run Degree Audit, View Grade Report, View/Pay Bills, Apply for Financial Aid, Check Aid Status.

#### Canvas:

Canvas is extremely versatile software that not only allows instructors to easily place course materials online, but also contains multiple communication tools that allow instructors and students to collaborate in new and exciting ways, and acts as a portal to other web services at the University of Cincinnati.

As a first-time user of Canvas, one must first activate their account, then click the Create Account button and fill out the requested information. The username and password that appears on the next screen will be required to log in to Canvas the next time.

### Fellowships and Scholarships

#### Award Opportunities at the Graduate College

The Graduate College office sponsors awards, fellowships, scholarships and assistantships for deserving students, including Student Conference Travel Award. Please visit the Graduate College website (<https://grad.uc.edu/student-life/awards.html>) for more details.

#### Graduate Assistantships, NIEHS Fellowships, NIOSH Fellowships

Graduate assistantships are available for full-time PhD students along with tuition remission. These assistantships provide the opportunity to apply classroom learning to ongoing research projects and to learn state-of-the-art biostatistical & bioinformatical methods, which are extremely beneficial for completion of the academic program. These assistantships are provided by the Department, individual faculty grants or contracts or external sources. Expectations are that students will, over the period of the assistantship, provide approximately 20 hours of service weekly, often with their advisor, which is also an integral part of their learning experience.

### Study Space

**Students in the Department of Biostatistics, Health Informatics & Data Science have access to dedicated office cubicles located on the 4th floor of the Stetson Building.** Each cubicle is furnished with comfortable seating and ample desk space to support student work. This study area is open to all Biostatistics students, but sign-up is required for access to the building. Additional study space is located in the Health Sciences Library, located in the Medical Sciences Building/CARE building as well as in the multiple libraries of UC's West Campus.

#### Libraries

University of Cincinnati Libraries offer access to an outstanding research library collection of 2.8 million volumes and a wide range of services to help students with their research needs. Students have access to the University of Cincinnati Libraries' online library catalog and information about resources and services. Students also have access to the [Health Sciences Library](#). The libraries' websites serve as local gateways to OhioLINK, which includes a statewide library catalog of over 38 million items from 83 other academic libraries across Ohio as well as over 4700 electronic journals.

Each University of Cincinnati library is home to a knowledgeable staff eager to assist students, faculty, and staff with their research and service needs. Among the most important services provided by our staff are instruction in library research, assistance with the appropriate use of electronic resources, and help creating electronic Dissertations and Theses.

The Health Sciences Library is located on the E level of the Medical Sciences Building/CARE building. Contact information and directions:

Circulation Desk: 558-0127  
Reference: 558-5628

Technology Support: 558-4173

The entrance to the library is in the Medical Sciences Building on the E level across from MSB E351 and between Kresge Auditorium and the bank of passenger elevators.

### **Professional Societies and Organizations**

The following is a non-comprehensive list of scientific societies and Organizations in Biostatistics and Bioinformatics

- [American Statistical Association](#) (ASA)
- [Biometrics Society](#) (ENAR)
- [Institute of Mathematical Statistics](#) (IMS)
- [International Biometric Society](#) (IBC)
- [International Society for Clinical Biostatistics](#) (ISCB)
- [Society for Clinical Trials](#) (SCT)

### **Student Organizations**

- [Health Sciences Graduate Association \(HSGA\)](#)
- [UC Student Organizations](#)

### **GSGA Travel Awards**

Travel awards may be given to full-time graduate students who are attending or presenting papers at conferences. Non-presenters will be eligible for an award if they can demonstrate that they must attend a conference, which is vital for their professional development. These students will be eligible for such an award once during their academic period at UC. Presenters will be eligible for an award once each academic year.

Presenters at conferences will be given preference. Many conferences also offer competitive student travel awards. For more information and to receive a copy of the Travel Award Guidelines for Individual Travelers, contact the [Graduate Student Government](#) (GSG), Room 683 Steger Student Life Center (West Campus) at 556-610. (All awards are subject to availability of funds.)

### **Graduate Student Research Forum**

The Annual College of Medicine Graduate Student Research Forum is another opportunity for students to gain experience in presenting research findings. The purpose of this annual event is to promote scientific communication among students and their research advisors in our various graduate Departments, as well as to inform the scientific community about current graduate student research activities at the College of Medicine. Every graduate student should consider presenting their research poster at this forum. Monetary awards are given to the students with the most outstanding poster presentations.

### **Career Opportunities**

Biostatisticians play essential roles in designing studies and analyzing data from research problems. They help formulate the scientific questions to be answered, determine the appropriate sampling techniques, coordinate data collection procedures, and carry out statistical analyses to answer those scientific questions. Research problems are as diverse as the study of factors affecting heart and lung disease, testing new drugs to combat AIDS, assessing indoor air quality in schools, working with various cancer studies, evaluating dental health and dental procedures, evaluating psychiatric symptoms and drug and alcohol use, transplanting organs and bone marrow, and studying inner ear infection. Biostatisticians also help develop statistical techniques. Active areas of research include Bayesian methods, high-speed computing and simulation, survival analysis, analysis of geographical patterns of disease, longitudinal data analysis, and methods for analyzing data from epidemiologic studies and clinical trials.

### **Computer Account and Printing Services**

The University provides all students computer accounts free of charge. The Bearcat Online system is a client-

server system that allows you to exchange electronic mail (e-mail) with other computer users on campus and around the World, and access the diverse resources of the Internet. You may access your Bearcat Online account from your home, office or a campus computer lab.

Wireless LANS at UC: Wireless connectivity is free to UC students. You will need to enter your password in the field to connect to Secure wireless. For off campus access to software on your personal computer contact the UC IT.

### [University Bookstores](#)

The University of Cincinnati Bookstore is your source for all of your textbook, apparel, and supply needs. They have the largest selection of used textbooks in the community. Students need to shop early as the used books, which retail at 25% less than the new retail price, sell quickly. If you have any questions, contact them at (513) 556-1400. You are also able to order [Textbooks](#) online through the bookstores.

### [University Health Services](#)

The mission of University Health Services is to provide superb health care and health education in a compassionate and caring environment, to assist the University in providing a safe environment for students and employees, and to provide wellness in a Just Community.

All students are required to be covered by health insurance, either the Student Insurance Program or another policy, which must be at least as comprehensive as the University policy. Full-time, co-op, and part-time students taking six or more credit hours are all eligible for coverage and will be automatically charged unless they have previously waived coverage during the current academic year. Graduate students enrolled in less than six (6) credit hours may purchase coverage with: 1) an Insurance Action Form; 2) written certification of matriculation from your academic department; and 3) payment.

### [Mental Health Services](#)

The UHS Mental Health Clinic provides professional, confidential mental health services for UC students with Student Health Insurance.

Services include counseling for situational stress, anxiety, depression, relationship issues, grief and loss, sexual abuse, bipolar disorders, and personality disorders. They also perform psychological assessments.

For UC students with Student Health Insurance, the cost is \$17 per visit for counseling, but students should obtain an appointment referral from University Health Services first (East Campus phone number: 516-584- 4457).

### **ID Badges / Keys / Parking Passes**

Students are required to wear/show photo ID badges. Access Control is responsible for the physical security of the University, as well as providing photo identification for all employees and students. Access Control provides the following services:

- Control and service for the over 50,000+ locks in use at the University.
- Issuance of keys to students, faculty, and staff.
- Production of photo ID badges for all University employees and students.
- Control access to areas using a card access system. This system allows access via the University photo ID card.

General Information: Badge/Key/Parking Passes Office: 4 Edwards Center

- To order your keys complete the [Key and Card Access Request Form](#) located here.
- Take the *CCM Plaza-Eden Ave.* shuttle or park your car for free for 30 minutes in the Cory Garage to pick your keys, parking passes, and ID badges.

### [Parking](#)

All students are eligible to purchase a parking decal. To park on campus, one must display a Parking Services issued decal or use a parking garage and pay the hourly rate. Decals are issued on a semesterly or academic year basis

and are most easily purchased through the Parking Services' web site during priority registration prior to the start of each semester. The priority registration dates coincide with those for priority class registration. Internet access for priority registration is available in the parking Offices and in some computer labs on campus. Contact the Parking Office at 556-2283.

### **Shuttle Bus**

The University of Cincinnati offers a shuttle bus service that transports students, staff, and faculty across campus. Buses run every 7-10 minutes Monday through Friday year-round (except holidays). Their website has up-to-date route information.

- For Shuttle GPS tracking view visit UC's [TRANSLOC](#) website.

### **Housing**

As a student of the University of Cincinnati you may need to locate housing in the surrounding university or Cincinnati areas. It is important to remember that the Graduate Studies Office does not directly handle any housing request or student placement in housing and that locating, as well as any and all associated costs with student housing are the primary responsibility of the student once they arrive in Cincinnati. Below is a list of helpful links where you can find more information regarding housing:

Off Campus [Graduate and Family Housing](#)

[International Students Temporary Housing](#)

More housing options can be found using [Uptown Rental Properties, LLC](#)

### **Sports and Exercise**

The Fitness Center (FC) at CARE/Crawley on Eden Avenue at the Uptown East Campus offers 12,000 square feet of fitness and wellness space. The Fitness Center at CARE/Crawley offers membership options for everyone including UC students and employees, university affiliates (e.g., Children's Hospital), and community members. Membership also provides access to the Campus Recreation Center. Additional options include supplemental memberships for spouses/domestic partners or legal dependents. The University of Cincinnati Campus Recreation Center (CRC) is a state-of-the-art fitness and recreation facility on the Main (West) Campus. With over 200,000 square feet of recreation space, the CRC offers university students, employees, and friends of the university a wide range of exercise and fitness opportunities.

*For more information and facility hours call:*

Campus Recreation Center: 513-556-0604

Fitness Center at CARE/Crawley: 513-558-0604

*BearCat Fitness Trail - A Cross Campus Challenge*

The Bearcat Fitness Trail combines 15 exercise routines and 1.4 miles of trail for walking or jogging to provide a well-balanced fitness program for the entire body. The fitness trail spans across the East and West campuses to provide a total campus connection. Take a casual walk along the Bearcat Fitness Trail and enjoy your campus community or get in full exercise mode and work out on the Cross Campus Challenge.

### **Dining near the Medical Center**

Cincinnati offers many fine dining adventures, but few are within walking distance from the Kettering Building. If you're seeking to dine between classes, the nearest facilities are the Medical Sciences Building cafeteria, Children's Hospital Medical Center cafeteria, University Hospital's cafeteria, or the Veteran's Hospital cafeteria. Chipotle and Zoup are just up the street on the corner of MLK Drive and Highland. The Kingsgate Marriott Conference Hotel also offers a buffet lunch for around \$12 per person. Another venue is the University Hall cafeteria, which offers an inexpensive dining experience.

## Public Safety

The Department of Public Safety is comprised of four distinct, but interrelated units – University Police, Emergency Preparedness, Parking Services, and Support Services.

### **How to Contact the Police**

- Police Headquarters: 3 Edwards Center 51 West Corry Street Cincinnati, Ohio 45221-0215
- Primary phone numbers are: Emergencies 911
- To contact UC Police 911 from a non-university phone or cell phone dial 556- 3911
- Non-Emergencies 556-1111, 558-1111
- Office 556-4900 (If long distance, the area code is 513)
- Help Phones
- Email: [ucpd@uc.edu](mailto:ucpd@uc.edu)

### **Nightride**

NightRide, operated by students, is a free nighttime transportation service. It provides students, faculty, and staff safe and reliable transportation to and from locations within a one-mile radius of the UC campus. A UC ID is required and users may take one non-UC person as a guest.

NightRide's number is 513-556-RIDE (7433)