Mellon College of Science

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Location: Doherty Hall 1324
www.cmu.edu/mcs (http://www.cmu.edu/mcs/)

The Mellon College of Science (MCS) has provided the undergraduate training for many of today’s leading scientists. We have earned national recognition for our integration of undergraduate education and research from such organizations as the National Science Foundation, the Howard Hughes Medical Institute, and the Beckman Foundation. MCS students gain a broad education in science, mathematics, and the liberal arts while using state-of-the-art computational approaches in their courses, laboratories, and research activities. Our faculty members are committed to teaching as well as to a wide range of scientific research. This combined emphasis on education and research brings special benefits to students, including increased awareness of current scientific developments that are incorporated in classroom instruction, and, most importantly, opportunities to participate with faculty, graduate students, and other research scientists in a variety of research projects.

In the context of rigorous training in each field, the MCS curriculum emphasizes problem-solving, communication, and analytical skills, and it teaches our students the value of hard work and discipline. Our students go on to highly successful careers in a broad range of fields like astrophysics, biotechnology, computer science, business management, environmental science, health care policy, investment banking, marketing analysis, medicine, patent law, and pharmaceuticals. Our alumni credit their education in science for preparing them for a lifetime of learning and achievement; their employers attest to their ability to succeed and to continue learning in an ever-changing world.

The MCS Departments of Biological Sciences, Chemistry, Mathematical Sciences, and Physics each outline their degree programs and courses in the departmental sections. Students select their major in the spring of the first year so that the sophomore year begins with a focus within a department. Most of the courses required within a major are scheduled in the sophomore year so that the sophomore year begins with a focus within a department. Most of the courses required within a major are scheduled in the sophomore and junior years, leaving much of the senior year and part of the junior year open for electives. This provides the opportunity to participate in undergraduate research, explore interdisciplinary studies, study abroad, pursue additional majors or minors in other fields, or take other specialty courses oriented toward immediate job placement upon graduation or entry into graduate studies.

Science education in the 21st Century demands educational experiences that are much broader than the traditional preparation of a scholar in a chosen field of science. We want our MCS graduates to be scholars who are deeply trained in their discipline(s), and also professionals adept at communicating to broad audiences, accustomed to working in diverse, multidisciplinary teams, and keenly aware of the global context of their work. We want them to be citizens who are actively involved and globally engaged, and to grow as persons with a sense of wellness and balance.

With these ambitions in mind, we have set forth fifteen (15) outcomes that all MCS undergraduate students should complete in their time at Carnegie Mellon. Upon graduation, MCS students should be able to:

1. Apply foundational and advanced mathematical and scientific knowledge in a chosen field of study appropriately and fluently to solve complex problems, to integrate concepts across disciplines, and to adapt their knowledge to new situations.
2. Critically assess their current state of knowledge and expertise and acquire new knowledge in pursuit of both specific scientific goals and new intellectual interests broadly throughout their lifetime.
3. Communicate effectively via oral, visual, and written formats with an understanding of the perspectives and expectations of diverse audiences, including those within their chosen discipline, outside that discipline (but within STEM), and non-scientists.
4. Participate effectively in multidisciplinary research and/or other teams pursuing a shared vision while optimizing team outcomes.
5. Use the appropriate tools and required media literacy to acquire, assess, and analyze data and information from diverse sources.
6. Recognize and explain the importance of at least one current research topic in a STEM field outside of their major.
7. Recognize and explain the similarities and differences in analyzing/approaching problems, including in technical and non-technical fields other than their major.
8. Demonstrate knowledge of the arts, humanities, and social sciences.
9. Recognize the interplay of science, society, public policy, business, and economics.
10. Identify global examples of the reciprocal relationships among science, technology, political forces, societal contexts, and environmental issues.
11. Describe multiple similarities and differences between one’s own culture and that of others.
12. Engage in recursive, reflective processes to assess their own levels of physical, emotional, and social wellness and then to choose activities that promote these aspects of wellness.
13. Engage in recursive, reflective processes to balance multiple endeavors by setting priorities and managing time in academic, meta-curricular, and personal dimensions.
14. Recognize ethical issues and appreciate the complexities of interrelationships among them, and the use of information in ethical and legal manners.
15. Articulate how one’s own developing skills in science and technology can be increasingly used in constructive community service or engagement that recognizes the potential impact on local and global issues, including environmental impact and sustainability.

Tailoring Your Education

The Mellon College of Science offers students tremendous opportunity for tailoring their education to meet individual professional objectives. Whether you target your degree to a particular field in your discipline via departmental options and concentrations, add a secondary major, minor, or degree to your primary degree program, participate in honors programs, or pursue a master’s degree along with your bachelor’s degree, MCS has much to offer you. Many of these opportunities are outlined below.

Departmental Concentrations

Each department in MCS offers degrees and programs that allow students to explore particular fields within a science discipline. These are outlined below — see the departmental sections for further details.

Biological Sciences
- Biochemistry
- Biophysics
University Student-Defined Majors
With a well-thought proposal, you may be able to pursue a major you have designed to meet your particular interests and goals. Please see the catalog section on Student-Defined Majors (http://coursecatalog.web.cmu.edu/aboutcmu/undergraduateoptions/#studentdefinedmajortext).

General Education Requirements

Students pursuing any MCS bachelor's degree will fulfill the 15 Core Education outcomes through their primary MCS major and by completing the following technical and nontechnical breadth requirements prior to graduation.

Technical Breadth Requirements

As a 21st Century practicing scientist or mathematician, our graduates will work with others from a variety of technical backgrounds. Therefore, all of our students will be broadly trained within the technical fields of science and math. Students will fulfill this training by completing four (4) technical courses in the Science, Technology, Engineering, and/or Mathematics (STEM) fields at Carnegie Mellon University.

A student must take at least 9 units, outside of their primary major department, from each of four categories listed below. These may include prerequisite courses or courses required by their major Department but must be outside their home Department. AP/IB/Cambridge credit may not be used to fulfill these requirements. At least three of these courses must be taken in their first year. The categories are:

A. Life Sciences
(Refer to your specific department for how this category should be fulfilled. Some courses have prerequisites that can be satisfied by AP, IB, Cambridge A Level Exams. Please check the prerequisites requirements as necessary.)

LIFE SCIENCES
02-223 Personalized Medicine: Understanding Your Own Genome 9
02-250 or 03-250 Introduction to Computational Biology 12
02-261 Quantitative Cell and Molecular Biology Laboratory 9
03-116 Phage Genomics Research 6
03-117 Frontiers, Analysis, and Discovery in Biological Sciences 6
03-121 Modern Biology 9
03-123 Honors Modern Biology 10
03-124 Modern Biology Laboratory 9
03-125 Evolution 9
03-127 How Biological Experiments Work- A Project Course 9
03-132 Basic Science to Modern Medicine 9
03-133 Neurobiology of Disease 9
03-135 Structure and Function of the Human Body 9
03-161 Molecules to Mind 9
03-231 Honors Biochemistry 9
03-232 Honors Biochemistry II 9
42-101 Introduction to Biomedical Engineering 12
42-202 Physiology 9
85-219 Biological Foundations of Behavior 9

B. Physical Sciences
(Refer to your specific department for how this category should be fulfilled. Some courses have prerequisites that can be satisfied by AP, IB, Cambridge A Level Exams. Please check the prerequisites requirements as necessary.)

PHYSICAL SCIENCES
09-105 Introduction to Modern Chemistry I 10
09-106 Modern Chemistry II 10
09-107 Honors Chemistry: Fundamentals, Concepts and Applications 10
09-214 Physical Chemistry 9
09-217 Organic Chemistry I 9
09-219 Modern Organic Chemistry 10
09-221 Laboratory I: Introduction to Chemical Analysis 12
A. The following three courses must be taken in the first year:

- 38-101 EUREKA!: Discovery and Its Impact
- 76-101 Interpretation and Argument

B. The following courses must be taken in the Spring of the junior year:

- 38-302 Science and Society and either 38-303 Professional Development and Life Skills or 70-246 Innovation & Entrepreneurial Mindset

C. ENGAGE Courses:
The ENGAGE courses are self-directed learning opportunities (using the MyCORE online platform) designed to enhance students’ engagement with wellness, the arts and community service. Please see the course description for information on when these courses should be taken:

- ENGAGE COURSES
  - 38-110 ENGAGE in Service
  - 38-220 ENGAGE in the Arts
  - 38-230 ENGAGE in Wellness: Looking Inward
  - 38-330 ENGAGE in Wellness: Looking Outward
  - 38-430 ENGAGE in Wellness: Looking Forward

D. Cultural/Global Understanding Course:
Cultural or global understanding course(s) may be taken at any time. Nine (9) or more units from the following group of courses will fulfill this requirement. Any student who finds an appropriate Carnegie Mellon course not on the list below that might fulfill this requirement should contact their academic advisor to review the course description to determine if it can be substituted. Cultural and global understanding courses that are taken while studying abroad can be used to fulfill this category. In addition, transfer courses will also be considered for this category. However, this course requirement cannot be satisfied with AP/IB/Cambridge exam credit.

- CULTURAL/GLOBAL UNDERSTANDING
  - 57-173 Survey of Western Music History
  - 57-209 The Beatles
E. Nontechnical Elective Courses

To fulfill this requirement, students must complete a minimum of four (4) nontechnical courses totaling at least 36 units in the College of Fine Arts, the Tepper School of Business, and/or the Dietrich College for Humanities and Social Sciences. A maximum of 18 units of these units may be fulfilled via AP/IB/Cambridge exam credit. Up to 36 units of these nontechnical elective units may be filled by transfer credit (with prior approval through the MCS transfer credit process). Courses counted toward the Cultural/Global Understanding requirement and the First-Year Writing requirement do not count toward this requirement.

Note: Check our web site for courses from DC, CFA, and Tepper that may NOT be used (http://www.cmu.edu/mcs/undergrad/advising/hss-finearts/deletions.html) to satisfy this requirement because they are too technical in nature, plus a list of courses in other colleges (including SCS, CIT, and Heinz College) that do satisfy (http://www.cmu.edu/mcs/undergrad/advising/hss-finearts/additions.html) this requirement.

The following requirements apply to all MCS bachelor’s degrees:

1. Students must complete a minimum of 360 units.
2. The four courses required for the Technical Breadth category can be completed at Carnegie Mellon or via transfer credit.
3. AP/IB/Cambridge exam credit cannot be used to fulfill the Cultural/Global Requirement. Cultural and global understanding courses that are taken while studying abroad can be used to satisfy this requirement. In addition, transfer courses will also be considered for this category.
4. For the Nontecthical Electives requirement, students must complete a minimum of four courses totaling at least 36 units with a maximum of 18 units from AP/IB/Cambridge exam credit. In addition, transfer courses will also be considered for this category.

Honors Degree Programs in MCS

Several of the departments in MCS offer students an opportunity to participate in a departmental honors degree program. Some of these programs result in a master’s degree along with the bachelor’s degree (see next section on accelerated master’s programs). These programs are listed below; see the department’s section of the catalog for more details.

• Honors Program in Research Biology
• Departmental Honors in Chemistry
• Honors B.S./M.S. Program in Chemistry
• Honors B.S./M.S. Program in Mathematical Sciences

Accelerated Master’s Programs

Carnegie Mellon offers some accelerated master’s programs for motivated students, whereby students complete both the bachelor’s and the master’s degree in four or five years. Some programs are in the student’s home department in MCS as part of an honors program, while others are offered through one of our graduate schools at Carnegie Mellon. Below is a listing of the programs currently available to MCS students; please see the appropriate sections of the catalog for more details.

• Honors B.S./M.S. Program in Chemistry
• Honors B.S./M.S. Program in Mathematical Sciences
• Accelerated Master’s Program in the Heinz College

Study Abroad

There are many programs for studying abroad, usually during your junior year. Please see the catalog section on Undergraduate Options for more details, and talk with the Office of International Education to get information and advice specifically for you.

Pre-Professional Programs

Many students in the Mellon College of Science decide to pursue professional training such as medical school or law school after completing their undergraduate work. Carnegie Mellon offers strong advising services to support these students. Through these programs, students get help with everything from course selection to identification of important experiential opportunities to the application process itself.

Health Professions Program
Faculty Contact: Jason D’Antonio

Please see the Undergraduate Options (http://coursecatalog.web.cmu.edu/aboutcmu/undergraduateoptions/#healthprofext) section for details on the Health Professions Program.

Pre-Law Advising Program
Faculty Contact: Joseph Devine
Please see the Undergraduate Options (http://coursecatalog.web.cmu.edu/aboutcmu/undergraduateoptions/#prelawtext) section for details on the Pre-Law Advising Program.

**Intercollegiate Programs**

Bachelor of Science and Arts Degree Program (BSA)

Students in the Bachelor of Science and Arts Degree Program (http://coursecatalog.web.cmu.edu/servicesandadoptions/intercollegeprograms/bxaintercollege.html) are jointly admitted to MCS and the College of Fine Arts (CFA). This is a degree program for students who are naturally gifted in both the arts and the sciences, and allows for the combining of talents in these areas.

Science and Humanities Scholars Program (SHS)

Students who entered Carnegie Mellon prior to the fall of 2018 are eligible for this program and should see their entering year catalog (http://coursecatalog.web.cmu.edu/previous/) for more information and the SHS general education requirements.

**Applying Your Education Through Research**

An important feature of education in MCS is the opportunity for undergraduate research experience. This experience may be arranged as a course taken for credit or occasionally as a part-time job. Our website (http://coursecatalog.web.cmu.edu/schools-colleges/melloncollegeofscience/www.cmu.edu/mcs/) offers a range of useful information including links to faculty research areas, links to undergraduate research programs at other institutions, and ideas on how to get involved. Because of the strong research base of MCS, undergraduate research positions offer an exciting opportunity to apply your theoretical training to participate in the discovery of new knowledge.

Students can earn MCS Research Honors for significant research accomplishments; see the policy outlined below for the requirements.

**Mellon College of Science Research Honors**

Undergraduates in the Mellon College of Science will be awarded MCS College Honors at the completion of their degree if they have met one of these requirements:

1. Successfully completed the Honors BS/MS program in the Department of Chemistry or Department of Mathematical Sciences.
2. Successfully completed the departmental honors program in the Department of Biological Sciences or the Department of Chemistry.
3. Earned a cumulative grade point average of ≥3.20 (by their seventh semester or by the time of graduation) and carried out significant research. Typically, this would consist of an academic project carried out for at least two semesters. However, a single project that spans a summer and a semester or that the research mentor deems to be significant and sustained, even if the student worked for pay rather than credit, will be allowed. In addition, some form of public dissemination of this research, which has been approved by the MCS Associate Dean for Undergraduate Affairs, such as a peer reviewed publication, research thesis, or presentation at an external scientific meeting is required. The Meeting of the Minds by itself is not sufficient and participation in a pre-approved judged competition (eg. Sigma Xi, Math Department competition, or Psychology department competition) is necessary.

Final approval of nominations for MCS Honors will come from the Dean of MCS and the MCS Associate Dean for Undergraduate Affairs.

**Academic Standards**

**Academic Actions**

**MCS Dean’s List**

Each semester MCS recognizes those students with outstanding academic records by naming them to the Dean’s List. The criteria for such recognition are as follows:

- **Dean’s List**
  - The student must earn a quality point average of at least 3.50 while completing a minimum of 36 factorable units and earning no incomplete grades.

- **Dean’s List High Honors**
  - The student must earn a quality point average of at least 3.75 while completing a minimum of 36 factorable units and earning no incomplete grades.

**Probation, Suspension, and Drop**

In the first year, quality point averages below 1.75 in either semester invoke an academic action. For all subsequent semesters an academic action will be taken if the semester QPA or the cumulative QPA (excluding the first year) is below 2.00.

The progression below probation, suspension, and drop is typical. However, in unusual circumstances, MCS College Council may choose to suspend or drop a student without prior probation.

- **Warning of probation**
  - First-year students who earn between a 1.75 and 1.99 semester QPA will receive a Warning of Probation. This indicates that the student did not qualify for probation because they are a first-year student (see below for details of probation standards), but if their semester
The semester QPA of a student in good standing beyond the first year falls below 2.00.

A student drops below full-time status (less than 36 units) after the 10th day of classes in a semester. The student would be on probation for the next semester (fall and spring only).

The term of probation is one semester as a full-time student. A student is occasionally continued on probation who has had one semester on probation and is not yet meeting minimum requirements but whose record indicates that the standards are likely to be met at the end of the next semester of study. First-year students are no longer on probation at the end of the second semester if their semester QPA is 1.75 or above.

Suspension
A student who does not meet minimum standards at the end of one semester of probation will be suspended.

A first-year student will be suspended if the QPA from the first two semesters is below 1.75.

A student in the third or subsequent semester of study will be suspended if the semester factor or the cumulative factor (excluding the first year) is below 2.00 for two consecutive semesters.

The minimum period of suspension is one academic year (two semesters). At the end of that period a student may return to school on probation by:

- Receiving permission in writing from the MCS Associate Dean for Undergraduate Affairs.
- Completing a Return from Leave form from Enrollment Services.
- Providing transcripts and clearance forms if the student has been in a degree program at another college or university, even though academic credit earned will not transfer to Carnegie Mellon unless prior approval has been granted by the MCS Associate Dean for Undergraduate Affairs.

Employment within the university in non-student jobs is possible for students on academic suspension, subject to the hiring criteria of the hiring department. However, a student on academic suspension wishing to accept a job on campus must speak with the Associate Dean of the student’s college to ensure that the employment will not constitute a violation of the terms of suspension. The Associate Dean will generally allow such employment, in consultation with the Dean of Student Affairs. One employment benefit not available to students on academic suspension who accept a full-time job with the University is the option to take courses through tuition remission. The option to take courses becomes available only after the academic suspension is over.

Drop
This is a permanent severance from the Mellon College of Science. Students are dropped when it seems clear that they will never be able to meet minimum standards. A student who has been suspended and who fails to meet minimum standards after returning to school is dropped.

A student who has been academically dropped or academically suspended and who is not employed by the University must absent themselves from campus and is, for the term of the suspension, barred from all activities and affiliations that stem from one’s status as an enrolled student. These include registering or enrolling for courses, sitting in on classes, living in residence halls or Greek houses, membership and participation in student activities, and employment in student jobs. (NOTE: Exceptions to the restriction from student jobs for students on academic suspension will in general be granted for summer employment if the position was accepted prior to the decision to drop.)

Transfer into MCS Departments
This section describes the variety of entry points into the Mellon College of Science for students already admitted to a university (Carnegie Mellon or another university). All prospective students should contact the Office of Admission for details about the application process for Carnegie Mellon University.

Students entering MCS or already declared in MCS:

Entering undergraduate students admitted to MCS can choose to pursue any major within MCS. This choice must be made prior to the first semester of the sophomore year (normally during the second semester of the first year) and does not require approval by any department.

Students who have declared a major in MCS and wish to transfer into another department within MCS must have approval (https://www.cmu.edu/mcs/undergrad/advising/forms/) from the new department (generally through the primary academic advisor (https://www.cmu.edu/mcs/undergrad/advising/) in the new department) and from the MCS Associate Dean for Undergraduate Affairs. Students wishing to transfer into the Mathematical Sciences Department must have completed 21-127 Concepts of Mathematics or 21-128 Mathematical Concepts and Proofs AND 21-241 Matrices and Linear Transformations or 21-242 Matrix Theory with grades of B or better in both courses as well as an overall QPA of 3.5 or higher.

MCS undergraduate students beyond the first year wishing to transfer into another MCS department may do so if they are not on academic probation and if there is room in the department of their choice. If the demand for any department exceeds the space available, then the department will admit students based on a comparative evaluation of all applicants at the end of each semester, up to the limit of available space.

Students enrolled in another college at Carnegie Mellon:

Undergraduate students admitted to colleges other than MCS and wishing to transfer into an MCS department during their first year should consult with the MCS Associate Dean for Undergraduate Affairs (https://www.cmu.edu/mcs/undergrad/advising/). Students may submit an internal transfer request (https://www.cmu.edu/mcs/undergrad/advising/forms/) no earlier than the first day of their second semester.

Potential transfer students into the departments of Biological Sciences, Chemistry, or Physics must also have credit for 21-120 Differential and Integral Calculus and, depending on major choice, should have completed one of the following courses at Carnegie Mellon: 03-121 Modern Biology, 09-105 Introduction to Modern Chemistry I, or 33-111 Physics I for Science Students. Higher level courses will also be considered by the MCS Associate Dean as alternatives to these courses. Students wishing to transfer into the Mathematical Sciences Department must have completed 21-127 Concepts of Mathematics or 21-128 Mathematical Concepts and Proofs AND 21-241 Matrices and Linear Transformations or 21-242 Matrix Theory with grades of B or better in both courses as well as an overall QPA of 3.5 or higher.

Undergraduate students not in MCS and wishing to transfer into a department in MCS beyond the first semester will be considered for transfer on a space available/academic performance basis. An MCS department may refuse a transfer to a non-MCS student if there are space restrictions and/or if the student’s chance for success is determined to be questionable based on past academic performance.

Students wishing to transfer from another university into an MCS department:

A student first applies through the Office of Admission. If the Office of Admission believes the applicant is acceptable, the student's record is sent to the appropriate department for evaluation and a decision on acceptance. The MCS department head has the right to refuse to accept the student if there are space restrictions and/or if the student’s chance for success in the MCS department is determined to be questionable based on past academic performance.

Graduation Requirements
To be eligible to graduate, undergraduate students must complete all course requirements for their program with a cumulative Quality Point Average of at least 2.00 for all courses taken. For undergraduate students who enrolled at Carnegie Mellon as freshmen and whose freshman grades cause the cumulative QPA to fall below 2.00, this requirement is modified to be a cumulative QPA of at least 2.00 for all courses taken after the freshman year. Note, however, the cumulative QPA that appears on the student’s final transcript will be calculated based on all grades in all courses taken, including freshman year. Some programs may have additional QPA requirements.
requirements in order to graduate. Students are encouraged to confirm all graduation requirements with their academic advisor.

A minimum of 360 units must be completed. This will include the MCS Core Courses (technical and nontechnical electives) and all departmental course requirements.

Students will be required to meet the residency requirement and to have met all financial obligations to the university before being awarded a degree. The residency requirement is detailed in the Academic Regulations section of the catalog. A student may seek permission to modify graduation requirements by petition to the MCS College Council.

Graduation Honors
There are two types of honors awarded at graduation.

University Honors
University Honors are automatically awarded to students who have earned a cumulative Q.P.A. of 3.5 or better after either seven semesters or by the time they are certified for graduation.

College Research Honors
Please see the section “Mellon College of Science Research Honors (p. 5)” for information on how to qualify for College Research Honors.

Faculty
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