

DEPARTMENT *of*
MEDICAL AND MOLECULAR SCIENCES

MASTER OF SCIENCE IN MEDICAL SCIENCES
Program Policies



February 2021

Revised February 17, 2023

I. Program History and Description

A. Statement of purpose and expectation of graduate study in the program

The Master of Science in Medical Sciences (MMS) is designed for practicing professionals who want to advance their knowledge and skills in the clinical laboratory sciences and develop new proficiencies needed to meet the challenges of a changing profession and fast-paced development in technology. In today's competitive employment market, individuals seeking management and leadership positions in the laboratory-based health professions require a graduate level degree. The MMS will allow students to specifically tailor their program of study to meet their specific career goals whether it be laboratory administration, research or laboratory science education. In addition, the curricular flexibility of this program will allow laboratory professionals to gain knowledge and technical competency in emerging areas of practice in the laboratory such as molecular diagnostics. The program is useful for those wishing to pursue a clinical focused MS to enhance educational and career trajectories in other health professions.

The MMS is designed for individuals holding a baccalaureate degree in a laboratory field with an interest in advancing theoretical and clinical learning, practice, and research. The program prepares the student for advanced practice opportunities with academic, industrial and clinical professional growth through:

- advanced expert-knowledge and skills
- critical thinking proficiency
- interdisciplinary collaboration through a focused advanced practica
- increased skills in evidence-based practice, and research methodologies
- conduct of translational research in laboratory science

Individuals seeking leadership positions in laboratory management, education and research will earn an MS in Medical Sciences, through either full- or part-time study. Students must have a BS or a post-baccalaureate certificate in a laboratory field such as

medical laboratory sciences, biotechnology, cytogenetic technology or cytotechnology. (Other laboratory professionals may be eligible, based on training and experience.) The program is **customized** to each student's unique interests and professional goals.

An overarching goal of this program is to provide a cadre of leaders in the laboratory based health professions. The new program aligns with the vision of the University of Delaware as a center for graduate level professional education and training.

The proposed new major is compatible with the academic priorities of the University by supporting the initiative of creating a diverse and stimulating undergraduate

academic environment. This new program aligns with the UD Path to Prominence *One Health Initiative* where the University desires to expand its graduate level health and medical education programs.

B. Current Status

The MS degree in Medical Sciences (MMS) received permanent status approval from the Faculty Senate in April 2022.

C. Degrees Offered

MS in Medical Sciences

D. College/Department where the program resides

The MS in Medical Sciences is housed in the Department of Medical and Molecular Sciences in the College of Health Sciences

II. Admission

University Statement regarding Graduate Admissions: Admission to the graduate program is competitive. Those who meet stated minimum requirements are not guaranteed admission, nor are those who fail to meet all of those requirements necessarily precluded from admission if they offer appropriate strengths.

A. Admission Requirements

Expected Minimum Requirements for Admission into the Medical Sciences

Program - Admissions decisions are made by the Medical Sciences Program Committee. Students will be admitted to the program based on enrollment availability and their ability to meet the following minimum recommended entrance requirements:

- **Prior Degree Requirements:** BS, equivalent degree or post-baccalaureate certificate in a laboratory profession (such as medical laboratory sciences, biotechnology, cytogenetic technology or

cytotechnology; other laboratory professionals may be eligible, based on training and experience) from an accredited college or university.

- The GRE is not required, TOEFL requirements are described in detail below for international applicants
- An undergraduate GPA of 3.0 or higher.

- Written statement of goals and objectives (the personal statement) that clearly identifies the applicant's research and curriculum interests and explains how admission to the program will facilitate his/her professional objectives.
- Current résumé and two letters of recommendation.

All students will be expected to be sufficiently conversant in English and knowledgeable in the written word to convey clear, logical and complex written expressions.

Admission Procedures - Applicants must submit all of the following items directly to the University Office of Graduate Studies using the online admission process before admission can be considered:

1. **Application Deadlines:** A completed application should be submitted no later than February 1 for the fall semester, and October 1 for the spring semester to ensure consideration.
2. A nonrefundable application fee must be submitted with the application. Credit card payment is accepted with the online application. Checks must be payable to the University of Delaware. Applications received without the application fee will not be processed. International students paying by check must use a check drawn on a US bank or an International Postal Money Order.
3. Applicants must submit responses to specific questions asked on the application; a resume; and a statement of professional goals and objectives.
4. Applicants must submit at least two letters of recommendation. All letters of recommendation should be mailed directly to the Office of Graduate Studies.
5. One official transcript of all US colleges and universities attended must be sent

directly from the institution to the Office of Graduate Studies or be provided in a sealed

envelope with the application packet. Students who have attended the University of Delaware need not supply a transcript from Delaware.

6. One official transcript of all non-US based college and university records is required. The transcript must list all classes taken and grades earned. If the transcript does not state that the degree has been awarded, send a degree certificate that states that the degree has been awarded. If the degree has not been awarded or the degree certificate has not been issued, evidence of the awarded degree must be provided prior to the first day of classes in the term of admission. For institutions that issue documents only in English, send the English original. For institutions that issue documents both in English and a foreign language, send both the English language original and the foreign language original. For institutions that issue documents only in a foreign language, send the foreign language original and a certified translation in English. The translation must be certified by an official of the issuing institution, a state- or court-appointed translator, or the Embassy of the issuing country in the United States. If it is necessary to send non-original documents: a. The documents must be original “attested copies”, officially attested to by the issuing institution or the Embassy of the using country in the United States, and b. Certified translations must be originals, no copies will be accepted.

7. International student applicants must demonstrate a satisfactory level of proficiency in the English language if English is not the first language. The Test of English as a Foreign Language (TOEFL) is offered by the ETS in test centers throughout the world. The University requires an official paper-based TOEFL score of at least 550, at least 213 on the computer-based TOEFL, or at least 79 on the Internet-based TOEFL for an applicant to be considered for admission. In addition, departments may elect to require that the applicant provide a score from the Test of Spoken English (TSE). TOEFL scores and TSE/SPEAK scores more than two years old cannot be validated or considered official.

8. International students must be offered admission to the University and provide evidence of adequate financial resources before a student visa will be issued. The

University has been authorized under federal law to enroll nonimmigrant alien students. International students are required to purchase the University-sponsored insurance plan or its equivalent.

9. All first-time international students are required to attend the Orientation Day for new international students, which takes place before classes begin.

10. It is a Delaware State Board of Health regulation and a University of Delaware mandate that all graduate students with a birth date after January 1, 1957, be immunized for measles, mumps and rubella (MMR). Also, students may be required to provide evidence of PPD (Mantoux) Tuberculosis Screening Test within 6 months prior to beginning classes. Students who are admitted beginning January 2002 are required to show proof of vaccination against meningococcal disease unless granted a waiver. Students should refer to and complete the Student Health Service Immunization Documentation form upon admission.

Admission Application Processing - Applications will be processed as they are submitted. The admission process is completed as follows: First, completed applications consisting of the application form, undergraduate/graduate transcripts, letters of recommendations, resume, statement of purpose, and written statement of goals and objectives are reviewed by the Program Committee of the Medical Sciences Program. The Program Committee arrives at an admission decision after reviewing the completed application. Students are notified in writing of the admissions decision within two weeks of the decision. There is only one category of admission – there is no provisional admission to the MMS.

III. Academic

A. Degree Requirements

The MS in Medical Sciences (MMS) is built on 32 – 33 graduate credits that include both core courses, fieldwork experiences and individualized concentration electives.

The curriculum can be completed in as little as three semesters (accelerated format), in a traditional four semester format, or in an extended part-time format over the course of six-semester.

Core Courses

- Methods in Bioscience Education
- Research Design and Statistics
- Research or Capstone Project
- Laboratory Administration Fieldwork
- Laboratory Education/Instruction Fieldwork
- Regulatory and Fiscal Issues in Lab Management

Select 6-8 credits of concentration electives from graduate level courses offered throughout the University. These courses should focus on and reflect contemporary areas of clinical or research laboratory management, administration and advanced practice.

Concentration Areas include but are not limited to:

- management and supervision
- financial management
- regulatory and quality management
- advanced research skills
- population health

MS in Medical Sciences: Curriculum

SEMESTER CREDITS

CORE COURSES (12 credits)

MMSC 603	Research Design and Statistics	3
MMSC 604	Methods in Bioscience Education	3
MMSC 605	Regulatory and Fiscal Issues in Laboratory Management	3
MMSC 803	Seminar (3 total, 1 per semester – 1.0 credit each)	3

FIELDWORK EXPERIENCES (8 credits)¹

MMSC 611	Advanced Practicum I	2
MMSC 612	Advanced Practicum II	2
or		
MMSC 631	Laboratory Education Administration and Instruction*	2
MMSC 613	Advanced Practicum III	2
MMSC 614	Advanced Practicum IV	2
or		
MMSC 632	Laboratory Administration and Management	2

SCHOLARLY PRODUCT & CONCENTRATION ELECTIVES (12-14)^{2,3}

MMSC 815	Contemporary Topics Research (2 total, 3 credits each)	6
	Concentration Elective(s) ³	6-8

Total Credits for the Master of Science in Medical Sciences minimum 32

¹Students must earn 8 credits in the fieldwork experiences category through an individualized combination of the following courses: Advanced Practica, Laboratory Education and Administration, Laboratory Administration and Management.

²To meet the scholarly product requirement, students may complete a literature review/health services/ outcomes based research project or engage in a wet-bench research project with a selected PI (MMSC815). Students must meet with the MMS program director to determine which type of project best meets their educational needs.

³See Table 1 for a list of potential concentration elective courses. Selections are tailored to meet each student's educational goals.

Table 1 - POTENTIAL CONCENTRATION ELECTIVE COURSES

MMSC608	Molecular Preparatory Techniques	2
MMSC625	Basic Molecular Techniques	4
MMSC 690	Genetics and Molecular Diagnostics	3
MMSC 691	Molecular Diagnostics	3
MMSC 692	Application of Molecular Diagnostic Techniques	3
MMSC651	Cell and Tissue Culture Techniques	4
MMSC 627	Introduction to Flow Cytometry	2
MMSC635	Practical Genomic, Proteomics and Bioinformatics	3
MMSC626	Protein Purification & Characterization	3
KAAP655	Advanced Physiology of Exercise	3
KAAP680	Exercise, Nutrition and Bone Health	3
KAAP802	Human Cardiovascular Control	3
KAAP840	Advanced Human Anatomy	3
MMSC805	Biomarker Development	3
MMSCT810	Evidence Based Practice	3
NTDT610	Overweight/Obesity Prevention and Management	3
NTDT611	Advanced Nutrition	3
NTDT630	Trace Minerals & Vitamins	3
NTDT640	Nutrition and Aging	3
NTDT655	Issues in International Nutrition	3
NURS621	Advanced Pathophysiology	3
NURS812	Responsible Conduct of Research	1 (online, fall)
BINF644	Bioinformatics	3
CISC636	Bioinformatics	3
BISC601	Immunochemistry	4
BISC602	Molecular Biology of Animal Cells	3
BISC604	Nucleic Acids Laboratory	4
BISC612	Advanced Cell Biology	3
BISC615	Vertebrate Developmental Biology	3
BISC619	Gene Expression Laboratory	4
BISC625	Cancer Biology	3
BISC626	Neuroscience I	4
BISC627	Neuroscience II	3
BISC639	Developmental Neurobiology	4
BISC645	Bacterial Evolution	3
BISC654	Biochemical Genetics	3
BISC656	Evolutionary Genetics	3
BISC660	Environmental Physiology	3
BISC665	Advanced Molecular Biology & Genetics	3
BISC675	Cardiovascular Physiology	3
BISC679	Virology	3
BISC693	Human Genetics	3
BISC806	Advances in Cell and Organ Systems	3
CHEM641	Biochemistry	3
CHEM642	Biochemistry	3
EDUC856	Introduction to Statistical Inference	3

2. Non-registered Requirements: Residency Requirement. At least three academic year semesters of graduate work are required for the MS degree. This residency requirement may be fulfilled using fall and spring semester combinations, summer and winter sessions do not meet the qualifications.

3. Course Substitutions. Courses in the core curriculum may not be substituted. Concentration electives will be chosen in consultation with the program director in accordance with the student's career goals. Transfer graduate coursework cannot count towards the degree.

B. Committees for exams, thesis or dissertations

N/A - the MMS is a non-thesis MS degree

C. Time Limit for Completing the Degree & Definition of Satisfactory

Academic Progress

1. Timetable. The time limit for completion of degree requirements begins with the date of matriculation and is specifically detailed in the student's letter of admission. Students entering the program are given 6 consecutive semesters to complete the program requirements. An extension of time limit may be granted for circumstances beyond the student's control. Requests for time extensions must be made in writing and approved by the student's dissertation committee and the director of the Medical Sciences Program. The director will forward the request to the Office of Graduate studies.

2. Submission of Required University Forms. To initiate the process for degree conferral, candidates must submit an "Application for Advanced Degree" to the Office of Graduate Studies. The application deadlines are February 15 for Spring candidates, January 15 for Winter candidates, May 15 for Summer candidates, and September 15 for Fall candidates. The application must be signed by the program director and department chair. There is an application fee of for doctoral degree candidates that is published by the university. Payment is required when the application is submitted.

Upon completion of the audit, the Office of Graduate Studies notifies students in writing when they have met all degree requirements.

3. Grade Requirements for Satisfactory Progress. Failure to satisfactorily progress in the program will be based on the University Graduate Policy as noted below: The Office of Graduate Studies monitors the academic progress of all graduate students and notifies students in writing of all academic deficiencies. The cumulative GPA after each 9-hour increment determines academic standing. The University's Academic Probation Policy is expressed in the following chart

If student is on:

If a student is on	Earns a GPA of	The status becomes
Any status	3.0 or above	Clear
Clear	2.99-2.5	Warning
Clear	2.49-2.	Probation
Probation	Below 3.0	Dismissal
Warning	Below 3.0	Probation
Any status	Below 2.0	Dismissal

4. Reasons for Dismissal/Termination from the Program. The Office of Graduate Studies notifies students when they are dismissed from graduate programs without completing a degree. Dismissals usually take place at the end of a term. Students may be dismissed for the following reasons:

- Upon the expiration of the three-year time limit required for students to complete their degree.
- Upon the failure to meet the grade point average requirements as stated in the policy on Academic Deficiency and Probation. Students may appeal dismissal through the Graduate College processes found [here](#).

IV. Evaluation

Students will be assessed through both direct and indirect measures as outlined below.

Direct Measures. Four Learning Outcomes have been identified for the program. Upon completion of the program, all students will:

1. Employ research methods to assess a problem in the field of medical science in an ethical manner. Course Assessed: MMSC 603 *Research Design and Statistics*
2. Communicate research findings in an effective manner. Course Assessed: MMSC 803 *Graduate Seminar*
3. Demonstrate the ability to quantitatively analyze data using several different statistical procedures. Course Assessed: MMSC 815 *Contemporary Topics Research*
4. Evaluate and assess regulatory and fiscal situations encountered in laboratory settings and make best-practice, evidence based recommendations. Course Assessed: MMSC 605 *Regulatory and Fiscal Issue in Laboratory Practice*

Indirect Measures.

Alumni Surveys Six Months, One-Year and Five-Year Post-Graduation

Surveys of graduates will be conducted one-year and five-year post-graduation. The surveys will focus on two major areas: program/education effectiveness and demographic information pertaining to employment status and/or graduate/professional school enrollment.

Field Experience Supervisor Surveys

Upon completion of the field experience(s), the field experience supervisor will complete a rubric designed to assess the affective skills demonstrated by the student.

V. Program Educational Goals

Outcomes for the MMS include the expectation that students will be able to:

- Critically review, appraise and synthesize the health sciences literature;
- Identify and systematically investigate research questions pertinent to clinical laboratory practice;
- Synthesize new concepts, models and theories through the appropriate application of empirical knowledge and the scientific method to help resolve clinical laboratory and health sciences issues or problems;
- Apply the advanced knowledge and technical skills needed to serve as active contributors and/or leaders in the laboratory science professions;
- Apply current knowledge to evaluate or design more effective ways to deliver clinical laboratory and health-related services;
- Use a variety of information technologies to address both theoretical and practical problems, enhance communication, and disseminate knowledge to applicable audiences and interest groups;
- Demonstrate proficiency in both oral and written communication, using both scholarly and technical formats;
- Work collaboratively with others to advance the scientific bases of knowledge in clinical laboratory science via ongoing scholarship;
- Integrate basic principles of ethics and cultural sensitivity within all interpersonal and professional activities.

VI. Financial Aid

There are no additional costs for the students in this program other than traditional graduate student tuition and fee expenses. This is a tuition generating graduate program and tuition remission and/or stipends are not offered. Graduate students in this

program would be eligible to apply for financial aid as applicable.

VII. Departmental Operations

This program was granted permanent status in April 2022. Department faculty will have primary teaching responsibility for the MMS core curricular courses. Existing departmental faculty will also participate in the program (Table 2).

Table 2 - Current Faculty Affiliated with the Program

Name	Degree	Rank	Specialty
Charles Swanik	Ph.D.	Professor, Deputy Dean	Administration
Esther Biswas-Fiss	Ph.D.	Professor and Chair	Molecular Diagnostics & Biotechnology
Leslie Allshouse	M.B.A., M.Ed.	Senior Instructor	Immunohematology
Subhasis Biswas	Ph.D.	Professor	Clinical Chemistry & Biotechnology
Mona Batish	Ph.D.	Associate Professor	Molecular Diagnostics & Seminar
Virginia Hughes	Ph.D.	Associate Professor	Hematology and Research Design, Statistics
Andrew Hollinger	M.S.	Instructor	Medical Microbiology, Molecular Diagnostics, Immunology/Virology
Kimberly Walker	Ph.D.	Instructor	Medical Microbiology, Clinical Chemistry, Body Fluid Analysis

Graduate Coordinator. The MMS department chair will appoint a graduate coordinator for the Medical Sciences Master's Program from among the department faculty. The term of service for the graduate coordinator is three years, with no limit on the number of consecutive terms that may be served. The graduate coordinator serves as the program representative and point person and is responsible for the following:

- Corresponding with prospective students
- Maintaining program records

- Holding elections for members of the Program Committee
- Chairing Program Committee meetings
- Admitting students to the program following approval of the Program Committee
- Chairing meetings of the Medical Sciences faculty as necessary for review/revision of program policies and curriculum
- Final approval of degree granting

Program Committee. The Medical Sciences Graduate Program Committee will consist of an affiliated faculty member from the department, serving in staggered, three-year terms. The graduate program coordinator will serve as chair of the Program Committee. Responsibilities of the Program Committee shall include:

- Admission of students into the program
- Approval of changes to the graduate curriculum

- Oversight of student progress in the program, including dismissal of students who fail to make satisfactory progress

Medical Sciences Students

- A. Student Organization.** Students in the program will be encouraged to periodically meet as a group so that the student representative can pass on any pertinent information from program meetings and so the group can discuss any issues or concerns they might have. Concerns can be brought to the attention of the program faculty by the elected student representative.
- B. Laboratory Safety and Research Regulations and Standards of Student Conduct.** Graduate students performing laboratory research are subject to all University regulations regarding safety, human subjects, animal use, and hazardous and radioactive material use and disposal. These guidelines may be found in the University of Delaware Policies and Procedures Manual. Additional information can be obtained from the UD Research and Graduate Studies website: <http://www.udel.edu/research/> All training and regulatory authorizations must be updated at the time of proposal submission.
- C. Travel.** Students will be encouraged to attend regional scientific meetings and symposia. Funding will be sought from available University/College/departmental funds should a student attend a conference for the purpose of presenting a peer-reviewed poster or to play a leadership role in the conference.

VIII. Appendix

Appendix

Suggested Course Sequence

**Department of Medical and Molecular
Sciences MS in Medical Sciences**

**Sample Schedule of Course Completion*
Four Semester Option**

Fall 1

MMSC 603 Research Design	3
MMSC 604 Methods in Bioscience Education	3
MMSC 803 Seminar	1
MMSC 611 Advanced Practica I	<u>2</u>
	9

Spring 1

MMSC 603 Reg & Fiscal Issues in Lab Mgmt	3
MMSC 803 Seminar	1
MMSC 631 Lab Education & Admin	2
Concentration Elective	<u>3</u>
	9

Fall 2

MMSC 815 Research	3
MMSC 803 Seminar	1
MMSC 612 Advanced Practica II	2
Concentration Elective	<u>3</u>
	9

Spring 2

MMSC 632 Lab Admin & Management	2
MMSC 613 Advanced Practica III	2
MMSC 815 Research	<u>3</u>
	7

Sequences can vary; for example, the program can be completed in an extended part-time option over the course of 5--6 semesters, where students complete an average of 4--6 credits per semester. An accelerated 3 semester option is also possible.