

<b>Fiscal Unit/Academic Org</b>	Molecular Genetics - D0340
<b>Administering College/Academic Group</b>	Arts and Sciences
<b>Co-administering College/Academic Group</b>	
<b>Semester Conversion Designation</b>	New Program/Plan
<b>Proposed Program/Plan Name</b>	Combined BS and MS in Molecular Genetics
<b>Type of Program/Plan</b>	Combined program (e.g. BS/MS, Ph.D./MD)
<b>Program/Plan Code Abbreviation</b>	
<b>Proposed Degree Title</b>	

## Credit Hour Explanation

Program credit hour requirements		A) Number of credit hours in current program (Quarter credit hours)	B) Calculated result for 2/3rds of current (Semester credit hours)	C) Number of credit hours required for proposed program (Semester credit hours)	D) Change in credit hours
Total minimum credit hours required for completion of program				60	
Required credit hours offered by the unit	Minimum			26	
	Maximum			56	
Required credit hours offered outside of the unit	Minimum			4	
	Maximum			34	
Required prerequisite credit hours not included above	Minimum			50	
	Maximum			50	

## Program Learning Goals

Note: these are required for all undergraduate degree programs and majors now, and will be required for all graduate and professional degree programs in 2012. Nonetheless, all programs are encouraged to complete these now.

**Program Learning Goals**      • Learning goals are described in the attached proposal (they do not fit in the allotted space)

## Assessment

Assessment plan includes student learning goals, how those goals are evaluated, and how the information collected is used to improve student learning. An assessment plan is required for undergraduate majors and degrees. Graduate and professional degree programs are encouraged to complete this now, but will not be required to do so until 2012.

**Is this a degree program (undergraduate, graduate, or professional) or major proposal?** Yes

**Does the degree program or major have an assessment plan on file with the university Office of Academic Affairs?** Yes

## Program Specializations/Sub-Plans

If you do not specify a program specialization/sub-plan it will be assumed you are submitting this program for all program specializations/sub-plans.

## Pre-Major

**Does this Program have a Pre-Major?** No

**Attachments**

- Proposed BS\_MS compiled 090121.pdf: Original program proposal  
*(Program Proposal. Owner: Cole, Susan Elizabeth)*
- REVISION BS\_MS Molgen submitted.docx: Revised program proposal  
*(Program Proposal. Owner: Cole, Susan Elizabeth)*

**Comments**

- See feedback email sent 10-6-2021 *(by Steele, Rachel Lea on 10/06/2021 03:20 PM)*

**Workflow Information**

Status	User(s)	Date/Time	Step
Submitted	Cole, Susan Elizabeth	09/01/2021 01:27 PM	Submitted for Approval
Approved	Vaessin, Harald Emil Friedrich	09/01/2021 02:45 PM	Unit Approval
Approved	Vankeerbergen, Bernadette Chantal	09/20/2021 11:46 AM	College Approval
Revision Requested	Steele, Rachel Lea	10/06/2021 03:20 PM	ASCCAO Approval
Submitted	Cole, Susan Elizabeth	10/14/2021 02:39 PM	Submitted for Approval
Approved	Cole, Susan Elizabeth	10/14/2021 02:40 PM	Unit Approval
Approved	Vankeerbergen, Bernadette Chantal	10/15/2021 03:59 PM	College Approval
Pending Approval	Cody, Emily Kathryn Jenkins, Mary Ellen Bigler Hanlin, Deborah Kay Hilty, Michael Vankeerbergen, Bernadette Chantal Steele, Rachel Lea	10/15/2021 03:59 PM	ASCCAO Approval



## THE OHIO STATE UNIVERSITY

Department of Molecular Genetics

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To: Office of Academic Affairs  
From: Harald Vaessin, Chair, Department of Molecular Genetics  
Susan Cole, Vice Chair, Department of Molecular Genetics  
Date: October 13th, 2021  
Re: Development of combined BS/MS degree in Molecular Genetics

Dear Colleagues,

The Department of Molecular Genetics is happy to submit a revision of the proposed combined BS/MS degree in response to the review by the Natural and Mathematical Sciences Panel of the ASC Curriculum Committee:

Our responses can be found below and in the attached document (highlighted by a bar on the left of the page.)

- **Contingency: The Panel requests that the department add the desired term of implementation to the proposal.**

The desired term of implementation (AU22) has been included in the system and on Proposal page 1.

- **Contingency: The Panel asks that the department correct the language surrounding the lack of a direct entry at the MS level (Program Proposal, pg. 2 under “Molecular genetics BS/MS proposal: Program Rationale” and Program Proposal, pg. 3 under “Minor updates to Molecular Genetics MS program to facilitate BS/MS”), as a direct entry MS has recently been approved per the department’s request.**

Requested changes to proposal pages 2 and 3 have been completed

- **Contingency: The Panel requests that the department clarify how the requirement to take at least one course in each of the four pillars of Molecular Genetics (Program Proposal pg. 5 under “General Requirements”) is related to the old requirements for the degree. Could it be that the requirement was already there but perhaps not articulated (because due to the smaller number of courses available students couldn’t help but take course work in the four pillars)? Otherwise, if this is an “addition” or “reorganization” of the requirements of the MS, the Panel asks that it be included in the list of changes to the program (Program Proposal, pg. 3-4 under “Minor updates to Molecular Genetics MS program to facilitate BS/MS”).**

When the MS degree was used exclusively as an exit degree for the PhD program, the required first year curriculum for the PhD program fulfilled the four pillars (PhD students are required to take Molgen5700, Molgen5701, Molgen5705, and Molgen5715). We chose not to include a prescribed curriculum for the direct admit MS or the MS portion of the BS/MS degree (to allow

additional student flexibility), and instead clarified the previously unarticulated breadth requirement that had formerly been fulfilled by the required PhD curriculum. This has been more clearly stated on program proposal page 3, bullet point four

- **Recommendation: The Panel asks the department to consider whether the addition of the “four pillars requirement” (see contingency 3 above) will result in more than 10 percent of the program being altered.**

Because this is a restatement of a previously existing requirement (as described above), it does not result in more than 10% of the program being altered.

*Comment: The Panel suggests that the department be more specific regarding information provided to students via the 4-year plan and the advising sheet, especially as the department crafts their forms and handouts for the new GE in AU22.*

*o The Panel recommends labeling all General Education courses by category in the 4-year plan and differentiating them from the Molecular Genetics major electives so that it is clear to students that all requirements have been accounted for.*

*o The Panel encourages indicating which major pre-requisites will also be used to meet General Education requirements and specifying which GE category they fulfill.*

*Comment: The Panel engaged in an extensive discussion of the cost of the program and the value of the degree to the student. The Panel encourages the department to consider offering Teaching Assistantships and Research Assistantships to students in this program whenever possible to further the goals of access and affordability.*

We thank the committee for these comments and will take them into account as we craft advising sheets for the new GE. The department is committed to the principles of access and affordability and will make every effort to provide appropriate assistantships to students when possible.

Thank you for your consideration

*Susan Cole*

Susan Cole, Ph.D.

Professor and Vice Chair of Molecular Genetics

The Ohio State University



THE OHIO STATE UNIVERSITY

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To: Office of Academic Affairs  
From: Harald Vaessin, Chair, Department of Molecular Genetics  
Susan Cole, Vice Chair, Department of Molecular Genetics  
Date: September 1 2021  
Re: Development of combined BS/MS degree in Molecular Genetics

Dear Colleagues,

The Department of Molecular Genetics would like to propose a new Combined BS/MS degree in Molecular Genetics. The aims of this program are:

- to offer our undergraduate Molecular Genetics majors the opportunity to complete two degrees in only 5 years, preparing these excellent students for admission to diverse PhD and professional degree programs
- to provide additional mechanisms to retain outstanding undergraduates in our program to complete graduate degrees at OSU
- To increase enrollment in upper-level coursework currently targeted to students in the PhD program

The attached proposal further describes the proposed program, and contains all required documents for review.

Thank you for your consideration

*Susan E Cole*

Susan Cole, Ph.D.  
Professor and Vice Chair of Molecular Genetics  
The Ohio State University



## **Molecular Genetics BS/MS proposal:**

### **Program Rationale**

The following document presents the rationale and plan for creation of a combined BS/MS degree in Molecular Genetics, with a desired implementation term of AU22. Currently, the Molecular Genetics Department offers a BS undergraduate degree and a graduate-level PhD degree, with no direct entry at the MS level. Our advisors report that high-performing students in the Molecular Genetics major are interested in combining the BS degree with an MS in order to:

- enhance their credentials to increase competitiveness for professional school, PhD programs, or other career paths.
- increase their research experiences before committing to a research-based career path.
- increase their breadth or explore the field of molecular genetics.

A review of the curriculum suggests it is possible for accelerated students to complete the requirements for their undergraduate degree as well as coursework for a MS degree in Molecular Genetics in five years (and occasionally in four years for those who enter OSU with significant college credit). The plan described below fits the Graduate School's description of the purpose of a combined program as "to give outstanding students an opportunity to pursue simultaneously two degrees in different colleges or schools by reducing the amount of time required to complete both sets of degree requirements."

Though our PhD program has a prescriptive curriculum in the first year, we anticipate that students entering the BS/MS program will have diverse and varied goals, and have thus maintained flexibility in the MS curriculum, while ensuring breadth by requiring students to complete coursework that reflects the four "pillars" of Molecular Genetics, namely genetics/genomics, molecular biology, cell biology, and developmental biology. For Molecular Genetics majors, these breadth requirements are completed at the 5000 level during the BS, while students from other majors may complete them during the MS.

### **Executive Summary**

The proposed combined BS/MS degree program allows students to double-count some advanced Molecular genetics courses, normally taken by first-year graduate students in our program or other graduate programs, as elective credits for the fourth year of the undergraduate major. By double-counting nine credits of these electives for both the undergraduate and graduate degrees, a student in the combined degree program can fulfill the undergraduate degree requirements generally in their fourth year and be able to complete the remaining requirements for the Masters degree in an additional year. This combined degree plan allows students to enhance their undergraduate training with graduate-level coursework and complete an MS degree with a reduced time commitment.

The undergraduate BS degree in Molecular Genetics requires completion of 121 credit hours including Molecular Genetics major. We observe that many of our advanced students arrive at OSU with Advanced Placement, College Credit Plus, or other college-level credits enabling them to accelerate their progress through the Molecular Genetics major. Many students start core coursework at the 5000 level in the second year and many take upper-division courses as early as their third year. The MS degree requires 30 credit hours of coursework, and by applying 9 of these credit hours towards the fulfillment of undergraduate major elective credits, students can complete the combined degree in five years. Overviews and advising materials for the BS and MS

programs are found in Appendices A-C

The combined degree program will be discussed with students during appointments with advisors. We anticipate that most candidates will apply during the Spring semester of the student's third year following consultation with their major advisor or faculty advisor for admission to the program at the beginning of the student's fourth year. By the time of admission, applicants to the combined degree program must:

- be in good academic standing (with at least a 3.5 GPA)
- have completed MOLGEN4606 and at least one additional MOLGEN core class
- have identified a Molecular Genetics faculty member who is willing to oversee their MS exam

GRE scores will not be required for the combined BS/MS degree. Applications will be reviewed by the Molecular Genetics Department Graduate Studies Committee to assess the readiness of the student for accelerated studies. Upon admission, a Molecular Genetics faculty member identified by the student and approved by the GSC chair will serve as the student's BS/MS advisor. A committee consisting of the advisor and one additional Molecular Genetics faculty member will oversee the final MS exam (written exam only for Plan A, written and oral exam for Plan B).

Based on Molecular Genetics Department exit surveys, and discussions with faculty advisors and honors advisors, we anticipate that 3-6 students will enroll in the combined degree program each year, and that these numbers may increase as the program is socialized.

Students in the combined BS/MS degree program who are doing laboratory research as undergraduates (MOLGEN 4998(H)/4999(H)) can receive research distinction (including honors) with the BS component, but those credit hours may not count towards the MS. Students who wish to continue or begin research during the MS degree years will enroll in MOLGEN7999-Thesis Research, and may complete a thesis as part of the Plan A MS degree. Advising materials, sample curricula are found in appendices C and D, with assessment information for the combined program found in Appendix E

A student in the combined degree program can elect to leave the program without penalty. The completed graduate courses will continue to count as elective credits towards the student's Molecular Genetics BS degree. As graduate students, students in the combined BS/MS program may on occasion receive financial support through appointment as graduate teaching assistants (GTAs) after completion of the requirements for the BS degree (i.e., after receiving their BS degree) depending on the student's interests and the availability of teaching positions and funding in the Department.

We believe the opportunity to obtain a combined BS/ MS degree will be attractive to high-achieving students at Ohio State University preparing for either professional school (e.g., medical school or PhD programs) or seeking employment in Molecular Genetics fields where a MS degree will enhance their record for better career positions than those available to BS degree-holding graduates. In addition, the advanced knowledge and training of graduates with an MS degree will enhance the reputation of Ohio State University programs in scientific fields and industries. Students enrolled in the Molecular Genetics BS with PCMB specialization (appendix A4-A6) are also eligible for the combined BS/MS degree.

### **Minor updates to Molecular Genetics MS program to facilitate BS/MS**

The Molecular Genetics MS program has historically been utilized as an exit degree for PhD candidates who choose to depart the program prior to completion of the PhD. In order to facilitate

admission to the combined BS/MS program the department has activated the "direct admission" option for the Molecular Genetics MS program effective SP22. Given the likelihood that some non-OSU students will have interest in a dedicated MS program, we will use this opportunity to begin admitting a modest number of students to a dedicated, direct admission MS program (starting with no more than 5 students per year). The activation of a direct admission to the MS and the combined BS MS program spurred us to develop formal learning goals and advising goals for the MS. Some minor changes were made to the MS program as approved at quarter to semester conversion, including

- Updating class numbers in the curricular map and approved coursework list (our MS and PhD program were approved early in the quarter to semester conversion process, prior to finalization of the numbering system, and several classes that are listed at the 6000 level in our conversion document ended up at the 5000 level.)
- Adding a small number of appropriate 5000 level courses that were developed after semester conversion to the "approved course" list
- Updating advising sheets
- Clarifying a pre-existing breadth requirement that students complete coursework in four "pillars" of Molecular Genetics. When the MS degree was used exclusively as an exit degree for the PhD program this expectation was fulfilled by the required first year curriculum. Anticipating that direct-admit MS students may have broad interests that are not well served by that four-course curriculum, we instead clearly articulated a breadth requirement for direct-admit MS students.
- The program as approved at conversion appears as Appendix B and the updated documents appear as Appendix C. These updates do not alter more than 10% of the previously approved curricular requirements, which are quite broad and non-prescriptive.



## **Overview of Proposed BS/MS program in Molecular Genetics:**

### **Application Requirements:**

- Junior year or completion of 90 credit hours
- 3.5 gpa required

**Degree timeline:** 3 years BS + 1-2 years MS

### **General requirements:**

1. A minimum of 30 total semester credit hours must be completed at the graduate level with a GPA of 3.0.
2. Of the 30 total graduate credit hours, a minimum of 8 semester credit hours must be Molecular Genetics courses at the 5000 level or above, excluding credits for classes graded on an S/U basis.
3. 9 credit hours can double count for the BS and MS. These credits will count as elective credits for the BS degree.
4. At least one course in each of the 4 pillars of Molecular Genetics (genetics/genomics, molecular biology, cell biology, and developmental biology) must be completed. Coursework completed at the 5000 level or higher as part of the BS degree can fulfill this requirement without counting towards the 9 credit hours of double counted coursework, and most Molecular Genetics majors will complete this requirement as part of the BS.
5. Completion of MOLGEN7600
6. The student must identify a “sponsoring faculty member” (the research advisor if the student plans a thesis option, the faculty member who will oversee the 5193 enrollment if non-thesis). This faculty member must supply a letter of recommendation when the student applies.
7. Required core coursework for the Molecular Genetics BS may not be double counted for the MS degree.

### **Thesis-based (Plan A) Masters requirements**

All general requirements above must be fulfilled. In addition the Plan A MS requires

1. Completion of a minimum of 8 semester credit hour of research (MG 7999).
2. Satisfactory completion of a written thesis that is approved by the student's committee and submitted to the Graduate School as described in the Graduate School Handbook.
3. Satisfactory completion of a final oral exam.
4. The examining committee shall consist of the advisor for MG7999 credits and one additional Molecular Genetics faculty member

### **Non-thesis-based (Plan B) Masters requirements**

All general requirements above must be fulfilled. In addition

1. Research (enrollment in MG 7999) encouraged but not required
2. Satisfactory completion of a final written and oral exam, generally in the context of MG 5193 (Individual Studies).
3. The examining committee shall consist of the faculty instructor for MG5193 credits and one additional Molecular Genetics faculty member

## **APPENDIX A: Molecular Genetics BS**

Appendix A1 includes an overview of the BS

Appendix A2 contains advising documents for the BS

Appendix A3 contains a sample 4 year curriculum for the BS

Appendix A4 contains an overview of the BS with PCMB specialization

Appendix A5 contains advising documents for the BS with PCMB specialization

Appendix A6 contains a sample 4 year curriculum for the BS with PCMB specialization

## A.1 BS in Molecular Genetics Overview

### Molecular Genetics Undergraduate Major

Students can earn the Bachelor of Science in Molecular Genetics by completing the necessary prerequisites, core courses, and electives. The major program must be approved by a major advisor from the Department of Molecular Genetics.

#### **Required Prerequisites (do not count toward the 30 hour major):**

- Biology 1113 and 1114
- Chemistry 1210 and 1220
- Chemistry 2510, 2520, 2540, and 2550
- Math 1156, OR Math 1151
- Physics 1200 and 1201

Honors or more advanced versions for any of these courses are acceptable.

#### • **Core Requirements (the core comprises at least 19 credit hours):**

- Biochemistry 4511 OR Biochemistry 5613 AND 5614
- MOLGEN 4606, 5607 or 5607E, 5608 or 5608E, 5645, and 5601 or 5602

**Lab courses (5601 or 5602) require either MOLGEN 4606 or MOLGEN 4500 as a prerequisite.**

Molecular Genetics majors with at least two semesters of undergraduate research credit (MOLGEN 4998, 4998H, 4999, or 4999H, or their equivalent) may substitute 3 semester credit hours of Undergraduate Research for the MOLGEN laboratory course requirement. **A major advisor must approve this substitution.**

#### • **Electives** (choose at least 3 electives from the following list; electives plus the core must total at least 30 credit hours; at least one course totaling at least 2 credit hours must be taken from within the department): Note that completion of the Molecular Genetics Core (MOLGEN 4606, 5607, 5608, and 5645) is a prerequisite for many 5000 level Molecular Genetics courses.

- Molecular Genetics courses:  
2220H, 2690, 3300, 3436, 4503, 4591S, 4703, 5193, 5194, 5300, 5623, 5630, 5632, 5643, 5650, 5700, 5701, 5705, 5715, 5733, 5735, 5795, 5796, 5797, 5798, 5800
- MOLGEN 4700 may be used as an elective in some circumstances. **A major advisor must approve this IN ADVANCE.**
- Other Life Sciences courses:  
Biochemistry 5621  
EEOB 4520,  
Microbiology 4000, 4100, 4130, 4140, 5122, 5161
- Neuroscience 4050
- Psychology 5602
- Biophrm 5733
- Up to 3 semester credit hours of MOLGEN 4998 (or 4998H) Undergraduate Research and/or MOLGEN 4999 (or 4999H) Thesis Research can count towards the 30 credit hours required for the Molecular Genetics major, and can count as one of the three required electives if not used as a substitute for the Molecular Genetics lab requirement. Credit hours of 4999 or 4999H that are fulfilling a requirement for a research thesis can NOT count towards the major
- No more than 3 credits of coursework graded S/U can count towards the major
- A maximum of 3 credit hours at the 2000 level may count towards the 30-hour major
- Other elective courses may be substituted with permission of advisor.

**Appendix A.2**

**Molecular Genetics BS advising form** Student ID #: \_\_\_\_\_

Expected Graduation Term: \_\_\_\_\_ Student Name.#: \_\_\_\_\_

Second Major: \_\_\_\_\_

Minor: \_\_\_\_\_

**Part A: General Education not fulfilled by Part B**

GE Category	Course Number	Credit Hours	Grade	Term Taken
Writing		3		
		3		
Literature		3		
VPA		3		
Soc. Sci. 1:		3		
Soc. Sci. 2:		3		
Historical Study		3		
Cultures & Ideas		3		
Foreign Language		4		
		4		
		4		
Social Diversity*		3		
Global Studies*		3		
		3		

\*Courses in these areas can overlap with another GE category when applicable

**Part B: Major Prerequisites**

Course	Credit Hours	Grade	Term Taken	Course	Credit Hours	Grade	Term Taken
Math 1151	5			Chem 1210	5		
OR Math 1156	5			Chem 1220	5		
Bio 1113	4			Chem 2510	4		
Bio 1114	4			Chem 2520	4		
Physics 1200	5			Chem 2540	2		
OR Physics 1250	5			Chem 2550	2		
Physics 1201	5						
OR Physics 1251**	5						

Honors courses can substitute where available

Additional courses may be required or suggested for pre-professional students

\*\*Math 1152 is a prerequisite/co-requisite for Physics 1251

**Molecular Genetics BS advising form p2**

### Part C: Molecular Genetics BS Core

Course	Title	Major Credit Hours	Grade	Term Taken
BIOCHEM 4511	Intro to Biological Chemistry	4		
OR BIOCHEM 5613^	Biochemistry and Molecular Biology 1	3		
OR BIOCHEM 5614^	Biochemistry and Molecular Biology 2	3		
MOLGEN 4606	Molecular Genetics	4		
MOLGEN 5607	Cell Biology	3		
OR MOLGEN 5607E		4		
MOLGEN 5608	Genes and Development	3		
OR MOLGEN 5608E		4		
MOLGEN 5645	Quantitative, Population, and Evolutionary Genetics	2		
MOLGEN 5601	Molecular Microbiology Lab	4		
OR MOLGEN 5602	Cell and Developmental Biology Lab	4		

^ Both Biochem 5613 & 5614 must be completed as substitution for Biochem 4511

### Part D: Molecular Genetics BS Electives

Course	Title	Major Credit Hours	Grade	Term Taken	Mark if S/U***

At least 1 course totaling at least 2 credits must be from within the MOLGEN department

\*\*\*At most 3 credits graded S/U may be counted toward the major

### BS Degree

Major Core Credits ( $\geq 19$ ): \_\_\_\_\_

Major Elective Credits ( $\geq 6$ ): \_\_\_\_\_

Major Credits not graded S/U ( $\geq 27$ ): \_\_\_\_\_

Total BS Major Credits ( $\geq 30$ ): \_\_\_\_\_

Upper Division Credits ( $\geq 39$ ): \_\_\_\_\_

Total BS Credits ( $\geq 121$ ): \_\_\_\_\_

### Molecular Genetics BS advising form p3

### Appendix A.3 Sample 4 year Molecular Genetics BS curriculum

*(Placed into Calculus/Math Placement Test Score of L) MOLGEN 4606 in Autumn*

<b>Year 1 – Autumn</b>		<b>Year 1 – Spring</b>	
ARTSSCI 1100.07 (College Survey)	1	Chem 1220	5
Math 1151 or 1156	5	Bio 1113	4
Chem 1210	5	GE: Foreign Language 1	4
GE or MOLGEN Major Elective*	3	GE or MOLGEN Major Elective*	3
Semester Total	14	Semester Total	16
		Year 1 Total	30
<b>Year 2 – Autumn</b>		<b>Year 2 – Spring</b>	
Chem 2510	4	Chem 2520	4
Chem 2540	2	Chem 2550	2
Bio 1114	4	Biochem 4511 or MOLGEN 5601**	4
MOLGEN 4606	4	GE: Foreign Language 3	4
GE: Foreign Language 2	4	GE or Free Elective	3
Semester Total	18	Semester Total	17
		Year 2 Total	35
<b>Year 3 – Autumn</b>		<b>Year 3 – Spring</b>	
Biochem 4511 or MOLGEN 5602**	4	MOLGEN 5608	3
MOLGEN 5607	3	MOLGEN Major Elective*	2 – 3
Physics 1200	5	Physics 1201	5
GE	3	GE	3
		GE	3
Semester Total	15	Semester Total	16 – 17
		Year 3 Total	31 – 32
<b>Year 4 – Autumn</b>		<b>Year 4 – Spring</b>	
MOLGEN 5645	2	MOLGEN Major Elective*	2 – 3
MOLGEN Major Elective*	2 – 3	GE or MOLGEN Major Elective*	3
GE or MOLGEN Major Elective*	3	Free Elective (as needed)	3
GE or Free Elective (as needed)	3	Free Elective (as needed)	3
Free Elective (as needed)	2 – 3	Free Elective (as needed)	2 – 3
Semester Total	12 – 14	Semester Total	13 – 15
		Year 4 Total	25 – 29
*MOLGEN major elective courses vary from 1-5 credits. Some MOLGEN electives (e.g. 2220H, 2690, 3300, 3436) can be taken during Year 1. MOLGEN major coursework including electives must total at least 30 credits.			
**Either MOLGEN 5601 or 5602 is required	Grand Total	121+ Credit Hours	

## Appendix A.4 BS in Molecular Genetics with PCMB specialization overview

### Molecular Genetics Undergraduate Major with PCMB specialization

Students interested in focusing on plant biology may earn the Bachelor of Science in Molecular Genetics with PCMB specialization by completing the necessary prerequisites, core courses, and electives. Please see your major advisor if you would like more information about this course of study.

- **Required Prerequisites (do not count toward the 30 hour major):**

- Biology 1113 and 1114
- Chemistry 1210 and 1220
- Chemistry 2510, 2520, 2540, and 2550
- Math 1156 OR Math 1151
- Physics 1200 and 1201

Honors or more advanced versions for any of these courses are acceptable.

- **Core Requirements (the core comprises at least 20 credit hours):**

- Biochemistry 4511 OR Biochemistry 5613 AND 5614
- MOLGEN 4606, 5607 or 5607E, 5608 or 5608E, 3300, and 3436

- **Electives (choose at least 3 electives from the following list; electives plus the core must total at least 30 credit hours):**

- Molecular Genetics courses:

4503, 4998, 4998H, 4999, 4999H, 5193, 5194, 5601 or 5602, 5630, 5643, 5735, 5795, 5797, 5798, 5800

**Completion of MOLGEN 4606 is a prerequisite for most other 5000 or 6000 level MG courses.**

- Up to 3 semester credit hours of MOLGEN 4998 (or 4998H) Undergraduate Research and/or 4999 (or 4999H) Thesis Research can count towards the 30 credit hours required for the Molecular Genetics major with PCMB specialization. Credit hours of 4999 or 4999H that are fulfilling a requirement for a research thesis can NOT count towards the major.
- In order to count toward the PCMB specialization, MOLGEN 4503, 4998, 4998H, 4999, 4999H, 5193, 5194, 5795, 5797, and 5798 must be carried out with a Plant Biology emphasis. Lab courses 5601 and 5602 must include a plant biology module to count towards the PCMB specialization.
- No more than 3 credit hours of S/U graded coursework can count towards the major
- Other elective courses may be substituted with permission of advisor.

## Appendix A.5 Molecular Genetics BS with PCMB specialization advising form

Student ID #: \_\_\_\_\_

Expected Graduation Term: \_\_\_\_\_ Student Name.#: \_\_\_\_\_

Second Major: \_\_\_\_\_

Minor: \_\_\_\_\_

### Part A: General Education not fulfilled by Part B

GE Category	Course Number	Credit Hours	Grade	Term Taken
Writing		3		
		3		
Literature		3		
VPA		3		
Soc. Sci. 1:		3		
Soc. Sci. 2:		3		
Historical Study		3		
Cultures & Ideas		3		
Foreign Language		4		
		4		
		4		
Social Diversity*		3		
Global Studies*		3		
		3		

\*Courses in these areas can overlap with another GE category when applicable

### Part B: Major Prerequisites

Course	Credit Hours	Grade	Term Taken	Course	Credit Hours	Grade	Term Taken
Math 1151	5			Chem 1210	5		
OR Math 1156	5			Chem 1220	5		
Bio 1113	4			Chem 2510	4		
Bio 1114	4			Chem 2520	4		
Physics 1200	5			Chem 2540	2		
OR Physics 1250	5			Chem 2550	2		
Physics 1201	5						
OR Physics 1251**	5						

Honors courses can substitute where available

Additional courses may be required or suggested for pre-professional students

\*\*Math 1152 is a prerequisite/co-requisite for Physics 1251



**Molecular Genetics BS with PCMB specialization advising form p2**

**Part C: Molecular Genetics BS Core**

Course		Title	Major Credit Hours	Grade	Term Taken
BIOCHEM 4511		Intro to Biological Chemistry	4		
OR	BIOCHEM 5613^	Biochemistry and Molecular Biology 1	3		
OR	BIOCHEM 5614^	Biochemistry and Molecular Biology 2	3		
MOLGEN 4606		Molecular Genetics	4		
MOLGEN 5607		Cell Biology	3		
OR	MOLGEN 5607E		4		
MOLGEN 5608		Genes and Development	3		
OR	MOLGEN 5608E		4		
MOLGEN 3300		Molecular Microbiology Lab	3		
MOLGEN 3436			3		

^ Both Biochem 5613 & 5614 must be completed as substitution for Biochem 4511

**Part D: Molecular Genetics BS Electives**

Course	Title	Major Credit Hours	Grade	Term Taken	Mark if S/U***

At least 1 course totaling at least 2 credits must be from within the MOLGEN department

\*\*\*At most 3 credits graded S/U may be counted toward the major

**BS Degree**

Major Core Credits ( $\geq 20$ ): \_\_\_\_\_

Major Elective Credits ( $\geq 6$ ): \_\_\_\_\_

Major Credits not graded S/U ( $\geq 27$ ): \_\_\_\_\_

Total BS Major Credits ( $\geq 30$ ): \_\_\_\_\_

Upper Division Credits ( $\geq 39$ ): \_\_\_\_\_

Total BS Credits ( $\geq 121$ ): \_\_\_\_\_

**Appendix A.6 Sample 4 year curriculum Molecular Genetics BS with PCMB Specialization**  
*(Placed into Calculus/Math Placement Test Score of L) MOLGEN 4606 in Autumn*

<b>Year 1 – Autumn</b>		<b>Year 1 – Spring</b>	
ARTSSCI 1100.07 (College Survey)	1	Chem 1220	5
Math 1151 or 1156	5	Bio 1113	4
Chem 1210	5	GE: Foreign Language 1	4
GE or MOLGEN Major Elective*	3	GE or MOLGEN Major Elective*	3
Semester Total	14	Semester Total	16
		Year 1 Total	30
<b>Year 2 – Autumn</b>		<b>Year 2 – Spring</b>	
Chem 2510	4	Chem 2520	4
Chem 2540	2	Chem 2550	2
Bio 1114	4	MOLGEN3300	3
MOLGEN 4606	4	GE: Foreign Language 3	4
GE: Foreign Language 2	4	GE or Free Elective	3
Semester Total	18	Semester Total	16
		Year 2 Total	34
<b>Year 3 – Autumn</b>		<b>Year 3 – Spring</b>	
MOLGEN3436	3	MOLGEN 5608	3
MOLGEN 5607	3	BIOCHEM4511	4
Physics 1200	5	Physics 1201	5
GE	3	GE	3
GE	3		
Semester Total	17	Semester Total	15
		Year 3 Total	32
<b>Year 4 – Autumn</b>		<b>Year 4 – Spring</b>	
MOLGEN Major Elective*	2 – 3	MOLGEN Major Elective*	2 – 3
MOLGEN Major Elective*	2 – 3	GE or MOLGEN Major Elective*	3
GE or MOLGEN Major Elective*	3	Free Elective (as needed)	3
GE or Free Elective (as needed)	3	Free Elective (as needed)	3
Free Elective (as needed)	2 – 3	Free Elective (as needed)	2 – 3
Semester Total	12 – 15	Semester Total	13 – 15
		Year 4 Total	25 – 30
*MOLGEN major elective courses vary from 1-5 credits. Some MOLGEN electives (e.g. 2220H, 2690, 3300, 3436) can be taken during Year 1. MOLGEN major coursework including electives must total at least 30 credits.			
**Either MOLGEN 5601 or 5602 is required	Grand Total	121+ Credit Hours	

**Appendix B Molecular Genetics MS program as approved at Semester conversion**

**Appendix C Updated materials for MS with Direct admission**

Appendix C1 contains an updated MS overview

Appendix C2 contains a list of Molecular Genetics MS degree coursework

Appendix C3 contains MS advising sheets

## **Appendix C.1 Updated MS overview (note that Direct Admission will be activated during BS/MS development)**

### **The Molecular Genetics Masters Program**

We offer two direct admit options for MS degrees: thesis (Plan A) and non-thesis (Plan B). Both options follow Graduate School requirements, including total credit hour requirements, Bachelors degree with appropriate background to take the required core courses, minimum GPA of 3.0, makeup of the Master's examination committee, and the format of the final Masters exam (including both written and oral components).

#### **General requirements:**

1. A minimum of 30 total semester credit hours must be completed at the graduate level with a GPA of 3.0.
2. Of the 30 total graduate credit hours, a minimum of 8 semester credit hours must be Molecular Genetics courses at the 5000 level or above, excluding credits for classes graded on an S/U basis.
3. At least one course in each of the 4 pillars of Molecular Genetics (genetics/genomics, molecular biology, cell biology, and developmental biology) must be completed.
4. Completion of MOLGEN7600

#### **Thesis-based (Plan A) Masters requirements**

1. All general requirements above must be fulfilled. In addition the Plan A MS requires
2. Completion of a minimum of 8 semester credit hour of research (MG 7999).
3. Satisfactory completion of a written thesis that is approved by the student's committee and submitted to the Graduate School as described in the Graduate School Handbook.
4. Satisfactory completion of a final oral exam.
5. The examining committee shall consist of the advisor for MG7999 credits and one additional Molecular Genetics faculty member

#### **Non-thesis-based (Plan B) Masters requirements**

1. All general requirements above must be fulfilled. In addition
2. Research (enrollment in MG 7999) is encouraged but not required
3. Satisfactory completion of a final written and oral exam, generally in the context of MG 5193 (Individual Studies).
4. The examining committee shall consist of the faculty instructor for MG5193 credits and one additional Molecular Genetics faculty member

As before, successful completion of the MolecularGenetics PhD Candidacy exam can be used to meet requirement 3 for the non-thesis Masters degree.

**Appendix C2. Molecular Genetics Coursework for MS**

<i>Course Number</i>	<i>Course Title</i>	<i>Credit Hours</i>	<i>Pillar</i>	<i>Learning goals</i>
MolGen 5193	Individual Studies	1 to 3	can meet any pillar with approval of GSC	2-A 3-A
MolGen 5194	Group Studies	1 to 3	can meet any pillar with approval of GSC	2-A
MolGen 5300	Cancer Genetics	3	1 or 2	1-I
MolGen 5601	Eukaryotic Molecular Genetics Lab	3 or 4	2 or 3	1-I 3-A
MolGen 5602	Eukaryotic Cell and Developmental Laboratory	3 or 4	2,3, or 4	1-I 3-A
MolGen 5607	Cell Biology	3	3	1-I
MolGen 5608	Genes and Development	3	4	1-I
MolGen 5623	Genetics and Genomics	2	1	1-I 3-A
MolGen 5630	Plant Physiology	3		1-I
MolGen 5632	Insect Molecular Genetics	2		1-I
MolGen 5643	Plant Anatomy	3	4	1-I
MolGen 5645	Quantitative, Population, and Evolutionary Genetics	2	1	1-I
MolGen 5650	Analysis and Interpretation of Biological Data	3		1-I
MolGen 5700	Systems of Genetic Analysis	3	1	1-I
MolGen 5701	DNA Transactions and Gene Regulation	3	2	1-I
MolGen 5705	Advances in Cell Biology	2	3	1-I
MolGen 5715	Developmental Genetics	2	4	1-I
MolGen 5733	Advanced Human Genetics	2	1	1-I
MolGen 5735	Plant Biochemistry	3		1-I

MolGen 5795	Special Topics in Molecular Genetics	1 to 3	can meet any pillar with approval of GSC	
MolGen 5796	Current Topics in Signal Transduction	1 to 2	2 or 3	1-I
MolGen 5797	Study at a Foreign Institution	1 to 3		
MolGen 5798	Study Tour: Domestic	1 to 3		
MolGen 5800	Organelle Biology	2	2 or 3	1-I
MolGen 7600	First-Year Student Orientation	1	NA	
MolGen 7741	Molecular Virology and Pathogenesis of Viruses	5	1	1-A
MolGen 7807	Gene Expression: Post-Transcriptional Control	3	1 or 2	1-A 3-A

**Pillars of Molecular Genetics:**

1. genetics/genomics
2. molecular biology
3. cell biology and
4. developmental biology

**Learning goals (B- beginning, I = Intermediate, A= Advanced)**

1. Demonstrate a broad base of knowledge in several areas, including genetics, cell biology, and developmental biology. Goal is partially achieved by requiring one course in each pillar above.
2. Demonstrate a deep understanding of an area of special interest.
3. Effectively communicate research findings via oral and written presentations to specialized scientific and general audiences.

**Approved coursework from other departments that can count towards the MOLGEN MS \***

<i>Course Number</i>	<i>Course Title</i>	<i>Credit Hours</i>	<i>Pillar</i>
BMI 5730	Intro to Bioinformatics	3	1
BMI 8150	Rigorous and Reproducible Design and Data Analysis	3	
CBG 5700	Intro to Personalized Therapeutics & Pharmacogenomics	3	1
Micro 8050	RNA World	2	2

\* Additional courses may be used with permission of the Graduate Studies committee

**Appendix C3 MS advising sheets**

**Molecular Genetics MS Advising form Plan A**

Student ID #: \_\_\_\_\_

Expected Graduation Term: \_\_\_\_\_ Student Name.#: \_\_\_\_\_

**Part A: Required Courses**

Course	Credit Hours	Grade	Term Taken
MOLGEN7600	1		

**Part B: At least 8 credit hours of Molecular Genetics Coursework at the 5000 level or above**

Course	Credit Hours	Grade	Term Taken	Course	Credit Hours	Grade	Term Taken

**Part C: Thesis research: at least 8 credit hours of MOLGEN7999**

Course	Credit Hours	Grade	Term Taken	Course	Credit Hours	Grade	Term Taken
MOLGEN7999				MOLGEN7999			
MOLGEN7999				MOLGEN7999			
MOLGEN7999				MOLGEN7999			

**Part D: Elective credits**

Course	Credit Hours	Grade	Term Taken	Course	Credit Hours	Grade	Term Taken

**Breadth requirement**

indicate which courses above fill the pillars of Molecular Genetics indicated below

Pillar	Course	Title
Genetics/Genomics		
Molecular Biology		
Cell Biology		
Developmental Biology		

**MS Degree**

Required MOLGEN7600 (1): \_\_\_\_\_

Molgen electives not graded S/U ( $\geq 8$ ): \_\_\_\_\_

Molgen 7999 ( $\geq 8$ ): \_\_\_\_\_

Additional elective credits ( $\geq 14$ ): \_\_\_\_\_

Breadth requirement filled (Y/N): \_\_\_\_\_

Total MS Degree Credits ( $\geq 30$ ): \_\_\_\_\_



# Molecular Genetics MS Advising form Plan B

Student ID #: \_\_\_\_\_

Expected Graduation Term: \_\_\_\_\_ Student Name.#: \_\_\_\_\_

## Part A: Required Courses

Course	Credit Hours	Grade	Term Taken
MOLGEN7600	1		
MOLGEN5193	3		

## Part B: At least 8 credit hours of Molecular Genetics Coursework at the 5000 level or above

Course	Credit Hours	Grade	Term Taken	Course	Credit Hours	Grade	Term Taken

## Part C: Elective credits

Course	Credit Hours	Grade	Term Taken	Course	Credit Hours	Grade	Term Taken

## Breadth requirement

indicate which courses above fill the pillars of Molecular Genetics indicated below

Pillar	Course	Title
Genetics/Genomics		
Molecular Biology		
Cell Biology		
Developmental Biology		

## MS Degree

Required courses (4): \_\_\_\_\_

Molgen electives not graded S/U ( $\geq 8$ ): \_\_\_\_\_

Additional elective credits ( $\geq 18$ ): \_\_\_\_\_

Breadth requirement filled (Y/N): \_\_\_\_\_

Total MS Degree Credits ( $\geq 30$ ): \_\_\_\_\_

**Appendix D BS MS combined degree materials**

Appendix D1 contains a sample 5 year BS/MS plan a curriculum

Appendix D2 contains a sample 5-year BS/MS plan B curriculum

Appendix D3 contains sample BS/MS advising sheets

**APPENDIX D.1 Sample 5-year BS/MS plan A curriculum**

*(Placed into Calculus/Math Placement Test Score of L) MOLGEN 4606 in Autumn*

<b>Year 1 – Autumn</b>		<b>Year 1 – Spring</b>	
ARTSSCI 1100.07 (College Survey)	1	Chem 1220	5
Math 1151 or 1156	5	Bio 1113	4
Chem 1210	5	GE: Foreign Language 1	4
GE	3	GE	3
Semester Total	14	Semester Total	16
		Year 1 Total	30
<b>Year 2 – Autumn</b>		<b>Year 2 – Spring</b>	
Chem 2510	4	Chem 2520	4
Chem 2540	2	Chem 2550	2
Bio 1114	4	Biochem 4511 or MOLGEN 5601**	4
MOLGEN 4606	4	GE: Foreign Language 3	4
GE: Foreign Language 2	4	GE	3
Semester Total	18	Semester Total	17
		Year 2 Total	35
<b>Year 3 – Autumn</b>		<b>Year 3 – Spring</b>	
Biochem 4511 or MOLGEN 5602**	4	MOLGEN 5608	3
MOLGEN 5607	3	MOLGEN BS Elective*	2 – 3
Physics 1200	5	Physics 1201	5
GE	3	GE	3
		GE	3
		<i>Apply to MS Program</i>	--
Semester Total	15	Semester Total	16 – 17
		Year 3 Total	31 – 32
<b>Year 4 – Autumn</b>		<b>Year 4 – Spring</b>	
MOLGEN 5645	2	MOLGEN BS/MS Elective*	3
MOLGEN BS/MS Elective*	3	MOLGEN BS/MS Elective*	3
GE	3	GE	3
Free Elective (as needed)	3	Free Elective (as needed)	3
Free Elective (as needed)	1 – 3	Free Elective (as needed)	1 – 3
Semester Total	12 – 14	Semester Total	13 – 15
		Year 4 Total	25 – 29
*MOLGEN major elective courses vary from 1-5 credits. Some MOLGEN electives (e.g. 2220H, 2690, 3300, 3436) can be taken during Year 1. MOLGEN major coursework including electives must total at least 30 credits on BS degree.			
**Either MOLGEN 5601 or 5602 is required		Grand Total for BS Degree	121+ Credit Hours

<b>Year 5– Autumn</b>		<b>Year 5– Spring</b>	
MOLGEN 7600	1	MOLGEN 7999	4
MOLGEN 7999	4	MOLGEN MS Elective	3
MOLGEN MS Elective	3	MOLGEN MS Elective	2-3
MOLGEN MS Elective	2-3	MOLGEN MS Elective	2-3
Semester Total	10 – 11	Semester Total	11 – 13
		Year 5 Total	21 – 24
		Grand Total for MS Degree	30+ Credit Hours

**APPENDIX D.2 Sample 5-year BS/MS plan B curriculum**

*(Placed into Calculus/Math Placement Test Score of L) MOLGEN 4606 in Autumn*

<b>Year 1 – Autumn</b>		<b>Year 1 – Spring</b>	
ARTSSCI 1100.07 (College Survey)	1	Chem 1220	5
Math 1151 or 1156	5	Bio 1113	4
Chem 1210	5	GE: Foreign Language 1	4
GE	3	GE	3
Semester Total	14	Semester Total	16
		Year 1 Total	30
<b>Year 2 – Autumn</b>		<b>Year 2 – Spring</b>	
Chem 2510	4	Chem 2520	4
Chem 2540	2	Chem 2550	2
Bio 1114	4	Biochem 4511 or MOLGEN 5601**	4
MOLGEN 4606	4	GE: Foreign Language 3	4
GE: Foreign Language 2	4	GE	3
Semester Total	18	Semester Total	17
		Year 2 Total	35
<b>Year 3 – Autumn</b>		<b>Year 3 – Spring</b>	
Biochem 4511 or MOLGEN 5602**	4	MOLGEN 5608	3
MOLGEN 5607	3	MOLGEN BS Elective*	2 – 3
Physics 1200	5	Physics 1201	5
GE	3	GE	3
		GE	3
		<i>Apply to MS Program</i>	--
Semester Total	15	Semester Total	16 – 17
		Year 3 Total	31 – 32
<b>Year 4 – Autumn</b>		<b>Year 4 – Spring</b>	
MOLGEN 5645	2	MOLGEN BS/MS Elective*	3
MOLGEN BS/MS Elective*	3	MOLGEN BS/MS Elective*	3
GE	3	GE	3
Free Elective (as needed)	3	Free Elective (as needed)	3
Free Elective (as needed)	1 – 3	Free Elective (as needed)	1 – 3
Semester Total	12 – 14	Semester Total	13 – 15
		Year 4 Total	25 – 29
*MOLGEN major elective courses vary from 1-5 credits. Some MOLGEN electives (e.g. 2220H, 2690, 3300, 3436) can be taken during Year 1. MOLGEN major coursework including electives must total at least 30 credits.			
**Either MOLGEN 5601 or 5602 is required		Grand Total for BS Degree	121+ Credit Hours

<b>Year 5– Autumn</b>		<b>Year 5– Spring</b>	
MOLGEN 7600	1	MOLGEN 5193	3
MOLGEN MS Elective	3	MOLGEN MS Elective	3
MOLGEN MS Elective	3	MOLGEN MS Elective	2-3
MOLGEN MS Elective	2-3	MOLGEN MS Elective	2-3
MOLGEN MS Elective	2-3		
Semester Total	11 – 13	Semester Total	10 – 12
		Year 5 Total	21 – 25
		Grand Total for MS Degree	30+ Credit Hours

Appendix D3 Proposed BS/MS advising sheet

**Molecular Genetics BS/MS Advising form**

Student ID #: \_\_\_\_\_

Expected Graduation Term: \_\_\_\_\_ Student Name.#: \_\_\_\_\_

Second Major: \_\_\_\_\_

Minor: \_\_\_\_\_

**Part A: General Education not fulfilled by Part B**

Should complete majority prior to starting MS courses

GE Category	Course Number	Credit Hours	Grade	Term Taken
Writing		3		
		3		
Literature		3		
VPA		3		
Soc. Sci. 1:		3		
Soc. Sci. 2:		3		
Historical Study		3		
Cultures & Ideas		3		
Foreign Language		4		
		4		
		4		
Social Diversity*		3		
Global Studies*		3		
		3		

\*Courses in these areas can overlap with another GE category when applicable

**Part B: Major Prerequisites**

Should be completed prior to starting MS courses

Course	Credit Hours	Grade	Term Taken	Course	Credit Hours	Grade	Term Taken
Math 1151	5			Chem 1210	5		
OR Math 1156	5			Chem 1220	5		
Bio 1113	4			Chem 2510	4		
Bio 1114	4			Chem 2520	4		
Physics 1200	5			Chem 2540	2		
OR Physics 1250	5			Chem 2550	2		
Physics 1201	5						
OR Physics 1251**	5						

Honors courses can substitute where available

\*\*Math 1152 is a prerequisite/co-requisite for Physics 1251

## Molecular Genetics BS/MS Advising form p2

### Part C: Molecular Genetics BS Core

Course	Title	Major Credit Hours	Grade	Term Taken
BIOCHEM 4511	Intro to Biological Chemistry	4		
OR BIOCHEM 5613^	Biochemistry and Molecular Biology 1	3		
OR BIOCHEM 5614^	Biochemistry and Molecular Biology 2	3		
MOLGEN 4606	Molecular Genetics	4		
MOLGEN 5607	Cell Biology	3		
OR MOLGEN 5607E		4		
MOLGEN 5608	Genes and Development	3		
OR MOLGEN 5608E		4		
MOLGEN 5645	Quantitative, Population, and Evolutionary Genetics	2		
MOLGEN 5601	Molecular Microbiology Lab	4		
OR MOLGEN 5602	Cell and Developmental Biology Lab	4		

^ Both Biochem 5613 & 5614 must be completed as substitution for Biochem 4511

MolGen 4606 and at least 1 more course in Part C MUST be completed prior to starting MS courses  
 OSU GPA must be  $\geq 3.5$  prior to starting MS courses

### Part D: Molecular Genetics BS Electives/MS Requirements

up to 9 credit hours can count towards both the BS and MS degrees

Course	Title	BS Credit Hours	MS Credit Hours	Grade	Term(s) Taken	Mark if S/U
MOLGEN7600	First Year Student Orientation	0	1			
MOLGEN						
MOLGEN						
MOLGEN						
MOLGEN						
MOLGEN						
MOLGEN						
Space for Additional Approved Coursework						



## Molecular Genetics BS/MS Advising form p3

**Breadth requirement: at least one course at the 5000 level or above in each of the pillars of Molecular Genetics**

Pillar	Course	Title
Genetics/Genomics		
Molecular Biology		
Cell Biology		
Developmental Biology		

### BS Degree

Major Core Credits ( $\geq 19$ ): \_\_\_\_\_

Major Elective Credits ( $\geq 6$ ): \_\_\_\_\_

Major Credits not graded S/U ( $\geq 27$ ): \_\_\_\_\_

Total BS Major Credits ( $\geq 30$ ): \_\_\_\_\_

Upper Division Credits ( $\geq 39$ ): \_\_\_\_\_

Total BS Degree Credits ( $\geq 121$ ): \_\_\_\_\_

### MS Degree

MOLGEN7600 (1): \_\_\_\_\_

Molgen Credits not graded S/U ( $\geq 8$ ): \_\_\_\_\_

Breadth requirement complete? \_\_\_\_\_

Total MS Degree Credits ( $\geq 30$ ): \_\_\_\_\_

**Appendix E BS/MS program assessment**

**Assessment:** Students in the Combined BS/MS program will be assessed according to our approved BS assessment plan (G1) during their early years and according to the MS assessment plan (G2) after admission to the graduate program. Students in the combined BS/MS program are anticipated to fulfill all learning goals associated with the BS degree and with the MS degree. A curricular map is found in E3

## Appendix E1 BS Learning goals and assessment

### Major Learning Goals

1. Undergraduate Molecular Genetics majors acquire a basic mastery of fundamental concepts of biology, chemistry, mathematics, physics, and the scientific method.
  2. Undergraduate Molecular Genetics majors acquire a basic mastery of fundamental areas of molecular genetics, including transmission genetics, the central dogma of molecular biology, regulation of gene expression, quantitative and population genetics, genomics, recombinant DNA and biotechnology, and cell and developmental biology.
  3. Undergraduate Molecular Genetics majors develop analytical and problem solving skills in areas of genetics and molecular biology.
  4. Undergraduate Molecular Genetics majors acquire a basic mastery of experimental techniques and approaches used in genetics and molecular biology.
  5. Undergraduate Molecular Genetics majors acquire a basic mastery of data analysis and statistical approaches used in genetics and molecular biology.
  6. Undergraduate Molecular Genetics majors effectively communicate their understanding of genetics and molecular biology both orally and in writing.
  7. Undergraduate majors participate in academic research and/or outreach activities that are consistent with their interests and postgraduate plans.
  8. Undergraduate majors acquire expertise relevant to their chosen area of specialization.
- Program learning goals with no asterisk = beginner's level; \* = intermediate level; \*\* = advanced level

### Assessment plan for Molecular Genetics BS

**LG1.** Undergraduate Molecular Genetics majors acquire a basic mastery of fundamental concepts of biology, chemistry, mathematics, physics, and the scientific method.

**Direct - Embedded testing** - Basic Biology Knowledge Quiz will be given to all students in the gateway course for the molecular genetics major, MolGen 4606, at the start of the semester.

**Indirect - Survey (Student)** - Graduating Senior Survey

**Criteria:** We expect that 70% of students feel their preparation from basic biology and chemistry courses was adequate for success in the major.

**LG2.** Undergraduate Molecular Genetics majors acquire a basic mastery of fundamental areas of molecular genetics, including transmission genetics, the central dogma of molecular biology, regulation of gene expression, quantitative and population genetics, genomics, recombinant DNA and biotechnology, and cell and developmental biology.

**Direct - Embedded testing** - Basic Biology Knowledge Quiz will be given to all students in the gateway course for the molecular genetics major, MolGen 4606, at the start of the semester.

**Indirect - Survey (Student)** - Graduating Senior Survey

**Criteria:** We expect that 70% of students feel their preparation from basic biology and chemistry courses was adequate for success in the major.

**LG3.** Undergraduate Molecular Genetics majors develop analytical and problem solving skills in areas of genetics and molecular biology.

**Indirect - Grade review** - Grade performance of majors in core and advanced elective courses.

**Criteria:** We expect that our MG undergraduate majors will perform at levels equal to other students in the classes with 75% or more earning grades of a B or better.

**Indirect - Survey (Student)** - Graduating Senior Survey.

**Criteria:** We expect that 70% of students feel their molecular genetics coursework was excellent

training for their future career aspirations.

**Direct - Embedded testing** - We will assess understanding of advanced molecular genetics concepts by evaluating embedded questions from exams in Molecular Genetics Core courses (MolGen 4606, MolGen 5607, MolGen 5608, MolGen 5645, MolGen 5601, and MolGen 5602). Whenever possible these questions will be drawn from the comprehensive portion of final exams and be representative of core learning goals for these core courses.

**Criteria:** Expectations are that 70% of students will have correct answers; aspirational goals are that 90% of students achieve a correct answer.

**Direct - Student Research** - Participation rates in undergraduate research or an advanced Molecular Genetics Lab class.

**Criteria:** Minimum undergraduate research participation rate of 50%; an aspirational rate would be 75%. In addition, we expect that 33% of students conducting undergraduate research will complete a senior theses; an aspiration goal is that 50% will complete this capstone event.

**LG4.** Undergraduate Molecular Genetics majors acquire a basic mastery of experimental techniques and approaches used in genetics and molecular biology.

**Indirect - Grade review** - Grade performance of majors in core and advanced elective courses.

**Criteria:** We expect that our MG undergraduate majors will perform at levels equal to other students in the classes with 75% or more earning grades of a B or better.

**Direct - Student Research** - Participation rates in undergraduate research or an advanced Molecular Genetics Lab class.

**Criteria:** Minimum undergraduate research participation rate of 50%; an aspirational rate would be 75%. In addition, we expect that 33% of students conducting undergraduate research will complete a senior theses; an aspiration goal is that 50% will complete this capstone event.

**Direct - Embedded testing** - We will assess understanding of advanced molecular genetics concepts by evaluating embedded questions from exams in Molecular Genetics Core courses (MolGen 4606, MolGen 5607, MolGen 5608, MolGen 5645, MolGen 5601, and MolGen 5602). Whenever possible these questions will be drawn from the comprehensive portion of final exams and be representative of core learning goals for these core courses.

**Criteria:** Expectations are that 70% of students will have correct answers; aspirational goals are that 90% of students achieve a correct answer.

**LG5.** Undergraduate Molecular Genetics majors acquire a basic mastery of data analysis and statistical approaches used in genetics and molecular biology.

**Indirect - Grade review** - Grade performance of majors in core and advanced elective courses.

**Criteria:** We expect that our MG undergraduate majors will perform at levels equal to other students in the classes with 75% or more earning grades of a B or better.

**Direct - Student Research** - Participation rates in undergraduate research or an advanced Molecular Genetics Lab class.

**Criteria:** Minimum undergraduate research participation rate of 50%; an aspirational rate would be 75%. In addition, we expect that 33% of students conducting undergraduate research will complete a senior theses; an aspiration goal is that 50% will complete this capstone event.

**Direct - Embedded testing** - We will assess understanding of advanced molecular genetics concepts by evaluating embedded questions from exams in Molecular Genetics Core courses (MolGen 4606, MolGen 5607, MolGen 5608, MolGen 5645, MolGen 5601, and MolGen 5602). Whenever possible these questions will be drawn from the comprehensive portion of final exams and be representative of core learning goals for these core courses.

**Criteria:** Expectations are that 70% of students will have correct answers; aspirational goals are that 90% of students achieve a correct answer.

**LG6.** Undergraduate Molecular Genetics majors effectively communicate their understanding of genetics and molecular biology both orally and in writing.

**Indirect - Grade review** - Grade performance of majors in core and advanced elective courses.

**Criteria:** We expect that our MG undergraduate majors will perform at levels equal to other students in the classes with 75% or more earning grades of a B or better.

**Direct - Student Research** - Participation rates in undergraduate research or an advanced Molecular Genetics Lab class.

**Criteria:** Minimum undergraduate research participation rate of 50%; an aspirational rate would be 75%. In addition, we expect that 33% of students conducting undergraduate research will complete a senior theses; an aspiration goal is that 50% will complete this capstone event.

**Direct - Embedded testing** - We will assess understanding of advanced molecular genetics concepts by evaluating embedded questions from exams in Molecular Genetics Core courses (MolGen 4606, MolGen 5607, MolGen 5608, MolGen 5645, MolGen 5601, and MolGen 5602). Whenever possible these questions will be drawn from the comprehensive portion of final exams and be representative of core learning goals for these core courses.

**Criteria:** Expectations are that 70% of students will have correct answers; aspirational goals are that 90% of students achieve a correct answer.

**LG7.** Undergraduate majors participate in academic research and/or outreach activities that are consistent with their interests and postgraduate plans.

**Indirect - Grade review** - Grade performance of majors in core and advanced elective courses.

**Criteria:** We expect that our MG undergraduate majors will perform at levels equal to other students in the classes with 75% or more earning grades of a B or better.

**Direct - Student Research** - Participation rates in undergraduate research or an advanced Molecular Genetics Lab class

**Criteria:** Minimum undergraduate research participation rate of 50%; an aspirational rate would be 75%. In addition, we expect that 33% of students conducting undergraduate research will complete a senior theses; an aspiration goal is that 50% will complete this capstone event.

**Direct - Embedded testing** - We will assess understanding of advanced molecular genetics concepts by evaluating embedded questions from exams in Molecular Genetics Core courses (MolGen 4606, MolGen 5607, MolGen 5608, MolGen 5645, MolGen 5601, and MolGen 5602). Whenever possible these questions will be drawn from the comprehensive portion of final exams and be representative of core learning goals for these core courses.

**Criteria:** Expectations are that 70% of students will have correct answers; aspirational goals are that 90% of students achieve a correct answer.

**LG8.** Undergraduate majors acquire expertise relevant to their chosen area of specialization.

**Indirect - Grade review** - Grade performance of majors in core and advanced elective courses.

**Criteria:** We expect that our MG undergraduate majors will perform at levels equal to other students in the classes with 75% or more earning grades of a B or better.

**Direct - Student Research** - Participation in undergraduate research or outreach experiences.

**Criteria:** We expect that 75% of our graduates will have participated in either undergraduate research or an outreach activity. An aspirational goal would be to achieve 90% participation.

**Indirect - Survey (Student)** - Graduating Senior Survey

**Criteria:** We expect that 70% of students feel their molecular genetics coursework was excellent training for their future career aspirations.

**Indirect - Job placement - Job or post-baccalaureate education placement**

**Criteria:** We expect that 75% of students are pursuing post-baccalaureate education or are working in an area related to their undergraduate degree.

## Appendix E2 MS Learning goals and assessment

### MS in Molecular Genetics learning goals/assessment:

Students should be able to:

1. Demonstrate a broad base of knowledge in several areas, including genetics, cell biology, and developmental biology.
2. Demonstrate a deep understanding of an area of special interest.
3. Effectively communicate research findings via oral and written presentations to specialized scientific and general audiences.

### MS in Molecular Genetics assessment:

LG1. Demonstrate a broad base of knowledge in several areas, including genetics, cell biology, and developmental biology.

**Direct**-Performance on general knowledge-based questions during the MS examination will be assessed by the committee (see attached rubric)

**Criteria** target goal of 70% of students having an average score of meets expectations or higher

**Indirect**-Performance in individual courses will be used to measure intermediate and advanced levels.

**Criteria:** Achievement of this goal will be based on student performance in the pillar and elective courses chosen by the students. An average GPA of 3.0 is required for retention in the program, the target goal is for 70% of MS candidates to achieve a B+ or better in at least one course in each Molecular Genetics pillar.

LG2. Demonstrate a deep understanding of an area of special interest.

**Direct:** The MS examination will be evaluated by the thesis committee (Plan A) or by the advisor and one member of the GSC (Plan B) (see attached rubric).

**Criteria** target goal of 70% of students having an average score of meets expectations or higher

LG3. Effectively communicate research findings via oral and written presentations to specialized scientific and general audiences.

**Direct:** The MS examination will be evaluated by the thesis committee (Plan A) or by the advisor and one member of the GSC (Plan B) (see attached rubric).

**Criteria** target goal of 70% of students having an average score of meets expectations or higher

Timeline:

Due to the small size of the program, assessment data for any given goal will be reported no more often than every 4 years, and every report shall contain a minimum of 10 students to allow anonymization.

Molecular Genetics MS final exam rubric

Candidate name: \_\_\_\_\_

Date of Assessment: \_\_\_\_\_

Nature of presentation: \_\_\_\_\_

<b>Assessment area</b>	<b>Does not meet expectations</b>	<b>Partially meets expectations</b>	<b>Meets expectations</b>	<b>Exceeds expectations</b>
Knowledge of concepts and methodology in research outside student's research area (LG1)				
Knowledge of concepts and methodology in research in student's research area (LG2)				
Ability to identify and define significant research problems (LG2)				
Command of the relevant literature (LG2)				
Ability to critically evaluate research findings (LG2)				
Incorporation of constructive criticism and advice (LG2)				
Clarity of written presentation (LG3)				
Clarity of Oral presentation (LG3)				



**Appendix E3 Curricular map and goals**

<b>Course Number</b>	<b>Course Title</b>	<b>Credit Hours</b>	<b>Role in Major</b>	<b>UG Program Learning Goals</b>	<b>MS Program Learning Goals</b>
Biochem 4511	Introduction to Biological Chemistry	4	core	1*, 2*, 3*, 4*, 5*	NA
MolGen 2220H	Intro to Molecular Life Sciences: Research Opportunities and Career Options	1	elective	1, 2	NA
MolGen 3300	General Plant Biology	3	elective	1*, 2*	NA
MolGen 3436	Introductory Plant Physiology	3	elective	1*, 2*	NA
MolGen 4503	Molecular Genetics Writing Project	1	elective	6**, 7**, 8**	NA
MolGen 4591S	DNA Fingerprinting Workshops in Columbus Public Schools	1	elective	6**, 7**	NA
MolGen 4606	Molecular Genetics	4	core (BS)	1*, 2*, 3*, 4*, 5*	NA
MolGen 4703	Human Genetics	3	Elective (BS)	2**, 3**, 4**, 8*	NA
MolGen 4998	Undergraduate Research in Molecular Genetics	1 to 3	Elective (BS)	3**, 4**, 5**, 6**, 7**, 8**	NA
MolGen 4998H	Undergraduate Research in Molecular Genetics	1 to 3	Elective(BS)	3**, 4**, 5**, 6**, 7**, 8**	NA
MolGen 4999	Thesis Research in Molecular Genetics	1 to 3	Elective(BS)	3**, 4**, 5**, 6**, 7**, 8**	NA
MolGen 4999H	Thesis Research in Molecular Genetics	1 to 3	Elective(BS)	3**, 4**, 5**, 6**, 7**, 8**	NA
MolGen 5193	Individual Studies	1 to 3	elective	6**, 7**, 8**	2-A, 3-A
MolGen 5194	Group Studies	1 to 3	elective	2**, 8**	2-A
MolGen 5300	Cancer Genetics	3	elective	2**, 3**, 4**, 8**	1-I
MolGen 5601	Eukaryotic Molecular Genetics Lab	3 or 4	core (BS) elective (MS)	2*, 3*, 4*, 5*, 6*, 7*	1-I, 3-A
MolGen 5602	Eukaryotic Cell and Developmental Laboratory	3 or 4	core (BS) elective (MS)	2*, 3*, 4*, 5*, 6*, 7*	1-I, 3-A
MolGen 5607	Cell Biology	3	core (BS) elective (MS)	1*, 2*, 3*, 4*, 5*	1-B

MolGen 5607E	Cell Biology	4	core (BS)	1*, 2*, 3*, 4*, 5*, 6*	NA
MolGen 5608	Genes and Development	3	core (BS) elective (MS)	1*, 2*, 3*, 4*, 5*	1-B
MolGen 5608E	Genes and Development	4	core (BS)	1*, 2*, 3*, 4*, 5*, 6*	NA
MolGen 5623	Genetics and Genomics	2	elective	2**, 3**, 4**, 8**	1-I, 3-A
MolGen 5630	Plant Physiology	3	elective	2**, 3**, 4**, 8**	1-I
MolGen 5632	Insect Molecular Genetics	2	elective	2**, 3**, 4**, 8**	1-I
MolGen 5643	Plant Anatomy	3	elective	2**, 3**, 4**, 6**, 7*, 8**	1-I
MolGen 5645	Quantitative, Population, and Evolutionary Genetics	2	core (BS) elective (MS)	1*, 2*, 3*, 4*, 5*	1-B
MolGen 5650	Analysis and Interpretation of Biological Data	3	elective	3**, 5**	1-I
MolGen 5695	Frontiers in Life Sciences Research: Genomics, Proteomics and Bioethics	1	elective	2**, 3**, 4**, 8**	1-I
MolGen 5700	Systems of Genetic Analysis	3	elective	2**, 3**, 4**, 8**	1-I
MolGen 5701	DNA Transactions and Gene Regulation	4	elective	2**, 3**, 4**, 8**	1-I
MolGen 5705	Advances in Cell Biology	2	elective	2**, 3**, 4**, 8**	1-I
MolGen 5715	Developmental Genetics	2	elective	2**, 3**, 4**, 8**	1-I
MolGen 5733	Advanced Human Genetics	2	elective	2**, 3**, 4**, 8**	1-I
MolGen 5735	Plant Biochemistry	3	elective	2**, 3**, 4**, 8**	1-I
MolGen 5795	Special Topics in Molecular Genetics	1 to 3	elective	2**, 3**, 4**, 8**	1-I
MolGen 5796	Current Topics in Signal Transduction	1 to 2	elective	2**, 3**, 4**, 8**	1-I
MolGen 5797	Study at a Foreign Institution	1 to 3	elective	6*, 7*, 8*	1-B
MolGen 5798	Study Tour: Domestic	1 to 3	elective	6*, 7*, 8*	1-B
MolGen	Organelle Biology	2	elective	2**, 3**, 4**, 8**	1-I

5800				8**	
MolGen 7600	First-Year Student Orientation	1	required(MS)	NA	1-B
MolGen 7741	Molecular Virology and Pathogenesis of Viruses	5	elective	NA	1-A
MolGen 7999	Thesis Research	1-12	required (planA) elective (planB)	NA	2A, 3A
MolGen 7807	Gene Expression: Post- Transcriptional Control	3	elective (MS)	NA	1-A 3-A

### **Undergraduate Major Learning Goals**

**(no asterisk = beginner's level; \* = intermediate level; \*\* = advanced level)**

1. Undergraduate Molecular Genetics majors acquire a basic mastery of fundamental concepts of biology, chemistry, mathematics, physics, and the scientific method.
2. Undergraduate Molecular Genetics majors acquire a basic mastery of fundamental areas of molecular genetics, including transmission genetics, the central dogma of molecular biology, regulation of gene expression, quantitative and population genetics, genomics, recombinant DNA and biotechnology, and cell and developmental biology.
3. Undergraduate Molecular Genetics majors develop analytical and problem solving skills in areas of genetics and molecular biology.
4. Undergraduate Molecular Genetics majors acquire a basic mastery of experimental techniques and approaches used in genetics and molecular biology.
5. Undergraduate Molecular Genetics majors acquire a basic mastery of data analysis and statistical approaches used in genetics and molecular biology.
6. Undergraduate Molecular Genetics majors effectively communicate their understanding of genetics and molecular biology both orally and in writing.
7. Undergraduate majors participate in academic research and/or outreach activities that are consistent with their interests and postgraduate plans.
8. Undergraduate majors acquire expertise relevant to their chosen area of specialization.

### **MS Learning goals**

**(B- beginning, I = Intermediate, A= Advanced)**

1. Demonstrate a broad base of knowledge in several areas, including genetics, cell biology, and developmental biology. Goal is partially achieved by requiring one course in each pillar above.
2. Demonstrate a deep understanding of an area of special interest.
3. Effectively communicate research findings via oral and written presentations to specialized scientific and general audiences.