

DEPARTMENT *of*  
MEDICAL AND MOLECULAR SCIENCES

4+1 DEGREE PROGRAM

BS IN APPLIED MOLECULAR BIOLOGY  
AND  
BIOTECHNOLOGY  
MS IN MEDICAL SCIENCES  
Program Policies

---

---



February 2021

# Table of Contents

<b>Part I. Program History</b>	<b>Page</b>
A. Statement of purpose and expectation of graduate study in the program .....	3
B. Current status .....	5
C. Degrees offered.....	5
<b>Part II. Admission</b>	
A. Admission requirements and University policy statement on admission.....	5
B. Specific Admission Procedures.....	6
C. Application deadlines.....	6-8
D. Special requirements – immunizations .....	8
E. Admission application processing.....	8
<b>Part III. Academic</b>	
A. Degree Requirements	
1. Course requirements.....	9-11
2. Course substitutions .....	11
3. Grade minimums .....	11
4. Expectations of facility of expression in English (oral and written) .....	12
B. Committees for exams, thesis, or dissertations .....	12
C. Timetable and definition of satisfactory progress towards the degree	
1. Academic load and normal progress .....	12
2. Forms required.....	12
3. Grade requirements (general and specific).....	12-13
4. Identify consequence for failure to make satisfactory progress .....	13
5. Protocol for grievance procedure if student has been recommended for termination for failure to make satisfactory progress .....	13
6. Thesis/dissertation progress timetable guidelines .....	13
7. Thesis/dissertation defense guidelines .....	13
<b>Part IV. Assessment Plan</b>	
A. Direct.....	14
B. Indirect .....	14
<b>Part V. Financial aid</b>	
A. Financial awards statement .....	15
<b>Part VI. Departmental Operations</b>	
A. Overview and governance.....	15-16
B. General student responsibilities .....	17
C. Student government and organizations (both student and professional).....	17
D. Travel for professional meetings or presentation.....	17
<b>Part VII. Appendix</b>	
<b>Appendix 1 – Suggested course sequence.....</b>	<b>17</b>

## **I. Program History and Description**

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

This accelerated degree program provides high performing students with the opportunity to complete a bachelor's degree in Applied Molecular Biology & Biotechnology and a master's degree in Medical Sciences in less time and at less cost than completing both programs individually. With a combined degree, students will have specialized, in-depth professional skills knowledge and will be prepared to succeed within the increasingly complex biotechnology sector. In today's competitive employment market, individuals seeking management and leadership positions in the laboratory based professions require a graduate level degree. The 4+1, BS/MS in AMBB/MMS will allow students to specifically tailor their graduate program of study to meet their specific career goals, whether it be laboratory administration, research settings or laboratory science education.

While completing the BS in Applied Molecular Biology & Biotechnology degree, students will take six (6) credits of graduate-level courses in lieu of regularly required undergraduate courses in the major. The six credits will be counted toward both the Bachelor of Science degree and the Master of Science.

Benefits of pursuing an accelerated 4+1 BS/MS, AMBB/MMS student include:

- Completing both degrees in less time
- Graduate credits taken in undergraduate junior & senior years may apply toward both the bachelor's and master's degrees.
- Completion of a full-time master's degree without interrupting your professional career.
- A leg up in the job market upon graduation.
- Opportunities to engage in advanced study
- Better preparation for professional credentialing such as the ASCP(MB) exam.

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

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

- Critically review, appraise and synthesize the biomedical sciences literature;
- Identify and systematically investigate research questions pertinent to biomedical laboratory practice;
- Synthesize new concepts, models and theories through the appropriate application of empirical knowledge and the scientific method to help resolve laboratory and biomedical sciences issues or problems;
- Apply the advanced knowledge to evaluate or design more effective ways to deliver 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 biomedical laboratory science via ongoing scholarship;
- Integrate basic principles of ethics and cultural sensitivity within all interpersonal and professional activities.

The proposed new program is compatible with the academic priorities of the University by supporting the initiative of creating a diverse and stimulating undergraduate academic environment. This new initiative aligns with the UD Path to Prominence *One Health Initiative* where the University desires to expand its graduate level health and biomedical education programs.

#### **A. Current Status**

This proposal requests approval for a non-thesis 4+1, BS/MS Bachelor of Science in Applied Molecular Biology & Biotechnology/MS degree in Medical Sciences.

## **II. Admission**

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 4+1, Bachelor of Science in Applied Molecular Biology & Biotechnology /Master of Science in Medical Sciences** – Admissions decisions are made by the Masters in 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:

- Application is competitive and a minimum cumulative GPA of 3.2 is required for consideration. A high level of academic success in first four semesters of coursework of the AMBB major is required.
- **The GRE is not required** as strong successful progress towards completion of a rigorous, standards based (hence uniform) BS degree in the laboratory based professions is a reliable indicator of success in the MS in Medical Sciences.
- **Written statement of goals and objectives** (the personal statement) that clearly explains how admission to the program will facilitate his/her professional objectives.
- **Two letters of recommendation**, one of which must be from an MLS faculty member who is familiar with the applicant.
- Submission of a **Graduate Course Completion Form** as part of the application process.

## **B. Specific Admission Procedures –**

Students apply for admission to the Masters in Medical Sciences by May 15<sup>th</sup> of their sophomore year and are provisionally admitted as juniors. Application is competitive and a minimum cumulative GPA of 3.2 is required for consideration. Following provisional admission, students must maintain a 3.0 GPA throughout their remaining undergraduate studies. Students who fail to demonstrate satisfactory academic progress may be restricted from progressing to the graduate phase of the program. Once students complete their baccalaureate degree, the provisional status is removed.

Information about how to apply to the MMS is available online. ***Some application requirements specific to this program are:***

1. Submission of a **Graduate Course Completion Form** as part of the application process - <http://www1.udel.edu/gradoffice/forms-new/4+1.pdf>
2. Only current UD students can apply to the 4+1 program. ***The admission application fee will be waived.***
3. Applicants must submit two letters of recommendation. **For students applying to the 4 +1 BS/MS programs, one letter must be from a professor in the Department of Medical and Molecular Sciences.**

## **C. Applicant Deadlines –**

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:

4. A completed application should be submitted no later than May 15<sup>th</sup> of the sophomore year.

#### **D. Special Requirements – Immunizations**

It is a Delaware State Board of Health regulation and a University of Delaware mandate that all graduate student 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.

#### **E. Admission Application Processing –**

Applications will be processed as they are submitted. Following submission, the application materials 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. It should be noted, admission to the BS/MS in Medical Sciences does not confer admission to the Ph.D. in Medical Sciences, which is a distinct graduate program offered through the College of Health Sciences.

### **III. Academic**

#### **A. Degree Requirements**

##### **1. Course Requirements**

**Undergraduate Phase** – Students will complete all the required credits for the bachelors in AMBB.

Students will take two (2) 600-level courses as part of the requirements for the AMBB degree. These courses are to be chosen from the course requirements for the MMS and will also count towards their AMBB degree requirements.

**Table 1 – Recommended 4+1 Graduate Courses to be Completed in the Undergraduate Phase**

<b>Traditional AMBB BS Degree Curriculum</b>	<b>4+1 BS/MS Degree Curriculum</b>
<i>MMSC 490 Clinical Molecular Cell Biology</i>	<i>MMSC 690 Clinical Molecular Cell Biology</i>
<i>MMSC 375 – Statistics for Medical Laboratory Sciences</i>	<i>MMSC 603 – Research Design</i>

**\*\*HELPFUL HINT\*\*** After choosing the two 6xx-level courses (as mentioned above) and you have room in your schedule for courses that do NOT apply to your Undergraduate degree program, consider dual-listed, 4xx/6xx, courses and take the course(s) as a 6xx-level. These courses may possibly count toward your Master's degree, with prior approval from the Office of Graduate and Professional Education.

Students enrolled in MMSC 690 will have different expectations than those enrolled in MMSC490, the undergraduate counterpart. Specifically, examination questions for MMSC 690 will require demonstration of a higher degree of synthesis and application of learning objectives in the course. MMSC 690 students will be required to complete an out of class project which demonstrates their ability to build and integrate basic concepts with those available in the current scientific literature.

**Graduate Phase** - Students will complete an additional 26 credits of coursework to meet the course requirements for the MMS degree. Students must achieve a 3.0 GPA (B average) in their graduate work to earn the MMS.



## MS in Medical Sciences: Curriculum

### SEMESTER CREDITS

#### CORE COURSES (12 credits)

MMSC 603	Research Design	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)<sup>1</sup>

MMSC 611	Advanced Practicum I	2
MMSC 612	Advanced Practicum II	2
<b>OR</b>		
MMSC 631	Laboratory Education Administration and Instruction*	2
MMSC 613	Advanced Practicum III	2
MMSC 614	Advanced Practicum IV	2
<b>OR</b>		
MMSC 632	Laboratory Administration and Management	2

#### SCHOLARLY PRODUCT & CONCENTRATION ELECTIVES (12-14)<sup>2,3</sup>

MMSC 868	Research (2 total, 3 credits each)	6
<b>OR</b>		
MMSC 815	Contemporary Topics Research (2 total, 3 credits each)	6
Concentration Elective(s) <sup>3</sup>		6-8

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

<sup>1</sup>Students 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.

<sup>2</sup>To meet the scholarly product requirement, students may take a literature review/health services/ outcomes based research project course (MMSC 800) or engage in a wet-bench research project with a selected PI (MMSC 868). Students must meet with the MMS program director to determine which course best meets their educational needs.

<sup>3</sup>See Table 2 for a list of potential concentration elective courses. Selections are tailored to meet each student's educational goals. Support from affected departments were obtained during the initial approval process for the MS in Medical Sciences (16-17 Senate Cycle).

**Table 2 - POTENTIAL CONCENTRATION ELECTIVE COURSES**

MMSC 608	Molecular Preparatory Techniques	2
MMSC 625	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
MEDT626	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
MMSC 805	Biomarker Development	3
MMSC 810	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
CHEM641	Biochemistry	3
CHEM642	Biochemistry	3
EDUC856	Introduction to Statistical Inference	3

2. **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.
3. **Grade Minimums** – Students must achieve a 3.0 GPA (B average) in their graduate work to earn their MMS.

**4. Expectations of facility of expression in English (oral and written)** – All students will be expected to be sufficiently conversant in English and knowledgeable in the written work to convey clear, logical and complex written expressions.

**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 3 consecutive semesters, beyond completion of the undergraduate curriculum, 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 Graduate Program Director. 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 master's 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 semester

determines academic standing. The University’s Academic Probation Policy is expressed in the following chart:

**1. Consequence for failure to make satisfactory progress**

If student is on:

<b>If a student is on</b>	<b>Earns a GPA of</b>	<b>The status becomes</b>
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

**2. 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.

**3. Thesis/dissertation progress timetable guidelines**

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

**4. Thesis/dissertation defense guidelines**

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

#### **IV. Assessment Plan**

Faculty who will be affiliated with the program plan to work with the UD Center for Educational Effectiveness in spring 2019 to fully develop the program's assessment plan. This work will entail the development of a curriculum map to align selected courses with the intended learning outcomes of the program.

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

**B.** Employ research methods to assess a problem in the field of medical science in an ethical manner. Course Assessed: MMSC 603 *Research Design*

**C.** Communicate research findings in an effective manner. Course Assessed: MMSC 803 *Graduate Seminar*

**D.** Demonstrate the ability to quantitatively analyze data using several different statistical procedures. Course Assessed: MMSC 868 *Experimental Research* or MMSC 800 *Contemporary Topics Research*

**E.** 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*

#### **B. 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. Financial Aid

A. During your first four years in the AMBB program, you pay undergraduate tuition and fees. During the fifth year of study, and any subsequent period if it became necessary, applicable tuition and fees are those for MMS graduate students. 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.

## VI. Departmental Operations

**Table 3 - Current Faculty Affiliated with the Program**

<b>Name</b>	<b>Degree</b>	<b>Rank</b>	<b>Specialty</b>
Charles Swanik	Ph.D.	Deputy Dean	Administration
Esther Biswas-Fiss	MS, Ph.D.	Professor & Chair	Molecular Diagnostics & Biotechnology
Leslie Allshouse	M.Ed., M.B.A.	Senior Instructor	Immunohematology
Mona Batish	Ph.D.	Assistant Professor	Applied Molecular Biology
Subhasis Biswas	Ph.D.	Professor	Applied Molecular Biology
Karen Brinker	M.S.	Senior Instructor	Clinical Chemistry
Virginia Hughes	Ph.D.	Associate Professor	Hematology and Public Policy
Donald Lehman	Ed.D.	Associate Professor	Medical Microbiology

---

Huey-Jen Lin	Ph.D.	Associate Professor	Molecular Diagnostics
Raelene Maser	Ph.D.	Associate Professor	Hematology
Mary Ann McLane	Ph.D.	Professor	Clinical Chemistry
Vijay Parashar	Ph.D.	Assistant Professor	Applied Molecular Biology
Marie Wood	M.S.	Instructor	Clinical Chemistry & Medical Microbiology

---

**Graduate Coordinator.** The MLS 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**

- 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. 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.
- D. 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.

## **VII. Appendix**

### **Appendix 1.- Suggested Schedule of Course Completion**



# **Appendix 1 - Suggested Course Sequence**

## Department of Medical and Molecular Sciences

### 4+1, BS/MS Bachelor of Science Applied Molecular Biology and Biotechnology /Master of Science in Medical Sciences

#### Sample Schedule of Course Completion

##### *Undergraduate Phase*

MMSC 603 Research Design	3 (satisfies MScore)
MMSC 690 Genetic & Mole.Diagn. for Clinical Lab elective)	<u>3</u> (satisfies concentration 6

##### *Graduate Phase*

###### **Summer**

MMSC 868 Research 3

###### **OR**

MMSC 815 Contemporary Topics Research 3

MMSC 803 Seminar 1  
4

###### **Fall**

MMSC 868 Research 3

###### **OR**

MMSC 815 Contemporary Topics Research 3

MMSC 604 Methods in Bioscience Education 3

MMSC 803 Seminar 1

Concentration Elective 3

Fieldwork Experiences Selective\* 2  
12

###### **Spring**

MMSC 605 Regulatory & Fiscal Issues in Lab Mgmt.

3 MMSC 803 Seminar 1

Fieldwork Experiences Selectives\* 6  
10

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