UNIVERSITY OF DELAWARE

DEPARTMENT *of* MEDICAL AND MOLECULAR SCIENCES

MEDICAL DIAGNOSTICS PRE PA BS/MS 4+1 Program Policies

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MISSION STATEMENT

The Department of Medical and Molecular Sciences is committed to providing skilled, critically-thinking practitioners equipped to be future leaders in health sciences. In this pursuit, the Department is committed to active engagement of undergraduate and graduate students in experiential learning, to forming collaborative partnerships with educational, clinical, industrial, and research experts locally and globally, to discovering innovative breakthroughs in research that contribute to the health and basic sciences body of knowledge, and to provide a cadre of leaders in the laboratory-based professions.

ADMINISTRATIVE OFFICIALS

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PROGRAM OVERVIEW

A central tenet of the University of Delaware is to encourage students to achieve their highest standard of scholarship and to help them assume responsibility for developing and achieving their own goals and objectives. Moreover, the mission of the College of Health Sciences (CHS) is, in part, to educate the next generation of healthcare professionals in a collaborative and interprofessional learning environment. In accordance with this, the aim of the Medical Diagnostics Pre-PA BS/MS 4+1 Program is to prepare students to function in professional positions as competent practitioners for the healthcare environment of the 21st century, and to prepare students to be life-long learners remaining current with advances in medical science.

This accelerated degree program provides high performing students with the opportunity to complete a BS degree in Medical Diagnostics and a MS in Medical Sciences in less time and at a reduced cost than completing either program individually. With a combined degree, students will have specialized, in depth professional skills knowledge and will be prepared to succeed within the increasingly complex biomedical science 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 MDD/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 Medical Diagnostics 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 BS degree and the MS degree.

GOALS

1. Critically review, appraisee and synthesize the biomedical sciences literature.
2. Identify and systematically investigate research questions pertinent to biomedical laboratory practice.
3. 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.
4. Apply the advanced knowledge to evaluate or design more effective ways to deliver laboratory and health related services.
5. Use a variety of information technologies to address both theoretical and practical problems, enhance communication, and disseminate knowledge to applicable audiences and interest groups.
6. Demonstrate proficiency in both oral and written communication, using both scholarly and technical formats.
7. Work collaboratively with others to advance the scientific bases of knowledge in clinical laboratory science via ongoing scholarship.
8. Integrate basic principles of ethics and cultural sensitivity within all interpersonal and professional activities

ADMISSION REQUIREMENTS

Admission to the BS/MS 4+1 Program is competitive and the deadline to submit the application is May 15th of the students sophomore year. Admission decisions are made by the Masters in Medical Sciences (MMS) Program Committee. Students will be admitted to the program based on enrollment availability and their ability to meet the following minimum recommended entrance requirements:

- A minimum cumulative GPA of 3.2 is required for consideration; a high level of academic success in the first four semesters of coursework of the MDD 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 MMSC faculty member who is familiar with the applicant
- Submission of a Graduate Course Completion Form (http://www1.udel.edu/gradoffice/forms-new/4+1.pdf) as part of the application process
- Admission is limited to current UD Students; the admission application fee is waived

Admission Application Processing

Applications will be processed as they are submitted. Following submission, the application materials are reviewed by the Program Committee of the Masters in Medical Sciences Degree. The Program Committee arrives at an admission decision after reviewing the completed application. Students are notified in writing of the admissions decision after reviewing the completed application. Students are notified in writing of the admissions decisions within two weeks of the decision. It should be noted that 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.

HEALTH AND SAFETY REQUIREMENTS

Health Requirements

To safeguard the health and safety of staff and patients when performing educational activities in the clinical setting, students may be required to have a routine physical examination before the start of volunteer activities. The physical examination provides verification that the student appears to be free from disease or any impediment which would interfere with normal activity, study, or physical effort.

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.

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.

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 peerreviewed poster or to play a leadership role in the conference.

Immunizations

Before starting clinical activities, students may be required to have specific testing and/or immunization (or documentation thereof) for hepatitis B, tetanus, measles (rubeola), mumps, and rubella (MMR), varicella (chicken pox), influenza and tuberculosis. Students might be required to submit documentation of immunity as evidenced by positive immune titers for several of these diseases. For the safety of patients, healthcare institutions have the right to refuse students participation, if the student is unwilling to comply with immunization requirements.

Healthcare personnel are among those at increased risk for acquiring hepatitis B virus infection due to their frequent contact with human blood and other body fluids. A student who wishes to be immunized may receive the injections from his or her primary care provider. Such immunizations should begin at least six months prior to volunteer activities. Alternatively, the vaccine is available through Student Health Services paid for by the student. The vaccine is administered as a series of three injections given at appropriate intervals over a six-month period. If a student has been vaccinated previously, most hospitals will require a blood test to determine antibody titer to the hepatitis B virus.

ACADEMIC REQUIREMENTS

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

Core Courses (12 credits)		**Semester Credits**
MMSC603	Research Design	3
MMSC604	Methods in Bioscience Education	3
MMSC605	Regulatory and Fiscal Issues in Laboratory Management	3
MMSC803	Seminar (3 total, 1 per semester-1 credit each)	3
Fieldwork Experiences (8 credits)[1]		
MMSC611	Advanced Practicum I	2
MMSC612	Advanced Practicum II	2
Or		
MMSC631	Laboratory Education Administration and Instruction*	2
MMSC613	Advanced Practicum III	2
MMSC614	Advanced Practicum IV	2
Or		
MMSC632	Laboratory Administration and Management	2
Scholarly Product & Concentration Electives (12-14)[2-3]		
MMSC868	Research (2 total, 3 credits each)	6

Or

MMSC815	Contemporary Topics Research (2 total, 3 credits each)	6
Concentration Elective(s)		6-8

Total Credits for the Masters in Medical Sciences, minimum of 32

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

[2]To meet the scholarly product requirement, students may take a literature review/health services/outcomes-based research project course (MMSC800) or engage I na wet-bench research project with a selected PI (MMSC868). Students must meet with the MMS Program Director to determine which course best meets their educational needs.

[3]See Table 2 for a list of potential concentration elective courses. Selections are tailored to meet each student's educational goals.

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

Traditional MDD BS Degree Curriculum	4+1 BS/MS Degree Curriculum
BISC401-Molecular Biology of the Cell	MMSC490 Clinical and Molecular Cell Biology
STAT408-Statistical Research Methods I Or STAT200-Basic Statistical Practice	MMSC603 Research Design

Note: After choosing the two 600 level courses 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 MS degree, with prior approval from the office of graduate and professional education. In addition, students enrolled in mmsc690 will have different expectations than those enrolled in mmsc490, the undergraduate counterpart. Specifically, examination questions for mmsc690 will require demonstration of a higher degree of synthesis and application of learning objectives in the course. mmsc690 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. In the Graduate Phase of this program, students will complete an additional 26 credits of coursework to meet degree requirements maintaining a minimum GPA of 3.0 throughout the program.

Table 2: Potential Concentration Elective Courses

Course	Name	Credits
MMSC608	Molecular preparatory techniques	2
MMSC625	Basic Molecular Techniques	4

MMSC690	Clinical and Molecular cell Biology	3
MMSC691	Human Molecular Genetics	3
MMSC692	Application of Molecular Diagnostics Techniques	3
MMSC651	Cell and Tissue Culture Techniques	4
MMSC627	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
NTDT610	Overweight/obesity Prevention and Management	3
NTDT611	Advanced Nutrition	3
NTDT630	Trace Minerals & Vitamins	3
NTDT640	Nutrition & Aging	3
NTDT655	Issues in International Nutrition	3
NURS621	Advanced Pathophysiology	3
NURS812	Responsible conduct of research	1
BINF644	Bioinformatics	3
CISC636	Computational Biology and Bioinformatics	3
CHEM641	Biochemistry	3
CHEM642	Biochemistry	3
EDUC856	Introduction to Statistical Inference	3

Courses in the Core Curriculum may not be substituted. Concentration electives will be chosen in consultation with the Program Director in accordance with the students career goals. Transfer graduate coursework cannot count toward the MMS degree.

Committees for Exams, Theses, or Dissertations

The MMS Degree is a non-thesis MS Degree

Time Limit for Completing the Degree & Definition of Satisfactory Academic Progress

Time Table: The time limit for completion of degree requirements begins with the date of matriculation and is specifically detailed in the student's letter of acceptance. Students entering the programs 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, Esther Biswas-Fiss, Ph.D.

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 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

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 Table 3.

Table 3: Consequence for Failure to make Satisfactory Progress

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

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 should be dismissed for the following reasons:

- Upon the expiration of the 3-yr time limit required for students to complete their degree
- Upon the failure to meet the GPA requirements as stated in the policy on Academic Deficiency and Probation

Thesis/Dissertation Progress Timetable Guidelines: N/A-the MMS is a non-thesis MS degree

Thesis/Dissertation Defense Guidelines: N/A-the MMS is a non-thesis MS degree

Tuition and Fees: During your first four years in the MDD 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.

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.

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: MEDT 603 Research Design
2. Communicate research findings in an effective manner. Course Assessed: MEDT 803 Graduate Seminar
3. Demonstrate the ability to quantitatively analyze data using several different statistical procedures. Course Assessed: MEDT 868 Experimental Research or MEDT 800 Contemporary Topics Research
4. Evaluate and assess regulatory and fiscal situations encountered in laboratory settings and make best-practice, evidence based recommendations. Course Assessed: MEDT 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.

<u>Field Experience Supervisor Surveys</u>

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.

DEPARTMENTAL OPERATIONS

Graduate Coordinator: The MMSC 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.

Table 4. Faculty Associated with the MMS Program

Name	Degree	Rank	Specialty
Esther Biswas-Fiss	Ph.D.	Professor & Chair	Molecular Diagnostics & Biotechnology
Leslie Allshouse	M.Ed, M.B.A.	Senior Instructor & Vice Chair	Immunohematology
Mona Batish	Ph.D.	Assistant Professor	Applied Molecular Biology
Subhasis Biswas	Ph.D.	Professor	Applied Molecular Biology
Virginia Hughes	Ph.D.	Associate Professor	Hematology, Immunohematology, Statistics, Research Design, Public Policy
Donald Lehman	Ed.D.	Professor	Medical Microbiology
Denene Lofland	Ph.D.	Associate Professor	Medical Microbiology, Regulatory Affairs
Huey-Jen Lin	Ph.D.	Associate Professor	Molecular Diagnostics
Vijay Parashar	Ph.D.	Assistant Professor	Applied Molecular Biology

APPENDIX A. SUGGESTED COURSE SEQUENCE

4+1, BS/MS Bachelor of Science Medical Diagnostics/Master of Science in Medical Sciences
Sample Schedule of Course Completion

Undergraduate Phase	
MMSC 603 Research Design	3 (satisfies MS core)
MMSC 690 Clinical & Molecular Cell Biology	3 (satisfies concentration elective)
	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
MMSC803 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 Practicum; Laboratory Education Administration and Instruction; Laboratory Administration and Management.

APPENDIX B. CORE COURSES FOR BS IN MDD

HLTH 241 Ethical Aspects of Healthcare (3)
Study of basic ethical thought and principles and their applications to selected contemporary issues in healthcare

MMSC 360 Clinical Immunology and Medical Virology (3)
Introductory immunology concepts and use of immunological assays, such as enzyme immunoassays and fluorescent antibody assays, for diagnosis of infectious diseases and immunological disorders. Study of viruses, diseases they cause, and methods used to diagnose viral infections.

MMSC 402 Body Fluid Analysis (1)
Overview of protocols, technical and clinical correlations involved in body fluid analysis of non-blood body fluids, including urine, synovial, cerebrospinal, seminal, serous, amniotic and gastric fluids.

MMSC 407 Clinical Physiological Chemistry I (3)
Application and theory of manual and automated techniques used in diagnostic and therapeutic medicine. Emphasis on clinical procedures for carbohydrates, proteins, lipids, nonprotein nitrogenous compounds, blood gases and pH, and electrolytes.

MMSC 436 Clinical Physiological Chemistry II (3)
Application and theory of methodologies in enzymology, endocrinology and toxicology. Relationship of normal and abnormal laboratory findings in organ functional tests.

MMSC 423 Hematology I (2)
Quantitative and qualitative study of the formed elements of blood with emphasis on the normal state, as well as the study of normal and abnormal coagulation and hemostasis.

MMSC 433 Hematology II (2)
Study of the pathophysiology of erythrocytic and leukocytic disorders and the laboratory findings of these disorders.

MMSC 428 Medical Microbiology (3)
Study of the occurrence and pathogenesis of human infections and microorganisms associated with humans in health and disease.

MMSC 409 Immunohematology I (2)
Study of antigen and antibody systems of human red cells and compatibility testing of blood for transfusion.

MMSC 420 Immunohematology II (2)
Study of blood and component transfusions, their risks, complications and quality assurance. Blood component therapy and testing of the neonate and adult is also covered.

MMSC 438 Diagnostic Bacteriology and Medical Mycology (2)
Diagnostic bacteriology, emphasizing the correlation of in vitro and in vivo findings in the diagnosis and treatment of infectious disease, including human mycoses. Identification of pathogenic and nonpathogenic bacteria and fungi in clinical specimens.

MMSC 462 Interdisciplinary Healthcare Perspectives (3)
Final reflective component of the volunteer experiences accumulated throughout the student's undergraduate years in preparation for a graduate program in a healthcare field. Evidence of critical thinking and knowledge of healthcare concepts will be demonstrated through various assignments.

MMSC 490 Clinical and Molecular Cell Biology (3)
Molecular diagnostics topics emphasize DNA, RNA and protein structure and function, including detailed review of the central dogma. Genetic topics emphasize cell development, chromosome structure and function, and disease inheritance patterns.

MMSC 491 Human Molecular Genetics (3)
Molecular processes required to diagnose inherited disorders, cancer, hematological disorders, and infectious agents. Additionally, the employment of DNA identity based testing in transplantation, paternity testing and forensics will be discussed.

BISC 401 Molecular Biology of the Cell (3)
Introduction to the molecular biology of eukaryotes and prokaryotes. Topics include structure and function of proteins and nucleic acids, replication and repair of DNA; biosynthesis of RNA and proteins, membranes, transport, composition and function of the eukaryotic cell, chromosomes, viruses, the immune system and recombinant DNA.

BISC 403 Genetics (3)
The physical and chemical basis of heredity, the nature and mechanisms of gene action.

NOTE: STUDENTS TAKE THE SEQUENCE OF MMSC 490 AND MMSC491 OR BISC401 AND BISC403. Courses that can substitute for MMSC462 include HLTH320, HLTH395, HLTH411, HLTH467, HLTH492, BHAN236, and NURS214. MMSC270 may substitute for BISC300. Students must earn a total of 120 credits for graduation.