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Welcome!

Dartmouth is unlike any other place you might consider for graduate school. It combines the best features of a small college town with a pristine local environment. The College also benefits from world-class university facilities, an outstanding faculty, and a commitment to individualized education for our students. The faculty at Dartmouth are prized for their ability to conduct significant scholarly research and teach classes at the same time. Dartmouth also has one of the smallest student-to-faculty ratios of top-ranked research universities. Within this close-knit environment, we celebrate diversity and keep social impact at the forefront of campus life. Thus the Dartmouth experience provides students with outstanding training, access to resources, expert knowledge, and balanced professional skills to succeed in their chosen field.

Dartmouth offers master’s programs in several individual departments, allowing incoming students with a bachelor’s degree to deepen their theoretical knowledge and enhance their professional status in their specific field, be that in Computer Science, Physics, Engineering, Earth Science, Public Health, Music, Comparative Literature, or Liberal Studies. Graduates of the master’s programs become practicing experts in their field, and often choose to go on for further study.

Doctoral programs at Dartmouth prepare individual scientists to acquire a deep expertise base. Typically these students are driven to these programs by a personal love of learning science, technology, engineering, or mathematics. When they emerge from these programs, these graduates are poised to become national leaders. Many go on to research and teaching positions at other major universities, while others obtain R&D positions in companies, or found their own start-up technology companies.

Each student receives individual mentoring from his or her research advisor, which is critical to the research doctoral experience. All students admitted into the doctoral programs are supported on fellowships or stipends that are funded at among the highest levels in the country.

Graduate professional development is also abundant at Dartmouth, with many opportunities on campus, such as teaching to an audience and developing scholarship. Assistance with resume and curriculum vitae writing is available throughout the year, as is business training opportunities in entrepreneurial thinking, business strategies, and technical management.

The overall Dartmouth experience gives students the ability to obtain a doctorate while offering a healthy balance in lifestyle choices, engaged colleagues, and a supportive environment. Students have many opportunities to broaden their perspective beyond their individual area of study by engaging in public policy seminars and providing service to society through organizations on campus, which offer areas of enormous strength and leadership. Graduate students are also routinely involved in extracurricular leadership development programs and clubs, as well as leisure outdoor activities with their peers.

As you consider what graduate program is right of you, take the time to investigate this bulletin as well as the Dartmouth website to read about the areas of study, courses, individual research programs and student-focused activities available across our campus.

Sincerely,

Brian W. Pogue
Dean of Graduate Studies
Biochemistry

In a typical mitosis when one cell divides to give rise to two daughter cells, the chromosomes are split equally between the two. This segregation fidelity ensures that the genetic information is kept throughout generations. In cancer, however, many cells mis-segregate their chromosomes resulting in daughter cells that have a lower and/or higher number of chromosomes than their normal counterparts. Sam Bakhoum—Sam Bakhoum

The program in biochemistry provides a broad range of opportunities for study and research leading to the Ph.D. degree. With 21 program faculty members, whose primary appointments span five academic departments on campus, and approximately 40 students, there is a close interaction between students and faculty. All courses of study are arranged in accordance with individual needs and interests.

DEGREE REQUIREMENTS

To qualify for award of the Ph.D. degree, a student must fulfill the following requirements:

1. Satisfactory completion of an intensive three-term core course entitled “Biochemistry, Cell and Molecular Biology;” a one-term teaching assignment; and a three-term course in laboratory biochemistry. The last will consist of three small research projects, conducted in rotation with different faculty members for periods of about three months each. To enroll in the three-term “Biochemistry, Cell and Molecular Biology,” course, students select Biochemistry 101 (fall), Genetics 102 (winter), and Biochemistry 103 (spring).

2. Satisfactory completion of three other graduate-level courses in biochemistry or related disciplines.

3. Attendance at the weekly seminar series of the program.

4. Participation in a journal club during fall, winter, and spring terms every year and in the weekly Research in Progress series.

5. Satisfactory completion of an oral qualifying examination.

6. Satisfactory completion of a significant research project and preparation of a thesis acceptable to the thesis advisory committee.

7. Successful defense of the thesis in an oral examination and presentation of the work in a lecture.

Faculty

Department of Biochemistry

C. K. Barrows: Biochemical and molecular analysis of vesicular transport in the secretory pathway.


C. N. Coile: Nucleocytoplasmic transport of messenger RNA and proteins in yeast; nuclear envelope dynamics and nuclear pore complex assembly.

D. A. Compton: Chromosomal instability and aneuploidy in cancer cells.

H. N. Higgs: Biochemistry, biophysics, and cell biology of actin cytoskeletal dynamics in mammalian cells.

G. E. Lienhard: Signal transduction and membrane trafficking; with emphasis on signaling from the insulin receptor and the regulation of glucose transport by insulin.

J. J. Lobos: Fungal genetics and the molecular analysis of circadian clocks.

D. R. Madson: Ion channel structure, function, and trafficking.

L. C. Myers: Molecular mechanisms of transcriptional regulation.

S. Supattapone: Study of mechanisms by which prions and other misfolded proteins cause neurodegeneration, using a combination of biochemical, cell culture, and genetic techniques.

B. L. Travnikov: Mitochondrial bioenergetics, function of supernumerary subunits in mitochondrial energy transducing enzyme complexes.


Department of Genetics

J. C. Dolan: Molecular mechanisms of the biological clock; molecular genetics of the temporal aspects of gene regulation.

Department of Medicine

B. A. Arrick: Regulation of growth factor gene expression, role of growth factors in tumor cell biology, cancer genetics.

C. E. Brachard: Molecular and cellular biology of matrix metalloproteinase gene expression in connective tissue disease and tumor invasion.

L. A. Wittles: Role of protein phosphorylation in cellular energy homeostasis and metabolism; AMP-activated protein kinase.

Department of Physiology

L. P. Henderson: Molecular and cellular basis for the action of anabolic steroids in the mammalian CNS.

R. A. Muck: Connecting neurotrophic factors, neuronal ion channel regulation, and the effects of cholesterol dysregulation during neurodegenerative disease.

Department of Chemistry

F. J. Kell: Protein crystallography, molecular motors, cellular transport mechanisms, and enzyme mechanisms.

D. F. Moise: Structure based design of molecular therapeutics for cancer, osteoporosis, viral infection, and drug adhesion.

E. Pletneva: Protein folding and mechanisms of conformational switching, redox-linked structural changes in heme proteins.

Application materials are available through the MCB program:

Graduate Admissions Committee

Molecular and Cellular Biology Program

7560 Remsen Building, Room 239
Hanover, NH 03755-3842

e-mail: MCB@dartmouth.edu

web: http://dms.dartmouth.edu/mcb/

For information specific to the biochemistry program:

Department of Biochemistry

Dartmouth Medical School

7200 Vail Building, Rooms 414
Hanover, NH 03755-3844

e-mail: biochemistry@dartmouth.edu

web: http://dms.dartmouth.edu/biochem/

Students interested in a combined M.D.-Ph.D. program in biochemistry should also contact:

The M.D.-Ph.D. Committee

Dartmouth Medical School

7936 Rubin Building, Rooms 403
Hanover, NH 03756

e-mail: mdphd@dartmouth.edu

web: http://dms.dartmouth.edu/mdphd/
The department offers two graduate programs leading to the Ph.D. degree: a Graduate Program in Ecology and Evolutionary Biology (EEB) and a Graduate Program in Molecular and Cellular Biology (MCB). Each program emphasizes independent research to prepare students for careers in academic institutions, government agencies, and industry. Five years are usually required for completion of coursework and research leading to the Ph.D. In addition to offering two graduate programs, the department also participates in the M.D.-Ph.D. Program, based in the Dartmouth Medical School. Many scientists located in other departments in the College as well as in the Dartmouth Medical School and the Thayer School of Engineering interact with members of the Department of Biological Sciences, contribute to graduate teaching, and are available for consultation on graduate student research.

For further information and application materials:
Chair, Graduate Admissions Committee
Ecology and Evolutionary Biology
Department of Biological Sciences
6044 Gilman Hall
Dartmouth College
Hanover, NH 03755-3576
e-mail: biology@dartmouth.edu
web: www.dartmouth.edu/~biology

ECOLOGY AND EVOLUTIONARY BIOLOGY
Faculty and students in the Graduate Program in Ecology and Evolutionary Biology conduct basic and applied research on topics in population, community, and ecosystem ecology of temperate and tropical aquatic and terrestrial systems. Dartmouth’s location provides easy access to a great variety of natural habitats, including several extensive Dartmouth-owned areas. Entering students begin their research in a lab of their choice and take a series of courses chosen in consultation with members of their advisory committee. See also the related Dartmouth graduate program “Earth, Ecosystem, and Ecological Sciences” on page 24.

FACULTY
K. L. Cottingham. Aquatic community and ecosystem ecology; quantitative ecology and biostatistics.
A. J. Erives. Gene regulation in the evolution and development of metazoan systems.
R. E. Keddy. Population and community ecology; evolutionary ecology; plant-animal interactions; mutualisms; plant-mating systems; invasive species.
D. R. Pearl. Forest ecology, tropical ecology; plant competition and coexistence, forest decline, and forest management.
B. W. Taylor. Aquatic ecology; ecosystem ecology; nutrient cycling in rivers; tropical ecology; predator-prey interactions; invasive species.
MOLeCULAR AND CELLuLAR BIOLOGY

At Dartmouth, graduate training in seven interrelated disciplines leading to the Ph.D. degree is directed under the auspices of the Molecular and Cellular Biology Program (MCB). Graduate training in the MCB Program is organized around the research expertise of the faculty members involved, who have interests in the following broadly defined areas: biochemistry, cell biology, development, genetics, immunology, microbiology, and neurobiology. The program provides students with a wide range of research opportunities, related course offerings, and broad exposure to research outside of Dartmouth through a number of seminar series featuring speakers from across the United States and Canada, as well as from overseas.

During their first year, all students attend a three-term course in biochemistry, cell and molecular biology offered by program faculty. Additional required courses, as well as electives, are selected from a comprehensive group of graduate courses. Three one-term rotations in individual faculty members’ laboratories train students in research techniques and allow students to select a thesis adviser from among their rotation sponsors. Students choose in which laboratories they perform their three research rotations, aided by input from a faculty committee, and then select a thesis adviser at the end of their third rotation. See also a separate listing in this bulletin, under “Molecular and Cellular Biology,” a Dartmouth interdepartmental graduate program, on page 48.

FAcuLTy

E. M. Berger. Molecular genetics, cell biology: the molecular basis of changes in gene expression mediated by cedhysterone and juvenile hormone in Drosophila

S. E. Bieger. Molecular and genetic analysis of chromosome behavior in Drosophila melanogaster

P. J. Doherty. Molecular genetics: Regulation of visual transduction in Drosophila, molecular mechanisms of retinal degeneration

A. J. Erkert. Gene regulation in the evolution and development of metazoan systems

A. Glaser. Cell biology and genetics: cellar cycle control in multicellular cells, evolution of the cell cycle, morphogenesis

R. H. Gross. Computational biology, bioinformatics: RNA folding, sequence comparisons and clustering, gene expression data analysis, and genomic comparisons

M. L. Guerinot. Molecular genetics, microbiology: the regulation of gene expression by iron in the rhizobial/legume symbioses and in the model plant Arabidopsis thaliana.

T. Jack. Molecular genetics of flower development in Arabidopsis.


E. Lambie. Developmental genetics: signal transduction and germline maturation during nematode development.

C. R. McClung. Molecular genetics: The molecular basis for circadian rhythmicity in the model plant system Arabidopsis.


R. D. Sloboda. Cell biology: biochemical, immunological and molecular techniques are currently being employed to study microtubule-based cell motility in Arabidopsis thaliana.

E. F. Smith. Molecular, genetic, and biochemical analysis of eukaryotic flagellar motility and assembly in Ciliophorans and red algae.


DEGREE REQUIREMENTS

The Graduate Program in Biological Sciences leads to the Ph.D. degree. Students are not normally admitted for a master’s degree. Although certain formal requirements must be met, the department encourages the design of flexible programs reflecting each student’s particular research orientation. Such programs may focus on one traditional discipline within the biological sciences, or incorporate several in an interdisciplinary study.

To fulfill the general requirements for a Ph.D. in biology, a student must:

1. Complete the required coursework.
2. Pass an oral examination on material broadly related to the student’s major area of concentration.
3. Prepare and defend a written thesis proposal.
4. Complete a doctoral dissertation, successfully defending it publicly and before a faculty committee.

Each student must also fulfill a teaching requirement, usually by participating in an undergraduate laboratory instruction.

For further information and application materials:

Molecular and Cellular Biology Graduate Program
7560 Remsen Building, Room 239
Dartmouth Medical School
Hanover, NH 03755-3842

e-mail: mcb@dartmouth.edu
web: dms.dartmouth.edu/mcb

Students interested in a combined M.D.-Ph.D. Program in Molecular and Cellular Biology should contact:
Chair, M.D.-Ph.D. Committee
Dartmouth Medical School
Rubin Bldg., Room 605
Lebanon, NH 03756

web: http://dms.dartmouth.edu/mdphd/
The Department of Chemistry offers a Ph.D. program that is based on exciting forefront research in molecular science and a strong commitment to graduate education. With 16 tenure-track faculty and about 30 graduate students, the low student-to-faculty ratio facilitates close interaction in both research and teaching. In addition, there are abundant opportunities for productive collaboration and research that span the traditional chemistry subdisciplines.

Faculty research interests are diverse, with active externally funded projects underway in organic, organometallic, physical, theoretical, inorganic, materials, and biological chemistry.

The Department of Chemistry is housed in Burke Laboratory, the newest addition to the Sherman Fairchild Physical Sciences Center. Burke has modern spacious laboratories and offices, and specialized laboratories for magnetic resonance (NMR, EPR) and laser spectroscopy. The Fairchild Center also houses Kresge Library with extensive holdings in chemistry and the other physical sciences.

**DEGREE REQUIREMENTS**

Although earning a master's degree is possible, students are normally admitted only to begin working immediately toward the Ph.D. The program has two tracks, one with an emphasis on materials, leading to a Ph.D. degree in chemistry. Both tracks have the following requirements for admission to candidacy for the Ph.D. degree:

1. Demonstrate basic knowledge in three of the four fields of biological, inorganic, organic, and physical chemistry.
2. Submit an original research proposal in an area not closely related to your thesis research topic.
3. Pass five cumulative predoctoral examinations drawn from several areas of chemistry.
4. Pass a comprehensive preliminary examination, which is given orally.
5. Pass four core and three elective graduate courses in materials chemistry and related fields.
6. Present an annual "research in progress" seminar to the Materials Chemistry Group.

After meeting these requirements, the student must independently complete and succeedively defend a thesis. Each student must also fulfill a teaching requirement, usually by participating in undergraduate laboratory instruction.

To earn the M.S., a student must pass eight approved graduate courses, complete and defend orally a master's thesis, and fulfill a teaching requirement.

**FACULTY**

I. Afraimovich. Materials chemistry: supramolecular chemistry, molecular machines, molecular wires, physical organic chemistry, organometallic chemistry.

J. J. BallaRino. Physical chemistry and materials: laser spectroscopy, mass spectrometry, thin film formation, chemistry at surfaces, ab initio calculations, and sensors.

R. S. Cantor. Biophysical chemistry: computational and theoretical studies of the effect of lipid bilayer composition on the function of intrinsic membrane proteins via changes in bilayer physical properties. Application to fast synaptic neurotransmission and the molecular mechanism of anesthesia.

D. Chichild. Physical chemistry: quantum mechanical calculations of ground and excited state properties of molecules; theoretical studies of the electronic structure of organic molecules in external magnetic and electric fields; theoretical studies of carbocation-pi complexation in the gas phase and in solution; computational studies of the solvation of iron pairs.

D. S. Gluck. Homogeneous catalysis and materials chemistry: catalysis, materials chemistry, metal-mediated organophosphorus chemistry, hydrophosphinolation, phosphinination, phosphorane complexes, ligand design, asymmetric synthesis, and nanocluster synthesis.


R. D. Hughes. Inorganic, organometallic, and organic chemistry: mechanisms of metal-promoted organic reactions, catalytic reactions of unsaturated molecules, coordination stabilizers of reactive organic species; organometallic synthesis; activation of carbon-fluoride bonds; fluorinated organometallic compounds.

P. A. Jacobi. Organic chemistry: total synthesis of natural products, new synthetic methods, molecular rearrangements; heterocyclic chemistry.


J. E. Lock. Physical chemistry and polymer chemistry: theory and simulation of complex fluids and their mixtures; predictions of structure-property correlations in polymer melts and blends; glassy and relaxation behavior in polymers.

D. F. Meier. Biophysical chemistry: high resolution NMR, peptide hormone structure and function.

P. M. Miles. Chemical education and analytical chemistry.

E. V. Pletneva. Biophysical chemistry: protein dynamics, cell signaling, laser spectroscopy, NMR.


D. E. Wilcox. Bioinorganic chemistry: metal binding properties of Cys- and His-rich proteins, biomolecular calorimetry, biochemistry of essential (Zn, Cu) and toxic (Hg, As) metals, EPR spectroscopy of metals in biological systems, in vivo detection and quantification of nitric oxide and oxygen.

J. S. Wien. Physical chemistry: weak intermolecular forces, spectroscopy and reaction dynamics, quantum solids, and matrix isolation spectroscopy.


**For further information and application materials:**

Department of Chemistry
Dartmouth College
6128 Burke Laboratory
Hanover, NH 03755-3364

e-mail: Chemistry@dartmouth.edu

web: www.dartmouth.edu/~chem

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**Kristen Mascall**

In addition, the Chemistry Ph.D. track has these additional requirements:

1. Demonstrate basic knowledge in three of the four fields of biological, inorganic, organic, and physical chemistry.
2. Submit an original research proposal in an area not closely related to your thesis research topic.
3. Pass five cumulative predoctoral examinations drawn from several areas of chemistry.
4. Present at least one seminar lecture before the department, on a subject distinct from the thesis research topic.

"What interested me about Dartmouth was the wide variety of graduate level courses available and the organic chemistry research conducted here. Also, the small college size allows for greater faculty and student interaction.”

—Kristen Mascall

Faculty mentor: Peter A. Jacobi
DARTMOUTH GRADUATE ARTS & SCIENCES
COMPARATIVE LITERATURE

Comparative Literature
Christina Stoltz is studying an autobiography written by Bibish, a young Uzbek belly dancer who currently resides outside of Moscow, and also the figure of Bibish herself, as a popular “addendum” to her own work. A disjunction exists between the ways in which Bibish’s claims to authenticity are reproduced professionally and the ways in which the commodifies herself as authentic to remain relevant socially. Stoltz examines the point where Bibish’s contradic- tory commercialization and self-styling intersect with Western culture.

The aim of Dartmouth’s one-year Master of Arts Program in Comparative Literature is to develop the linguistic and critical skills necessary for Ph.D. study or other careers in teaching and international studies. The curriculum stresses intensive language study, broad-based theory and methodology courses, research tools, directed independent work, and pedagogical training. The pro- gram is designed to consolidate and extend students’ undergraduate research experience and to provide an enriched background for advanced scholarly work. Each student’s program of study is individually designed in consultation with faculty advisors. Applications are accepted in all language areas supported by the Dartmouth curriculum. In addition to the core faculty in Comparative Literature, students may work with any member of the faculty with relevant expertise.

DEGREE REQUIREMENTS
Nine courses fulfill the degree requirement. Students must complete the Dartmouth Comparative Literature theory sequence (or take equivalent courses):

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>COLT 100</td>
<td>Contemporary Literary Criticism and Theory</td>
</tr>
<tr>
<td>COLT 101</td>
<td>Special Topics in Literary and Cultural Theory</td>
</tr>
<tr>
<td>COLT 102</td>
<td>Tutorial</td>
</tr>
<tr>
<td>COLT 103</td>
<td>Workshop in Critical Writing</td>
</tr>
<tr>
<td>COLT 104</td>
<td>Graduate Workshop in Research and Methodology</td>
</tr>
<tr>
<td>COLT 105</td>
<td>Thesis or other careers in teaching and international studies</td>
</tr>
</tbody>
</table>

Four electives: distributed according to the student’s language abilities, literary interests, and advisor requirements.

The major text presentation: In conjunction with COLT 105 and COLT 106, each student will study at least one major text in his/her field of specialization, and will prepare a lecture on that text for formal presentation to Comparative Literature students and faculty.

The A.M. essay: In conjunction with COLT 103 and COLT 102, students prepare a profession- ally competent paper with potential for publication. This paper reflects the student’s methodol- ogal training and critical expertise in comparative literary study.

Teaching and Research: Students work for two quarters as an assistant or intern on projects related to teaching and/or research. Opportunities include serving as an “apprentice teacher” in a foreign language course, a teaching assistant in a literature course, a research assistant work- ing with an individual professor, and an internship with a collaborating campus program in the humanities.

ADMISSIONS REQUIREMENTS
1. A strong undergraduate record in a major in any humanities field.
2. Fluent reading, writing, and speaking knowledge of one foreign language (three upper-level courses minimum).
3. Beginning training in a second foreign language (minimum of an introductory course).
4. The successful completion of an independent writing project or honors thesis in the undergraduate major.
5. A writing sample.
6. Three letters of recommendation.

FACULTY

R. Bron: Spanish and Portuguese, Comparative Literature.
K. Conley: French and Italian, Comparative Literature.
J. Crewe: English, Comparative Literature.
G. Gemünden: German, Comparative Literature.
M. J. Green: French and Italian, Comparative Literature.
L. Higgins: French and Italian, Comparative Literature.
K. Jewell: French and Italian, Comparative Literature.
I. Kacandes: German, Comparative Literature.
H. Kaimrid: Asian Studies, Comparative Literature.
J. Kopper: Russian, Comparative Literature.
L. D. Kritchman: French and Italian, Comparative Literature.
D. LaGuardia: French and Italian, Comparative Literature.
A. Lawrence: Film and Television Studies.
A. Martin: Spanish and Portuguese, Comparative Literature.
M. O’Toole: English, Comparative Literature.
G. Parki: French and Italian, Comparative Literature.
B. Pastor: Spanish and Portuguese, Comparative Literature.
I. Revie: Spanish and Portuguese, Comparative Literature.
S. Sippit: Spanish and Portuguese, Comparative Literature.
A. Sarkowski: French and Italian, Comparative Literature.
R. Verona: French and Italian, Comparative Literature.
M. Warren: Comparative Literature.
D. Washburn: Asian Studies, Comparative Literature.
M. Williamson: Classical Studies, Comparative Literature.

For further information and application materials:
Graduate Program in Comparative Literature
Reed Hall, HB 6051
Hanover, NH 03755-3511
E-mail: comparative.literature@dartmouth.edu
Web: www.dartmouth.edu/~complit

During a three-week research trip to Russia and Kyrgyzstan, I discovered how under-developed contemporary critical analyses of women’s social and economic positions within Eastern Europe really are and how the increase in domestic violence throughout Russia and Central Asia is directly proportional to the increase in U.S. and Western involvement in political, developmental, and humanitarian projects there; I explored the complexities of this “growing” trend in my graduate thesis.”

Christina Stoltz
Thesis advisor
John Kopper and Jennifer Fluri
Graduate research in Computer Science is typically conducted in the context of funded research in a variety of areas and is often interdisciplinary. Departmental interests focus on algorithms, parallel and distributed systems, robotics, graphics, computer vision, bioinformatics, neuroscience, scientific computation, image analysis, security, mobile computing, wireless sensor networks, computational biology, and computational geometry.

Extensive computing equipment is used to conduct research. Dedicated labs exist for image analysis, graphics, computer vision, robotics, theory and algorithms, advanced imaging systems, neuroscience analysis, mobile and wireless computing, sensor networks, security, and computational biology. The department received a major NSF infrastructure grant that has helped to upgrade and expand these facilities.

PH.D. PROGRAM

During the first year, students engage in research projects with faculty and start to take a set of core graduate courses and topics courses. In the second year and beyond, students become progressively more engaged in research while completing their course requirements.

DEGREE REQUIREMENTS

The requirements for the Ph.D. degree in Computer Science are as follows:

1. Admission to the degree program by an admissions committee of the associated faculty.
2. Completion of a course of study that includes:
   - (a) Computer Science 105, 107, and 108.
   - (b) Two of Computer Science 104, 106, and 109. If 109 is not taken, Computer Science 39 must be taken, unless the departmental advisor to Ph.D. students certifies that the student has taken an equivalent course elsewhere.
   - (c) Five additional courses, which may be chosen from Computer Science courses numbered between 100 and 199 and the courses Computer Science 53, 58, 52, 54, and 78 taken for graduate credit (which involves additional work not required of undergraduates). These can include whichever of Computer Science 104, 106, and 109 is not used to satisfy requirement (b) above. At most two of these courses can be numbered below 100.

A student's course of study is subject to the approval of the departmental advisor to Ph.D. students. Students normally take the five core courses specified in requirements (a) and (b) above by the end of their second year.

3. Students are expected to pass the Research Presentation Exam by the end of the winter term of their third year. An examining committee consisting of three faculty members, appointed by the departmental advisor to Ph.D. students, will select a paper for the student to present. The paper is selected in the area of Computer Science that the student chooses to be examined in. The student will have a month to read the paper, and will then present the paper to the committee and will orally answer questions on the paper. The committee will evaluate the student's presentation and performance answering questions, and will determine whether the student passes the examination. A student repeats this exam until he/she eventually passes the exam. In each attempt, the student is assigned a new paper, but not necessarily a new committee. Passing the Research Presentation Exam is a prerequisite to thesis proposal (see requirement 5 below). For more details on this exam, consult the Computer Science department web page.

4. At least one term of participation in undergraduate teaching. That is, the student must pass Computer Science 257.

5. Each student must display readiness for research in one area by giving a written and a public oral presentation of his/her research plan. This thesis proposal will be judged by a faculty committee chosen by the student; the rules used for the composition of this committee are the same as for a Ph.D. defense committee; this committee does not require the approval of the Dean of Graduate Studies, but must be approved by the departmental advisor to Ph.D. students. The presentation will be followed by a question period in which the student demonstrates mastery of the relevant area, and defends the proposed thesis plan.

6. Six terms in residence at Dartmouth. (This is a College requirement.)

7. Preparation of a thesis acceptable to a faculty committee and a public defense of this thesis. The committee shall be formed for the purpose of guiding the student's research, according to the rules of the College. This committee must be approved by the Dean of Graduate Studies. All members of the committee shall read and sign the thesis in its final form.

FACULTY

C. Bailey-Kellogg. Computational biology, scientific data mining.
D. Balcen. Robotics locomotion and manipulation.
A. Campbell. Wireless sensor network systems.
A. Chakrabarti. Complexity theory, approximation algorithms, data stream algorithms.
T. Conlin. Algorithm engineering, parallel computing, high-latency computations, computer science writing.
R. L. Drysdale. Computational geometry, algorithms.
H. Erskin. Image processing, computer vision, computational and human aspects of perception.
R. Grangier. Computational neuroscience, brain engineering, robotics.
P. Jayant. Distributed algorithms, lower bounds and impossibility results in parallel and distributed computing.
M. D. McKelly. Programming methodology, security.
D. Rockmore. Computational harmonic analysis.
S. W. Smith. Security, privacy, trusted computing, PKI.
P. Winkler. Discrete mathematics, theory of computing, probability theory, applications.
A. Zomorodian. Computational topology.

Graduate Courses in Computer Science

COSC 104. Artificial Intelligence
COSC 105. Algorithms and Data Structures
COSC 106. Numerical Linear Algebra
COSC 107. Computer Architecture
COSC 108. Advanced Operating Systems
COSC 109. Theory of Computation
COSC 110. Writing, Presenting, and Evaluating Technical Papers in Computer Science
COSC 118. Programming Languages
COSC 134. Machine Learning and Statistical Data Analysis
COSC 136. Numerical & Computational Tools
COSC 143. Introduction to Bioinformatics
COSC 146. Mathematical Optimization and Machine Learning
COSC 153. Introduction to Computational Neuroscience
COSC 182. Topics in Computer Graphics
COSC 185. Algorithms Seminar
COSC 186. Computer Systems Seminar

Dedicated labs exist for image analysis, graphics, computer vision, robotics, theory and algorithms, advanced imaging systems, neuroscience analysis, mobile and wireless computing, sensor networks, security, and computational biology.

“Research on embedded systems exposes the problems that arise in real deployments and is perfect for learning how to approach these problems, find solutions, and design algorithms and system architectures able to operate in real settings. During this process, skills like creativity, project management, team work, and problem solving are honed up every day and refined over time.”

—Emiliano Miluzzo
Faculty advisor: Andrew T. Campbell
MASTER'S (M.S.) PROGRAM

We have two tracks in the M.S. program: a coursework track and a thesis track.

DEGREE REQUIREMENTS

The requirements for the M.S. degree in computer science are as follows:

1. For the coursework track, the student must satisfactorily complete thirteen Computer Science courses taken for graduate credit. At least five of these courses must be numbered above 100. At least one of these thirteen must be an advanced topics graduate course in Computer Science (listed as Computer Science 181–188). Any courses taken outside of the Computer Science department must be approved by the departmental advisor to Master's students. The student may use up to two research credit courses (e.g., 297-299) to satisfy these requirements, but only if the student earns an HP and the M.S. advisor approves the substitution. Per department policy, selected upper-level undergraduate courses may count for graduate credit for the M.S. degree.

2. For the thesis track, the student must satisfy these coursework and research requirements:
   (a) The student must satisfactorily complete nine Computer Science courses taken for graduate credit. At least three of these courses must be numbered above 100. At least one of these nine must be an advanced topics graduate course in Computer Science (listed as Computer Science 181–188). Any courses taken outside of the Computer Science department must be approved by the departmental advisor to Master's students. No research credit courses (e.g., 297-299) may be used to satisfy these requirements. Per department policy, selected upper-level undergraduate courses may count for graduate credit for the M.S. degree.
   (b) By the end of the third term of enrollment, the student must petition to and be accepted for the thesis track by the departmental Master’s committee.
   (c) The student must satisfactorily complete at least six course equivalents of research from Computer Science 297-299.

   (d) By the end of the fourth term of study, the student must complete a thesis proposal, consisting of a written document and a public presentation. This thesis proposal will be judged by a faculty committee chosen by the student; the rules used for the composition of this committee are the same as for an M.S. defense committee as noted in the Graduate Student Handbook, “three faculty members from the student’s department/program (including the dissertation advisor).” One of the three may be from outside the department/program, but this is not a requirement.

   (e) The student must prepare a thesis acceptable to a faculty committee and give a public defense of this thesis. The thesis should represent mostly independent work, and be of sufficient quality to merit publication (with suitable revision) in a refereed venue. The committee shall be formed for the purpose of guiding the student’s research, according to the rules of the College. This committee must be approved by the Dean of Graduate Studies. All members of the committee shall read and sign the thesis in its final form. We expect that the thesis, including a copy of the signature page, shall be published as a departmental Technical Report.

   All students start out in the coursework track. As noted in 2(a) above, students may then apply to move to the thesis track. Students may also petition to move back to the coursework track, although we expect that will be uncommon. Students are expected to complete the M.S. degree in a maximum period of seven consecutive terms.

   Students who are currently enrolled in a Ph.D. program in a department other than Computer Science at Dartmouth may apply for a tuition scholarship and to be considered for concurrent enrollment.

   The Computer Science M.S. degree is not intended to be an outlet for students leaving the Computer Science Ph.D. program (nor is it intended to be a degree concurrent with a Computer Science Ph.D.). We encourage Dartmouth undergraduates to consider staying on for a Computer Science M.S. degree. Students may transfer up to five courses taken while an undergraduate to the M.S. program, as long as these satisfy the policy established by the Office of Graduate Studies and the department.

M.D.-PH.D. PROGRAM IN COMPUTATIONAL BIOLOGY

Dartmouth College offers an M.D.-Ph.D. program. Students interested in computational biology receive an M.D. from Dartmouth Medical School and a Ph.D. from the Dartmouth Department of Computer Science. The Dartmouth M.D.-Ph.D. Program in Computational Biology is committed to the development and application of new, path-breaking computational tools to explore problems at the frontiers of biology and medicine. This unique program brings together scientists in computer science, mathematics, and engineering with those in biology and medicine. We emphasize the development of computational tools and technologies needed to analyze proteins, nucleic acids, and their interactions in complex biological systems. The Computational Biology Program is equally strong in medical imaging, image processing, and scientific computation. The Computational Biology Program envisions that advances in many fields, such as genetics, immunology, and drug design will be facilitated by interdisciplinary interactions between the computational and biological sciences, and aims to provide new approaches for analyzing fundamental and challenging problems in modern biology and medicine.

Students with diverse backgrounds, including computer science, biology, engineering, physics, chemistry, and biochemistry are encouraged to apply.
Chris Peck is developing a series of pieces exploring unreliable narration, text as music notation, shifting modes of audience participation, and relationships between music composition and social change.

“Our program offers a unique combination of freedom to pursue adventurous interdisciplinary work and access to deep academic and technical resources. Instead of coming up with creative answers to that tech enough? we tend to focus on “What better?” The program has a long history of coming up with creative answers to that sort of question, often leading to both beautiful music and social change.”
—Chris Peck
Faculty mentor: Michael Casey

Regardless of a student's area of specialization within the program, the requirements for completion of the master of arts degree in digital musics include:

1. A minimum of seven terms in residence.
2. Demonstrated experience and expertise on an acoustic musical instrument; an understanding of Western music theory that includes four-part harmony, modulation, and form and analysis; a knowledge of musical styles that includes the music of the world’s peoples, twentieth-century art music, American popular music, and traditional Western art music.
3. Enrollment in the Proseminars in Music and Technology (Music 101–105), given each term, for a total of seven graduate seminars.
4. A number of electives in different disciplines (as well as music), including, but not limited to engineering, psychology, computer science, mathematics, physics. The electives and the specific courses in computer science and engineering will depend on the student’s background and area of specialization within the program. Electives may be used to remedy deficiencies in mathematics, computer science, engineering, or music.
5. Directed research (thesis courses). Two courses (Music 138) taken under the joint supervision of a member of the music faculty and a member of another cooperating department.
6. A thesis approved by the student’s graduate committee demonstrating a mastery of the materials in the student’s area of concentration within the program.

FACTOR

D. Casal
M. Casey. Composition, computer music research.
K. Donal. Composition.
L. Polansky. Composition, synthesis, and musical systems.

AFFILIATED FACULTY

D. Ehrlich. Film and Television Studies. Animation.

For further information and application materials:
Graduate Program in Digital Musics
6242 Hallgarten Hall
Hanover, NH 03755
e-mail: Digital.Musics@Dartmouth.edu
web: http://digitalmusics.dartmouth.edu
phone: 603-646-3974
fax: 603-646-0258

The Dartmouth College Graduate Program in Digital Musics is an interdisciplinary degree program dedicated to work that explores the interrelationships among music, technology, cognitive and computer science, acoustics, and related disciplines. While in the program, students are encouraged to pursue and develop their individual goals, and their work may be directed towards creative, research, theoretical, or technical topics. We are interested in students who are highly motivated and who want to help redefine the future of music and technology.

DEGREE REQUIREMENTS

The field of digital musics requires knowledge and skills in music, computer science, engineering or physics, as well as some significant expertise in one or more of these disciplines. In addition to music, graduate students in our program may bring to bear experience in other, widely diverse fields (such as visual art, philosophy, mathematics, and so forth). Candidates for admission to the master of arts program often satisfy one or more of the following criteria:

- **Music**: A bachelor’s degree in music or equivalent experience and demonstrated accomplishment in musical composition and/or performance.
- **Computer Science**: A bachelor’s degree in computer science or equivalent experience. This might include knowledge of applied mathematics, artificial intelligence, or related areas of science and engineering.
- **Engineering Sciences or Physics**: A bachelor’s degree in engineering sciences or physics, or equivalent experience. This could include a knowledge of acoustics, digital electronics and microprocessors, techniques of modeling and analyzing systems, or general hardware design.
- **Music Cognition**: Demonstrated knowledge and experience in the field.
- **Proven excellence or demonstrated potential in some other field, in preparation for advanced work in digital musics.”
Earth Sciences

Nathan Hamm is examining the transport of very fine (silt) particles in streams, rivers, and the ocean. The goal of his research is to improve scientists’ ability to predict rates of sediment erosion and deposition as functions of water speed, bed permeability, and particle size. His group is also trying to identify the specific physical processes responsible for the behavior seen in natural and artificial (laboratory flume) water flows.

“I’ve always liked the descriptive aspect of earth science, but found myself drawn towards the more predictive, quantitative side of the field, where you try and understand what forces and processes are responsible for features we observe in nature. I like how the field of sediment transport has a practical side which helps us manage rivers and other waterways today.”

—Nathan Hamm
Advisor: Brian Dzulak

The Department of Earth Sciences offers programs leading to the M.S. and Ph.D. degrees. The M.S. requires at least three terms of residence and seven courses at the graduate level, not more than four of which may be replaced by research or special study approved and supervised by the department. The Ph.D. requires approximately three years if done after completion of an M.S. program, or four to five years from the time of admission if pursued directly from the bachelor level. The Ph.D. program includes coursework, the successful completion of a first-year summer research project, a qualifying examination, a dissertation, and an oral defense of the dissertation. At least one term of supervised undergraduate teaching is required of all graduate students. Each student’s program is arranged, according to his or her individual needs and research interests, in consultation with the faculty advisor and the department.

Areas of current faculty and student research within the department include watershed hydrology and hydrochemistry, stable and radiogenic isotopic geochemistry, soil and aqueous geochemistry, environmental geochemistry, geobiology, geomorphology, geodynamics, geomechanics, stratigraphy, sedimentology, and remote sensing. Ongoing research projects cover a wide range of subjects and field-based study areas. Examples include: fluvial geomorphology of dammed and undammed catchments in the western U.S., Canada, and New England; snow hydrology in the Central Sierras of California; natural and anthropogenic arsenic pollution in surface and groundwater of New Hampshire; mechanisms of contaminant transport and sequestration in streams, estuaries and near-shore environments; development and application of physical models of flow, including the generation of avalanches, and submarine turbidity currents; studies of the behavior and budget of osmium in World oceans; and studies of early earth and solar system evolution.

Other examples include the use of stable isotopes of biomarkers (e.g. amino acids and fatty acids) to determine the flow of nutrients through the metabolism of individual microorganisms and microbial communities under a range of environmental conditions; impact of subsurface pressure and temperatures on the survival, metabolic activity, adaptation, and evolution of microbial life; studies examining the terrestrial record of quaternary climate change including studies of climate change in China using sediments in the Loess Plateau (China), glacier deposits from Greenland, Peru and North America, and fluvial and lacustrine deposits from North America and Europe; sediment compaction and diagenesis; climate change in North China using hydrology and oxygen isotopes in sediments; the biogeochemical cycling of iron, sulfur, and trace metals in soils and sediments; sedimentology of rift-valley basins and Holocene climate change in East Africa; paleo-ecological studies of dinosaur trackways in Wyoming, geomorphology of the Basin and Range; studies of ice deformation applied to the ice caps of Earth and Europa; experimental studies of brittle failure of crustal rocks and the brittle–ductile transition; and remote sensing applied to geological and environmental problems in northern New England.

Many ongoing collaborative research projects take advantage of nearby resources, including those of the U.S. Army’s Cold Regions Research Laboratory, the research laboratories of New England Research, Inc., the Thayer School of Engineering, and other schools and departments.

RESEARCH FACILITIES

The department is housed in Fairchild and Steele Halls, two of the three buildings in the Sherman Fairchild Physical Sciences Center which combines the earth sciences, chemistry, and physics departments. The Fairchild Center also contains the physical sciences library, specialized service shops, and computing clusters. Research facilities are varied and include instrumentation for stable isotopes, mass spectrometry (Delta+XL and Delta+Advantage) and radiogenic isotopic mass spectrometry (Triton and VG-Sector), high resolution inductively coupled plasma mass spectrometry, inductively coupled plasma optical emission spectrometry, Raman and infrared spectromicroscopy, potassium-argon geochronology, gas chromatography, gas chromatography-mass spectrometry, high performance liquid chromatography, ion chromatography, dissolved organic carbon analysis, powder x-ray diffraction, fission track dating, paleomagnetism, fluid inclusions, high-resolution inductively coupled plasma mass spectrometry, and high-resolution gamma-spectrometry (Infinna Ge detector). Field equipment includes real-time differential GPS total stations, high resolution robotic laser total stations, bed load sediment samplers, autosamplers and data loggers for hydrologic studies, multispectral imaging systems, and magnetometers. The department also has specialized laboratories for stable, radiogenic, and cosmogenic isotope extraction and analysis, hydrological characterization, rock deformation studies, mineral separation, image processing, and numerical modeling. Servo-controlled tri-axial hydraulic load frames, high-pressure permeometers, and cold rooms are available for research studies at nearby facilities.

MASTER OF SCIENCE DEGREE REQUIREMENTS

1. Successfully complete seven courses eligible for graduate credit at the discretion of the thesis committee.
2. Complete the equivalent of three terms of thesis research for registered credit.
3. Complete a thesis of professional quality, with a view to scholarly publication, and pass a final oral examination on the topic of the thesis.
4. An essential element of graduate education at Dartmouth is the experience gained in teaching other students. Therefore, at least one term of undergraduate teaching is required of all graduate students. Students may participate in more than one term of teaching. Each student’s program will be arranged, according to his/her individual needs and interests, and the teaching needs of the department.

PH.D. PROGRAM DEGREE REQUIREMENTS

1. Satisfy all courses and teaching required for the M.S. degree.
2. Pass the following required courses or their equivalents, if not passed prior to entering the Ph.D. Program:
   - Differential Equations (Math 23)
   - Mathematical Modeling in the Earth Sciences (EARS 107)
   - Analysis of Environmental Data (EARS 115)
   - One upper level science or engineering course outside the Department carrying graduate credit.
3. Pass a minimum of nine courses carrying graduate credit, including those fulfilling the above requirements.
4. Pass a general oral exam and defense of results from a summer research project during fall term of the second year.
5. Complete a dissertation of professional quality. Most often, the dissertation is a series of publishable papers on a particular theme that is connected by appropriate text. The candidate must pass a final oral examination on the thesis.

FACULTY

J. L. Aronson. Geochemistry; evolution of sedimentary basins.
W. B. Dade. Earth surface processes; sediment transport.
X. Feng. Stable isotope geochemistry; hydrochemistry; dendroclimatology.
R. Hawley. Glaciology; remote sensing.
G. D. Johnson. Stratigraphy and sedimentology; foreland basin studies; sedimentary petrology.
M. A. Kelly. Geomorphology; Quaternary Climate Change.
C. E. Renshaw. Surface and subsurface hydrogeology; structural geology and geomechanics.
M. Sharma. Isotope geochronology and geochemistry.
L. J. Sonder. Geodynamics; continental deformation; thermal and mechanical behavior of the lithosphere.

For further information and application materials:
Department of Earth Sciences
Dartmouth College
6105 Fairchild Hall
Hanover, NH 03755-3571
e-mail: earth.sciences@dartmouth.edu
web: www.dartmouth.edu/~earthsci

Areas of current faculty and student research within the department include watershed hydrology and hydrochemistry, stable and radiogenic isotope geochemistry, soil and aqueous geochemistry, environmental geochemistry, geobiology, geomorphology, geodynamics, geomechanics, stratigraphy, sedimentology, and remote sensing.
In 1993, Dartmouth initiated an interdisciplinary graduate environmental science program called the Earth, Ecosystem, and Ecological Sciences Program (EEES). EEES is not a degree-granting program. Rather, it is an umbrella organization that facilitates and enhances environmental science education at the graduate level. The Ph.D. degree is offered in either biology or earth sciences and EEES fellows take a number of courses in their home department as well as EEES courses offered through biology, earth sciences, or the Environmental Studies Program. Prospective applicants apply through either biology or earth sciences departmental programs.

The EEES fellowship is similar to other Dartmouth graduate fellowships. Responsibilities are slightly different than regular departmental teaching assistantships in that EEES fellows usually participate in environmental science courses as well as specialty courses within earth sciences or biology. Teaching responsibilities for EEES fellows are equal to the responsibilities of students in their degree-granting departmental program.

Earth, Ecosystem, and Ecological Sciences

Thomas Morrison is researching the proximate drivers of long-distance animal migration. He studies a wild population of migratory wildebeest in Northern Tanzania that have been dramatically affected by habitat loss due to small-scale cultivation and poaching and have declined eight-fold over the last 15 to 20 years.

He monitors the dynamics of the population by estimating seasonal rates of population change. To do this, he re-identifies individual animals by their unique shoulder stripe pattern at different times during their migratory cycle.

Because the size of the population is too large (~2000) to re-identify individuals by eye, Morrison uses custom-made software that extracts stripe patterns digitally then compares them, similar to a fingerprint-matching program. The ability to track individuals in this manner provides a robust and non-invasive way to study how and where the population is changing in space and time.
DEGREE REQUIREMENTS

- Three terms in residence at Dartmouth.
- Nine approved graduate-level courses, five of which must be engineering courses (or, for students whose prior preparation is an accredited B.E. or B.S. in engineering, six graduate-level courses).
- One Applied Mathematics course (see list at right).
- Minimum of two courses in engineering breadth.
- Minimum of three courses in engineering depth.
- A thesis approved by the student’s graduate committee demonstrating the ability to do research and contribute to the field.
- An oral defense of the thesis.
- Courses taken previously (e.g., as an undergraduate) may be used in satisfaction of the requirement but do not reduce the number of courses required, unless the student is admitted with advanced standing.

B.E./M.S. With the approval of the Graduate Program Committee, M.S. candidates may be awarded a B.E. degree simultaneously with the M.S. degree if: a) a substantial portion of the student’s undergraduate program was taken at Dartmouth or in one of its official exchange programs, and b) the ABET criteria for the B.E. are satisfied. Students wishing to take advantage of this opportunity should plan their M.S. programs appropriately. At least one term prior to the scheduled M.S. thesis defense, the B.E./M.S. candidate submits to the Registrar a Bachelor of Engineering program plan approved by both his/her advisor and the director of the Bachelor of Engineering Program.

M.E.M./M.S. With the approval of the Graduate Program Committee, M.S. candidates may be awarded the M.E.M. degree simultaneously with the M.S. degree if their program of courses meets all the requirements of both degrees. This option is provided for students who wish to qualify both in research and in the practical application of engineering and management.

M.S./M.D. The M.S./M.D. program is offered by the Thayer School of Engineering and Dartmouth Medical School and is designed for individuals intending to pursue clinical practice but with an interest in developing research skills in a related engineering area. It is also well suited for individuals interested in developing better understanding of imaging and other technologies they will employ as practising physicians. The program provides M.D. students with a funded research experience in engineering that is expected to lead to research publications as well as provide practical engineering design and analysis experience. Individuals holding an undergraduate degree in engineering and meeting the entrance requirements of each school are eligible to apply. Application must be made to each school separately. Candidates are M.D. students who apply to the Thayer School for admission in their first, second, or third year of medical school. Studies for the Thayer M.S. will be carried out in the fourth and part of the fifth year. For specific program requirements, consult the Thayer Guide to Programs and Courses or the Thayer website (http://engineering.dartmouth.edu).

DOCTOR OF PHILOSOPHY

The foundation for doctoral work is undergraduate preparation in science, mathematics, and engineering principles. Ph.D. candidates are expected to develop breadth as well as depth through coursework and research. Applicants for the program must have a bachelor’s or master’s degree in engineering or science.

DEGREE REQUIREMENTS

For students with undergraduate preparation in engineering, such as a B.E. or B.S. degree, Ph.D. coursework normally includes three courses supporting engineering science breadth, three courses in applied mathematics, and four courses leading to a depth of knowledge in a specialty. The actual program of study is developed based on each student’s background and professional interests.

The benefits of a graduate degree in engineering sciences include developing the skills and the experience to innovate. Working within a single, unified department of engineering makes exposure to different areas and ideas a natural part of the program. The opportunities for creativity go far beyond a typical advanced degree in engineering due to the close collaborations with Dartmouth’s other professional schools. The technical breadth accrued by our graduates prepares them to take the lead in whatever field they choose, seeing new connections and building intellectual bridges to a wide range of colleagues.

In research, the Thayer School faculty is advancing innovation in three areas that cut across traditional engineering disciplines and address critical human needs: engineering in medicine, energy technologies, and complex systems.

Graduate students interact with experts across the hall and across campus, from other Dartmouth graduate programs, Dartmouth Medical School and Dartmouth-Hitchcock Medical Center, and the Tuck School of Business.

MASTER OF SCIENCE

The master of science (M.S.) program prepares graduates for entering the workforce with an advanced level of engineering skills and project management experience. Some M.S. graduates enter their careers in leadership positions in industry; others choose to further their research by entering the Ph.D. program. Applicants for the program must have a bachelor’s degree in engineering or the physical sciences.

A faculty advisor aids each candidate in developing his or her program. The individual course of study must be submitted to, and approved by, the Thayer School Graduate Program Committee during the student’s first term of residency.

Kelly Michaelsen is studying biomedical engineering, focusing on near infrared breast imaging, using diffuse optical tomography. She will be looking specifically at in vivo fluorescence imaging, which is useful in tumor detection.

“Dartmouth is one of only a few schools that has an M.D.-Ph.D. program where you can pursue a Ph.D. in engineering and the program is flexible and focused on each individual student. Plus the professors are so friendly and go out of their way to help you learn.”

—Kelly Michaelsen

Advisor: Brian Pogue
A special advisory committee for each first-year doctoral student is appointed by the program director at matriculation or, at the latest, during the first academic term in the doctoral program. This three-member committee includes the student’s prospective thesis advisor and at least one member of the faculty from an area outside the student’s anticipated research topic.

- Nine terms after the bachelor’s degree, at least three of which occur after successful completion of the oral examination. Residency includes:
  - Five terms of participation in the weekly Thayer School Seminar on Applied Science and Technology (ENGG 196), plus one-time completion of the special graduate seminar in Science, Technology, and Society (ENGS 195).
  - Annual participation in the Research-in-Progress Workshop (ENGG 190), for which each candidate in residence presents his or her individual research progress.
  - Proficiency in the principles and methods of engineering, applied science, and applied mathematics underlying the anticipated thesis research in an oral qualifying examination. The examination covers at least three fundamental areas selected by the candidate in consultation with his or her thesis advisor and approved by the Graduate Program Committee.
  - Technical breadth in engineering or applied science either by taking an approved course of study in one or more areas outside of or secondary to the candidate’s main area of specialization OR completion of a project in an area outside the candidate’s main area of specialization.
  - Mastery in the chosen area of research by orally defending a thesis proposal and by completing a program of study approved by the Graduate Program Committee.
  - Professional competence in resource development either by completing a competitive research proposal for a research project OR by developing a business plan for a technology startup company. The proposal or business plan may be developed either independently or as part of the Ph.D. Professional Workshops (ENGG 197).
  - A significant contribution to knowledge through original research combined with professional expertise in the chosen area of study, including presenting elements of the doctoral research at a professional meeting with the candidate as first author, writing a dissertation of professional quality certified by the candidate’s thesis committee, having a prepublication of at least one manuscript on the doctoral research with the candidate as first author, and presenting a public oral defense of the dissertation.
  - The oral examination, procedures for demonstrating technical breadth, thesis proposal, and a workshop to facilitate development of a competitive research proposal OR business plan are described in more detail in the Thayer School Guide to Programs and Courses.

**INNOVATION PROGRAM**

The Thayer School offers a special innovation program for Ph.D. students interested in combining their technical expertise with business acumen. The technical breadth requirement is satisfied by taking courses in innovation and business, and the student works with mentors to explore the commercial potential of their research area. More detail is available at http://engineering.dartmouth.edu/graduate/phd/requirements.html#innovation

**M.D.-PH.D. PROGRAM IN BIOMEDICAL ENGINEERING**

Thayer School of Engineering and Dartmouth Medical School offer an M.D.-Ph.D. Program in biomedical engineering. Students must apply to the Medical School as well as Thayer School, indicating their interest in the joint program. Both degrees are awarded simultaneously after typically six to six-and-a-half years of study.

**DEGREE REQUIREMENTS**

**M.D. Component**

- Completion of the four-year M.D. curriculum. Elective time of year four can be devoted to Ph.D. dissertation research. For details, see the M.D.-Ph.D. Program on page 44.

**Ph.D. Component**

- **Residency** A minimum of five terms including three terms of participation in the weekly Thayer School Seminar on Applied Science and Technology (ENGG 196).
- **Technical proficiency** The principles and methods of engineering, applied science, and applied mathematics underlying the anticipated thesis research. The oral qualifying examination covers at least three fundamental areas selected by the candidate and approved by the thesis advisor.
- **Technical breadth** An approved course of study in one or more areas outside of or secondary to the main area of specialization OR completion of a project in an area outside the candidate’s main area of specialization.
- **Specialization** Mastery of the body of knowledge pertaining to the candidate’s chosen area of research with the program of study and the oral defense of the thesis proposal approved by the M.D.-Ph.D. Biomedical Engineering Committee.
- **Research** Original research making a significant contribution to knowledge, combined with demonstration of professional expertise in the chosen area of study. The candidate presents, as first author, elements of the doctoral research at a professional meeting with the committee; writes a dissertation certified by the candidate’s thesis committee; publishes, as first author, at least one manuscript on the doctoral research; and presents a public oral defense of the dissertation.

**FACULTY**

- M. Albert. Snow physics; transport phenomena; numerical modeling.
- I. Babka. Materials science; phase transformations; electron microscopy; x-ray diffraction and tomography; structure/property relationships in intermetallic compounds, ice, and nanocrystalline materials.
- A. Bowie. Electrical impedance tomography; inverse problems; measurement instrumentation design.
- M. E. Borisk. Decision Theory; integrated systems modeling and management; Bayesian statistics; uncertainty analysis; risk assessment; variation methods; improve probabilities; sustainability science.
- J. P. Collinge. Design and analysis of orthopedic prostheses; design and metallurgy of porous-metal-coated implants; study of implant-host interfaces; growth and repair of cartilage.
- B. Cushman-Roisin. Environmental transport processes; environmental fluid mechanics; industrial ecology.
- G. Cytrynski. Information systems and theory.
- S. C. Diamant. Biomedical imaging; functional neuroimaging; physiological modeling; heart rate variability; stroke recovery; Alzheimer’s disease.
- H. J. Frost. Material science; modeling of microstructural evolution; deformation and fracture at high temperatures.
- E. Gammell. Non-linear optics; integrated optics and semiconductor photonic devices; laser; electro-optics, fiber optics.
- T. U. Giachos. Biomechanics; lifecycle costing of competing manufacturing technologies; fermentation technology; metabolic engineering; protein expression; glycoprotein engineering.
- U. J. Gibson. Electromagnetic properties of nanoscale materials; material science; properties of periodic structures in reduced dimensions and small length scales; Langmuir-Blodgett and vapor deposition of optical coatings; protein crystal growth; nanobiology and nanowire growth.
- R. J. Gross. E-engineering information technologies; near-real-time scheduling and dispatching; assembly system design; product design; multi-objective optimization; integrated material handling system concepting and design; intelligent control systems.
- K. Grieve. Protein engineering; directed evolution; biotherapeutics; applied biocatalysis; high throughput screening.
- H. Halter. Biomedical instrumentation; electrical impedance tomography and spectroscopy; medical imaging; tissue impedance; cancer detection technologies.
- E. W. Hansen. Image and signal processing, optics, digital system design.

**COURSE OF STUDY**

Two years of study in basic science at the Medical School followed by two years at Thayer School taking courses, qualifying for Ph.D. candidacy, passing the oral examination, and initiating dissertation research. The Ph.D. research is then continued in concert with years three and four of the M.D. program (the clinical years). During the fourth year the dissertation research is counted as elective courses toward the M.D.
A. Hartov. Biomedical engineering, medical imaging, electrical impedance tomography; image-guided surgery, cryosurgery; ultrasound, multi-modality imaging.
J. J. Haile. Mercury; particulate matter; air pollution control; CO2 capture; combustion-derived pollution.
C. E. Hutchinson. Entrepreneurship; emerging technologies.
S. Ji. Image-guided surgery; medical imaging; multi-modality imaging; image analysis.
S. Jane. Optical spectroscopy and imaging systems for biomedical applications.
F. E. Kennedy Jr. Surface mechanics and tribology (friction, wear, lubrication, surface deformation); mechanical design; mechanical behavior of materials; biomechanics.
R. C. Laser. Electronic and optoelectronic packaging; optoelectronic transceiver modules; electronic manufacturing; operations design of experiments; statistical analysis; materials science.
F. Liebman. Fluorescence molecular imaging; diffuse optical tomography.
C. G. Lively. Microfabrication technology; micro-optics and binary optics; micro-mechanical and electromechanical systems (MEMS); micro-robotics.
W. Lotko. Geospace environment; space plasma physics, modeling, simulation; electromagnetic fields and waves.
D. R. Lynch. Advanced computational methods with applications in environmental engineering, oceanography, and water resources; scientific management of natural resources; physical/chemical interactions in the coastal ocean.
L. R. Lyu. Biomass conversion and sustainable resource utilization; metabolic engineering; applied microbiology; process design and evaluation.
S. P. McGrath. Mobile computing and intelligent software applications for biomedical, emergency management; command and control applications.
P. M. Maloney. Microwave imaging ultrasound computed tomography for biomedical applications; microwave antenna design; ultrasound-based elasticity imaging; thermal modeling and system design for focused ultrasound surgery applications.
K. M. Ossama. Analog Very Large Scale Integration (VLSI); low-power VLSI for nonlinear signal processing; implantable electronics; nonlinear dynamics.
R. Oskar. Networked systems; sensor networks; swarms and self-organizing systems; complex networks; distributed control and robotics; data fusion; multi-agent systems; and evolution of behavior.
K. D. Paulsen. Biomedical engineering; numerical methods in electromagnetics; cancer therapeutics; medical imaging methodologies; bioelectromagnetics.
V. F. Petrovsky. Ice physics and ice engineering; de-icing and anti-icing technology; ice and snow friction modification.
M. Q. Piak. System identification; iterative learning control; model predictive control; control of robotic swarms; intelligent control; adaptive control.
B. A. Precice. Biomedical optics and lasers; medical imaging; image-guided spectroscopy of cancer; photodynamic therapy; modeling of a tumor pathophysiology and contrast.
L. R. Ray. Dynamics and controls; non-linear estimation; mobile robots; active noise control; damage detection in smart structures; mechatronics.
P. J. Rosas. Product design; human-centered design; cognitive strategies and methodologies for creative design practice.
E. Santoro. Intelligent systems; artificial intelligence; probabilistic reasoning; adversarial modeling; intent inference; user modeling; information retrieval; evolutionary computation; socio-cultural modeling.
E. M. Schlosser. Flow and fracture of ice; mechanical behavior of metals and alloys; physical metallurgy and materials science.
S. G. Sheppard. Solar wind-magnetosphere-ionosphere coupling; large-scale plasma convection; HF radar remote sensing; numerical methods and simulation; geomagnetically induced currents; magnetic spacecraft shielding.
F. Shirazi. Numerical methods in computational electromagnetics; electromagnetic sensing methodologies; detection and discrimination of sub-surface objects; linear and non-linear inverse-scattering; induced geo-electromagnetic fields; micro strip antennas; photonic band gaps; near field optics; DNA sequencing; electrostatic discharge.
S. Srinivasan. Diffuse optical imaging and image-guided spectroscopy for cancer, diagnosis and treatment monitoring; fluorescence tomography.
A. V. Streletz. Computational sciences; space plasma physics; electromagnetic waves in non-homogeneous media.
C. R. Sullivan. Power electronics; micro-fabricated magnetic components; electromagnetic design of power electronics components; micro-fabricated magnetic components; nano-composite magnetic materials; energy efficiency and renewable energy.
S. Taylor. Distributed computing and web technologies.
B. S. Tlusty. Therapeutic heating of tissue; biomedical engineering; antenna theory.
D. W. Van Citters. Orthopaedic failure analysis and design; wear of polymers; polymer processing; biomaterials and surgical device design.
P. M. Vlaisavljev. Rheology of complex fluids; dynamics of surfactants at interfaces; biological fluid dynamics.

Admission to the M.E.M., M.S., and Ph.D. programs is through:
Graduate Admissions
Thayer School of Engineering
Dartmouth College
8000 Cummings Hall
Hanover, NH 03755

e-mail: engg.admissions@Dartmouth.edu
phone: Toll-free from U.S or Canada: 1-888-THAYER6 (1-888-842-9576)
All others: 603-646-2606
Apply online at:
http://engineering.dartmouth.edu/admissions/graduate/application.html
Erika Artinger is investigating the role of a critical proto-oncogene, the Mixed Lineage Leukemia (MLL) gene in blood cell development and in leukemia. She is focusing on defining the MLL-dependent gene regulatory networks that delineate hematopoietic stem cell identity and maintenance.

**DEGREE REQUIREMENTS**

To qualify for award of the Ph.D. degree, a student must fulfill the following requirements:

1. Satisfactory completion of an intensive three-terms course in general genetics and biochemistry, a one-terms teaching assignment, and a three-terms course in laboratory genetics. The latter will consist of three small research projects, conducted in rotation with different faculty members for periods of about three months each.

2. Satisfactory completion of three other graduate-level courses in genetics or related disciplines.

3. Attendance at the seminar series of the program.

4. Participation in departmental colloquia and the weekly Research in Progress Series.

5. Satisfactory completion of an oral qualifying examination.

6. Satisfactory completion of a significant research project, and preparation of a thesis describing this research.

7. Successful defense of the thesis in an oral examination, and presentation of the work in a lecture.

**FACULTY**

**Department of Genetics**

Y. Ahmed. Genes involved in the regulation of programmed cell death in animals.

B. Conkright. Regulation of programmed cell death in C. elegans.

J. C. Dunlap. Molecular genetics of the circadian biological clock in *N. tabaci*.

P. Ernst. Chromatin regulatory proteins in the development of the hematopoietic and immune systems; genetic pathways involved in leukemogenesis.

S. Graber. Quantitative mass spectrometry and proteomics.


J. H. Monos. Computational genetics, bioinformatics, genetics of common human diseases.

C. W. Perkel. Offaction and behavioral neurogenetics in *Drosophila*.


S. G. Tevosian. Early developmental regulators required for heart and gonadal development in mammals.

**Department of Biochemistry**


J. J. Losos. Fungal genetics; Molecular genetics of biological clocks.


**Department of Biology**

S. E. Bickel. Regulation of chromosome segregation in *Drosophila*.

P. J. Doppelf. Regulation of signal transduction in *Drosophila*.


M. L. Guerriero. Genetics and molecular genetics of metal uptake.

T. P. Jack. Genetics and molecular genetics of flower development in *Anabipous*.

E. J. Lambi. Dissection of the TRPM channel regulation and function in C. elegans.

C. R. McClung. Genetics and molecular genetics of clocks in plants.

**Department of Medicine**


**Department of Microbiology and Immunology**

S. N. Fishbein. DNA elements in regulation of mammalian genes during development.


**Department of Pathology**

T. K. Mohandas. Human genetics; human cytogenetics; molecular cytogenetics; X-chromosome inactivation.

**Department of Pharmacology and Toxicology**

M. D. Cole. Molecular basis of cancer; transcription factors; mechanisms of chromosome-mediated transcriptional control; target genes for oncogenic pathways.

**Department of Pediatrics**

M. A. Israel. Regulation of cellular differentiation and proliferation during development and tumorigenesis.

**For further information or application materials:**

MCB Graduate Program

Dartmouth Medical School

7500 Remsen Building, Room 239

Hanover, NH 03755-3842

e-mail: MCB@dartmouth.edu

web: dms.dartmouth.edu/mcb/

**For information specific to the genetics programs:**

Department of Genetics

Dartmouth Medical School

7500 Remsen Building

Hanover, NH 03755-3844

e-mail: genetics.department@dartmouth.edu

web: www.dartmouth.edu/~genetics/

**Students interested in a combined M.D.-Ph.D. Program in genetics should also contact:**

The M.D.-Ph.D. Committee

Norris Cotton Cancer Center

One Medical Center Drive

603 Rubin Building

Lebanon, NH 03756

web: dms.dartmouth.edu/mdphd/
Ph.D. Requirements

1. Satisfactory completion of all required coursework for the Ph.D.,
2. Passing all required written Ph.D. exams,
3. Passing the oral defense for the proposal for dissertation research, and
4. Completing and defending the thesis research, and depositing the approved thesis.

Qualifications and Requirements for Admission

Most applicants enter after earning a related master’s degree or after related work experience. The strength of an applicant’s academic background and experience and other evidence of promise in graduate study are more important than the particular area. Applicants without a prior degree must provide GRE or MCAT scores. Competitive applicants to the Ph.D. Program typically meet the following criteria:

Scores: Combined verbal and quantitative GRE scores of 1200 or higher and an Analytical Writing score of 4.5 or higher, or combined 3 scores of MCAT scores of 27 to 30 or higher.

Grades: Undergraduate and graduate GPAs of 3.0 or higher.

Ph.D. Requirements for the Degree

1. A minimum of 60 credits.
2. Satisfactory completion of the required M.S. courses.
3. A research practicum or project.
To satisfy (1), the Ph.D. student at the Institute should satisfactorily complete, by the end of the second year:
- 6 credits as a supervised teaching assistant (ECS 250-254).
- 4 credits of the Advanced Statistics & Methods course (ECS 245).
- 6 credits of the Advanced Methods in Health Services Research course (ECS 147).
- At least 12 credits of coursework at the graduate level other than doctoral seminars or courses reflecting teaching or directed research.

To satisfy (3) and (4), the Ph.D. student at the Institute should satisfactorily complete an oral defense of the thesis proposal, generally by the beginning of the third year; then the student carries out the proposed research, defends a written thesis, and deposits the final approved thesis, generally by the end of the fourth year.

**FACULTY**

**D. L. Antognini.** Study of organizations, including how incentive and control structures affect behavior, how organizational practices influence outcomes, and the causes, process and effects of organizational and institutional change.

**J. A. Baron.** Clinical epidemiology, cancer epidemiology, and epidemiology of fractures.

**S. J. Bartels.** Health care management for older persons with serious mental disorders, Medicaid and Medicare costs of medical and psychiatric disorders in older adults, shared decision making for older adults.

**E. M. Beiler.** Use of medical geography in understanding issues of public health.

**W. C. Black.** Diagnostic imaging tests and clinicians’ perceptions of the prevalence of disease.

**J. P. W. Bunum.** Effectiveness and efficiency of health care delivery to high risk elderly including the old and cognitively impaired.

**M. A. Dalziel.** Obesity prevention, tobacco prevention, media, family and environmental influences on adolescent health.

**R. E. Drake.** Assessing the outcomes and cost-effectiveness of treatments for psychiatric disorders and substance abuse.

**E. S. Fisher.** Uses of administrative databases for epidemiological and clinical research.

**A. B. Flexner.** Theory and policy implications of professional and organizational factors that influence the efficiency and outcomes of health care; decision making in health care; leadership.

**T. C. Foster.** Health care process improvement and quality improvement.

**P. B. Gardent.** Leadership and strategy in health care.

**D. C. Goodman.** The epidemiology of medical care for children, non-medical reasons for hospitalization, epidemiology of pediatric asthma.

**S. R. G. Finkelstein.** Effect of new technology in surgery, decision analysis.

**N. Jones.** Policy and economic implications of various methods of health care financing and health system reforms.

**M. R. Kassan.** Epidemiological studies focusing on the biologic mechanism and prevention of human cancers.

**R. J. Larson.** Health outcomes research.

**D. S. Likosky.** Improving neurological outcome of cardiac surgery.

**H. Llewellyn-Thomas.** Assessment of patient health status and shared decision making applications.

**D. O. Staiger.** Health Economics, econometric methods including instrumental variable modeling, hospital performance, nursing workforce.

**J. E. Wennberg.** Medical care epidemiology and health policy, treatment of prostate disease, and community based primary care research.

**W. B. Weeks.** Patient safety, quality improvement, and business aspects of medicine.

**J. N. Weinstein.** Treatment of tumors of the spine; evaluation of spine surgery.

**J. H. Wasson.** Geriatrics, clinical epidemiology, health services research, treatment of prostate disease, and community based primary care research.

**S. Woloshin.** Medical decision making and risk communication.

**M. Zinkin.** Health economics, cost-effectiveness, measuring variations in the process, outcomes, and costs of medical care for chronic disease patients treated in different systems of health care.

For further information on the programs:
Center for Education
30 Lafayette Street, 1st Floor
Centerra Resource Park
Lebanon, NH 03766
E-mail: The.Dartmouth.Institute.edprog@dartmouth.edu
Web: http://tdi.dartmouth.edu
Phone: 603-653-3268
The Dartmouth Master of Arts in Liberal Studies (M.A.L.S.) Program is designed for individuals who want to engage in interdisciplinary study of the liberal arts at the graduate level. Dartmouth has offered a master’s degree program for adults in liberal studies since 1970.

The Master of Arts in Liberal Studies Program at Dartmouth College is specifically suited for students who want to engage in both directed and independent work on issues that extend beyond monodisciplinary perspectives. Each term of the academic year, the M.A.L.S. program offers interdisciplinary courses that use a team-taught approach. Imagine taking a course on democracy team-taught by a professor from the philosophy department and a professor from the geography department, or a course entitled “Containment Culture,” which incorporates film studies, history, politics, and cultural theory. The independent study component offers students the opportunity to take the initiative in identifying topics of interest and studying them on a one-to-one basis with an academic advisor who is an expert in the field.

In most graduate programs, students are expected to bring their academic pursuits into conformity with the demands of a particular department or profession. In the M.A.L.S. program, students have the opportunity to select from an internationally acclaimed faculty who are prepared to help them design an individual plan of study suited to their intellectual, personal, or professional interests.

Since the Liberal Studies Program grew out of a critical re-examination of the founding premises of traditional academic disciplines, M.A.L.S. students are encouraged to combine disparate subject areas in order to forge new areas of scholarly inquiry.

The M.A.L.S. program also offers concentrations in cultural studies, creative writing, and globalization studies. The cultural studies concentration consists of coursework in interdisciplinary research areas examining race, class, gender, Post-Colonial Studies, and Performance/Media studies. Creative writing majors are expected to complete creative writing workshops and an independent creative project in various genres such as fiction, poetry, non-fiction, journalism, screenwriting, and oral history, in addition to their interdisciplinary coursework. Candidates pursuing the globalization studies track explore topics in the social sciences that contribute to the phenomenon of globalization, including coursework in economics, sociology, history, political science, geography, and anthropology, among other disciplines.

During the past three summers, M.A.L.S. symposia have been devoted to the topics of “The Prisonhouses of Democracy,” “1968,” and “The Literature of the Great Depression.”

M.A.L.S. STUDENTS

The M.A.L.S. graduate program attracts a diverse group of adults, including educators, health professionals, business people, artists, lawyers, writers, and recent college graduates. Students range in age from their early twenties to retirement years, and come from all regions of the United States and numerous foreign countries. Our international students have come from Bahrain, Bosnuia, Canada, China, Ecuador, England, Greece, Hungary, Indonesia, India, Kenya, Morocco, the Netherlands, Niger, Nigeria, Peru, the Philippines, Russia, Taiwan, and Turkey, and bring with them a range of cultural perspectives.

Students come to the Dartmouth program for a variety of reasons: to engage in self-directed study in the liberal arts at the graduate level; to discover the value of true interdisciplinary study; and to have the experience of disciplined scholarship or creative work in pursuing independent study and a thesis. Individuals entering the program often return to formal academic work after years away from school and discover new confidence in their intellectual strengths. Students who graduate with a M.A.L.S. degree will have not only expanded their base of formal knowledge, but will have enhanced their capacity for analytic insight, creative research, and independent thought, as well.

During the past few years, M.A.L.S. graduates have received recognition through prestigious awards such as the Fulbright Fellowship and MacArthur Genius Grant, as well as John Sloan Dickey Foundation, Reynolds, and Rockefeller Foundation grants. Many have successfully continued into doctoral and professional school programs at renowned institutions.

DEGREE REQUIREMENTS

1. A minimum of eight courses, total, including:
   - At least four liberal studies graduate courses, three of which must be interdisciplinary courses.
   - One independent study course.
   - The remaining courses may be Dartmouth courses or liberal studies courses. Students selecting a concentration will focus their remaining coursework and independent study in appropriate topics for the track.

2. Two symposium seminars, or one symposium and an approved substitute

3. A final thesis

4. A minimum of ONE summer in residence

Students must enroll within the academic year of their admission, and all degree requirements must be satisfied within six years of program entry.
ADMISSIONS

Applicants to the Master of Arts in Liberal Studies program are required to have a bachelor’s degree. Because of the strong academic program at Dartmouth, a student’s motivation, maturity, and ability to do independent graduate work are central to acceptance. It is useful for candidates who have been out of college for a significant period of time, or who feel that their undergraduate performance does not accurately reflect their academic ability, to submit some evidence of their current academic aptitude. Transcripts of more recent coursework will be evaluated carefully.

The program welcomes applications from international candidates with demonstrated proficiency in English. Because facility in written and spoken English is of vital importance in the Master of Arts in Liberal Studies Program, all applicants for whom English is not their native language or who have not attended an English-speaking undergraduate institution must take the Test of English as a Foreign Language (TOEFL).

The admissions evaluation emphasizes the candidate’s articulation of his or her interests, the suitability of our curriculum to those interests, and the individual’s ability to take initiative in designing a course of study. We look at a candidate’s record of achievement, his/her goals for the future, and how the M.A.L.S. Program at Dartmouth College will help bridge them.

FACULTY

M. Bronski. Jewish Studies.
R. Bueno. Spanish Language and Literature.
J. Divine. English (Skidmore College).
G. Edmondson. English.
E. Gick. Economics.
B. Krueger. Creative Writing.
S. Lee. Creative Writing.
A. Leduc. Creative Writing.
P. McKee. English.
K. Mladek. German Studies.
A. Nadol. English (University of Kentucky).
D. Pease. English, MALS Chair.
W. Phillips. Film Studies.
M. Pensa. Sociology.
T. Powers. English.
P. Rodol. Education.
C. Wein. Journalism.

For more information:
The M.A.L.S. Program
6092 Wentworth Hall
Dartmouth College
Hanover, NH 03755-3526
e-mail: MALS.program@dartmouth.edu
web: www.dartmouth.edu/~mals
The Graduate Program in Mathematics at Dartmouth is designed to develop mathematicians highly qualified for both teaching and research at the college or university level or research in the mathematical sciences in industry or government. Students earn a master’s degree as part of becoming a candidate for the Ph.D. degree, but should not apply to study only for a master’s degree.

The department is housed in Kemeny Hall, a new state-of-the-art teaching facility, which provides classrooms, seminar rooms, computer laboratories, and offices for the department. Newly constructed space in adjacent Baker/Berry library houses the Cook mathematics collection, an excellent collection including over 300 mathematics journals. The graduate student office complex includes a comfortable lounge and a number of computers connected to the Dartmouth network. Students have the opportunity to purchase computers at a significantly reduced price through Dartmouth College.

**PROGRAM REQUIREMENTS**

During the first six terms (18 months) of residence a student develops a strong basic knowledge of algebra, analysis, topology, and a fourth area of mathematics chosen by the student. Areas recently chosen for this fourth area include combinatorics, applied mathematics, geometry, logic, number theory, probability, and statistics. Rather than using traditional qualifying exams, the department requires two faculty members to certify that the student knows the material on the departmental syllabus in each of the four areas. This certification may be based on a formal oral exam, coursework, informal discussions, supervised independent study, seminar presentations, informal oral exams, or any means that seems appropriate. Students and facility usually find a formal oral exam to be the most efficient route to certification.

After completion of at least eight graduate courses and certification, students are awarded the master’s degree and, subject to departmental approval, are admitted to candidacy for the Ph.D. degree. This normally occurs during the second year of graduate study. After admission to candidacy, the student chooses a thesis advisor and thesis area and begins in-depth study of the chosen area. Normally the thesis is completed during the fifth year of graduate study. The typical thesis consists of publishable original work. Areas recently chosen for this fourth area include algebra, analysis, applied mathematics, combinatorics, geometry, number theory, set theory, and topology. Students continue taking courses according to their interests and demonstrate competency in one foreign language while doing their thesis research.

Dartmouth is committed to helping its graduate students develop as teachers by providing examples of effective teaching in the graduate courses, by instruction in a graduate course on teaching mathematics, and by provision of carefully chosen opportunities to gain realistic teaching experience. These opportunities begin in tutorial or discussion leader positions for courses taught by senior faculty. They culminate in the third, fourth and fifth years, after completion of the graduate student teaching semesters, in the opportunity to teach twice in these three years. The first of these courses is normally a section of a multidiscipline course supervised by a senior faculty member, and the others are chosen to fit the interests and needs of the students and the department.

**A.M. DEGREE REQUIREMENTS**

The A.M. degree requirements are as follows:

1. Completion of at least twelve graduate courses at Dartmouth, of which at least two must be advanced graduate courses.
2. Certification in four areas of mathematics.
3. The College residence requirement.

**PH.D. DEGREE REQUIREMENTS**

For the Ph.D., the requirements are:

1. Completion of the master’s requirements.
2. Admission to candidacy.
3. Demonstration of a reading knowledge of one foreign language.
4. Completion of the teaching requirement.

**FACULTY**

M. Abkowitz. Algebraic topology, category theory and homological algebra.


V. Chekhnov. Topology, geometry, mathematical physics.

P. Doyle. Geometry, probability.

E. Easlick. Combinatorics.

*E. van Em. Noncommutative geometry, operator theory, index theory, contact geometry.*

C. S. Gordon. Differential geometry.

M. J. Groszek. Logic.

C. D. Laird. Analysis.

*M. G. Mainkar. Geometry/Algebra.*

R. Ogusana. Algebraic combinatorics.

S. Pauls. Geometry, applied mathematics.

C. Posner. Number theory.

D. Rockmore. Applied and computational harmonic analysis, networks, complex systems.

T. R. Shemanske. Number theory.


J. D. Trout. Functional analysis, operator algebras, noncommutative geometry, and mathematical physics.

*V. Vatter. Combinatorics.*

D. I. Wallace. Number theory, especially analytic number theory, observability of dynamical systems, mathematical biology.


D. P. Williams. Functional analysis, especially operator algebras.


*A. Yang. Number theory.*

*John Wesley Young Research Instructor, two- or three-year appointment.*

For further information and application materials:

Chair, Graduate Admissions Committee

Ph.D. Program in Mathematics

Department of Mathematics

Dartmouth College

6188 Kemeny Hall

Hanover, NH 03755-3551

e-mail: mathphd@dartmouth.edu

web: http://math.dartmouth.edu
DOCTORAL PROGRAMS AVAILABLE IN:

- Chemistry
- Computer Science (Computational Biology)
- Earth Sciences
- Ecology and Evolutionary Biology
- Engineering
- Health Policy and Clinical Practice
- Mathematics
- Molecular and Cellular Biology
- Biochemistry
- Biological Sciences
- Genetics
- Microbiology/Immunology
- Program in Experimental and Molecular Medicine (PEMM)
- Biomedical Physiology
- Cancer Biology and Molecular Therapeutics
- Cardiovascular Diseases
- Molecular Pharmacology, Toxicon and Experimental Therapeutics
- Neuroscience
- Physics and Astronomy
- Psychological and Brain Sciences

Dual degree candidates have financial assistance available to support flexible programming of individual students. The academic departments offer qualified students a scholarship to cover the costs of tuition and stipends during their graduate work. The Medical School offers tuition deferment (which upon satisfactory completion of the dual degree program, will become a full waiver) for every student in the program. While she/he is enrolled in the medical curriculum, there is stipend support for living expenses.

For further information about admissions:
http://dms.dartmouth.edu
If you have questions about the M.D.-Ph.D. Program:
Ann.M.Coady@dartmouth.edu

The M.D.-Ph.D. Program at Dartmouth is organized to permit students to achieve the full potential of both degrees in an efficient and effective manner while also developing an understanding of the health care system as a whole.

Dartmouth is committed to training physician-scientists for the 21st century. The program at Dartmouth offers opportunities that are challenging and rewarding for students who are committed and motivated. The program functions within the collegial and supportive environment of Dartmouth Medical School and Dartmouth College. Coursework within the Ph.D. curriculum is individualized and determined by the student and the graduate department sponsoring the degree, with guidance from the M.D.-Ph.D. Office. M.D.-Ph.D. students at Dartmouth begin their training by taking the first two years of medical school. Once those years have been completed, students then move into their graduate training and complete their Ph.D. before returning to the final years of the medical school curriculum. The time to finish both degrees is seven to eight years.

The M.D.-Ph.D. Program at Dartmouth is unique in that it encompasses the entire campus and thus offers our students doctoral programs in a wide variety of disciplines.
Microbiology and Immunology

Christina Megli is studying pathogenesis in *Vibrio cholera*, which causes cholera, which kills many people around the world. She is working to characterize the protein TcpF which is crucial for the bacterium to colonize the host.

“We are pursuing pre-clinical studies of a subunit vaccine which would contain TcpF as well as other proteins important in immunity to *Vibio cholerae* infection.”

**DEGREE REQUIREMENTS**

To qualify for award of the Ph.D. degree, a student must fulfill the following requirements:

1. Satisfactory completion of an intensive three-term course in cell and molecular biology and biochemistry, a one-term teaching assignment, and a three-term course in laboratory experience in microbiology and immunology, including cell and molecular biology. The last will consist of three small research projects, conducted in rotation with different faculty members for periods of approximately three months.

2. Satisfactory completion of three or more graduate level courses from the approved list of MCB course offerings.

3. Attendance at, and participation in, the weekly seminar series, and a journal club of the MCB Program.

4. Participation in the weekly Research in Progress series (RIP).

5. Satisfactory completion of an oral qualifying examination.

6. Satisfactory completion of a significant research project, and preparation of a thesis describing this research.

7. Successful defense of the thesis in an oral examination, and presentation of the work in a seminar.

**FACULTY**

Department of Microbiology and Immunology

B. Berwin. Immune regulation and antigen trafficking by molecular chaperones and scavenger receptors.

D. J. Bzik. Genetic disruption of apicomplexan parasites: Understanding host-parasite interplay, mining new drug targets, creating new vaccines for today and tomorrow.

A. Caruso. Regulation of virulence determinants, stress-induced response, and in vivo gene expression in *Staphylococcus aureus*.

J. R. Concejo-Garcia. Contributions of inflammatory cells to tumor vasculatization and immunosuppression; tumor immunotherapy.

M. W. Fanger. Immunology and Immunotherapy; Fr receptors; HIV infection of mucosal cells; tumor-associated antigens and targeted vaccines.

S. N. Fiering. Chromatin-based regulation of the mammalian genome; transcriptional regulation of the ß-globin locus; transgenic mice.

L. H. Kasper. Tumor immunology; generating immune responses to poorly immunogenic cancers.

E. J. Usherwood. Interaction between persistent virus infections and the immune system; immunological memory.

**Department of Medicine**

L. H. Kasper. Immunology and cell biology of parasitism, in particular *Toxoplasma gondii*; immunology of multiple sclerosis.


**Department of Pathology**

J. D. Gorham. Liver immunology and inflammation; immune effects of TGF-beta; T helper cell subset differentiation. Immune effects of TGF-b.

W. F. Hickey. Development of inflammation in the nervous system; autoimmune diseases; immunology of the central nervous system.

**Department of Physiology**

P. M. Guerra. Regulation of immunity by cytokines and hormones.

For application materials:

Molecular and Cellular Biology Graduate Program Dartmouth Medical School 7650 Remsen Building, Room 239 Hanover, NH 03755-3842 e-mail: MCBj@dms.dartmouth.edu http://dms.dartmouth.edu/mcb/

For more information:

Department of Microbiology and Immunology Dartmouth Medical School Vail Building, HB 7550 Hanover, NH 03755 e-mail: microbiology@dartmouth.edu web: http://dms.dartmouth.edu/microbio/ dms.dartmouth.edu/immuno/ www.dartmouth.edu/~mcb/ molpath

Students interested in a combined M.D.-Ph.D. program in microbiology and immunology should also contact:

The M.D.-Ph.D. Committee Dartmouth Medical School Norris Cotton Cancer Center One Medical Center Drive 603 Rubin Building Lebanon, NH 03756 web: http://dms.dartmouth.edu/ndphd/
The Graduate Program in Molecular and Cellular Biology (MCB) seeks to train highly qualified students for productive careers in research and teaching through the completion of a Ph.D. degree. The MCB program is an interdepartmental program, consisting of students and faculty from the Departments of Biological Sciences and Chemistry at Dartmouth College; the Departments of Biochemistry, Genetics, Microbiology and Immunology, Medicine, Physiology, and Pathology at Dartmouth Medical School, and Engineering Sciences at the Thayer School of Engineering. Numerous collaborations exist between MCB members and those in other Ph.D. programs at Dartmouth including the Departments of Computer Sciences, Psychology, and Pharmacology-Toxicology. In addition, the M.D.-Ph.D. program and the Program in Experimental and Molecular Medicine at Dartmouth Medical School provide research opportunities for students interested in the scientific basis of clinical medicine. Overall, there is a thriving community of students engaged in graduate education and research, and interaction among students in all the graduate programs is common and encouraged.

DEGREE REQUIREMENTS

The eight major requirements for the Ph.D. include research rotations, courses, one term of teaching, a qualifying exam, attendance at program seminars and functions, a thesis project and thesis, a thesis seminar, and a thesis defense. When the research rotations, three-term core course, and qualifying exam have been completed satisfactorily (by the end of the student’s second academic year), the student will be advanced to candidacy for the Ph.D. degree. Each student must earn four additional course credits. One of these four required courses must be a teaching course, assigned by the Graduate Committee in the student’s second year in the program, and this fulfills the one-term teaching assignment. The remaining three courses may be chosen in consultation with the student’s Advisory Committee from the MCB-approved course list compiled by the program from the various participating departments.

FACULTY

The program consists of 72 faculty members and approximately 150 graduate students with up to 25 students matriculating each year. Each student works closely with a faculty advisor and has the opportunity to interact daily with other members of the program.

For further information:
MCB Graduate Program at Dartmouth
Dartmouth Medical School
7560 Remsen, Room 239
Hanover, NH 03755-3842
e-mail: mcb@Dartmouth.edu
web: http://dms.dartmouth.edu/mcb/

Students interested in a combined M.D.-Ph.D. Program with Molecular and Cellular Biology should also contact:
The M.D.-Ph.D. Program at Dartmouth
Norris Cotton Cancer Center
One Medical Center Drive
603 Rubin Building, Level 6
Lebanon, NH 03756
web: http://dms.dartmouth.edu/mdphd

Molecular and Cellular Biology
Sarah Thompson’s research is focused on understanding how cancer cells gain and lose chromosomes, and also how cells with normal, diploid chromosome numbers become aneuploid (having an abnormal number of chromosomes), a common feature of cancer cells.

“I applied to graduate programs across the country, but chose to stay at Dartmouth (where I was working as a lab technician) because I enjoyed the easy-going, friendly atmosphere here. Also, I found many of the labs in the MCB graduate program at Dartmouth are also part of the Norris Cotton Cancer Center, which would give me a great opportunity to move into the field of cancer research.”

—Sarah Thompson
Advisor: Duane Compton
Elizabeth Macari’s research focuses on elucidating mechanisms of pharmacological therapies for sickle cell disease and beta-thalassemia. Her team is trying to determine a specific pathway to target in order to make a drug more specific and less toxic than those used in current therapies.

“We do competitive research in a collaborative and intellectually nurturing environment, and I think this is one of the features about the pharmacology and toxicology department that I appreciate the most. I also hope that the research I am doing will someday help patients, and that the tools I am learning now will help me in my career.”

—Elizabeth Macari

Faculty mentor: Christopher Lowrey

The Pharmacology and Toxicology faculty participate in a new graduate program offered at Dartmouth Medical School and Dartmouth College. The Program in Experimental and Molecular Medicine (PEMM) is a degree granting program which encompasses five broad disciplines (“tracks”): cancer biology and molecular therapeutics; neuroscience; molecular pharmacology, toxicology, and experimental therapeutics; biomedical physiology; and vascular biology. PEMM seeks to train the next generation of scientists and physician-scientists to engage in genomic, proteomic, cellular, and biomedical physiology for the purpose of translating this knowledge into disease treatment and prevention.

The curriculum for PEMM offers broad training in fundamental concepts of human biology at the molecular cell and organism levels, while also offering specific instruction in the diverse areas encompassed by the umbrella program. Most members of the Pharmacology and Toxicology faculty participate in PEMM. For full details of the curriculum and faculty research interests are listed under PEMM on page 60.

For more information:

Gail L. Paige, Program Coordinator
Program in Experimental and Molecular Medicine
Dartmouth-Hitchcock Medical Center, HB 7962
One Medical Center Drive
Lebanon, New Hampshire 03756
e-mail: Molecular.Medicine@dartmouth.edu
web: https://dms.dartmouth.edu/pemm/
phone: 603-650-4933
fax: 603-650-4932
Students are encouraged to test/demonstrate their interest in business management through auditing or enrolling in Tuck courses prior to applying to the program. Advisory faculty can be consulted to help customize pre-application plans or discuss options to dovetail these studies with their eventual plans in the M.B.A. Applications to the program can commence as of Fall 2009.

**DEGREE REQUIREMENTS**

Matriculating students must enter with the regular Tuck class in the fall, and complete the required first-year Tuck core curriculum. The second year of Tuck would require only two full terms of electives, totaling eight classes, with anticipated completion by March of the second year.

Courses taken during the Ph.D. program will be counted as four Tuck electives, eliminating the need for enrollment in the spring term of the final year. Thus, M.B.A. coursework required is expected to be one term less than for regular M.B.A. students. Students are expected to participate in an internship during the summer between 1st and 2nd Tuck years, to help reinforce the M.B.A. experience.

**TUITION/FUNDING**

Students in the Program will be responsible for tuition and fees to the College department in which they are currently enrolled. Funding for the M.B.A. degree may come from the existing financial aid application process managed by Tuck.

For further information about admissions, please refer to our website http://www.dartmouth.edu/gradstdy/programs/dartmouthphdmba.html

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**Ph.D.-M.B.A. Program**

“The Ph.D.-M.B.A. design builds upon the outstanding strengths that the campus already has and is a natural extension of what our students already do and are capable of. The new program simply takes the experience of our Ph.D. students to the next higher level, giving them the skills to implement financial and management decisions with their basis of scientific knowledge.”

—Brian Pogue, Dean of Graduate Studies

“Dartmouth is well positioned to lead in this area of scientific business development. The Tuck M.B.A. is leading the way in business management, and now Ph.D.-M.B.A. graduates will be able to create new career tracks for themselves and be well positioned to succeed in any pursuit.”

—Jim Yong Kim, Dartmouth President

The Ph.D.-M.B.A. program defines a new Dartmouth educational pathway, offering the unique opportunity for doctoral scientists to finish off their training with management education from the Tuck School of Business. The program will train a new class of scientific manager/entrepreneurs who are ready to lead the high-technology workforce of the 21st century.

This streamlined path permits Ph.D. candidates to obtain their M.B.A. degree immediately after completion of their Ph.D. program. Admission to the Tuck M.B.A. program is through the standard pathway, but the Ph.D. experience will count as their post-bachelor’s-degree work experience, which is five years on average.

**ADMISSIONS**

Applicants must complete the Tuck application forms and either of the GMAT® or GRE® General exams. While application and admission to the M.B.A. program can occur at any point while enrolled in the Ph.D. program, the normal application would occur in the third or fourth year of the Ph.D. program. If Ph.D. graduation does not occur before the fall term, students must apply for a deferral to enter into the M.B.A. program after completion of all Ph.D. requirements. Admission requirements for the Ph.D. and the M.B.A. must be fulfilled entirely for both programs. The M.B.A. application requires all the materials expected for the normal application process, including GMAT exams, letters of reference, transcripts, statement of interest and interview. Application fees to the Ph.D.-M.B.A. program may be waived for qualified Ph.D. students applying to the M.B.A. from within Dartmouth.
findings show that the density of the environment affects the distance at which we can see individual stars.”

environments that exist well beyond the distance at which we can see individual stars.”

trying to match observations with population synthesis models to explain the effects of environment on star formation.

Aside from their aesthetic beauty, they serve as laboratories to study stellar environments that exist well beyond the distance at which we can see individual stars.”

I’ve always been interested in galaxies. They are beautiful and fascinating. I’ve spent a lot of time studying them, trying to understand how they form and evolve."

Johnson’s work has focused around trying to match observations with population synthesis models to explain the effects of environment on star formation rates in these galaxies.

The Department of Physics and Astronomy offers a graduate program leading to the Ph.D. degree in physics and in astronomy and astrophysics. Graduate training and research are concentrated in several core areas: astronomy and astrophysics, quantum and condensed-matter physics, space and plasma physics, and theoretical physics. The department is dedicated to providing graduate students with a broad background in physics and astronomy and in-depth training in their field of specialization. As the smallest of the Ivy League institutions, Dartmouth maintains a tradition of close student-faculty interaction, a tradition that is also followed in the physics and astronomy graduate program. The department has 18 full-time faculty members, approximately 10 research professors and postdoctoral fellows, and 45 graduate students.

The department is located in Wilder Laboratory, which is connected to the Sherman Fairchild Physical Sciences Center, adjoining the Kresge Physical Sciences Library and the departments of chemistry and earth sciences. Wilder contains classrooms, offices, and advanced research laboratories for the condensed-matter physics and space physics groups. Research is also carried out at national facilities, including Argonne National Laboratory, Thomas Jefferson National Accelerator Facility, and the National Center for Atmospheric Research.

The astronomy group uses NASA facilities including the Hubble Space Telescope and the Chandra X-ray Observatory, and has access to extensive time on two telescopes at Kitt Peak, Arizona, and the 10-meter Southern African Large Telescope. The experimental space physics groups use NASA sounding rockets to launch instruments into space and also operate ground-based experiments in North America, Greenland, and the South Pole.

Computational research projects are enhanced by access to Beowulf clusters located on campus.

PH.D. PROGRAM

The graduate program leads to the Ph.D. degree in physics or in astronomy and astrophysics. The degree requirements for physics are distinct from those for astronomy and astrophysics. Students are not normally admitted for a master's degree.

Degree Requirements

A student will be admitted to Ph.D. candidacy upon:

1. Receiving degree credit for at least twelve graduate courses, exclusive of teaching courses.
2. Receiving credit for at least two terms of supervised undergraduate teaching (Physics 257 or 256).
3. Passing the departmental qualifying examination.
4. Passing a departmental review of the student’s course record and preliminary research progress.
5. Receiving credit for at least two terms of supervised undergraduate teaching (Physics 257 and 256).

Students must achieve thesis proposal certification by the end of the fall term of their fourth year, in order to remain in good standing. Students who successfully complete these requirements will be admitted to Ph.D. candidacy by the department.

A candidate will receive the Ph.D. degree upon:

1. Receiving degree credit for at least twelve graduate courses, exclusive of teaching courses. Only two of the 12 courses may be graduate research, both of which must be completed no later than the second summer term in residence.
2. Receiving credit for at least two terms of supervised undergraduate teaching (Physics 257 and 256).
4. Successfully defending the dissertation before the Ph.D. thesis committee in a public forum. It is expected that most students will receive the Ph.D. degree by the end of the fifth year of graduate study.
M.S. PROGRAM

Degree Requirements

The general requirements for the master's degree are given on page 74 of this bulletin. These requirements, together with the specific requirements of the Department of Physics and Astronomy indicated below, normally allow completion of the degree in two years. It is expected that graduate students who have not completed the equivalent of the Dartmouth physics major program will do so in their first year of graduate study.

Special requirements:

1. Degree credit for eight graduate courses, exclusive of teaching courses. Two of the eight courses may be graduate research. At least six of the eight courses should be in physics and astronomy.
2. Completion of a culminating experience chosen from the following options:
   a. Completion of a satisfactory thesis, which must be defended before the M.S. thesis committee in a public forum.
   b. Significant co-authorship of a publication submitted to a refereed journal or refereed conference proceedings, defended publicly.
   c. Passing the Ph.D. qualifying examination.
3. Credit for at least one term of supervised undergraduate teaching (Physics 257).

FACULTY

M. Blencowe. Condensed matter theory: nano to mesoscale electromechanical systems, nonequilibrium statistical mechanics, quantum measurement.
R. Caldwell. Theoretical cosmology, gravitation, and relativistic astrophysics.
B. Chaboyer. Theoretical stellar astrophysics, formation of the Milky Way, globular cluster ages.
R. Fesen. Optical, UV and x-ray studies of supernovae and supernova remnants, the interstellar medium.
M. Gleiser. Nonlinear and statistical field theory, cosmology, and astrobiology.
M. Hudson. Space plasma theory, plasma simulation; sun-earth connections, space weather, auroral particle acceleration and heating, ring current-plasmapause interaction, radiation belts, solar energetic particle trapping, and effects of geomagnetic storms.
J. LaBelle. Ionospheric and magnetospheric physics; plasma measurements in space; remote sensing of ionospheric plasma processes.
W. Lawrence. Condensed matter theory; quantum information, entanglement, many body theory; (Chair, Department).
K. Lynch. Ionospheric, auroral, and mesospheric plasma physics; sounding rocket and laboratory plasma experiments; (Chair, Graduate Committee).
R. Millan. Experimental space physics, radiation belt electron losses; hard x-ray/gamma ray observations and instrumentation.
A. Rimberg. Condensed matter experiment: electrical transport measurements of nanostructures such as quantum dots and single-electron transistors; quantum information science and quantum measurements; controlled physical realizations of open quantum systems; quantum noise and non-equilibrium effects.
B. Rogers. Theoretical and computational plasma physics.
J. Thorstensen. Optical studies of close binary stars; astrometry.
L. Viola. Theoretical quantum information science and quantum statistical mechanics: open quantum systems and quantum noise control, theory and applications of entanglement, quantum many-body systems.
M. Wybourne. Experimental condensed matter physics; (Vice Provost for Research).

For further information and application materials:
web: www.dartmouth.edu/~physics

The astronomy group uses NASA facilities including the Hubble Space Telescope and the Chandra X-ray Observatory, and has access to extensive time on two telescopes at Kitt Peak, Arizona, and the 10-meter Southern African Large Telescope.
Faculty in the Department of Physiology of Dartmouth Medical School participate in the new graduate program in Experimental and Molecular Medicine (PEMM). PEMM is a degree-granting program that encompasses five broad disciplines (“tracks”): cancer biology and molecular therapeutics; molecular pharmacology, toxicology and experimental therapeutics; neuroscience; biomedical physiology; cardiovascular diseases.

The curriculum for PEMM offers broad training in fundamental concepts of human biology at the molecular cell and organism levels, while also offering specific instruction in the diverse areas encompassed by the umbrella program. Most members of the Physiology program are members of the biomedical physiology track of PEMM. For full details of the curriculum and faculty research interests are listed under PEMM on page 60.

Amy Murphy is researching the influence of estrogens on innate immune responses. The immune response during infection in men and women differs significantly. Pre-menopausal women tend to fare better during an infection in comparison to post-menopausal women and men, indicating a role for estrogens in the response to infection.

"I hope to further our understanding of how estrogens influence immunity on a molecular level and identify potential targets for therapeutic use."
—Amy Murphy
Faculty advisors: Paul Guyre and Patricia Pioli

For more information:

Gail L. Paige, Program Coordinator
Program in Experimental and Molecular Medicine
Dartmouth-Hitchcock Medical Center, HB 7962
One Medical Center Drive
Lebanon, New Hampshire 03756
e-mail: Molecular.Medicine@ dartmouth.edu
web: http://dms.dartmouth.edu/pemm/
phone: 603-650-4933
fax: 603-650-4932
The Program in Experimental and Molecular Medicine (PEMM) at Dartmouth Medical School and Dartmouth College is a degree granting program that encompasses the following five broad disciplines ("themes"): biomedical physiology; cancer biology and molecular therapeutics; cardiovascular diseases; molecular pharmacology, toxicology, and experimental therapeutics; and neuroscience.

PEMM’s philosophy is based on the concept that the next generation of biomedical investigators must be capable of generating ideas efficiently from the bench to the clinic, and therefore must be trained in a manner that includes a broad understanding of the clinical environment. Accordingly, PEMM trains students to be members of research teams addressing clinical and preclinical questions, contributing to the design and implementation of clinical trials, dissecting the fundamental causes of disease, and participating in translational sciences through research in target identification, drug development, and mechanisms.

PEMM faculty are members of the Dartmouth Medical School departments of Pharmacology and Toxicology, Physiology, Medicine, Neurology, Psychiatry, Genetics, Microbiology and Immunology, Radiology, Surgery, Community and Family Medicine, and the College department of Psychology and Brain Science. Training in these broad disciplines is designed to install a clinically relevant understanding of disease pathophysiology and its diagnostic and therapeutic implications, thus producing a generation of scientists and physician-scientists prepared to engage in research in genomic, proteomic, cellular and organ-based systems for the purpose of translating knowledge into disease treatment and prevention.

Research topics are investigated with a variety of experimental models that employ a broad range of biochemical, biological, and molecular techniques, and that interface with related disciplines such as bioinformatics, immunology, structural biology, and chemistry. All students are given thorough instruction in the fundamentals of cell biology, molecular biology, physiology and pathophysiology, pharmacology, and human genetics. In addition, there are special courses on designing, implementing, and analyzing experimental models and clinical trials. Thus, this program is expected to provide students with a broad-based understanding of key biomedical problems and to develop their ability to carry out creative biomedical research.

QUALIFICATIONS AND ADMISSION REQUIREMENTS

All applicants must have a bachelor’s degree with adequate preparation in chemistry, biology, biochemistry, physics, and mathematics. A Graduate Record Examination score is required, as well as a demonstrated proficiency with the English language. In addition, the applicant must supply at least three letters of recommendation, all official academic transcripts, and a completed Dartmouth College application form for graduate study.

DEGREE REQUIREMENTS

- Successful defense of the thesis in an oral examination, and presentation of the work in a seminar.
- Satisfactory completion of an intense two-term core course, biostatistics, and four elective courses customized to the individual students chosen theme and research area
- A successfully written and defended grant proposal on a novel area of research
- Attendance and participation in weekly program seminars, research-in-progress, and journal clubs.
- Successful defense of the thesis in an oral examination, and presentation of the work in a seminar.
- A successfully written and defended grant proposal on a novel area of research.

FACULTY

The PEMM program is interdisciplinary and consists of 66 faculty members from 10 departments, including: Community and Family Medicine, MedCore, Microbiology and Immunology, Pathology, Pharmacology and Toxicology, Physiology, Psychiatry, Psychological and Brain Sciences, Radiology, and Surgery. Each student works closely with a faculty advisor and has the opportunity to interact daily with other members of the program. Students are encouraged to look at PEMM’s website for in-depth information about specific faculty and their research interests.

See http://dms.dartmouth.edu/pemm/faculty

Community and Family Medicine


Department of Medicine

P. J. Bisevski. Control of non-enzymatic glycation and oxidative stress, and their role in susceptibility to diabetic complications.

R. I. Evers. T-cell responses to influenza and other virus infection, the mechanisms of immunomodulation in respiratory virus infection.

G. L. Holmes. Effects of sepsis on the developing brain; the cognitive and electrophysiological consequences of recurrent seizures and status epilepticus.

A. L. Howells. Cellular mechanisms that control HIV-1 infection and replication in the female reproductive tract, the role of stress-steroid hormones, and the potential of RNA interference to inhibit mucosal HIV-1 transmission.
The PEMM program is interdisciplinary and consists of 66 faculty members from 10 departments, including: Community and Family Medicine, Medicine, Microbiology and Immunology, Pathology, Pharmacology and Toxicology, Physiology, Psychiatry, Psychological and Brain Sciences, Radiology, and Surgery.

W. B. Kinlaw. Cell culture and genetically engineered mouse models to understand the metabolic peculiarities of breast tumors, and to explore their potential as therapeutic targets.

M. Koe. Mechanisms of action of growth factors and their receptors in carcinogenesis, especially as it relates to enhanced migration and invasive growth of breast cancer cells, enhanced angiogenesis, and accelerated growth of tumors in vivo.

T. Laure. The means of modulating T-cell immune responses during HIV infection, the immunology of mucosal transmission of HIV, and immune responses to TB in HIV-infected adults with tuberculosis.

S. Lee. Molecular pathology of Parkinson’s disease; the biological function of Parkinson’s disease-associated genes using genetic, molecular, cellular, and model organism approaches.

L. D. Lewis. The pharmacokinetics and pharmacodynamics of novel anticancer agents when first given to cancer patients (i.e., first in man, Phase 1 studies of new drugs in cancer patients); mechanisms of mitochondrial toxicity of nucleoside analogues.

C. H. Lowrey. Role of epithigenes and cell stress signaling in normal and disease-related blood cell production; development of novel pharmacologic therapies for sickle cell disease, thalassemia and leukemia.

J. D. Pearlman. Translational imaging applications to angiogenesis and molecular markers.


R. B. Rorie. Regulation and function of mammalian hexokinases with specific emphasis on the interface between metabolism and cell survival in both adaptive (scleratic preconditining) and maladaptive (cancer) contexts.


C. Tomlinson. The role of aryl hydrocarbon receptor in adult-onset diseases from in utero exposures to environmental toxicants; development of high throughput genomics as a tool to predict the outcome of gene/environment interactions.

M. Vincenti. Regulation of matrix metalloproteinase gene expression in arthritis and cancer; how inflammatory signal transduction activates metalloproteinase transcription.

Department of Microbiology and Immunology

W. R. Green. Cell-mediated immunity to mouse retroviruses that cause either leukemia or immunodeficiency; studies on novel vaccine approaches.

J. A. Kelly. The role of Stat5 in T-cell development and lymphoma; identification of targets for novel molecular therapies.

Department of Pathology

B. T. Harris. Neurodegenerative diseases: ALS, Parkinson’s, Prion diseases utilizing cell culture methods and transgenic animal models.

W. F. Hickey. Neuropathology, neuroimmunology, autoimmunity and inflammatory diseases of the CNS, mechanisms of inflammation in the CNS.

R. V. Stan. Endothelial structures involved in vascular permeability in normal and disease states such as inflammation and cancer (angiogenesis).

Department of Pharmacology and Toxicology

M. Coli. Molecular basis of cancer; the role of transcription factors and chromatin modification on tumor cell growth with major emphasis on the Myc oncogene family and its role in the growth of both cancer and normal cells.

R. W. Craig. Understanding how a key regulator of cell viability discovered in the laboratory, MLCl, contributes to tumorigenesis and can be targeted for cancer therapy.

J. D bruks. Neuropharmacology; neuroimmunology; mechanisms that lead to chronic pain with a focus on spinal neurotransmitter responses; development of novel, non-addictive therapeutics for the prevention and treatment of chronic neuropathic and low back pain.


E. Emeryshvili. Vitamin A derivatives known as retinoids and their roles in tumor cell differentiation and chemoprevention.


D. J. Roberts. Elucidating the Hedgehog (Hh) signal transduction pathway in embryonic development and in cancer; the production and presentation of the secreted ligand and the down-streaming the signaling pathway downstream of the Hh receptor.

B. D. Royer. Modulation of acute and chronic toxicity and carcinogenic processes by cancer chemopreventive agents; evaluation of the effects of dietary dithiolothiones on prevention of liver cancer; chemoprevention of cancer.

Y. Sanchez. Checkpoint signaling events triggered during the response to DNA damage or replication interference: how they regulate cell cycle progression, DNA repair, and cell death. The role of checkpoints in the etiology of cancer and as drug targets for therapeutic enhancements of genotoxic cancer drugs.

M. Shahid. Discovery and development of cell probes and therapeutic agents targeting protein–protein interactions; chemical biology; peptide and organic small molecule synthesis; combinatorial chemistry; chemical libraries for in vitro and cell-based screening; biophysical analysis of protein–ligand interactions.

M. J. Sinella. Mechanistic links between stem cell pluripotency and cancer and identification of downstream genes signaling induced differentiation of solid tumors, especially in response to retinoids; finding causative genes in those tumors that are cured with differentiation and cytostatic therapy.

M. B. Skov. Chemoprevention of cancer, especially by retinoids and other ligands of the steroid receptor superfamily; peptide growth factors, especially transforming growth factor-beta (TGF-beta) and its mechanism of action; development of new natural products for prevention of cancer.

Department of Physiology

D. Bartlett. Mechanisms of control and integration of breathing movements by muscles of the respiratory pump and those of the upper airway. A possible role of heat stress in the sudden infant death syndrome.

R. A. Danksell. The role of mediatory serotonergic neurons in the sudden infant death syndrome. Inhibition of serotonergic neurons in the nucleus paragangioncellularis lateralis fragments sleep and decreases REM.

J. A. DuBenske. Cardiorespiratory control using heart rate variability and baroreflex characters to evaluate neonatal development and risk factors for sudden infant death.


V. A. Galbon. The roles of the isodihydroxy deoxyneuronal regulation of intracellular thyroid hormone levels and thyroid hormone action during development and in adult mammals. Studies use mice made deficient in the either or both the types 1 and 2 dehydrogenase deoxyneuronal.

P. M. Gewirtz. Mechanisms of hormone/cytokine interactions in control of immunity. Inflammation, repair, and autoimmunity.

L. P. Henderson. The long-term goals of the laboratory are to understand how steroid affects the expression and function of ion channels involved in synaptic signaling, with specific emphasis on the actions of anabolic androgenic steroid.

J. C. Hieger. Respiratory neurobiology especially in the areas of pH regulation in neurons and astrocytes, central chemosensitivity and comparative aspects of rhythm generation.

R. A. Maul. Cellular and molecular mechanisms underlying neuronal development in the CNS, particularly as related to neurodegenerative diseases; neurotrophin and growth factor actions; regulation of neuronal ion channels and genes; molecular biology; electrophysiology.


E. Nattie. Central chemoreceptors that sense changes in brain pH and stimulate breathing. The role of central chemoreception in the medullary barore in the sudden infant death syndrome.

B. A. Stainon. Ion channel regulation in kidney and lung, cystic fibrosis, molecular pathogenesis of Pseudomonas infection, and gene environment interactions.

C. R. Weber. Physiology of reproduction; cellular and molecular actions of sex hormones regulation of the mucosal immune system in the rodent and human female reproductive tract as it relates to protection against sexually transmitted diseases including HIV-1.

H. H. Yeh. Cellular and molecular mechanisms of neuroreceptor interactions and plasticity in the adult and developing CNS.

Department of Psychiatry
A. I. Greens. Animal and human studies of the actions of antipsychotic drugs, as related to their use in patients with schizophrenia and substance use disorders. The work focuses on brain reward circuitry, and manipulation of this circuitry by antipsychotic drugs and other psychoactive agents.

T. W. McAllister. Traumatic brain injury, neuropsychiatric disorders, neuropharmacology, functional MRI.

H. A. Wiestart. Neurobiological basis of heterogeneity in multiple sclerosis; structural and functional MRI and genotyping to discover neurobiological mechanisms of heterogeneity in symptomatology, course and treatment response in MS, with the ultimate aim of improving early, individualized characterization and treatment of the disease.

Department of Psychological and Brain Sciences
D. J. Bucco. Behavioral and neurobiological factors that modulate learning and memory using classical conditioning procedures with biochemical, pharmacological, and neuroanatomical techniques to study the role of cortical structures and subcortical neurochemical systems.

R. Granger. Computational and cognitive neuroscience: analyses of how our brains operate to perceive, comprehend, and manipulate their environments, as well as how they fail in certain conditions.

W. Kelley. Using functional magnetic resonance imaging (fMRI) to gain a better understanding of human memory function; how different kinds of information like words (verbal) or unfamiliar faces (non-verbal) are encoded into long-term memory.

J. S. Taube. Neurobiology of spatial orientation and navigation, learning and memory. Understanding the neurobiological basis of spatial cognition and navigation, and the neurobiological mechanisms underlying learning and memory.

P. J. Whalen. Using functional magnetic resonance imaging to assess the role of prefrontal and limbic circuits in the evaluation of events that predict biologically-relevant outcomes; understanding the emotion fear as well as disorders of fear management (e.g., anxiety disorders).

Department of Radiology
R. A. Kaufman. Developing magnetic resonance imaging (MRI) and magnetic resonance spectroscopy (MRS) techniques for neuroscience applications and tumor pathology.

H. M. Szwartz. Use of functional magnetic resonance imaging to assess the role of prefrontal and limbic circuits in the evaluation of events that predict biologically relevant outcomes. This work has implications for the understanding of the emotion fear as well as disorders of fear management (e.g., anxiety disorders).

Department of Surgery
A. C. Durham. Traumatic brain injury in infants and children, age-related differences in brain recovery following head trauma, utilizing laboratory and biomechanical models to study mechanisms of recovery and to discover novel therapeutics to prevent the sequelae of head trauma.

M. J. Mulligan-Keele. Inhibition of angiogenesis; anti-angiogenic mechanisms of a recombinant plasminogen activator inhibitor-1 protein, rPAI-123 in vitro and in vivo. Development of a novel system designed to deliver rPAI-123 to sites of neo-angiogenesis in tumors.

R. J. Powell. Defining the endothelial cell regulated pathways that control smooth muscle cell phenotype.

E. Rzucidlo. The impact of statins on the mTOR pathway, minimal hyperplasia and restenosis induced by stent.

For more information:
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web: http://dms.dartmouth.edu/pemm/
phone: 603-650-4933
fax: 603-650-4932
Ben Clark’s research focuses on how the brain organizes and processes mental images or maps of the environment for subsequent navigation. Previous work in his lab has identified cells in the rat limbic system that discharge as a function of the animal’s head direction. Clark is studying how this directional signal is derived and processed from sensory inputs.

The Department of Psychological and Brain Sciences offers graduate programs in both cognitive neuroscience and psychology.

COGNITIVE NEUROSCIENCE

The doctoral program in cognitive neuroscience at Dartmouth offers training in the areas of cognition, psychophysics, electrophysiology, functional imaging, and computer science. Although these areas receive particular emphasis in our graduate training program, they do not limit or exclude opportunities for training in other cognitive neuroscience subdisciplines in which the faculty has interest and expertise.

PSYCHOLOGY

The doctoral program in psychology stresses training in experimental research and in teaching. Students engage in research throughout their course of study, and the dissertation is viewed primarily as a coherent segment of a continuing habit of research rather than as an isolated effort. Each student also serves as a teaching apprentice under the direction of a member of the faculty. Much of the graduate training is tutorial in nature. With a student-faculty ratio of approximately 1:1, the program offers unusually close interaction between graduate students and faculty. Areas of specialization within the department are experimental social psychology, perception and cognition, and behavioral neuroscience.

QUALIFICATIONS AND ADMISSIONS REQUIREMENTS

The applicant must have completed the baccalaureate degree or its equivalent prior to matriculation. Applicants should complete the online Dartmouth College application form for graduate study and send a transcript of their college record and three letters of recommendation. The Graduate Record Examination is required.

DEGREE REQUIREMENTS

The department offers graduate training leading to the Ph.D., and the program emphasizes acquaintance with the basic psychological processes that form the core of experimental psychology. Students are encouraged in their research to address problems of broad significance and to be knowledgeable about the theory that makes breadth coherent. The requirements for the Ph.D. degree are as follows:

1. A passing grade in the statistics courses (100, 101), the proseminar (112), and in five additional graduate seminars.
2. Completion of the teaching apprenticeship program.
3. A passing grade in a specialist examination containing both written and oral parts, typically by the end of the second year.
4. Fulfillment of the two-year-residence requirement.
5. Completion of independent research and a dissertation; a defense of the dissertation; and presentation of the dissertation research in a public oral colloquium.
6. For more specific details regarding the program see the Departmental Guide to Graduate Training available from the department’s administrative assistant.

FACULTY

D. J. BeccCI. Behavioural Neuroscience, Brain mechanisms of learning, memory, and attention.
A. S. Clark. Neuroendocrinology, physiological psychology.
C. P. Chalmers. Developmental psychology, animal behavior.
R. H. Ganger. Computational and cognitive neuroscience.
T. F. Hesther. Experimental social neuroscience, personality, and motivation.
H. C. Hughes. Neurological aspects of visual perception, attention and visual processes.
J. G. Hull. Experimental social psychology of self.
G. C. Jersild. Learning, evaluation research.
J. Kralik. Neuropsychology.
P. U. Tse. Visual perception and attention.
G. L. Welford. Judgment and decision making in memory and choice.
Affiliated Faculty

D. J. Cecel. Developmental and educational cognitive neuroscience.
E. Temple. Developmental and educational cognitive neuroscience.

For further information and application materials:
Department of Psychological and Brain Sciences
Dartmouth College
6207 Moore Hall
Hanover, NH 03755-3578
E-mail: Psychological.and.brain.sciences@dartmouth.edu
Web: www.dartmouth.edu/~psych

Moore Hall also contains specialized laboratories for research in cognitive neuroscience, including a research-dedicated fMRI; animal behavior, including awake and behaving primate research; sensory, perceptual, and cognitive processes; and social psychology.
overlapping facilities and space for training in biochemistry, biology, molecular cell shops, and computing facilities. Similarly, the Gilman-Remsen-Vail cluster provides house programs in earth sciences, chemistry, and physics and provide a common library, service Sherman Fairchild Physical Sciences Center and the Burke Chemistry Laboratory building Research and Teaching.dartmouth.edu/~comp Consulting services, curricular and research support, computer sales and repair, and oversees research, scholarship, and administration. Computing Services provides classroom support, College, leads the institution in the application of information technology to learning, teaching, Peter Kiewit Computing Services, the central information technology group for Dartmouth in branch libraries. All libraries provide computerized literature searching services, including access to 8,000 electronic journals, and more than 180 databases. In addition, Dartmouth's library system participates in automated borrowing programs in cooperation with other research libraries. Computing Services Peter Kiewit Computing Services, the central information technology group for Dartmouth College, lead the institution in the application of information technology to learning, teaching, research, scholarship, and administration. Computing Services provides classroom support, consulting services, curricular and research support, computer sales and repair, and oversees the Learning Technology Venture fund. For more information, see their web site at www.dartmouth.edu/~comp Research and Teaching Several significant research and teaching facilities at Dartmouth have been designed to encourage contact and intellectual exchange among scholars in related disciplines. The Sherman Fairchild Physical Sciences Center and the Burke Chemistry Laboratory building house programs in earth sciences, chemistry, and physics and provide a common library, service shops, and computing facilities. Similarly, the Gilman-Remsen-Vail cluster provides overlapping facilities and space for training in biochemistry, biology, molecular cell biology, genetics, microbiology & immunology, pharmacology, and physiology. Moore Hall provides modern facilities for training in psychological and brain sciences, including the first MRI in the country dedicated to basic research. Kenney Hall (mathematics program) and MacLean Engineering Sciences Center (engineering sciences) embody Dartmouth’s integrative approach to research and learning. Finally, state-of-the-art research facilities at the Dartmouth-Hitchcock Medical Complex provide a rich training environment for programs in experimental and molecular medicine as well as microbiology & immunology, pharmacology, and physiology.

The Professional Schools
Graduate professional degrees are offered by the three associated schools of Dartmouth College: Dartmouth Medical School (M.D. and M.P.H.), the Thayer School of Engineering (B.E., M.E.M.), and the Amos Tuck School of Business Administration (M.B.A.). Together the resources of these schools represent a unique opportunity for graduate students in Ph.D. programs to branch out into subjects which are closely allied with, but outside the traditional bounds of, their particular field of study. It is not unusual, for example, for graduate students in biology and chemistry to take courses at the Medical School. Similarly, several science departments have close ties to the Thayer School of Engineering. For those planning to pursue a career in industry, the Tuck School of Business Administration offers a wide range of courses, as well as a sizable library of business-oriented computer programs designed by Tuck faculty and students.

THE COMMUNITY
Dartmouth is located in Hanover, New Hampshire, a small New England town dating back to a few years before the College’s founding in 1769. Although Hanover has changed consider- ably since the time when Dartmouth’s founder, Eleazar Wheelock, chose his site in the North Country wilderness, the natural beauty of the town’s surroundings still plays an important role in the community’s life and spirit. Situated in the “Upper Valley” of the Connecticut River, between the White Mountain range of New Hampshire and the Green Mountains of Vermont, Hanover combines the advantages of a rural setting with the resources of a university.

Cultural Attractions
Aside from the many outdoor activities available in the Hanover area—Alpine and Nordic skiing, rock climbing, hiking, canoeing, sailing, riding—Hanover also offers an active cultural life, centered on the Hopkins Center for the Creative and Performing Arts. Each year the Hopkins Center sponsors an active film society, two full concert series, many dramatic pro-ductions, art shows, and other events. The Center also provides special workshops open to all faculty and students for woodworking, sculpture, painting, and various craft forms.

Housing
The College assists graduate students in arranging for appropriate housing, either in College facilities or in private accommodations in the Hanover area. Sachem Village Sachem Village is located approximately two miles from the Dartmouth cam-pus in West Lebanon, N.H. It was developed to provide housing to those graduate students with families. Priority in housing is given first to students with children, then students with a spouse or domestic partner. Space permitting, single graduate students may rent at Sachem Village. There are 26 single-level, two- and three-bedroom duplexes ($780-842, rent does not include heat), 24 two-story, two-bedroom townhouses ($995, rent does not include heat), and 205 newer two-story, one- to three-bedroom units in clusters of two to four apartments ($990-1,603). There is a Community Center with three study rooms available for student use. Applications may be filled out online at www.dartmouth.edu/real estate/residential/sachem/index.html.

There is a variety of housing available for single graduate students in the Arts and Sciences and the Thayer School of Engineering.

North Park Street Graduate Housing Dartmouth has 32 apartments available at our North Park Street Graduate Housing complex for 110 single, first-year graduate students. There are 26 four-bedroom apartments, two-two-bathroom apartments, one-one-bedroom apartments, and four studio apartments. The Housing Programs Office will assign four roommates to live in all of the four-bedroom apartments (everyone does have their own private bedroom, but students share the two bath-rooms and living room, and kitchen). Roommates are all of one gender, but we try to have students from a mix of programs and nations. Prices range from $816-1,010 per month. Because of lim-ited parking on campus, tenants living in these apartments who are not assigned a parking space will not have parking privileges in any other Dartmouth parking lot. (An exception is made for Medical School and TDI students.) Pets are not permitted. Applications may be filled out online at www.dartmouth.edu/real estate

Dartmouth Libraries
The resources of the College library system, an extensive and well-balanced collection of more than 2,500,000 volumes, are made easily accessible to all members of the Dartmouth community through the library’s open stack policy. Baker/Berry Library, the nucleus of the system, houses the main collection, as well as an outstanding reference collection, microform, a government documents section, a large periodical collection, and many special collections. Collections in art, biomedical sciences, business and engineering, English, mathematics, and physical sciences are housed in branch libraries. All libraries provide computerized literature searching services, including access to 8,000 electronic journals, and more than 180 databases. In addition, Dartmouth’s library system participates in automated borrowing programs in cooperation with other research libraries.

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South Street There are eleven units (a combination of two and three bedroom apartments). These are a mix of employee and graduate student rentals. Roommate assignments are not done at this location. Pets are not permitted. Prices range from $1,400–2,400 per month. Parking is available at an additional cost. Applications may be filled out online at www.dartmouth.edu/realestate

Other Graduate Apartments The College also has some one-, two- and three-bedroom apartments in buildings near campus (37 West Wheelock Street, 1 and 3 Sanborn Street, and 25 Lebanon Street). Roommate assignments are not done at these locations. Applications may be filled out online at www.dartmouth.edu/realestate

Upper Valley Rental List The Housing Programs Office also maintains a list of private landlords on their website (www.dartmouth.edu/realestate). This is an excellent resource for graduate students.

Inquiries and applications for graduate student housing should be directed to: Housing Programs Office, 7 Lebanon Street, Suite 107, Hanover, NH 03755 (603-646-2170) e-mail: Housing.Program@Dartmouth.edu

Transportation Hanover is located on the western border of New Hampshire; it is about two hours by car from Boston and about five from New York City, all via interstate highways. Air passage is available by Eastern Airlines from Boston and New York to Lebanon Regional Airport, about five miles away. Vermont Transit provides bus service from Boston, New York, Montreal, and other points directly to Hanover. The Amtrak rail route connecting Washington, New York, and St. Albans, Vermont (with shuttle to Montreal) stops at White River Junction, Vermont, about five miles away.

GRADUATE STUDENT SERVICES

Graduate Career Office

The Graduate Career Office (GCO) provides Dartmouth graduate students and alumni important resources and information for conducting a successful job search. The Graduate Career counselor is available for individual appointments to discuss career options and job search strategies. In addition, the GCO offers a range of programs and workshops throughout the year, including resume writing, curriculum vitae writing, job searching, and interviewing.

Health Service

The Dartmouth College Health Service provides comprehensive ambulatory and emergency services year-round. The Health Service is located in Dick Hall’s House, better known as Dick’s House, on Rope Ferry Road, an extension of North Main Street. Clinic hours are 8:30 a.m. to 11:30 a.m. and 1 to 4:30 p.m. Monday through Friday. On Saturday clinic hours are 1 to 8 p.m. only. Urgent problems are treated at any time.

Each full-time student paying full tuition is entitled to the Health Care Service through Dick’s House from the day before registration for a term until the registration day for the following term. Those students who register for the fall term become entitled to Health Care Service on September 1. Eligibility ceases when enrollment in Dartmouth College is terminated by withdrawal, suspension, or separation.

Health Insurance

All students must either enroll in the Dartmouth Student Group Health Insurance Plan (DSGHP) or certify, through a yearly waiver application, that they are already covered by their own comparable insurance. For stipend-supported students, the fee is paid for by the student’s program. The 2009–10 annual fees are outlined in the table below.

Dartmouth Student Group Health Insurance Plan

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<th>2009–10</th>
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<tr>
<td>Student</td>
<td>$1,786</td>
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<tr>
<td>One dependent</td>
<td>$2,973*</td>
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<td>Two or more</td>
<td>$4,171*</td>
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| * Fee for dependents is in addition to the fee for student coverage.

ADMISSIONS AND FINANCIAL INFORMATION

Application Procedure

Men and women who wish to be admitted as graduate students should write directly to the department in which they plan to study for information. Applicants may apply online at https://app.applyyourself.com/id/dart.grad. A completed application should include 1) a transcript of the college record; 2) three letters of recommendation; 3) Graduate Record Verbal and Mathematical Aptitude Test scores, and such Advanced Test scores as may be requested by individual departments; and 4) the standard Dartmouth application form for graduate study. All of these materials should be sent directly to the department involved.

Foreign students must also supply evidence that they have a reading and speaking knowledge of English. The Educational Testing Service examination, “Test of English as a Foreign Language” (TOEFL) or the “International English Language Testing System” examination (IELTS) should be taken when possible and the scores sent to the department to which the student is applying.

Once a student is accepted, continuing registration from term to term is contingent upon satisfactory performance. If at any time it appears that a graduate student, because of low grades or for other reasons, is not making satisfactory progress toward meeting the degree requirements, that student may be refused further registration.

Scholarships and Fellowships

Most graduate students receive financial assistance through a program of Dartmouth fellowships and loans. These are supported through Dartmouth, federal and private funds. In 2009–10 most fellows receive a carry-stipend of $1,986 to $2,167 per month, plus a scholarship covering full tuition ($38,445 for the 2009–10 academic year). Insofar as is consistent with the terms of individual awards, each student’s program of coursework, teaching and research is designed to promote most effectively his or her academic progress without reference to the source of financial support. Students are also urged to apply for fellowships that are offered by various agencies, such as the NSF and EPA Graduate Fellowships.

Refund Policy

The Dartmouth College policy on refund of payments by students who withdraw voluntarily or are dismissed during any terms is as follows:

- Tuition: Before beginning of term classes, full refund; during first two weeks of term, 80%; during third week, 60%; during fourth week, 40%; during fifth week, 20%; after fifth week, no refund.
- Scholarships: Accounts credited in the same proportion as tuition is charged; i.e., if before classes begin, no credit; during first two weeks, 20%; during third week, 40%; during fourth week, 60%; during fifth week, 80%; after fifth week, 100%.
- Board: Pro rata basis.
- Dormitory rooms: Before beginning of classes, full refund; during first three weeks, 50%; after third week, no refund.
- Scholarships: Accounts credited in the same proportion as tuition is charged; i.e., if before classes begin, no credit; during first two weeks, 20%; during third week, 40%; during fourth week, 60%; during fifth week, 80%; after fifth week, 100%.
- Board: Pro rata basis.

Requests for refunds should be submitted in writing to the Controller of Dartmouth College, and any balance due will be paid within forty days.

Loans

The College makes available small emergency loans to graduate students on a short-term, on-interest basis. Long-term loans, such as Perkins and Stafford, are also available.
**ACADEMIC REQUIREMENTS**

**Candidacy for Advanced Degrees**

Admission as a regular graduate student presumes candidacy for the master’s degree, if that degree is offered by the department. To become a candidate for the Ph.D. degree, a student must 1) satisfy the coursework and language requirements, if any; 2) pass all required qualifying examinations, if any; 3) prepare a statement on the nature and scope of the research problem he or she intends to pursue; and 4) receive the endorsement of her or his department. Normally all of this should be accomplished by the end of a student’s second year in residence.

**Residence Requirements**

Candidates for a master’s degree must spend at least three terms (one academic year) in residence at Dartmouth, for Ph.D. candidates the requirement is six terms (two academic years). However, to prevent unduly prolonged residence, it is expected that the requirements for the Ph.D. degree will be completed no later than seven years after initial enrollment, unless the student enters with a master’s degree in his or her field of proposed study, in which case the doctorate must be completed in five years. Failure to complete the work in the time periods specified or failure to meet the academic standards of the graduate program shall necessitate reevaluation of a student’s progress and may result in a notice of termination.

**Course Requirements**

Master’s degree candidates must receive credit for at least eight graduate courses as a prerequisite to the degree. These courses may be replaced in part by research coursework and language requirements, if any; however the research coursework, if any; must be completed no later than the end of a student’s second year in residence. Additional requirements may be imposed by the individual departments. Course requirements for the Ph.D. are established by the individual departments.

**Transfer of Credit**

Upon recommendation of the department accepting the student for graduate work, credit for graduate courses (not research) taken at other institutions may be granted by the dean of Graduate Studies. Not more than three of the course requirements for the master’s degree nor more than six for the Ph.D. degree may be fulfilled in this way.

**Language Requirement**

There is no institutional language requirement for the master’s degree. Candidates for the Ph.D. must meet the language requirement as established by their departments, usually prior to enrollment in the third year of graduate study.

**Thesis**

The nature of the master’s thesis requirement varies among the disciplines, though in general emphasis is placed on the preparation and beginning of scholarly research, rather than on the accomplishment of an extensive research project. In certain departments, the master’s thesis is not required. Upon the recommendation of the department and the dean of Graduate Studies, the thesis may be waived or modified.

The Ph.D. is awarded for independent scholarly accomplishment of a high order. It is presumed that all or part of the dissertation will be suitable for publication in scholarly journals. The dissertation itself is made available to interested readers through microfilm copies from University Microfilms, Ann Arbor, Michigan, and through an abstract published in the periodical Dissertation Abstracts.

**Thesis Defense Committee**

The makeup of the thesis defense committee must be approved by the dean of Graduate Studies. It is the responsibility of the department to submit to this office for approval, a suggested examining committee for each degree candidate, along with information regarding the date, time, and place of the examination. The chair of the examining committee must be a regular member of the Dartmouth faculty in the student’s department.

The Ph.D. examination committee consists of a minimum of three faculty members from the student’s department/program of study (including the dissertation advisor) and one from outside the department/program. The A.M., M.S., or M.A.L.S. examination committee generally consists of three faculty members from the student’s department/program of study (including the dissertation advisor). One of the three may be from outside the department/program, but this is not a requirement.

Copies of the regulations regarding the preparation of the manuscript are available in this office and will be sent immediately upon request.

**The Ph.D. Oral Examination**

When the Ph.D. thesis has been completed, it is read by members of a committee appointed by the dean of Graduate Studies in consultation with the department. This committee also conducts an oral examination of the candidate, in which he or she must both defend the dissertation and demonstrate in the widest sense that she or he is prepared for a scholarly career in the field. Part of the oral examination is frequently conducted as a public lecture or colloquium.

**Additional Departmental Requirements**

Within the context of these institutional degree requirements, each department has established its own sequence for degree candidacy and its own schedule of written examinations and other special requirements. These requirements are outlined in the individual program statements that follow. For more complete information, however, the prospective student is advised to contact the department directly.
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