

# Multidisciplinary Biomedical Science

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The MS Program in Multidisciplinary Biomedical Science (MBS) is intended for both domestic and international students who have some undergraduate STEM background and who wish to expand their foundation of knowledge in the biomedical sciences. MBS offers a 45 hour, research-intensive thesis option (Plan I), and a 30 hour non-thesis option (Plan II).

## Why MBS?

If you are on the pre-health track (e.g., pre-med; pre-dental; pre-PA; pre-pharmacy), you are interested in careers in research science, science education, or you are considering alternative careers (e.g., scientific policy, science communication, biomedical sales), MBS may be the right Program for you.

## Admission Requirements:

Direct-admittance to MBS requires a 3.0 minimum overall GPA and successful completion of the following pre-requisites: Introductory Biology (BY 123-124 if from UAB or equivalent) and Organic Chemistry (CH 235-238 if from UAB or equivalent). Your pre-requisite GPA and your Biology-Chemistry-Physics-Math (or BCPM) GPAs will also be considered in our administrative review of your application. The GRE is not required. For international applicants, the minimum TOEFL and IELTS scores required for direct entry are 80 and 6.5, respectively.

Students are required to submit their transcripts, a personal statement, and three letters of recommendation. Once these materials are received and the application fee is processed, applications will be reviewed.

Accelerated Learning Opportunities

### ***MBS via the Accelerated Bachelors/Masters (ABM) Program***

Multidisciplinary Biomedical Sciences offers an Accelerated Bachelors/Masters (ABM) option for high-achieving undergraduates. Distinct advantages of MBS-ABM include the use of up to 12 hours of shared credit that is applied to both your BS and MS degrees, taking graduate courses at the undergraduate tuition rate, and additional opportunities for academic advising and mentoring. The vast majority of MBS-ABM students are able to graduate with both their BS and MS degrees in 4 years, thus potentially making you more competitive for the next phase of your career trajectory. To be eligible for ABM, students must have met the following requirements prior to matriculating:

- Junior status (60 credit hours, 36 of these hours at UAB)
- Minimum 3.5 undergraduate GPA
- Completed the following pre-requisite courses: BY 123, BY 124, CH 235, CH 236, CH 237 and CH 238

### ***MBS via Early Acceptance***

The UAB Early Acceptance (EA) Program is designed for academically superior high-school students, allowing them to be admitted to MBS at the same time they are admitted to an undergraduate program.

EA students may also utilize the ABM Program as a mechanism for admission to MBS.

## Deadlines for all Applicants:

- **Fall:** August 1
- **Spring:** December 1
- **Summer:** April 15

## For More Information:

Please contact Ms. Jessamine Huffman (Program manager; [msmbs@uab.edu](mailto:msmbs@uab.edu)) or Dr. John Shacka (Program Director; [shacka@uab.edu](mailto:shacka@uab.edu)), or visit our website: <https://www.uab.edu/graduate/programs/msmbs>

## M.S. in Multidisciplinary Biomedical Science

The MS in Multidisciplinary Biomedical Science (MBS) is intended as a terminal degree for students desiring many different career paths, including but not limited to: research (laboratory jobs in academia or industry), further graduate study (e.g. PhD), professional school (e.g., medical or dental), science education, scientific policy, science communication, or biomedical sales.

### Thesis (Plan I)

The Plan I MS in MBS thesis degree at UAB can be completed over the course of five-six semesters if full-time, including at least one summer semester. Plan I students will complete a rigorous mentored research project in addition to a curriculum of required core and elective classes related to the biomedical sciences.

Successful completion of the Plan I MS in MBS degree requires passing 45 credit hours (30 hours = coursework; 15 hours = supervised research) and maintaining a minimum 3.0 GPA. Students must obtain a minimum C final grade in all required (non-elective) classes in order to graduate. However, only one C final grade is allowed among our three required core science courses- MBS 601, MBS 602, and MBS 603.

### Coursework

Plan I students must complete the following required classes:

- 1) core science (MBS 601 (4 hours), MBS 602 (4 hours), MBS 603 (4 hours), 12 hours total)
- 2) biostatistics (BST 603, 3 hours) or equivalent with permission
- 3) three semesters of colloquium (MBS 697 (1 hour), 3 hours total)
- 4) three-four semesters of non-thesis research (MBS 698, 9 hours total)
- 5) one-two semesters of thesis research (MBS 699, 6 hours total)
- 6) electives (12 hours total).

Students have the option of earning a concentration by completing at least nine of their elective credit hours in a single subject area.

## Research

Plan I students must complete five separate semesters of research totaling a minimum of 15 credit hours, including a minimum of 9 hours of MBS 698 (non-thesis research) over three-four semesters, and 6 hours of MBS 699 (thesis research) over one-two semesters (at least one semester is required). When registered for MBS 698 or MBS 699, students are expected to work on average a minimum of 15-20 hours/week on their research projects. During their first semester in the program, before they start their research projects, students undergo a mentor match process to choose their faculty thesis adviser, with the expectation that this decision is made before the start of their second semester. Plan I students will form a committee of three faculty that is chaired by their thesis adviser and are required to hold a minimum of three committee meetings (1: introductory; 2: qualifying exam; 3: thesis defense; additional meetings may be needed depending on student progress). The thesis project must be approved by the student's committee. For the qualifying exam, Plan I students are expected to prepare a seven page "NIH-style" grant proposal, plus a separate reference section, that is adjusted to the scope of their research project, and vet their proposals in front of their committee. Following qualification for thesis candidacy, Plan I students are required to complete a thesis document of their research findings and defend it publicly as a presentation to their committee and others (e.g., students, lab members, family members), which is followed immediately by a private defense with their committee. Plan I students work on their research projects for five semesters, typically semesters 2-6 while in the Program. During their first semester in the program, Plan I students should register for zero hours of MBS 698, to accommodate the mentor match process. Before students begin their research they must complete all lab-specific safety training. Students must also complete Responsible Conduct of Research (RCR) training for MS students before the end of their first semester registered for MBS 698.

Requirements	Hours
<b>Required MBS Coursework</b>	<b>18</b>
MBS 601 Molecular and Cell Biology	
MBS 603 General Human Physiology	
MBS 602 Biochemistry and Cell Biology	
MBS 697 Colloquium for MBS Plan I Thesis Students (Must be repeated twice for a total of 3 Credit Hours)	
BST 603 Introductory Biostatistics for Graduate Biomedical Sciences <sup>1</sup>	
<b>Research <sup>2</sup></b>	<b>15</b>
MBS 698 Non-Thesis Research	
MBS 699 Thesis Research	
<b>Electives <sup>3, 4</sup></b>	<b>12</b>
<b>Total Hours</b>	<b>45</b>

<sup>1</sup> In place of BST 603, students may take one of the following statistics courses, with permission of the Course Director and MBS Program Director: BST 601, BST 611.

<sup>2</sup> Students may enroll in MBS 698 (totaling 9 hours) for 3-4 semesters, and MBS 699 (totaling 6 hours) for 1-2 semesters (but a minimum of 1 semester). Total credit hours for MBS 698 and MBS 699 must equal a minimum of 15 hours. Students may take one extra semester of MBS 698 or MBS 699 in lieu of one 3 hour elective course, for a total of 18 research hours.

<sup>3</sup> Students may select from the following electives: BY 501, BY 511, BY 512, BY 515, BY 527, BY 530, BY 531, BY 614, BY 616, BY 617, BY 620, BY 626, BY 629, BY 632, BY 633, BY 634, BY 636, BY 637, BY 640, BY 644, BY 662, BY 674, BY 675, BY 695, BY 697,

CNBY 600, CNBY 610, CNBY 620, CNBY 630, CNBY 640, CNBY 660, CNBY 670, EPI 600, GGSC 610, GGSC 615, GRD 617, GGSC 620, GGSC 635, GGSC 665, GGSC 670, GGSC 690, GGSC 691, GRD 701, GRD 703, GRD 705, GRD 706, GRD 709, GRD 713, GRD 716, GRD 717, GRD 719, GRD 722, GRD 727, GRD 735, GRD 739, GRD 745, GRD 751, GRD 759, GRD 760, GRD 761, GRD 773, GRD 774, INFO 601, INFO 602, INFO 603, INFO 604, INFO 610, LEAD 500, LEAD 501, LEAD 502, LEAD 503, LEAD 505, LEAD 506, LEAD 520, LEAD 521, LEAD 522, LEAD 523, LEAD 524, LEAD 525, LEAD 540, LEAD 542, LEAD 543, LEAD 544, LEAD 560, LEAD 570, LEAD 590, MBS 696, MIC 600, MIC 603, MIC 660, MIC 661, MIC 665, NBL 624, NBL 625, NBL 633, NBL 634, NBL 644, NBL 655, NBL 656, NBL 657, NBL 684, PHR 611, PHR 612, PHR 613, PHR 614, PHR 615, PHR 696, PSDO 630, PY 620, PY 653, PY 683, PY 687, PY 693.

For other elective options please discuss first with the MBS Program Director before registering.

<sup>4</sup> Students may use 9 elective hours in one of the following themes to pursue a specialized concentration:

**Bioinformatics:** INFO 601, INFO 602, INFO 603, INFO 604, INFO 610

**Cancer Biology:** CNBY 600, CNBY 610, CNBY 620, CNBY 630, CNBY 640, CNBY 660, CNBY 670, PHR 615

**Genetic and Genomic Sciences**

**(GGSC):** GGSC 610, GGSC 615, GGSC 620, GGSC 635, GGSC 665, GGSC 670, GGSC 690, GGSC 691, BY 531, BY 634, BY 637

**Immunology:** MIC 600, MIC 603, MIC 660, MIC 661, MIC 665

**Neuroscience:** NBL 624, NBL 625, NBL 633, NBL 634, NBL 644, NBL 655, NBL 656, NBL 657, NBL 684, PY 620, PY 653, PY 683, PY 687, PY 693

**Pharmacology:** PHR 611, PHR 612, PHR 613, PHR 614, PHR 615, GGSC 670, PHR 696

## Non-Thesis (Plan II) for Traditional MS Students

The Plan II MSBMS non-thesis degree at UAB can be completed over the course of three semesters if full-time, including one summer semester. Plan II students will complete a rigorous curriculum of required core and elective classes related to the biomedical sciences.

Successful completion of the Plan II MSBMS degree requires passing 30 credit hours of coursework and maintaining a minimum 3.0 GPA. Students must obtain a minimum C final grade in all required (non-elective) classes in order to graduate. However, only one C final grade is allowed among our three required core science courses- MBS 601, MBS 602, and MBS 603.

## Coursework

Plan II students must complete the following required classes:

- 1) Core Science (MBS 601 (4 hours), MBS 602 (4 hours), MBS 603(4 hours), 12 hours total)
- 2) Biostatistics (BST 603, 3 hours) or equivalent with permission
- 3) Non-Thesis Colloquium (MBS 695, 1 hour)
- 4) Biotechnology skills lab (BT 650, 2 hour, OR BT 651, 2 hour)

5) Electives (12 hours total). Students have the option of earning a concentration by completing at least nine of their elective credit hours in a single subject area.

Requirements	Hours
MBS 601 Molecular and Cell Biology	4
MBS 602 Biochemistry and Cell Biology	4
MBS 603 General Human Physiology	4
MBS 695 Professional Development Colloquium for Non-Thesis Students	1
BT 650 Applications in Biotechnology I <sup>1</sup>	2
BST 603 Introductory Biostatistics for Graduate Biomedical Sciences <sup>2</sup>	3
<b>Electives</b> <sup>3, 4, 5</sup>	<b>12</b>
<b>Total Hours</b>	<b>30</b>

<sup>1</sup> Students may substitute BT 651 (spring semester) for BT 650 (fall semester).

<sup>2</sup> In place of BST 603, students may take one of the following statistics courses, with permission of the Course Director and MBS Program Director: BST 601, BST 611.

<sup>3</sup> Students may select from the following electives: BY 501, BY 511, BY 512, BY 515, BY 616, BY 617, BY 527, BY 530, BY 531, BY 614, BY 620, BY 626, BY 629, BY 632, BY 633, BY 634, BY 636, BY 637, BY 640, BY 644, BY 662, BY 674, BY 675, BY 695, BY 697, CNBY 600, CNBY 610, CNBY 620, CNBY 630, CNBY 640, CNBY 660, CNBY 670, EPI 600, GGSC 610, GGSC 615, GGSC 620, GGSC 635, GGSC 665, GGSC 670, GGSC 690, GGSC 691, GRD 617, GRD 701, GRD 703, GRD 705, GRD 706, GRD 707, GRD 708, GRD 709, GRD 713, GRD 716, GRD 717, GRD 719, GRD 722, GRD 727, GRD 735, GRD 739, GRD 745, GRD 751, GRD 759, GRD 760, GRD 761, GRD 773, GRD 774, INFO 601, INFO 602, INFO 603, INFO 604, INFO 610, MBS 696, MBS 698, MIC 600, MIC 603, MIC 660, MIC 661, MIC 665, NBL 624, NBL 625, NBL 633, NBL 634, NBL 644, NBL 655, NBL 656, NBL 657, NBL 684, PHR 611, PHR 612, PHR 613, PHR 614, PHR 615, PHR 696, PSDO 630, PY 620, PY 653, PY 683, PY 687, PY 693. For other elective options please discuss with the MBS Program Director.

<sup>4</sup> Students may use 9 elective hours in one of the following themes to pursue a specialized concentration:

**Bioinformatics:** INFO 601, INFO 602, INFO 603, INFO 604, INFO 610

**Cancer Biology:** CNBY 600, CNBY 610, CNBY 620, CNBY 630, CNBY 640, CNBY 660, CNBY 670

**Genetic and Genomic Sciences (GGSC):**

GGSC 610, GGSC 615, GGSC 620, GGSC 635, GGSC 665, GGSC 670, GGSC 690, GGSC 691, BY 531, BY 634, BY 637

**Immunology:** MIC 600, MIC 603, MIC 660, MIC 661, MIC 665

**Neuroscience:** NBL 624, NBL 625, NBL 633, NBL 634, NBL 644, NBL 655, NBL 656, NBL 657, NBL 684, PY 620, PY 653, PY 683, PY 687, PY 693

**Pharmacology:** PHR 611, PHR 612, PHR 613, PHR 614, PHR 615, GGSC 670

<sup>5</sup> As the majority of ABM students entering our program already perform undergraduate research, and also have required colloquium courses with similar content for their majors, we do not require them to take

BT 650/ BT 651 or MBS 695. These three hours may be used for elective coursework to complete requirements for their MS degree.”

## Non-Thesis (Plan II) for Accelerated Bachelor's/Master's (ABM) Program Students

Undergraduates at UAB who meet qualifications for admission the Accelerated Bachelor's/Master's (ABM) program, and/or who also received an early acceptance (EA) option for a MS program at UAB, may choose to complete the Plan II MS non-thesis degree in MBS. Plan II students will complete a rigorous curriculum of required core and elective classes related to the biomedical sciences. Up to 12 of these elective credit hours may be used as shared credit towards both their B.S. and M.S. degrees. Successful completion of the Plan II MSBMS degree requires passing 30 credit hours of coursework and maintaining a minimum 3.0 GPA.

### Coursework

Plan II students must complete the following required classes: 1) core science (MBS 601 (4 hours), MBS 602 (4 hours), MBS 603 (4 hours), 12 hours total); 2) biostatistics (BST 603, 3 hours) or equivalent with permission; and 4) electives (15 hours total). Students have the option of earning a concentration by completing three elective courses (minimum 9 hours) in a single subject area. Students must obtain a minimum C final grade in all required (non-elective) classes in order to graduate. However, only one C final grade is allowed among our three required core science courses- MBS 601, MBS 602, and MBS 603.

Requirements	Hours
MBS 601 Molecular and Cell Biology	4
MBS 602 Biochemistry and Cell Biology	4
MBS 603 General Human Physiology	4
BST 603 Introductory Biostatistics for Graduate Biomedical Sciences <sup>1</sup>	3
<b>Electives</b> <sup>2,3</sup>	<b>15</b>
<b>Total Hours</b>	<b>30</b>

<sup>1</sup> In place of BST 603, students may take one of the following statistics courses, with permission of the Course Director and MBS Program Director: BST 601, BST 611.

<sup>2</sup> Students may select from the following electives: BY 501, BY 511, BY 512, BY 515, BY 527, BY 530, BY 531, BY 614, BY 616, BY 617, BY 620, BY 626, BY 629, BY 632, BY 633, BY 634, BY 636, BY 637, BY 640, BY 644, BY 662, BY 674, BY 675, BY 695, BY 697, CNBY 600, CNBY 610, CNBY 620, CNBY 630, CNBY 640, CNBY 660, CNBY 670, EPI 600, GGSC 610, GGSC 615, GGSC 620, GGSC 635, GGSC 665, GGSC 670, GRD 617, GRD 701, GRD 703, GRD 705, GRD 706, GRD 707, GRD 708, GRD 709, GRD 713, GRD 716, GRD 717, GRD 719, GRD 722, GRD 727, GRD 735, GRD 739, GRD 745, GRD 751, GRD 759, GRD 760, GRD 761, GRD 773, GRD 774, INFO 601, INFO 602, INFO 603, INFO 604, INFO 610, MBS 696, MBS 698, MIC 600, MIC 601, MIC 602, MIC 603, MIC 604, NBL 624, NBL 625, NBL 633, NBL 634, NBL 644, NBL 655, NBL 656, NBL 657, NBL 684, PHR 611, PHR 612, PHR 613, PHR 614, PHR 615, PHR 684, PSDO 630, PY 620, PY 653, PY 683, PY 687, PY 693. For other elective options please discuss with the MBS Program Director.

<sup>3</sup> Students may use 9 elective hours in one of the following themes to pursue a specialized concentration:

**Bioinformatics:** INFO 601, INFO 602, INFO 603, INFO 604, INFO 610

**Cancer Biology (CNBY):** CNBY 600, CNBY 610, CNBY 620, CNBY 630, CNBY 640, CNBY 660, CNBY 670, PHR 615

**Genetic and Genomic Sciences**

**(GGSC):** GGSC 610, GGSC 615, GGSC 620, GGSC 635, GGSC 665, GGSC 670, GGSC 690, PHR 611, PHR 612, PHR 613, PHR 614, PHR 615, PHR 696, GGSC 670

**Immunology:** MIC 600, MIC 601, MIC 602, MIC 603, MIC 604

**Neuroscience:** NBL 624, NBL 625, NBL 633, NBL 634, NBL 644, NBL 655, NBL 656, NBL 657, NBL 684, PY 620, PY 653, PY 683, PY 687, PY 693

**Pharmacology:** PHR 611, PHR 612, PHR 613, PHR 614, PHR 615, PHR 696, GGSC 670

## Courses

### **MBS 601. Molecular and Cell Biology. 4 Hours.**

This course will provide a broad but rigorous overview of molecular biology. Cell structure between prokaryotes and eukaryotes will be compared and contrasted. DNA structure/organization will be discussed with respect to replication and repair mechanisms. Mendelian, non-Mendelian and chromosomal bases of genetics will also be discussed. Transcription and translation will be discussed in detail, along with their respective regulatory mechanisms. Throughout this course there will be a focus on intracellular organelles that contribute to the generation and regulation of DNA, RNA and protein. Finally, when possible, relevance to human disease will be presented and discussed.

### **MBS 602. Biochemistry and Cell Biology. 4 Hours.**

This course will cover the structure, function and metabolism of biological macromolecules including proteins, carbohydrates, lipids and nucleotides. A rigorous overview of pathways will be discussed that are important for the effective metabolism of macromolecules (e.g. glycolysis, citric acid cycle) and generation of energy for cells. The last part of this course will discuss membrane structure and function, and will provide an overview of eukaryotic cell signaling.

### **MBS 603. General Human Physiology. 4 Hours.**

This course begins with the study of basic cell function, then proceeds to a rigorous overview of specific human organ systems.

### **MBS 695. Professional Development Colloquium for Non-Thesis Students. 1 Hour.**

This course will provide a rigorous overview of scientific reading, writing, and presenting skills, with a focus on career development. Students will work in teams to read, present and critique journal club articles; prepare and review resumes, individualized development plans (IDPs) and personal statements, followed by submission of re-writes; and learn effective interview skills via mock interview format.

### **MBS 696. Special Topics. 1-3 Hour.**

To be determined by the Program Director and prospective Course Directors.

### **MBS 697. Colloquium for MBS Plan I Thesis Students. 1 Hour.**

This required colloquium course will be taught using a journal club format. Students will be taught to critically review scientific literature, while gaining effective written and oral scientific communication skills. Students working in small groups will be responsible for choosing a current biomedical research article and sharing their review of this article with the class. Course members will be responsible for asking questions during the presentation and for submitting a review of each article in abstract form. The Course Director will provide initial instruction in the critical review, presentation and written summary of scientific literature. Topics to be covered include: critical review (background and rationale for study; identification of hypothesis; description of methods used; presentation of results and their interpretation; indicate significance of study and describe next step experiments), effective communication of research articles via Power Point presentations; and writing assignments based on articles discussed in class. When possible, scientific integrity in research will be a focus of in-class discussions.

### **MBS 698. Non-Thesis Research. 0-6 Hours.**

Students may perform independent study in a research laboratory setting. This work may contribute toward concentration credits subject to Program Director approval.

### **MBS 699. Thesis Research. 3-6 Hours.**

Supervised independent research.

**Prerequisites:** GAC M