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# Manual for Undergraduate Studies

# *Molecular Genetics*

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Department of Molecular Genetics

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# **DEPARTMENT OF MOLECULAR GENETICS**

## **College of Arts and Sciences, The Ohio State University**

105 Biological Sciences Building, 484 West 12<sup>th</sup> Avenue, Columbus OH 43210-1292 USA  
Telephone 614/292-8084 FAX 614/292-4466 <http://molgen.osu.edu/>

**Undergraduate Degrees Offered:** Bachelor of Science

### Undergraduate Faculty Advisors

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### Undergraduate Faculty Honors Advisors

Dr. Harold Fisk (Last Names: A-L)      [fisk.13@osu.edu](mailto:fisk.13@osu.edu)

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Note for Spring 2019, Dr. Fisk is filling in for Dr. Hopper

### Molecular Genetics Arts and Sciences Advisor

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### **Description**

The faculty of the Department of Molecular Genetics teaches and conducts research in genetics, epigenetics, molecular biology, cell biology, and developmental biology. They investigate scientific problems from the molecular to the population level, using a wide range of experimental systems including viruses, fungi, protists, plants and animals as well as human beings. While the department represents a diversity of interests and a broad mission, our faculty are united by a common interest in the structure, expression, and evolution of genes, and the use of techniques from genetics and molecular biology to address biological questions.

The use of molecular genetic tools is revolutionizing many areas of biology. The Molecular Genetics major provides the student with the background needed for success in a graduate program leading to an exciting career in the most active areas of pure and applied biology. The major provides an excellent entry route for professional schools in dentistry, medicine and veterinary medicine, where expertise in molecular, cellular, developmental, and traditional genetics is of increasing importance, as well as for advance graduate studies in any Molecular Biology related field.

## Planning a Major program.

All students are encouraged to meet with their faculty advisor during their freshman year or as soon as they begin considering a molecular genetics major program. It is strongly encouraged that students begin the molecular genetic core courses in their sophomore year (see sample curriculum on pages 10 and 11).

Completion of The Molecular Genetics Major satisfies the GE – Statistics/ Data Analysis requirement. Molecular Genetics 5650 provides additional statistical material to those seeking additional experience.

Students who complete 4 semester credit hours of Undergraduate Research (generally MOLGEN 4998 or 4998H) over two semesters may substitute 3 credits of independent research for the requirement to complete Molecular Genetics 5601 or 5602. Your advisor must approve this substitution. If not used in place of Molecular Genetics 5601 or 5602, three credits of independent research may count as an elective in the major.

**Sample curricula are shown on pages 10 and 11 of this manual.**

### **IMPORTANT NOTES:**

Courses in the major must be approved by your faculty advisor

A minimum grade of C- is required in each course in the major (Core requirements and Electives)

No more than 3 credit hours graded S/U can count towards the 30-hour major

At least 30 semester credit hours are required for the molecular genetics major. Lists of core and elective courses begin on page 4

Dual majors must consist of at least 18 unique hours in each major. Meet with your advisor to discuss a dual major curriculum

## **Molecular Genetics Undergraduate Major**

30 semester hours are required for the major

**Important Note: No more than 3 hours of S/U graded courses can count towards the 30 required hours**

**Part A. Required Prerequisites** (do not count toward the 30 credit hour major)

- Bio 1113 (4) AND 1114 (4)
- Chem 1210 (5) AND Chem 1220 (5)
- Chem 2510 (4), 2520 (4), 2540 (2), and 2550 (2)
- Math 1151 (5) OR Math 1156 (5)
- Physics 1200 (5) AND 1201 (5)

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

**Part B. Core Requirements** (the core comprises at least 19 credit hours of the 30 credit hour major):

- Biochemistry 4511 (4) OR Biochemistry 5613 (3) AND Biochemistry 5614 (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 Genetics Lab* OR MOLGEN 5602 *Cell and Developmental Biology Lab*

(Note: MOLGEN 5601 and MOLGEN 5602 are 4 semester credits in the autumn and spring semesters, 3 semester credits in the summer session).

Both lab courses require either MOLGEN 4606 or MOLGEN 4500 as a prerequisite.

MOLGEN majors who complete 4 semester credit hours of Undergraduate Research (generally MOLGEN 4998 or 4998H) over two semesters may substitute 3 credits of independent research for the core MOLGEN laboratory requirement. If not substituted for the MOLGEN laboratory core requirement, 1-3 credit hours of independent research may count as a major elective. If you plan to do independent research in a lab outside of Molecular Genetics, speak to your faculty advisor PRIOR to registering in order to confirm that the credits will count towards the major.

Please note that while we are only permitted to count three credit hours of S/U graded courses towards the 30 credit hour major, additional credits of MOLGEN 4998/4998H/4999/4999H still count towards your credits needed for graduation.

**Part C. Electives** (choose at least 3 electives from the following lists; 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. No more than three credit hours at the 2000 level can count towards the 30 credit-hour major):

**C.1 Electives requiring at most MG4606 or MG4500 as prerequisites**

MOLGEN 2220H (\*) *Introduction to Molecular Life Sciences: Research Opportunities and Career Options* (1)

MOLGEN 2690 (\*) *Genes and Society* (3)

MOLGEN 3300 (\*) *Plant Biology* (3)

MOLGEN 3436 (\*) *Plant Physiology* (3)

MOLGEN 4503 *Molecular Genetics Writing Project* (1)

MOLGEN 4591S *DNA Fingerprinting Workshop* (1) (No more than 3 semester credit hours of S/U coursework can count towards the 30 credit hour minor.)

MOLGEN 4700 *Molecular Cell and Developmental Biology* (3) (Note that this course is designed for students in the Molecular Genetics minor and in other biology majors, however in select cases, this course may be taken prior to 5607 or 5608 and count as an elective in the Molecular Genetics major. Any Molecular Genetics major interested in this option MUST receive permission from their faculty advisor BEFORE enrolling in MOLGEN 4700).

MOLGEN 4703 *Human Genetics* (2)

MOLGEN 4998 (or 4998H) *Undergraduate Research* and/or MOLGEN 4999 (or 4999H) *Thesis Research* Up to 3 credit hours can count towards the 30 credit hour major requirement (see page 4). No more than 3 semester credit hours of S/U coursework can count towards the 30 credit hour major. MOLGEN 4999 or 4999H hours that satisfy a thesis requirement can NOT be substituted for the lab requirement OR count as an elective).

MOLGEN 5193 *Individual Studies* (1-3) (No more than 3 semester credit hours of 5193 can count towards the major. No more than 3 semester credit hours of S/U coursework can count towards the 30 credit hour major)

MOLGEN 5194 *Group Studies* (1-3) (No more than 3 semester credit hours of 5194 can count towards the major.)

MOLGEN 5300 *Cancer Genetics* (2)

MOLGEN 5632 *Insect Molecular Genetics* (2)

MOLGEN 5650 *Analysis and Interpretation of Biological Data* (3)

MOLGEN 5797 *Study at a Foreign Institution* (1-15) (No more than 3 semester credit hours of 5797 can count towards the major. No more than 3 semester credit hours of S/U coursework can count towards the major.)

MOLGEN 5798 *Study Tour: Domestic* (1-15) (No more than 3 semester credit hours of 5798 can count towards the major. No more than 3 semester credit hours of S/U coursework can count towards the major.)

MOLGEN 5800 *Organelle Biology* (2)

\* **Note:** MOLGEN 2220H, MOLGEN 2690, MOLGEN 3300, and MOLGEN 3436 *do not require* MOLGEN 4500 or MOLGEN 4606 as a prerequisite

## **C.2 Electives requiring additional prerequisites.**

**Please consult the course catalog (<https://registrar.osu.edu/courses/>) or meet with your molecular genetics advisor for more information.**

Completion of a subset of the MOLGEN Core (MOLGEN 4606, 5607, 5608, and 5645) is a prerequisite for many 5000-level MOLGEN courses.

MOLGEN 5623 *Genetics and Genomics* (2)

MOLGEN 5630 *Plant Physiology* (3)

MOLGEN 5643 *Plant Anatomy* (3)

MOLGEN 5700 *Systems of Genetic Analysis* (3)

MOLGEN 5701 *DNA Transactions and Gene Regulation* (3)

MOLGEN 5705 *Advances in Cell Biology* (2)

MOLGEN 5715 *Developmental Genetics* (2)

MOLGEN 5733 *Advanced Human Genetics* (2)

MOLGEN 5735 *Plant Biochemistry* (3)

MOLGEN 5795 *Special Topics in Molecular Genetics* (1-3)

MOLGEN 5796 *Current Topics in Signal Transduction* (1 or 2)

**C.3 Electives offered by other departments** that can be used towards the molecular genetics major (please consult the course catalog for prerequisites). \*

Biochem 5621 *Introduction to Biological Chemistry Laboratory* (4)

Biophrm 5733 *Advanced Human Genetics* (2)

EEOB 4520 *Comparative Physiology* (3)

Micro 4000 *General Microbiology* (4)

Micro 4100 *General Microbiology* (5)

Micro 4130 *Microbial Genetics* (3)

Micro 4140 *Molecular Microbiology Lab* (3)

Micro 5122 *Immunology* (3)

Micro 5161 *Bioinformatics and Molecular Microbiology* (3)

Neuroscience 4050 *Neurogenetics* (3)

Psychology 5602 *Behavioral Genetics* (3)

\* Note: Other elective courses may be substituted with permission of major advisor.

## **Molecular Genetics Undergraduate Major with a Plant Cellular and Molecular Biology (PCMB) Specialization**

### **Part A. Required Prerequisites** (do not count toward the 30 credit hour major)

- Bio 1113 (4) AND 1114 (4)
- Chem 1210 (5) AND Chem 1220 (5)
- Chem 2510 (4), 2520 (4), 2540 (2), and 2550 (2)
- Math 1151 (5) OR Math 1156 (5)
- Physics 1200 (5) AND 1201 (5)

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

### **Part B. Core Requirements** (the core comprises at least 20 credit hours of the 30 credit hour major):

- Biochemistry 4511 (4) OR Biochemistry 5613 (3) AND Biochemistry 5614 (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 *General Plant Biology* (3)
- MOLGEN 3436 *Introductory Plant Physiology* (3)

**Part C. Electives:** (choose at least 3 electives from the following list: At least one course totaling at least 2 credit hours must be taken from within the department. No more than three credit hours at the 2000 level can count towards the 30 credit-hour major. Electives plus the core must total at least 30 credit hours):

#### **C.1 Electives requiring only MG4606 or MG4500 as prerequisites**

MOLGEN 4503 *Molecular Genetics Writing Project with a plant focus* (1)

MOLGEN 4998 (or 4998H) *Undergraduate Research* and/or MOLGEN 4999 (or 4999H) *Thesis Research with a plant focus* (up to 3 semester credit hours can count towards the 30 credit hour major requirement. No more than 3 semester credit hours of S/U coursework can count towards the 30 credit hour major). Note that MOLGEN 4999 or 4999H hours that satisfy a thesis requirement can NOT be substituted for the lab requirement OR count as an elective)

MOLGEN 5193 *Individual Studies* (1-3) with a plant focus (No more than 3 semester credit hours of 5193 can count towards the major. No more than 3 semester credit hours of S/U coursework can count towards the 30 credit hour major)

MOLGEN 5194 *Group Studies* (1-3) with a plant focus (No more than 3 semester credit hours of 5194 can count towards the major).

MOLGEN 5601 *Molecular Genetics Lab* or MOLGEN 5602 *Cell and Developmental Biology Lab with a plant module* (3-4)

MOLGEN 5797 *Study at a Foreign Institution* (1-15) with a plant focus (No more than 3 semester credit hours of 5797 or 5798 can count towards the major)

MOLGEN 5798 *Study Tour: Domestic* (1-15) with a plant focus (No more than 3 semester credit hours of 5797 or 5798 can count towards the major)

MOLGEN 5795 *Special Topics in Molecular Genetics* (with a plant focus) (1-3)

MOLGEN 5800 *Organelle Biology* (2)

## **C.2 Electives requiring additional prerequisites.**

**Please consult the course catalog (<https://registrar.osu.edu/courses/>) or meet with your molecular genetics advisor for more information.**

MOLGEN 5630 *Plant Physiology* (3)

MOLGEN 5643 *Plant Anatomy* (3)

MOLGEN 5735 *Plant Biochemistry* (3)

\* Note: Other elective courses may be substituted with permission of major advisor.



## **BS/MS in Molecular Genetics**

A combined BS/MS Degree in Molecular Genetics is an opportunity for qualified undergraduates in Molecular Genetics to begin the Master's program in Molecular Genetics during their senior year, with the possibility of completing the Master's degree the following year.

Students who are accepted in to the Molecular Genetics BS/MS Program are allowed to double count up to 10 semester credit hours of classes toward both the undergraduate and graduate degrees.

If you are interested in the pathway, please talk to your Molecular Genetics major advisor!

### **Eligibility**

Students must meet all requirements set by the Graduate School for combined BS/MS programs. These requirements can be found in in Section VIII.1 of the Graduate School Handbook (<http://www.gradsch.osu.edu/8.1-combined-programs.html>)and include the following criteria:

- Senior level standing in Molecular Genetics
- Completion of 90 undergraduate credit hours
- Minimum 3.5 cumulative GPA in all previous undergraduate work (this is a Graduate School requirement).
- Application for admission to the Molecular Genetics Master's program (indication that you want to complete a BS/MS degree). Admission by the Molecular Genetics Graduate Studies Committee and the OSU Graduate School

# Sample 4-Year Plan 1

(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

## Sample 4-Year Plan 2

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

<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	MOLGEN 4606	4
GE: Foreign Language 2	4	GE: Foreign Language 3	4
GE or MOLGEN Major Elective*	3	GE	3
Semester Total	17	Semester Total	17
		Year 2 Total	34
<b>Year 3 – Autumn</b>		<b>Year 3 – Spring</b>	
Biochem 4511 or MOLGEN 5602**	4	Biochem 4511 or MOLGEN 5601**	4
MOLGEN 5607	3	MOLGEN 5608	3
Physics 1200	5	Physics 1201	5
GE	3	MOLGEN Major Elective*	2 – 3
		GE	3
Semester Total	15	Semester Total	17 – 18
		Year 3 Total	32 – 34
<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	GE or 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 before MOLGEN 4606. MOLGEN major coursework including electives must total at least 30 credits.			
**Either MOLGEN 5601 or 5602 is required		Grand Total	121+ Credit Hours

# Molecular Genetics Undergraduate Minor

## Required prerequisites

- Biology 1113 and Biology 1114
- Chemistry 1210 and 1220

Honors or more advanced versions of these prerequisite courses can be substituted.

## Required Core Courses

One of the following courses:

- MOLGEN 4500 (3) or MOLGEN 4500E (4)
- MOLGEN 4606 (4)

AND

At least two of the following courses:

- MOLGEN 5607 (3) or 5607E (4)
- MOLGEN 5608 (3) or 5608E (4)
- MOLGEN 4700 (3)
- MOLGEN 5645 (2)

## Elective Courses

(Core plus electives must total at least 14 semester credit hours; no more than 3 semester credit hours can be graded S/U and count towards the Minor. Additional courses from the core list can count as electives once the core is completed)

- |                              |                             |
|------------------------------|-----------------------------|
| • MOLGEN 2220H (1)           | • MOLGEN 5300 (2)           |
| • MOLGEN 2690 (3)            | • MOLGEN 5601 or 5602 (3-4) |
| • MOLGEN 4503 (1)            | • MOLGEN 5623 (2)           |
| • MOLGEN 4591S (1)           | • MOLGEN 5632 (2)           |
| • MOLGEN 4703 (2)            | • MOLGEN 5650 (3)           |
| • MOLGEN 4998 or 4998H (1-3) | • Micro 4130 (3)            |
| • MOLGEN 5193 (1-3)          | • Micro 5161 (3)            |
| • MOLGEN 5194 (1-3)          |                             |

Alternative elective(s) may be approved by Molecular Genetics advisor

A minimum grade of C- is required in each course in the molecular genetics minor

# Plant Biology Undergraduate Minor

## Required prerequisites

- Biology 1113 and Biology 1114
- Chemistry 1210 and 1220

Honors or more advanced versions of these courses are acceptable.

## Required Core Course

- MOLGEN 3300 General Plant Biology (3)

## Elective Courses

(Electives must total at least 11 semester credit hours; no more than 3 semester credit hours can be graded S/U and count towards the Minor)

MOLGEN 3436 Introductory Plant Physiology (3)

MOLGEN 4503 Molecular Genetics Writing Project **on** a plant topic (1)

MOLGEN 4998 or 4998H (or 4999 or 4999H) Undergraduate Research (in a plant lab). (1-3). Credit hours of 4999 or 4999H that are fulfilling a requirement for a research thesis can NOT count towards the minor

MOLGEN 5193 Individual Studies on a plant topic (1-3).

MOLGEN 5194 Group Studies on a plant topic (1-3).

MOLGEN 5601 Molecular Genetics Lab or 5602 Cell and Developmental Biology Lab **with** a plant module (3-4)

MOLGEN 5630 Plant Physiology (3)

MOLGEN 5643 Plant Anatomy (3)

MOLGEN 5735 Plant Biochemistry (3)

Alternative elective(s) may be approved by MOLGEN Plant advisor

The minor program must be approved by a Plant Biology faculty advisor from the Department of Molecular Genetics.

A minimum grade of C- is required in each course in the plant biology minor

# **Molecular Genetics 4503: Molecular Genetics Writing Project**

## **Who should take MOLGEN 4503?**

MOLGEN 4503 is appropriate for students who wish to develop their writing skills while conducting library research on a topic of interest to them.

## **How do I enroll in MOLGEN 4503?**

### **PRIOR TO ENROLLMENT IN MOLGEN 4503, YOU MUST FIRST OBTAIN PERMISSION FROM A FACULTY MEMBER WHO IS WILLING TO SUPERVISE YOU.**

You should first match your interests with one or more faculty. The faculty and their interests are listed in the Molecular Genetics Undergraduate Handbook or from the departmental web site (<http://molgen.osu.edu/>). After you have chosen one or more faculty as potential MOLGEN 4503 advisors, you should make appointments to visit them and discuss the potential project. After a faculty member has agreed to advise you, you will need to go to the Molecular Genetics Office (105 Biological Sciences Building) and obtain the call number that corresponds to the advising faculty member.

## **After I enroll in MOLGEN 4503, what will I do?**

What will be expected of you will depend, to some extent, on the supervising faculty member. A paper (normally 10-15 pages double spaced) and a 15 minute oral presentation are required in all cases. The oral presentations are often given at lab meetings of the supervising faculty's lab group. Generally it is good to make an appointment with the supervising faculty member as early as possible in the semester so that you can clarify requirements and schedule. In most cases, you will be expected to carry out a thorough literature search of your topic, prepare an outline for the paper and one or more draft versions of the paper before preparing and submitting the final version. You should meet with the supervising faculty member at each stage to discuss your progress and have her/him critique your outline and drafts.

If you have questions, or a problem develops, you may contact your major advisor:

## Research Opportunities for Undergraduates in Molecular Genetics

Doing something with your own two hands is the best way to truly understand it. Today, biologists can analyze and manipulate the genetic material of almost any organism -- decoding the DNA sequence, determining the functions of genes and proteins, and even altering the genome directly. This means that a rigorous program in the life sciences must include an intensive laboratory experience. Just as twenty years ago every biologist had to know how to use a microscope, today's students must be familiar with methods such as recombinant DNA techniques and big data analysis. Your access to any career in the life sciences will be improved through hands-on experience in modern laboratory techniques.

The academic program in the Department of Molecular Genetics has been designed to facilitate this critical experience for all of our majors:

- An optional course for first and second-year students called "*Introduction to Molecular Life Sciences: Research Opportunities and Career Options*" will introduce you to a wide range of possible future careers and give you contact with departmental faculty who can supervise undergraduate research projects.
- The Department offers two laboratory courses involving rigorous and intensive training in molecular biology and molecular genetics (*Eukaryotic Molecular Genetics Laboratory*) and in cell biology and developmental biology (*Eukaryotic Cell and Developmental Biology Laboratory*), exposing our majors to a wide variety of techniques and exercises.
- Our students are encouraged to earn credit working in one of our research laboratories under the umbrella of *Undergraduate Research in Molecular Genetics* or *Honors Research*. This research experience allows the student to focus on a specific area of the field and gives exposure to modern research techniques, mentored by a university faculty member. Over 60% of our majors complete independent mentored research, with some authoring published papers or giving presentations at national meetings

The most frequently asked question is "***Why should I spend my time and effort on an undergraduate research project?***" There are several answers to this question:

- Research experience is essential for students planning to pursue a Ph.D. in the biological sciences, and will help an application for medical or other professional schools to stand out from the crowd. Research experience provides evidence to admissions committees that you have done more than merely pass classes with high grades. Tangible signs of success -- such as your name on a scientific publication, an honors thesis, or obtaining scholarships or awards for research will increase the impact of your application.
- Working in a laboratory allows you to get to know a faculty member outside the classroom. Our faculty members have national and international reputations in the scientific community, and their letters of recommendation are an important component of successful applications to graduate school or to potential employers.
- Some students will seek work as laboratory technicians. Because of the costs in both time and money required to train new employees, biotechnology and pharmaceutical companies tend to favor applicants with hands-on laboratory experience.
- Finally, most students find that performing original research and making new scientific findings is exciting and intellectually gratifying.

## Getting Started in Research:

The faculty of the Department of Molecular Genetics conducts research in genetics, molecular biology, cell biology and developmental biology. They approach scientific problems from the molecular to the population level in a number of different research areas using viruses, fungi, protists, plants and animals, as well as human beings. However, because all organisms are founded upon a uniform genetic plan, these diverse systems and organisms allow students the opportunity to explore essentially any aspect of the biology of plants and animals.

A student interested in this research experience should browse the department web site (<http://molgen.osu.edu>) for information about ongoing research projects in the labs of our faculty members. After reviewing this information, you should confer with your advisor about your top selections, and/or visit those labs of greatest interest to discuss the possibility of doing research there. Once a faculty member agrees to supervise you, you can enroll in one-to-three credit hours per semester of **MOLGEN 4998/4998H**, *Undergraduate Research in Molecular Genetics*. At least initially, you will meet regularly with the faculty research advisor and their graduate students to receive the training necessary to implement the project.

The training period can last from one to several semesters, during which time you will accumulate credit hours toward their degree (only 3 semester hours of MOLGEN 4998/4998H may be counted toward the Molecular Genetics major, though more can be used toward degree completion). In most cases, after this training period, you become a valuable and productive member of the laboratory staff and may continue with more independent research in later semesters. Your goal should be to obtain sufficient data to warrant a publication in a respected journal. You can also pursue a written thesis (see “**Thesis Research for Molecular Genetics Students**” below).

Students are particularly encouraged to consider a summer research experience. This can be particularly fulfilling, because it allows you to immerse yourself in a research project full time. Scholarships and fellowships are available to support undergraduate summer research projects. Information on funding sources can be found at the Molecular Genetics (<https://molgen.osu.edu/research-scholarship-opportunities>) and Undergraduate Research Office (<https://ugresearch.osu.edu/Pages/For%20Current%20Researchers-%20Funding.aspx>) websites.



## Thesis Research for Molecular Genetics Students

Students may also complete a written thesis that leads to graduation with Research Distinction in Molecular Genetics. Generally, students complete two semesters of MOLGEN 4998/4998H before committing to this path. Students who wish to write a thesis must apply for graduation with research distinction through the College of Arts and Sciences, and must be enrolled in MOLGEN 4999/4999H (*Thesis Research in Molecular Genetics*) during the semester the thesis is defended. Graduation with research distinction requires a 3.0 minimum GPA and 4 hours of MOLGEN 4999. Graduation with honors and research distinction requires honors standing and 4 hours of MOLGEN 4999H (Note that these credits in 4999/4999H can not be applied to the 30-hour major) . After successful completion of the thesis and with approval from the Arts and Sciences Committee the student is eligible for “Graduation with Research Distinction in Molecular Genetics,” or “Graduation with Honors and Research Distinction in Molecular Genetics.” Graduation with distinction is a mark of excellence that documents the student’s aptitude for research.

Because of the protracted training period of one-to-three semesters (or more), students who wish to write a thesis must begin their research well before their senior year. We recommend that students make initial contacts with potential research advisors early in their academic career. This contact can even occur before students begin their molecular genetics core courses, e.g. in the freshman or sophomore year. This early start allows ample time for an initial training period during which the student can receive credit for MOLGEN 4998/4998H toward the major. It also provides the students with the opportunity to do summer research prior to planning the thesis and enrollment in MOLGEN 4999/4999H during the semester the thesis is written and presented.

Summer research experience is especially important for students interested in writing a thesis, because it provides a significant period during which the student can dedicate their time to their research project without the distraction of heavy coursework. A number of scholarships are available to undergraduate researchers for summer support, and in some cases, the faculty advisor may be able to provide support. Interested students should contact the Undergraduate Research or Honors offices for recent information regarding funding sources for undergraduate research. Information on funding sources can be found at the Molecular Genetics (<https://molgen.osu.edu/research-scholarship-opportunities>) and Undergraduate Research Office (<https://ugresearch.osu.edu/find-opportunities/fundforcurrentresearchers>) websites.

The honors program in Molecular Genetics is a research-experience based curriculum, and honors students are particularly encouraged to participate. Although undergraduate honors research is not required for graduation, the Department strongly emphasizes the importance of this research experience.

**A WARNING ABOUT GRADES:** It is absolutely essential that students perform to their best abilities in the classroom. On one hand, undergraduate research is an attractive part of the educational process; on the other hand, working in a lab takes one away from other endeavors, such as free time and study time. Because grades are important, we advocate that students with marginal grades (below a 3.0 GPA) spend their time improving their course performance rather than devoting the time to research.