

# Molecular Genetics

The molecular genetics major is concerned with current knowledge of the molecular nature of genes, their roles in controlling the function and development of organisms, their inheritance, and their evolution. The research and teaching interests of the faculty range over all areas of modern genetics as well as molecular, cellular, and developmental biology.

The common focus of the department faculty is on the role of genes and the use of molecular and genetic techniques to answer questions in modern biology. The goal of molecular geneticists is to get a better understanding of basic biology and to apply that knowledge to practical problems in medicine, plant and animal breeding, and conservation. The Department of Molecular Genetics emphasizes studies on eukaryotes (animals, plants, fungi, and protists), although most of the basic principles apply to prokaryotes (bacteria) as well.

## Pursuing Molecular Genetics at Ohio State

The molecular genetics major has no special requirements for high school preparation beyond what is needed for admission to the university. However, students with a good math and science background (biology, physics, and chemistry) will be especially well prepared for the major. Enriched, advanced, or honors courses, courses with an associated laboratory, and research experience are encouraged. Good written and oral communication skills are also important. Students with a strong interest and aptitude for science, as reflected in good grades, are most likely to succeed in the major.

All Ohio State freshman applicants are considered within a competitive admission process for the Columbus campus. The primary criteria for admission are the completion of the applicant's high school college preparatory program, performance in that program as indicated by class rank and/or grade-point average, and performance on either the ACT or SAT. Upon admission to the university, students can declare a major in molecular genetics within the College of Biological Sciences. Interested students should contact the undergraduate advisor for molecular genetics and an Undergraduate Student Academic Services (USAS) counselor.

## Molecular Genetics Requirements

Not included in the molecular genetics major, but required by it, are background courses that yield a basic understanding of the sciences upon which molecular genetics is built. All molecular genetics majors take math through Calculus II, one year of general chemistry, two quarters of organic chemistry with laboratory, one year of introductory physics, and two quarters of general biology. These basic math and science requirements of the molecular genetics major are nearly identical with the requirements of pre-medicine, pre-optometry, pre-dentistry, and pre-veterinary medicine.

The molecular genetics major consists of six required core courses, including Introductory Biochemistry, Molecular Genetics I and II, Cell Biology, Genes and Development, and the student's choice of two intensive laboratory courses focusing on eukaryotic model systems. Additional credit hours of courses in molecular genetics or selected from a list of approved courses offered by other departments are required to complete the 40 credit hour major. These additional courses are chosen in consultation with the advisor to meet the individual needs and interests of the student. The option to select specific elective courses in other departments gives students the flexibility to take courses required for admission to professional schools.

## More About Molecular Genetics

In 1992 the American Association for the Advancement of Science conducted an opinion poll of members, asking what scientific specialty holds the greatest promise over the next decade. "Genetics" or "molecular and cell biology," or both, were listed most often by biologists, medical scientists, social/behavioral scientists, chemists, and physicists/astronomers— even more often than their own specialties. Genetics was ranked second in frequency from engineers and Earth scientists. Only math/computer scientists failed to include one of the specialties of the molecular genetics department among their most-mentioned hot pursuits; however, they mentioned "biotechnology" second most often. A number of molecular genetics faculty work in the biotechnology area.

## Co-Curricular Opportunities

Molecular genetics majors at Ohio State are strongly encouraged to do a research project with a faculty member. Ohio State offers well-equipped laboratories containing sophisticated instrumentation for research. Information about choosing an undergraduate research laboratory is available on the Molecular Genetics Department web page and on the College of Biological Sciences web page, under "Undergraduate Information."

The Molecular Genetics Club and the College of Biological Sciences honorary student organization enhance learning opportunities and the quality of the undergraduate experience for students in molecular genetics. These clubs provide opportunities for students to interact with faculty, discuss careers and research areas with scientists from the Ohio State campus and beyond, and participate in service and outreach activities.

## Honors & Scholars Programs

The Honors Program in the Colleges of the Arts and Sciences provides high-ability students opportunities to pursue challenging academic programs. Honors students in molecular genetics are encouraged to meet with their faculty advisor on a regular basis and to construct an enhanced curriculum that includes honors courses, upper-division courses to meet general requirements, rigorous sequences, honors seminars, and a strong major,

**For more information, check these web sites:**

**Molecular Genetics:** [www.osumolgen.org](http://www.osumolgen.org)

**College of Biological Sciences:** [www.biosci.ohio-state.edu](http://www.biosci.ohio-state.edu)

**Ohio State:** [www.osu.edu](http://www.osu.edu)

**Admissions:** [undergrad.osu.edu](http://undergrad.osu.edu)

**Multicultural Center:** [multiculturalcenter.osu.edu](http://multiculturalcenter.osu.edu)

**First Year Experience:** [fye.osu.edu](http://fye.osu.edu)

## Curriculum Sample

This is a sample list of classes a student will take to pursue a degree in Molecular Genetics. Since university students need more than a specific education in a narrow field, they also will take classes to complete the General Education Curriculum (GEC). The GEC will allow students to develop the fundamental skills essential to collegiate success across major programs. Course work options satisfying the GEC often come from a variety of academic areas of study allowing students to tailor their GEC toward their interests. Note: This sample represents one of several possible paths to a degree in Molecular Genetics. Students should consult their advisor for help planning their curriculum. The departmental web site, [www.osumolgen.org](http://www.osumolgen.org), also provides useful details about the major and undergraduate opportunities in the department.

### Freshman Year:

Biological Sciences Survey	1
General Biology	10
Calculus & Analytical Geometry	10
General Chemistry	15
GEC (English composition)	5
GEC (foreign language)	10
Freshman Seminar	1
<b>Total hours</b>	<b>52</b>

### Sophomore Year:

General Physics	15
Organic Chemistry	6
Organic Chemistry Laboratory	4
GEC (arts and humanities)	5
GEC (foreign language)	10
GEC (second writing course)	5
Elective	5
<b>Total hours</b>	<b>50</b>

### Junior Year:

Introduction to Biological Chemistry	5
Molecular Genetics	8
Major laboratory course	5
Major course electives	8
GEC (arts & humanities)	10
GEC (social sciences)	10
<b>Total hours</b>	<b>46</b>

### Senior Year:

Molecular Genetics	6
Major course electives	9
Independent research	5
GEC (arts & humanities)	10
GEC (social sciences)	5
Electives	10
<b>Total hours</b>	<b>45</b>

including a significant research experience.

The Ohio State Scholars Programs feature residential communities for students who share academic interests and career goals. Two of the Scholars programs of interest to molecular genetics majors are the Biological Sciences and Health Sciences Scholars Programs. The Biological Sciences Scholars Program emphasizes research, with individualized advising and significant lab and field experience. The Health Sciences Scholars Program is focused on preparing students for careers in health sciences and health care.

## Career Prospects in Molecular Genetics

Molecular geneticists with a BS degree often work as laboratory technicians. They are in demand to work on research projects in universities. Federal and state government agencies such as the National Institutes of Health, Department of Energy, Department of Agriculture, and Environmental Protection Agency hire molecular geneticists to work on a variety of applied research problems. In the private sector, agricultural and pharmaceutical companies are increasingly hiring molecular geneticists to apply their skills to genetic engineering as well as classical breeding programs. The new and growing biotechnology industry is largely based on the expertise of molecular geneticists.

Many molecular genetics majors go to medical or other professional schools. The major program is rigorous and molecular genetics is an important area in modern medicine. Also, well-qualified majors are encouraged to participate in the faculty's research programs. As a result, molecular genetics majors have been successful in gaining entrance to professional schools.

Many molecular genetics graduates go on to graduate school. A few of these get an M.S. degree, which qualifies them for higher-paying laboratory technician jobs. Most go directly to the Ph.D. program. Keep in mind that most Ph.D. students, as part of their training, serve as research and teaching assistants and thereby earn their living and educational expenses while they are in graduate school. Molecular geneticists with a Ph.D. are widely employed by government and industry to design and supervise research and development projects. Nearly all colleges and universities have molecular geneticists on their faculties, teaching and doing research. Molecular geneticists with a Ph.D. plus postdoctoral research training are eligible for faculty positions at research-oriented universities like Ohio State.

An undergraduate major in molecular genetics does not limit one's options to careers in medicine or biological research. Because this major provides the academic preparation and strong science background appropriate for students who plan careers in marketing, business, or management in high technology industries, some molecular genetics students choose to use their science background to pursue a professional degree in business or law. A few students choose to put their molecular genetics training to use by obtaining a master's degree in education and becoming science teachers.

Salaries are commensurate with level of education and prior job experiences. Students who complete graduate and professional degrees can expect to earn substantially more than students with a bachelor's degree. Salaries in general are dependent upon a variety of economic factors and change with market trends.

For more information about careers in molecular genetics, call or write the Arts and Sciences Career Services Office, 06 Denney Hall, 164 West 17th Avenue, Columbus, Ohio 43210-1371, (614) 292-1868.

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## Contact information:

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