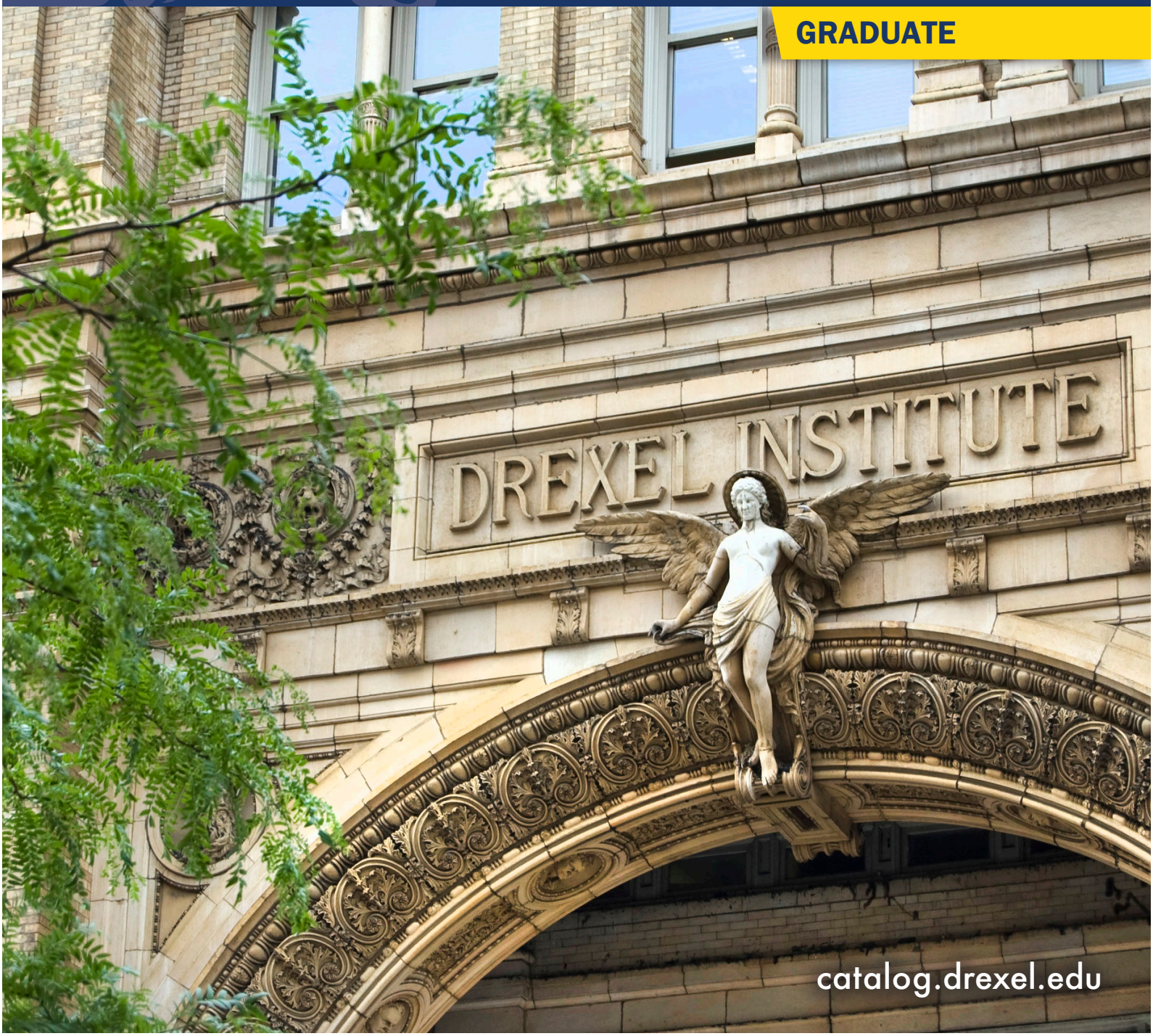
DREXEL UNIVERSITY
College of
Arts and Sciences

CATALOG
2024-2025

GRADUATE



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The College of Arts and Sciences

About the College

Here at Drexel's College of Arts and Sciences (https://drexel.edu/coas/), we aim to identify and address the unique challenges of our world through research, teaching, and community outreach. Our experiential, civically engaged, and practical approach to higher education is displayed in how we design graduate education (https://drexel.edu/coas/academics/graduate-programs/) for this ever-changing and evolving world. Innovation requires more than ambition – it requires versatility, dedication, creativity, and compassion. We measure success by lives impacted. Whether you want to gain a new certification or fresh skillset, increase your earning potential, or cultivate your career, there are plenty of reasons to apply to graduate school (https://drexel.edu/admissions/grad/) at Drexel University's College of Arts and Sciences (https://drexel.edu/coas/). Here, you can pursue an advanced degree and work together with our world-class faculty (https://drexel.edu/coas/faculty-research/overview/) on society-shifting research and scholarship, all the while preparing you for in-demand career opportunities.

Majors

Minors

Certificates

English Language Center

As part of the College of Arts and Sciences, Drexel's English Language Center (https://drexel.edu/elc/) offers the accredited Intensive English Program and International Gateway Program throughout the year. In addition to classes in academic skills such as essay writing and oral presentations, the Center offers Language of STEM (Science, Technology, Engineering, and Math), Language of Media and Design, Global Business English (GLOBE), English for Academic Purposes, ESL/EFL Teaching Enhancement, and other subjects.

Graduate Preparation and Resources

International students provisionally admitted to graduate programs participate in the Graduate Preparation (https://drexel.edu/elc/elc_programs/drexel-graduate-prep/) program at the English Language Center in a half-term program designed to prepare them for the academic work and culture of an American university.

All international students have access to free language tutoring and other academic skills workshops throughout the academic year.

Biological Sciences MS

Major: Biological Sciences
Degree Awarded: Master of Science (MS)
Calendar Type: Quarter
Minimum Required Credits: 45.0
Co-op Option: Available for full-time, on-campus master's-level students
Classification of Instructional Programs (CIP) code: 26.0101
Standard Occupational Classification (SOC) code: 19-1029

About the Program

The Department of Biology (http://drexel.edu/coas/academics/departments-centers/biology/) offers graduate programs in biological sciences leading to the thesis or non-thesis Master of Science degree. The curricula and research programs are designed to help students achieve success in their degree programs and pursue positions of leadership in their respective fields of research.

The intellectual life of the department relies heavily on the participation, creativity, and the energy of graduate students; therefore the department expects students to be vigorously involved in courses, seminars, journal clubs, research, informal discussions, and departmental functions.

Additional Information

For more information, contact the Department of Biology (https://drexel.edu/coas/academics/departments-centers/biology/) at 215-895-2624.

Degree Requirements (MS)

Soon after matriculation, the student completes a plan of study with the advisor outlining their specific program. Both thesis and non-thesis options are available. Conducting formal research necessary for the thesis is dependent upon the student finding a faculty member whom will serve as their faculty advisor and supervise a mutually agreed upon research project.

Students registering for an MS with graduate co-op will gain 6 months of work experience in the summer/fall term (year 1/year 2). The Steinbright Career Development Center (http://drexel.edu/scdc/) will provide students with an overview of professionalism, resume writing, and the job search process. Students will not earn academic credit for the co-op but will earn 9.0 non-academic co-op units per term.

Students wishing to pursue PhD candidacy are encouraged to elect the MS with thesis. After all other requirements are completed, the research MS student defends the thesis at a final oral examination.

Program Requirements

Requirements for the MS Curriculum with Thesis		
BIO 500	Biochemistry I	3.0
BIO 632	Advanced Cell Biology	3.0
BIO 635	Advanced Genetics and Molecular Biology	3.0
BIO 997	Research in Bioscience	12.0
ENVS 506	Biostatistics	3.0
Bioscience electives		21.0
RCRG 600	An Introduction to the Responsible Conduct of Research	0.0
Total Credits		**45.0**

Requirements for the Non-Thesis MS with Graduate Co-op		
BIO 500	Biochemistry I	3.0
BIO 632	Advanced Cell Biology	3.0
BIO 635	Advanced Genetics and Molecular Biology	3.0
COOP 500	Career Management and Professional Development for Master's Degree Students	1.0
ENVS 506	Biostatistics	3.0
Bioscience electives*		32.0
Total Credits		**45.0**

Requirements for the Non-thesis MS Curriculum		
BIO 500	Biochemistry I	3.0
BIO 632	Advanced Cell Biology	3.0
BIO 635	Advanced Genetics and Molecular Biology	3.0
ENVS 506	Biostatistics	3.0
Bioscience electives *		33.0
Total Credits		**45.0**

*

Non-thesis students may elect to take up to 4.0 credits of BIO 997 Research in Bioscience.

Bioscience Electives Include:

BIO 534	Bioinformatics I	3.0
BIO 613	Genomics	3.0
BIO 614	Behavioral Genetics	3.0
BIO 616	Biochemistry of Major Diseases	3.0
BIO 630	Cell Biology of Disease	3.0
BIO 644	Human Genetics	3.0
BIO 646	Stem Cell Research	3.0
BIO 650	Virology	3.0
BIO 661	Neurobiology of Autism Disorders	3.0
BIO 662	Biology of Neuron Function	3.0
BIO 663	Molecular Mechanisms of Neurodegeneration	3.0
BIO 664	Neurobiology of Disease	3.0
BIO 701	Bioscience Grant Writing	3.0
BIO 740	Readings and Critical Thinking in Biology	3.0

Sample Plan of Study (MS)

Thesis - MS Sample Plan of Study

First Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
BIO 500	3.0	BIO 635	3.0	BIO 632	3.0	VACATION	
Bioscience electives	6.0	BIO 997 (OR Bioscience Electives)	6.0	ENVS 506	3.0		
		RCRG 600	0.0	Bioscience elective or Research	3.0		
	9		**9**		**9**		**0**

Second Year

Fall	Credits	Winter	Credits
BIO 997	3.0	BIO 997	3.0
Bioscience electives	6.0	Bioscience electives	6.0
	9		**9**

Total Credits 45

Non-Thesis with Graduate Co-op - MS Sample Plan of Study

First Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
BIO 500	3.0	BIO 635	3.0	BIO 632	3.0	Bioscience electives	6.0
COOP 500	1.0	Bioscience electives	6.0	ENVS 506	3.0		
Bioscience electives	6.0			Bioscience elective	3.0		
	10		**9**		**9**		**6**

Second Year

Fall	Credits	Winter	Credits	Spring	Credits
COOP EXPERIENCE		COOP EXPERIENCE		Bioscience electives	8.0
	0		**0**		**8**

Total Credits 42

Non-Thesis - MS Sample Plan of Study

First Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
BIO 500	3.0	BIO 635	3.0	BIO 632	3.0	VACATION	
Bioscience electives	6.0	Bioscience electives	6.0	ENVS 506	3.0		
				Bioscience elective	3.0		
	9		**9**		**9**		**0**

Second Year			
Fall	**Credits**	**Winter**	**Credits**
Bioscience electives	9.0	Bioscience electives	9.0
	9		**9**

Total Credits 45

Program Level Outcomes

- Develop a strong foundation in the fields of biochemistry, cell biology, genetics and molecular biology.
- Develop critical thinking and reading skills in data-based research.
- Effectively communicate research results in written and oral formats.
- Identify individual skills, values and interests for developing and pursuing career goals.
- Propose and complete a research-based thesis project (MS-Thesis only).
- Write, present, and defend the results of a research thesis project (MS-Thesis only).

Biological Sciences Faculty

Ali Afify, PhD *(University of Konstanz)*. Assistant Professor. Insect olfaction; Sensory Neurobiology; Mosquito oviposition; Malaria.

Laura Duwel, PhD *(University of Cincinnati) Assistant Department Head, Department of Biology*. Teaching Professor. Immunology and microbiology.

Felice Elefant, PhD *(Temple University)*. Professor. Understanding the roles of two classes of chromatin regulatory proteins termed histone acetyltransferases(HATs)and histone de-methylases.

Denise Garcia, PhD *(UCLA)*. Associate Professor. Neuroscience, the role of astrocytes in the central nervous system.

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Robert Loudon, PhD *(Thomas Jefferson University)*. Associate Teaching Professor. Rho GTPases, regulation of actin cytoskeleton, Regulation of G protein-coupled receptors by receptor kinases and arrestins.

Alison Moyer, PhD *(North Carolina State University)*. Assistant Teaching Professor. Testing soft tissue preservation in the fossil record, Phage biology as part of the undergraduate research course SEA-PHAGES, STEM Education.

Michael O'Connor, MD, PhD *(MD, Johns Hopkins University; PhD, Colorado State)*. Professor. Biophysical and physiological ecology, thermoregulation of vertebrates, ecological modeling.

Sean O'Donnell, PhD *(University of Wisconsin-Madison)*. Professor. Climate ecology, focusing on geographic variation and species differences in thermal physiology; Behavior and ecology of army ant/bird interactions; Neurobiology, focusing on brain plasticity and brain evolution in social insects.

Ryan Petrie, PhD *(McGill University) Director, Biology Graduate Program* . Associate Professor. Cell Biology. Mechanisms of cell movement through three-dimensional extracellular matrix.

Megan V Phifer-Rixey, PhD *(University of Pennsylvania)*. Assistant Professor. Evolution; Genetics; Adaptation; Integrative Biology; Urban; Climate.

Jerome Ricard, PhD *(University Joseph Fourier, Grenoble, France)*. Assistant Teaching Professor. Inflammation and cell death after spinal cord injury. Regulation of cell death by Eph receptors.

Jacob Russell, PhD *(University of Arizona)*. Professor. Microbiomes and metagenomics; ecology and evolution of symbiosis.

Nianli Sang, MB, PhD *(M.B., Fudan University Shanghai Medical College; Ph.D., Thomas Jefferson University) Co-Director of the Cell Imaging Center*. Associate Professor. Molecular and cellular biology of cancer; posttranslational modification, folding and quality control of proteins and their implication in cell physiology and human diseases.

Usha Sanka, PhD *(Weill-Cornell University Graduate School of Medical Sciences)*. Associate Teaching Professor. Human Physiology, Climate change and human physiology, human physiology education, air quality and human health, climate change education.

Aleister Saunders, PhD *(University of North Carolina, Chapel Hill) Executive Vice Provost for Research and Innovation, Director of the RNAi Resource Center*. Professor. Identification and characterization of genes and proteins involved in Alzheimer's disease.

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Kevin P.W. Smith, PhD *(Drexel University)*. Associate Teaching Professor. Linking behavioral ecology and organismal diversity, neonate behavior in herpetological models, STEM education.

Jennifer Stanford, PhD *(Harvard University)*. Associate Professor. Evaluating and improving approaches to teach STEM content in higher education environments to promote student learning, engagement in STEM courses, and STEM student retention.

Monica M. Togna, PhD *(New Jersey Institute of Technology)*. Teaching Professor. Examination of the structure and function of living organisms from the cellular to the organismal level in order to better understand common physiological processes.

Emeritus Faculty

Joseph Bentz, PhD *(State University of New York [SUNY] at Buffalo)*. Professor Emeritus. Biophysics, biochemistry and biopharmaceutics, focused on the molecular basis of biological membrane transport and fusion.

Cecilie Goodrich, PhD *(Harvard University)*. Professor Emeritus. Neuroscience and systems physiology, postnatal maturation of physiology and behavior in relation to brain immunocytochemistry.

Donna Murasko, PhD *(Penn State Hershey Medical Center) Dean Emeritus*. Professor. The effects of aging on the adaptive immune response to influenza virus and retrovirus latency and reactivation.

Biological Sciences PhD

Major: Biological Sciences
Degree Awarded: Doctor of Philosophy (PhD)
Calendar Type: Quarter
Minimum Required Credits: 90.0 (post-bachelor's) or 45.0 (post-master's)
Co-op Option: None
Classification of Instructional Programs (CIP) code: 26.0101
Standard Occupational Classification (SOC) code: 19-1029

About the Program

The Department of Biology (http://drexel.edu/coas/academics/departments-centers/biology/) offers a graduate program in biological sciences leading to the Doctor of Philosophy degree. The curricula and research programs are designed to help students achieve success in their degree programs and pursue positions of leadership in their respective fields of research.

The intellectual life of the department relies heavily on the participation, creativity, and the energy of graduate students; therefore the department expects students to be vigorously involved in courses, seminars, journal clubs, research, informal discussions, and departmental functions.

Additional Information

For more information, contact the Department of Biology (https://drexel.edu/coas/academics/departments-centers/biology/) at 215-895-2624.

Degree Requirements

The Doctor of Philosophy in Biological Sciences is conferred in recognition of breadth of scholarship and scientific attainment plus demonstrated ability to complete original research.

The following general requirements must be satisfied in order to complete the PhD program in Biological Sciences:

- 90.0 (post-bac) or 45.0 (post-MS) credit hours total
- Establishing a plan of study
- 7 core courses
- Additional courses dependent on advisor or committee recommendations
- Candidacy exam/approval of dissertation proposal
- Dissertation/thesis
- Defense of dissertation/thesis
- A graduate research seminar presentation once a year for students in their third year and beyond.

Thesis Advisor/Plan of Study

For students admitted without an identified thesis advisor, the thesis advisor must be selected by the end of spring term in the first year. All students are asked to submit a plan of study by the end of the first year winter quarter. It is anticipated that the graduate coursework will be completed during the first two years or less. Students should check with the department for a list of available electives.

Program Requirements

Cell Molecular Genetics Track		
Core Requirement Courses		
BIO 701	Bioscience Grant Writing	3.0
BIO 740	Readings and Critical Thinking in Biology	3.0
RCRG 600	An Introduction to the Responsible Conduct of Research	0.0
Distribution Required Courses: Must take all 3		
BIO 500	Biochemistry I	3.0
BIO 632	Advanced Cell Biology	3.0
BIO 635	Advanced Genetics and Molecular Biology	3.0
Statistics Requirement Course		
ENVS 506	Biostatistics *	3.0
Required Elective Courses: Must take 1 **		**3.0**
Research and Research Seminars ***		**69.0**
BIO 864	Graduate Research Seminar	
BIO 997	Research in Bioscience	
Total Credits		**90.0**

*****

Or approved substitute course.

******

Any BIO 500+ course or approved graduate level course not otherwise taken as part of degree requirements

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BIO 864 and BIO 997 are taken multiple times to reach 90.0 credits.

Ecology Evolution Track		
Core Requirement Courses		
BIO 701	Bioscience Grant Writing	3.0
BIO 740	Readings and Critical Thinking in Biology	3.0
RCRG 600	An Introduction to the Responsible Conduct of Research	0.0
Distribution Required Courses: Must take 2		**6.0-7.0**
BIO 636	Population Genetics *	
ENVS 526	Molecular Ecology *	
ENVS 528	Conservation Biology	
Statistics Requirement Course		
ENVS 506	Biostatistics **	3.0
Required Elective Courses: Must take 2 ***		**6.0**
Research and Research Seminars †		**69.0**
BIO 864	Graduate Research Seminar	
BIO 997	Research in Bioscience	
Total Credits		**90.0-91.0**

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Offered every other year.

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Or approved substitute course.

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Any BIO 500+ course or approved graduate level course not otherwise taken as part of degree requirements

†

BIO 864 and BIO 997 are taken multiple times to reach 90.0 credits.

Sample Plan of Study

Cell Molecular Genetics Track

First Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
BIO 500	3.0	BIO 635	3.0	BIO 632	3.0	VACATION	
BIO 740	3.0	BIO 864	1.5	BIO 864	1.5		
BIO 864	1.5	BIO 997	4.5	BIO 997	1.5		
BIO 997	1.5	RCRG 600	0.0	ENVS 506*	3.0		
	9		**9**		**9**		**0**

Second Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
BIO 701	3.0	BIO 864	1.5	BIO 864	1.5	VACATION	
BIO 864	1.5	BIO 997	4.5	BIO 997	7.5		
BIO 997	4.5	Required Biology Elective	3.0				
	9		**9**		**9**		**0**

Third Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
BIO 864	1.5	BIO 864	1.5	BIO 864	1.5	VACATION	
BIO 997	7.5	BIO 997	7.5	BIO 997	7.5		
	9		**9**		**9**		**0**

Fourth Year

Fall	Credits
BIO 864	1.5
BIO 997	7.5
	9

Total Credits 90

*****

or approved substitution

Ecology Evolution Track

First Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
BIO 740	3.0	BIO 864	1.5	BIO 864	1.5	VACATION	
BIO 864	1.5	BIO 997	4.5	BIO 997	1.5		
BIO 997	1.5	RCRG 600	0.0	ENVS 506*	3.0		
Distribution Required Course	3.0	Distribution Required Course	3.0	Required Biology Elective	3.0		
	9		**9**		**9**		**0**

Second Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
BIO 701	3.0	BIO 864	1.5	BIO 864	1.5	VACATION	
BIO 864	1.5	BIO 997	4.5	BIO 997	7.5		
BIO 997	4.5	Required Biology Elective	3.0				
	9		**9**		**9**		**0**

Third Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
BIO 864	1.5	BIO 864	1.5	BIO 864	1.5	VACATION	
BIO 997	7.5	BIO 997	7.5	BIO 997	7.5		
	9		**9**		**9**		**0**

Fourth Year

Fall	Credits
BIO 864	1.5
BIO 997	7.5
	9

Total Credits 90

*
or approved substitution

Program Level Outcomes

- Develop a strong foundation in core areas of molecular & cellular biology (e.g., biochemistry, cell biology, genetics and molecular biology), molecular and behavioral ecology and/or conservation biology.
- Develop critical thinking and reading skills.
- Effectively communicate research results in written and oral formats.
- Formulate and write research grant proposals with effective questions, hypotheses and experimental designs.
- Develop the inductive and deductive reasoning skills to drive research projects productively and independently.
- Publish a peer-reviewed, primary research manuscript.

Biological Sciences Faculty

Ali Afify, PhD *(University of Konstanz)*. Assistant Professor. Insect olfaction; Sensory Neurobiology; Mosquito oviposition; Malaria.

Laura Duwel, PhD *(University of Cincinnati) Assistant Department Head, Department of Biology*. Teaching Professor. Immunology and microbiology.

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Emeritus Faculty

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Cecilie Goodrich, PhD *(Harvard University)*. Professor Emeritus. Neuroscience and systems physiology, postnatal maturation of physiology and behavior in relation to brain immunocytochemistry.

Donna Murasko, PhD *(Penn State Hershey Medical Center) Dean Emeritus*. Professor. The effects of aging on the adaptive immune response to influenza virus and retrovirus latency and reactivation.

Chemistry MS

Major: Chemistry
Degree Awarded: Master of Science (MS)
Calendar Type: Quarter
Minimum Required Credits: 45.0
Co-op Option: Available for full-time, on-campus master's-level students
Classification of Instructional Programs (CIP) code: 40.0501
Standard Occupational Classification (SOC) code: 19-2031

About the Program

The Department of Chemistry (http://drexel.edu/coas/academics/departments-centers/chemistry/) offers graduate programs in analytical chemistry, atmospheric chemistry, inorganic chemistry, organic chemistry, materials & polymer chemistry, physical chemistry, chemistry education, and biochemistry. The curriculum is designed to prepare students for the research and practical application of chemistry to challenges facing society. The department also encourages interdisciplinary activities. Many faculty members maintain active collaborations with colleagues in the College of Arts and Science, the School of Education, the College of Engineering, and the College of Medicine.

The chemistry faculty wants graduate students to understand the purpose of and need for fundamental research while working on problems of practical interest and application to the challenges facing society in the modern world. Areas of research include photochemical air pollution, synthesis and characterization of compounds of medicinal and industrial interest, drug discovery, and biologically-relevant macromolecules.

The Department of Chemistry strives to maintain a community of research scholars (faculty, postdoctoral fellows, and graduate and undergraduate students) that is large enough to provide a variety of experiences within chemistry, yet small enough to give each student individual attention. Both full- and part-time study are available.

Additional Information

For more information, contact:

Ezra Wood, PhD
Graduate Program Committee Chair
215.895.1681
Email: ew456@drexel.edu

Admission Requirements

Requirements for Admission

For admission to graduate study, the department requires a BS in chemistry or the equivalent. This requirement applies to full-time and part-time students working toward either the MS or PhD. Generally, in order to be considered for admission, a successful applicant should have taken two semester courses of organic, analytical and physical chemistry with corresponding laboratory courses. In addition, they should have taken an upper-level inorganic chemistry course. All entering MS and PhD students are required to take a series of two-hour exams in analytical, inorganic, organic, and

physical chemistry to help assess their preparation for graduate work in chemistry. The scores obtained on these exams are used as a basis for course selection.

Forms, details about requirements, and information about application deadlines are all available on the Chemistry (http://www.drexel.edu/grad/programs/coas/chemistry/) page of Drexel's Graduate Admissions website.

Degree Requirements

The MS degree is awarded after satisfactory completion of a minimum of 45.0 credit hours in chemistry and related fields, at least 30.0 credits of which must be taken at Drexel. Both thesis and non-thesis options are available.

Course Requirements

The course requirements for both thesis and non-thesis options are one complete sequence in the major area of interest; one of the sequence courses from each of analytical, organic, polymer, and inorganic chemistry; and two courses in physical chemistry. The remaining credits may be chosen from graduate courses within the department or from other departments offering courses related to the student's major areas.

Program Requirements

Major Sequence		**9.0**
Select one of the following sequences:		
Inorganic Chemistry		
CHEM 521	Inorganic Chemistry I	
CHEM 522	Inorganic Chemistry II	
CHEM 523	Inorganic Chemistry III	
Analytical Chemistry		
CHEM 530	Analytical Chemistry I	
CHEM 531	Analytical Chemistry II	
CHEM 755	Mass Spectrometry	
Organic Chemistry		
CHEM 541	Organic Chemistry I	
CHEM 542	Organic Chemistry II	
CHEM 543	Organic Chemistry III	
Physical Chemistry *		
CHEM 555	Quantum Chemistry Of Molecules I	
CHEM 557	Physical Chemistry I	
CHEM 558	Physical Chemistry II	
Polymer Chemistry		
CHEM 561	Polymer Chemistry I	
CHEM 562	Polymer Chemistry II	
CHEM 563	Polymer Chemistry III	
Additional Sequence Courses		12.0
CHEM 767	Chemical Information Retrieval	3.0
CHEM 865	Chemistry Research Seminar	3.0
Electives **		18.0
Total Credits		**45.0**

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Each of these courses can be replaced by CHEM 554 or CHEM 752.

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The remaining 18.0 credits may be satisfied by any graduate Chemistry courses. In some cases, course substitutions may be made with courses from other departments. Elective courses taken outside the department must receive prior departmental approval in order to be counted toward the degree. Graduate cooperative education placement is available for this major. Register for COOP 500 for 1.0 credit. The credit will count toward student's elective credits.

Thesis Option

Up to 9.0 credits of CHEM 997 *Graduate Research* may be counted towards a master's thesis. No later than the spring term of the first year of coursework, a student should choose a research advisor with whom to work in carrying out an original investigation in chemistry. The results will be written up in thesis form and submitted to an MS thesis committee consisting of the research advisor and two other departmental faculty appointed by the advisor. The acceptance by this committee of the MS thesis completes the thesis option requirements for the MS degree. Students in the MS program receiving financial aid from the department are generally required to elect the thesis option if they do not pursue the PhD program at Drexel.

Sample Plan of Study

Without Co-op

First Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
CHEM 521, 530, 541, 557, or 561*	3.0	CHEM 522, 522, 531, 542, 558, or 562*	3.0	CHEM 523, 755, 543, 555, or 563*	3.0	VACATION	
CHEM 865	3.0	Two Graduate CHEM Courses**	6.0	Two Graduate CHEM Courses**	6.0		
Graduate CHEM Course**	3.0						
	9		**9**		**9**		**0**

Second Year

Fall	Credits	Winter	Credits	Spring	Credits
CHEM 767	3.0	Two Graduate CHEM Courses**	6.0	Two Graduate CHEM Courses**	6.0
Graduate CHEM Course**	3.0				
	6		**6**		**6**

Total Credits 45

*****

In the Fall quarter, complete one course in one of the major areas: Analytical, Inorganic, Organic, Physical, or Polymer Chemistry.
In the Winter and Spring quarters, complete two other sequence courses in the major area. For the Physical Chemistry major area, CHEM 554 OR CHEM 752 can replace CHEM 557, CHEM 558 or CHEM 555.

******

SUGGESTED OPTIONS: major area electives and non-major area sequence electives not previously taken, CHEM 997 (*Research*, up to 9.0 credits). At least one sequence course from each of the major areas, a total of 12.0 credits, should be completed as part of the required CHEM electives.

With Co-op

First Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
CHEM 521, 530, 541, 557, or 561*	3.0	CHEM 522, 531, 542, 558, or 562*	3.0	CHEM 523, 755, 543, 555, or 563*	3.0	GRADUATE COOP EXPERIENCE	
CHEM 767	3.0	CHEM 865	3.0	Two Graduate CHEM Courses**	6.0		
COOP 500	1.0	Graduate CHEM Course**	3.0				
Graduate CHEM Course**	3.0						
	10		**9**		**9**		**0**

Second Year

Fall	Credits	Winter	Credits	Spring	Credits
GRADUATE COOP EXPERIENCE		Three Graduate CHEM Courses**	8.0	Three Graduate CHEM Courses**	9.0
	0		**8**		**9**

Total Credits 45

*****

In the Fall quarter, complete one course in one of the major areas: Analytical, Inorganic, Organic, Physical, or Polymer Chemistry.
In the Winter and Spring quarters, complete two other sequence courses in the major area. For the Physical Chemistry major area, CHEM 554 OR CHEM 752 can replace CHEM 557, CHEM 558 or CHEM 555.

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SUGGESTED OPTIONS: major area electives and non-major area sequence electives not previously taken, CHEM 997 (*Research*, up to 9.0 credits). At least one sequence course from each of the major areas, a total of 12.0 credits, should be completed as part of the required CHEM electives.

Facilities

There are seven undergraduate teaching laboratories in the department: three freshman Chemistry Laboratories, two advanced Organic Chemistry Laboratories, a Physical Chemistry Laboratory, an Analytical Instrumentation Laboratory, and a combined Analytical/Inorganic Chemistry Laboratory.

Mass Spectrometry Laboratory

The Chemistry Department maintains a professionally staffed mass spectrometry facility available to all members of the University community. Current operating instrumentation is listed below.

- Bruker Autoflex III matrix-assisted laser desorption ionization time-of-flight mass spectrometer (MALDI TOFMS NSF CRIF-MU #0840273)
- Thermo-Electron LTQ-FT 7T Fourier transform ion cyclotron resonance (FT-ICR) spectrometer with both atmospheric pressure chemical ionization (APCI) and electrospray ionization (ESI) sources interfaced with a Thermo-Finnigan Surveyor high-performance liquid chromatography (HPLC) system
- Micromass AutoSpec M high-resolution magnetic sector MS with fast atom bombardment, desorption chemical ionization and electron impact capability
- Sciex API3000 triple quadrupole mass spectrometer also equipped with both ESI and APCI sources interfaced to a Perkin-Elmer series 200 HPLC system
- Varian Saturn 2000 gas chromatograph/ion-trap mass spectrometer system with both electron impact and chemical ionization capability

Nuclear Magnetic Resonance Facility (NMR)

- 500MHz Varian Unity Inova NMR with multi-nuclear capability, a cryogenically cooled triple resonance model (1H {13C/15N}) probe suitable for protein analysis.
- 400 MHz Varian Mercury (2 RF channels) with double resonance auto-switchable broadband probe (1H/19F/13C/31P, 1H/19F{15N-31P})
- 90MHz Anasazi Eft-90 MHz NMR
- Varian E-12 X-band CW Electron Paramagnetic Resonance spectrometer (with 77 K cryogenic capability)

Analytical Instrumentation Laboratory

Mass Spectrometry

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- Micromass AutoSpec M high-resolution magnetic sector Mass Spectrometer with fast atom bombardment, desorption chemical ionization and electron impact capability
- Varian Saturn 2000 gas chromatograph/ion-trap mass spectrometer system with both electron impact and chemical ionization capability
- Shimadzu 2030 Gas Chromatography Mass Spectrometry (GC/MS) capable of Liquid, Headspace, and Solid Phase Micro Extraction (SPME)
- Shimadzu 8050 triple quadrupole mass spectrometer (MS) with atmospheric pressure chemical ionization (APCI), electrospray ionization (ESI), and Dual Ionization (DUIS) sources interfaced to a Shimadzu Prominence high-performance liquid chromatography (HPLC) system with additional Diode Array Detector (DAD).
- Shimadzu 8020 Benchtop Linear matrix-assisted laser desorption ionization time-of-flight mass spectrometer (MALDI-TOF)
- PerkinElmer Clarus 500 Gas Chromatography Mass Spectrometer (GC/MS)

Chromatography (Liquid and Gas)

- Shimadzu 2030 Gas Chromatography with both Flame Ionization (FID) and Barrier Discharge Ionization (BID) detectors
- PerkinElmer Clarus 500 GC with both Flame Ionization (FID) and thermal conductivity (TCD) detectors
- Shimadzu iSeries high-performance liquid chromatography (HPLC) system with diode array (DAD) and refractive index (RI) detectors
- Shimadzu Nexera ultra high-performance liquid chromatography system (UHPLC) with diode array (DAD), and evaporative light scattering (ELSD) detectors. This system is additionally interfaced to a Shimadzu Fraction Collector.
- SciEX PAC/E MDQ Plus Capillary Electrophoresis with single wavelength UV/Vis, and Diode Array detectors (DAD)

Absorbance Spectroscopy

- Thermo NanoDrop One UV/Vis Spectrometer
- Shimadzu UV1900 UV/Vis Spectrometer with temp. control
- Shimadzu UV2600 UV/Vis Spectrometer with temp. control
- Shimadzu UV3600Plus NIR/UV/Vis Spectrometer with temp. control and can additionally be interfaced with a 150mm integrating sphere
- Jasco J-1500 Spectropolarimeter (Circular Dichroism) with Temp. control
- Shimadzu AA-2000 atomic absorption spectrometer capable of Flame, Graphite Furnace, or Hydride Vapor Generator

Infra-Red Spectroscopy

- Shimadzu Tracer-100 FTIR spectrometer can be interfaced with Transmission, ATR, HATR, or Diffuse/Specular Reflectance accessories
- Shimadzu Tracer-100 interfaced with the AIM-9000 IR Microscope capable of measurements in the Near, Mid and Far IR region of the spectrum
- PerkinElmer Spectrum One FTIR can be interfaced with ATR, Transmission, or Diffuse/Specular Reflectance accessories
- PerkinElmer Spectrum 2 FTIR can be interfaced with ATR, Transmission accessories

Fluorescence Spectroscopy

- Shimadzu RF-6000 Fluorescence Spectrometer can be interfaced with sample temp. controller
- ISS Chronos DFD Digital Frequency and Time Domain Spectrometer capable of SteadyState and picosecond Lifetime measurements, can also be interfaced with sample temp. controller
- PerkinElmer LS-55 Luminescence Spectrometer
- Kin-Tek SF-2004 Stopped Flow Fluorescence Spectrometer, also interfaced with diode array absorbance detector
- Promega Qubit 4 Fluorimeter (470nm and 635nm LED excitation sources – for biological and protein applications)

Raman Spectroscopy

- Renishaw RM-2000 Vis Raman Spectrometer
- Renishaw RM-2000 UV Raman Spectrometer (Currently NOT operational)

Microscopy

- Veeco diNanoScope 3D Multimode Atomic Force Microscope
- Leica Inverted Fluorescence Microscope
- Zeiss Epi-Fluorescence Microscope
- Camaag TLC Plate Imager

Physical Measurements

- Shimadzu SALD 7500Nano Particle Size Analyzer equipped with a wet measurement, small volume and high concentration accessories
- Shimadzu TGA-50 Thermogravimetric analysis
- Brookfield DV-II+ Viscometer and Rheometer can be equipped with spindle, or cone/plate attachments
- Horiba LB-550 Dynamic Light Scattering

Electrochemistry

- BASi Epsilon Eclipse (Potentiostat | Galvanostat | Biopotentiostat) with Rotating Disk Electrode and C-3 cell stand accessories
- BASi PalmSens4 portable (Potentiostat | Galvanostat | Impedance Analyzer)

Synthesis

- CEM MARS6 Microwave Digestion System
- UCT Positive Pressure Manifold for Solid Phase Extraction (SPE)
- BioTage TurboVap LP Evaporator

Electronics Tools

- National Instruments ELVIS III with Complete Labview system
- Quanser Analog Electronics Lab interface Board for the ELVIS system
- Keysight InfiniiVision X-series Oscilloscope 4 channel 100MHz, with 20MHz arbitrary waveform generator, and 3-digit multimeter

Atomic Force Microscopy

The department has a Veeco multimode Atomic force microscopy (AFM) for research and education. AFM, also called scanning force microscopy (SFM), is one of the foremost tools for imaging, measuring, and manipulating matter at the nanoscale. It is when a fine tip is scanned across a surface the tip-surface force is measured to provide topographic, frictional, and adhesion information of a surface. With the ability to perform non-invasive, high-resolution surface imaging and force measurement, AFM has become an essential characterization tool in multiple disciplines in life science, biomedical engineering, nanoengineering, chemistry, materials science, and other related fields.

Other Departmental Facilities

The department has a VEECO INNOVA N3 Multimode scanning probe microscope and also maintains a computational chemistry laboratory equipped with nine Dell Optiplex 620 computers running Hyperchem v 8.0. Research laboratories for each of the department faculty members are located in

Disque and Stratton Halls as well as in the Bossone Research Center. Instrumentation available in the research laboratories is described on individual faculty web pages. Additional full-time support includes two instrument specialists (for NMR, the Analytical Instrumentation Laboratory and the Mass Spectrometry facility).

Program Level Outcomes

Non-Thesis Option

- Develop deeper knowledge in at least two areas of modern chemistry
- Add some knowledge in fields other than chemistry, which are related to the student's area of specialization
- Broaden the student's knowledge of experimental techniques and theoretical concepts
- Acquaint the student with research literature in their field of study

Thesis Option

- Develop deeper knowledge in at least two areas of modern chemistry
- Add some knowledge in fields other than chemistry, which are related to the student's area of specialization
- Broaden the student's knowledge of experimental techniques and theoretical concepts
- Acquaint the student with research literature in his/her field of study
- Conduct independent research under limited supervision within a research group
- Acquire a broader understanding of research strategies, scientific thinking and data analysis

Chemistry Faculty

Young-Hoon Ahn, PhD *(New York University)*. Associate Professor. Research in chemical biology and biochemistry focused on redox signaling, cysteine proteomics, and glutathione biology associated with cancers and cardiovascular diseases.

Reza Farasat, PhD *(University of Alabama)*. Assistant Teaching Professor. Modification of polymers for diverse applications; utilizing Thermoanalysis techniques to study polymeric and non-polymeric materials; nanotechnology; applying Multi-detector Size Exclusion Chromatography for characterization of polymers; creating composites to improve materials' properties.

Fraser Fleming, PhD *(University of British Columbia (Canada))*. Professor. Nitriles, Isonitriles, Stereochemistry, Organometallics

Joe P. Foley, PhD *(University of Florida) Department Head*. Professor. Separation science, especially the fundamentals and biomedical/pharmaceutical applications of the following voltage- or pressure-driven separation techniques: capillary electrophoresis (CE), electrokinetic chromatography, supercritical fluid chromatography, and high-performance and two-dimensional liquid chromatography (LC). Within these techniques, we explore novel separation modes (e.g., dual-opposite-injection CE and sequential elution LC), novel surfactant aggregate pseudophases, and chiral separations.

Lee Hoffman, PhD *(Flinders University, Adelaide, South Australia)*. Assistant Teaching Professor. Interfacial studies on the self-assembly of natural organic materials, understanding the nature of each component, and development of a mechanism describing this process;Dendrimer/metal nanocomposite design and synthesis hosting metal nanoparticles, utilizing the multivalent dendritic polymer architecture for further exploitation with other molecules such as antibodies and other targeting species.

Monica Ilies, PhD *(Polytechnic University of Bucharest)*. Associate Teaching Professor. Bioorganic chemistry and chemical biology; bioinorganic chemistry and biochemistry.

Haifeng Frank Ji, PhD *(Chinese Academy of Sciences)*. Professor. Micromechancial sensors for biological and environmental applications; Nanomechanical drug screening technology.

Daniel B. King, PhD *(University of Miami) Associate Department Head*. Associate Professor. Assessment of active learning methods and technology in chemistry courses; incorporation of environmental data into chemistry classroom modules; development of hands-on activities and laboratory experiments.

Myungwoon Lee, PhD *(Massachusetts Institute of Technology)*. Assistant Professor. Application of solid-state NMR and Cryo-electron microscopy to elucidate the structure and dynamics of membrane-associated biological macromolecules.

Jamie Ludwig, PhD *(UT Southwestern Medical Center)*. Discovery and optimization of biocatalytic transformations for use inorganic synthesis.

Craig McClure, PhD *(University of Michigan)*. Associate Teaching Professor. Promotion of quantitative literacy in introductory courses; development of guided inquiry activities for introductory chemistry; outreach programs in STEM fields.

Kevin G. Owens, PhD *(Indiana University)*. Associate Professor. Mass spectrometry research, including the development of sample preparation techniques for quantitative analysis and mass spectrometric imaging using matrix-assisted laser desorption/ionization (MALDI) time-of-flight mass

spectrometry (TOFMS) techniques for both biological and synthetic polymer systems, the development of laser spectroscopic techniques for combustion analysis, and the development of correlation analysis and other chemometric techniques for automating the analysis of mass spectral information.

Susan A. Rutkowsky, PhD *(Drexel University) Associate Department Head*. Associate Teaching Professor. Development of labs and lecture demonstrations for general and organic chemistry courses; STEM outreach programs.

Jeremiah Scepaniak, PhD *(New Mexico State University)*. Assistant Professor. Design transition metal-based contrast agents for MRI & synthesis of bimetallic complexes to activate small molecules.

Karl Sohlberg, PhD *(University of Delaware)*. Associate Professor. Computational and theoretical materials-related chemistry: (1) complex catalytic materials; (2) mechanical and electrical molecular devices.

Anthony Wambsgans, PhD *(Rice University)*. Associate Teaching Professor.

Ezra Wood, PhD *(University of California-Berkeley)*. Associate Professor. Radical chemistry and formation of secondary pollutants in urban and forest environments, impacts of biomass burning on air pollution and climate change, pollutant emissions, and design and deployment of novel instrumentation for field studies.

Jun Xi, PhD *(Cornell University)*. Associate Teaching Professor. Biomacromolecular interactions both in solution and in confined environment; mechanisms of DNA replication and DNA repair; structure and function of molecular chaperones; drug target identification and new therapeutic development; single molecule enzymology; DNA directed organic synthesis.

Emeritus Faculty

Anthony W. Addison, PhD *(University of Kent at Canterbury, England)*. Professor Emeritus. Design and synthesis of novel biomimetic and oligonuclear chelates of copper, nickel, iron, ruthenium and vanadium; their interpretation by magnetochemical, electrochemical and spectroscopic methods, including electron spin resonance; CD and ESR spectroscopy and kinetics for elucidation of molecular architecture of derivatives (including NO) of oxygen-binding and electron-transfer heme- and non-heme iron metalloproteins of vertebrate and invertebrate origins; energy-transfer by Ru, Ir and lanthanide-containing molecules and assemblies.

Reinhard Schweitzer-Stenner, PhD *(Universität Bremen (Germany))*. Professor. Exploring conformational ensembles of unfolded or partially folded peptides and proteins; determining the parameters governing peptide self-aggregation; structure and function of heme proteins; investigating protein-membrane interactions; use of IR, VCD, Raman, NMR and absorption spectroscopy for structure analysis.

Peter A. Wade, PhD *(Purdue University)*. Professor Emeritus. Exploration of a newly discovered [3,3]-sigmatropic rearrangement in which O-allyl nitronic esters are thermally converted to #,#-unsaturated nitro compounds; development and exploitation of a carbon-based hemiacetal mimic; and exploration of cycloaddition reactions involving nitroethylene derivatives and novel nitrile oxides.

Chemistry PhD

Major: Chemistry
Degree Awarded: Doctor of Philosophy (PhD)
Calendar Type: Quarter
Minimum Required Credits: 90.0
Co-op Option: None
Classification of Instructional Programs (CIP) code: 40.0501
Standard Occupational Classification (SOC) code: 19-2031

About the Program

The Department of Chemistry (http://drexel.edu/coas/academics/departments-centers/chemistry/) offers graduate programs in analytical chemistry, atmospheric chemistry, inorganic chemistry, organic chemistry, materials & polymer chemistry, physical chemistry, chemistry education, and biochemistry. The curriculum is designed to prepare students for the research and practical application of chemistry to challenges facing society. The department also encourages interdisciplinary activities. Many faculty members maintain active collaborations with colleagues in the College of Arts and Science, the School of Education, the College of Engineering, and the College of Medicine.

The chemistry faculty wants graduate students to understand the purpose of and need for fundamental research while working on problems of practical interest and application to the challenges facing society in the modern world. Areas of research include photochemical air pollution, synthesis and characterization of compounds of medicinal and industrial interest, drug discovery, and biologically-relevant macromolecules.

The Department of Chemistry strives to maintain a community of research scholars (faculty, postdoctoral fellows, and graduate and undergraduate students) that is large enough to provide a variety of experiences within chemistry, yet small enough to give each student individual attention. Both full- and part-time study are available.

Additional Information

For more information, contact:

Ezra Wood, PhD
Graduate Program Committee Chair
215.895.1681
Email: ew456@drexel.edu

Admission Requirements

Requirements for Admission

For admission to graduate study, the department requires a BS in chemistry or the equivalent. This requirement applies to full-time and part-time students working toward either the MS or PhD. Generally, in order to be considered for admission, a successful applicant should have taken two semester courses of organic, analytical and physical chemistry with corresponding laboratory courses. In addition, they should have taken an upper-level inorganic chemistry course. All entering MS and PhD students are required to take a series of two-hour exams in analytical, inorganic, organic, and physical chemistry to help assess their preparation for graduate work in chemistry. The scores obtained on these exams are used as a basis for course selection.

GRE scores are helpful to the Chemistry Department and the Office of Admissions, and are required to be considered for a Dean's Scholarship or a Provost's Fellowship.

Financial Assistance

Graduate students at Drexel can obtain two main types of financial support: teaching assistantships and research assistantships. Teaching assistantships are available on a competitive basis to incoming students and are normally renewable for several years.

Forms, details about requirements, and information about application deadlines are all available on the Chemistry (http://www.drexel.edu/grad/programs/coas/chemistry/) page of Drexel's Graduate Admissions website.

Degree Requirements

The PhD degree is awarded in any of eight main areas of chemistry: analytical, atmospheric, inorganic, organic, materials, physical, educational, or polymer chemistry. The degree recipient must demonstrate scholastic breadth in chemistry and contribute significantly to scientific advancement in a chosen major area. Requirements of the program include coursework, candidacy examinations, a chemical information retrieval or technical writing course, and successful completion of a publishable PhD thesis.

Course Requirements

Ninety credits of graduate-level work must be completed for the PhD degree. The Chemistry Department requires 30.0 credits of coursework in chemistry (outlined in the Course Requirements (p. 12) section of the MS program). The balance can be made up of advanced special topics courses and research credits.

Candidacy Requirements

To become a candidate for the PhD in chemistry at Drexel, a student must pass a prescribed set of cumulative examinations.

Cumulative Examinations

Written examinations designed to test a student’s background in their major area are given monthly during the academic year and occasionally during the summer at the discretion of the faculty. Students should begin taking these examinations after having completed three courses in the major area (usually the main sequence courses), though beginning these exams earlier is possible for well-prepared students. Students normally begin taking these examinations in the fall term of their second year.

Thesis Proposal and Seminar

All PhD students are required to write a Thesis Proposal related to their research. After final acceptance of the written proposal, the student will give a 30-45 minute Thesis Proposal Seminar presentation related to their research. The student’s presentation will be followed by a question and answer session during which the student should demonstrate proficiency with regard to the broader context of his research project. This will help the student become more knowledgeable about their research project by (i) promoting a greater fundamental understanding about the student's own specific research project and (ii) providing context and perspective about previous accomplishments in the field by other research groups as well as their own. The Research Advisor is expected to provide considerable input to the student about the breadth and depth of the literature review, the essential papers to read (and comprehend), the historical and current topics to include and/or emphasize in the seminar, and of course the details of the research project.

Annual Check of Progress

After having passed their Thesis Proposal Exams in their second year, all full-time and part-time research students are required to meet at least three members of their Dissertation Advisory Committee during the spring term of their third year, fourth year, etc. Students have to arrange for this meeting and inform the Graduate Advisor and the GPC chair once the meeting has been scheduled. They should send a three-page report about their research progress one week before their meeting with the committee. That report summarizes their accomplishments and lists their publications and conference presentations. At the meeting the student will present their research to their committee, which will discuss with them the content of the presentation and the progress of their research.

Thesis Pre-Defense

The PhD Candidate will meet with their full Thesis Advisory Committee including its outside member at least six months prior to planned thesis defense in order to ensure that the student has laid the foundation of the submission of a thesis and a final defense. It is the student's responsibility to schedule this meeting with their committee. The student should have submitted a manuscript for publication in a peer-reviewed journal to meet the publication requirement. If the Thesis Advisory Committee approves the student's completion plan, they can start writing their thesis and organize the defense. If the plan is not approved, the student has to meet their committee again at a time determined by the Committee Chair and the thesis advisor.

Thesis

A PhD thesis—the heart of the PhD degree—must be written, accepted by the research advisor, presented to a PhD Thesis Examining Committee, and defended orally to the satisfaction of the Examining Committee. It is the responsibility of the student, not the research advisor, to submit an acceptable thesis. It is expected that the student will have at least one peer-reviewed research article accepted for publication by the time of the thesis defense. The student must be the first author on this paper.

Facilities

There are seven undergraduate teaching laboratories in the department: three freshman Chemistry Laboratories, two advanced Organic Chemistry Laboratories, a Physical Chemistry Laboratory, an Analytical Instrumentation Laboratory, and a combined Analytical/Inorganic Chemistry Laboratory.

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Program Level Outcomes

- Demonstrate the ability to conduct independent research on a timely topic of modern Chemistry
- Acquire a broader and deeper knowledge in the student’s sub-discipline/field of specialization
- Demonstrate the ability to express research content and findings orally and in writing.
- Demonstrate an understanding of the relationship of their work to published literature.
- Demonstrate the ability to interact effectively with colleagues.
- Demonstrate the ability to utilize experimental and theoretical tools for one’s research.

Chemistry Faculty

Young-Hoon Ahn, PhD *(New York University)*. Associate Professor. Research in chemical biology and biochemistry focused on redox signaling, cysteine proteomics, and glutathione biology associated with cancers and cardiovascular diseases.

Reza Farasat, PhD *(University of Alabama)*. Assistant Teaching Professor. Modification of polymers for diverse applications; utilizing Thermoanalysis techniques to study polymeric and non-polymeric materials; nanotechnology; applying Multi-detector Size Exclusion Chromatography for characterization of polymers; creating composites to improve materials' properties.

Fraser Fleming, PhD *(University of British Columbia (Canada))*. Professor. Nitriles, Isonitriles, Stereochemistry, Organometallics

Joe P. Foley, PhD *(University of Florida) Department Head*. Professor. Separation science, especially the fundamentals and biomedical/pharmaceutical applications of the following voltage- or pressure-driven separation techniques: capillary electrophoresis (CE), electrokinetic chromatography, supercritical fluid chromatography, and high-performance and two-dimensional liquid chromatography (LC). Within these techniques, we explore novel separation modes (e.g., dual-opposite-injection CE and sequential elution LC), novel surfactant aggregate pseudophases, and chiral separations.

Lee Hoffman, PhD *(Flinders University, Adelaide, South Australia)*. Assistant Teaching Professor. Interfacial studies on the self-assembly of natural organic materials, understanding the nature of each component, and development of a mechanism describing this process;Dendrimer/metal nanocomposite design and synthesis hosting metal nanoparticles, utilizing the multivalent dendritic polymer architecture for further exploitation with other molecules such as antibodies and other targeting species.

Monica Ilies, PhD *(Polytechnic University of Bucharest)*. Associate Teaching Professor. Bioorganic chemistry and chemical biology; bioinorganic chemistry and biochemistry.

Haifeng Frank Ji, PhD *(Chinese Academy of Sciences)*. Professor. Micromechancial sensors for biological and environmental applications; Nanomechanical drug screening technology.

Daniel B. King, PhD *(University of Miami) Associate Department Head*. Associate Professor. Assessment of active learning methods and technology in chemistry courses; incorporation of environmental data into chemistry classroom modules; development of hands-on activities and laboratory experiments.

Myungwoon Lee, PhD *(Massachusetts Institute of Technology)*. Assistant Professor. Application of solid-state NMR and Cryo-electron microscopy to elucidate the structure and dynamics of membrane-associated biological macromolecules.

Jamie Ludwig, PhD *(UT Southwestern Medical Center)*. Discovery and optimization of biocatalytic transformations for use inorganic synthesis.

Craig McClure, PhD *(University of Michigan)*. Associate Teaching Professor. Promotion of quantitative literacy in introductory courses; development of guided inquiry activities for introductory chemistry; outreach programs in STEM fields.

Kevin G. Owens, PhD *(Indiana University)*. Associate Professor. Mass spectrometry research, including the development of sample preparation techniques for quantitative analysis and mass spectrometric imaging using matrix-assisted laser desorption/ionization (MALDI) time-of-flight mass spectrometry (TOFMS) techniques for both biological and synthetic polymer systems, the development of laser spectroscopic techniques for combustion analysis, and the development of correlation analysis and other chemometric techniques for automating the analysis of mass spectral information.

Susan A. Rutkowsky, PhD *(Drexel University) Associate Department Head*. Associate Teaching Professor. Development of labs and lecture demonstrations for general and organic chemistry courses; STEM outreach programs.

Jeremiah Scepaniak, PhD *(New Mexico State University)*. Assistant Professor. Design transition metal-based contrast agents for MRI & synthesis of bimetallic complexes to activate small molecules.

Karl Sohlberg, PhD *(University of Delaware)*. Associate Professor. Computational and theoretical materials-related chemistry: (1) complex catalytic materials; (2) mechanical and electrical molecular devices.

Anthony Wambsgans, PhD *(Rice University)*. Associate Teaching Professor.

Ezra Wood, PhD *(University of California-Berkeley)*. Associate Professor. Radical chemistry and formation of secondary pollutants in urban and forest environments, impacts of biomass burning on air pollution and climate change, pollutant emissions, and design and deployment of novel instrumentation for field studies.

Jun Xi, PhD *(Cornell University)*. Associate Teaching Professor. Biomacromolecular interactions both in solution and in confined environment; mechanisms of DNA replication and DNA repair; structure and function of molecular chaperones; drug target identification and new therapeutic development; single molecule enzymology; DNA directed organic synthesis.

Emeritus Faculty

Anthony W. Addison, PhD *(University of Kent at Canterbury, England)*. Professor Emeritus. Design and synthesis of novel biomimetic and oligonuclear chelates of copper, nickel, iron, ruthenium and vanadium; their interpretation by magnetochemical, electrochemical and spectroscopic methods, including electron spin resonance; CD and ESR spectroscopy and kinetics for elucidation of molecular architecture of derivatives (including NO) of oxygen-binding and electron-transfer heme- and non-heme iron metalloproteins of vertebrate and invertebrate origins; energy-transfer by Ru, Ir and lanthanide-containing molecules and assemblies.

Reinhard Schweitzer-Stenner, PhD *(Universität Bremen (Germany))*. Professor. Exploring conformational ensembles of unfolded or partially folded peptides and proteins; determining the parameters governing peptide self-aggregation; structure and function of heme proteins; investigating protein-membrane interactions; use of IR, VCD, Raman, NMR and absorption spectroscopy for structure analysis.

Peter A. Wade, PhD *(Purdue University)*. Professor Emeritus. Exploration of a newly discovered [3,3]-sigmatropic rearrangement in which O-allyl nitronic esters are thermally converted to #,#-unsaturated nitro compounds; development and exploitation of a carbon-based hemiacetal mimic; and exploration of cycloaddition reactions involving nitroethylene derivatives and novel nitrile oxides.

Communication, Culture and Media MS

Major: Communication, Culture and Media
Degrees Awarded: Master of Science (MS)
Calendar Type: Quarter
Minimum Required Credits: 45.0
Co-op Option: None
Classification of Instructional Programs (CIP) code: 09.0102
Standard Occupational Classification (SOC) code: 25-1122

About the Program

The master's program (MS) in Communication, Culture and Media is a great choice for academically oriented students who wish to learn the basics of research and theory in communication and media studies, possibly to test the waters for further study, or to explore a personal fascination with mass media, mediated communication, cultural studies, social change, and media. The program also encourages interdisciplinary approaches to the study of communication and media through faculty strengths in anthropology, communication, linguistics, and sociology.

The MS degree requires 45.0 credits of graduate-level coursework and the review by two faculty members of a major research or critical paper that has come out of the student's work while in the program.

Depending on how many courses are taken each year, the program can be completed part time in two to five years. Full time completion takes five terms, or just under a year and a half.

Additional Information

For more information, please visit the Communication, Culture and Media (https://drexel.edu/coas/academics/graduate-programs/communication-culture-media/) web page.

Admission Requirements

Applicants to the MS program will be evaluated based on:

- A 1,000 word statement of purpose
- Two letters of recommendation
- Transcripts of all college-level coursework
- GRE scores are recommended (especially for students whose GPAs are below 3.2)
- Resume
- For international applicants where English is not the official language, a TOEFL score of 100 (iBT) or equivalent score the International English Language Testing System (IELTS) minimum Overall Band Score: 7.0

Additional Information

For more information on how to apply, visit the Drexel University Requirements for Admissions (https://drexel.edu/academics/grad-professional-programs/coas/communication-culture-and-media/) page.

Degree Requirements (MS)

Core Requirements		
COM 610	Theories of Communication and Persuasion	3.0
CCM 704	Research Methods in Communication, Culture and Media	3.0
Required Electives. Choose three of the following:		**9.0**
CCM 710	Mass Communication and American Social Thought	
CCM 725	Political Communication	
CCM 740	Consumer Culture	
CCM 745	Digital Subjectivities	
CCM 750	Political Economy of Media	
CCM 760	The Body Digital: Biopolitics and Media	
Additional Electives *		
Three courses from the CCM rubric at 500 level or above		9.0
Free Electives **		
Seven Additional Graduate Level Electives		21.0
Total Credits		**45.0**

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There are several possible electives in CCM, including special seminars at the 800 level.

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Any appropriate graduate course offered in the University can serve as an elective if the student has sufficient background to take the course. Suggested courses for free electives might also include: CCM, COM, STS, PLCY, AADM, TVMN, and ENVP.

Sample Plan of Study (MS)

First Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
CCM 704	3.0	COM 610	3.0	CCM 740	3.0	VACATION	
CCM 745	3.0	CCM 750	3.0	Graduate Level Electives	3.0		
CCM Graduate Level Elective	3.0	Graduate Level Elective	3.0	CCM Graduate Level Elective	3.0		
	9		**9**		**9**		**0**

Second Year

Fall	Credits	Winter	Credits
Graduate Level Electives	6.0	Graduate Level Electives	9.0
CCM Graduate Level Elective	3.0		
	9		**9**

Total Credits 45

Program Level Outcomes

- Knowledge of how graduate-level research in Communication, Culture and Media is carried out.
- Knowledge and skills to critically assess a research project in Communication, Culture and Media, and the ability to ask questions that go beyond the work's stated conclusions.
- Graduate level understanding of theories to explain and define issues in social media, mass media, convergence, and agency and social change that pertain to communication, culture and media.
- Demonstrated understanding at the graduate level of how local and global culture affects, shapes, and alters individuals and societies.
- Knowledge and skills to demonstrate their own interest in and capability of pursuing doctoral level study in Communication, Media Studies or other Social Science.

Communication, Culture and Media Faculty

Ronald Bishop, III, PhD *(Temple University)*. Professor. Investigative reporting, sports journalism, journalism history, journalism sourcing patterns, textual narrative and ideological analysis, cultural history of fame.

Mary Ebeling, PhD *(University of Surrey)*. Professor. Science and technology studies; emerging technologies and biocapital; media and democratic cultures; radical social movements; sociology of markets; political sociology; and ethnographic methodologies.

Ernest A. Hakanen, PhD *(Temple University) Director, Graduate Programs in Communication, Culture & Media*. Professor. Telecommunications policy, adolescent media use, communication theory and history, global media, and semiotics.

Nahyun Kim, PhD *(Penn State University)*. Tenure Track Assistant Professor. Strategic communication, organizational communication, political consumerism, quantitative methods (experiments, survey, content analysis, computational text analysis).

Emmanuel F. Koku, PhD *(University of Toronto)*. Associate Professor. Social network analysis; qualitative/quantitative research; medical sociology; social epidemiology; social demography; sociology of development; communication and information technology; community and urban sociology.

Hyunmin Lee, PhD *(University of Missouri) Director, Undergraduate Programs in Communication*. Associate Professor. Social media strategies for relationship and reputation management in public relations; media messages of public health issues and its psychological and behavioral effects on the public.

Brent Luvaas, PhD *(UCLA)*. Professor. Visual anthropology; photography; social media; digital culture; urban futures; United States and Southeast Asia.

Douglas V. Porpora, PhD *(Temple University)*. Professor. War, genocide, torture, and human rights; macro-moral reasoning in public sphere debate; contemporary social theory moral and political communication; religion.

Rachel R. Reynolds, PhD *(University of Illinois)*. Associate Professor. Sociolinguistics, ethnography of communication and discourse analysis; violence against women in mass media; political economy of migration; semiotics including the textual, the visual and multimodal.

Wesley Shumar, PhD *(University of Pennsylvania)*. Professor. Digital media and learning; culture of higher education; entrepreneurship education; craft culture; semiotic of consumer culture.

Hilde Van den Bulck, PhD *(Katholieke Universiteit Leuven) Department Head of Communication*. Professor. Political economy of media structures; media policies for digitized media ecologies; stakeholders and coalitions in media policies; digitization; convergence and legacy media; public (service) media; celebrity culture and industry; fandom and anti-fandom.

Asta Zelenkauskaite, PhD *(Indiana University)*. Associate Professor. Social media; user-generated content; computer-mediated communication; interactivity; active audience analysis; mobile communication; gender and online identity; prosumer culture; internet of things; quantitative/qualitative research.

Communication, Culture and Media PhD

Major: Communication, Culture and Media
Degrees Awarded: Doctor of Philosophy (PhD)
Calendar Type: Quarter
Minimum Required Credits: 90.0 (post-bachelor's) or 45.0 (post-master's)
Co-op Option: None
Classification of Instructional Programs (CIP) code: 09.0102
Standard Occupational Classification (SOC) code: 25-1122

About the Program

The PhD program in Communication, Culture and Media develops innovative scholar-teachers who know how to impart theories and studies on the interaction of social forces and communication. Our graduates are trained as committed researchers in quantitative and qualitative approaches to communication study. The program also encourages interdisciplinary approaches to the study of communication and media through faculty strengths in anthropology, communication, linguistics, and sociology.

Additional Information

For more information, please visit the Communication, Culture and Media (https://drexel.edu/coas/academics/graduate-programs/communication-culture-media/) web page.

Admission Requirements

Applicants to the PhD program will be evaluated by the CCM Admissions Committee for acceptance into the program. Prospective students must submit with their application:

- A statement of purpose, up to 1500 words, explaining interest in the CCM program. This should include a description of research interests and major theoretical influences, and information on previous research experience, if any. The statement should explain why the CCM program foci and faculty expertise match the applicant's specific interests. If the previous degree(s) obtained is not in communication, it is important to explain here what influenced the decision to pursue communication and media studies.
- Three letters of recommendation
- Curriculum vitae
- Transcripts of all college-level coursework demonstrating completion of a BA/BS at minimum
- A writing sample (essay, paper, thesis, article, or capstone project) that demonstrates proficiency in description and analysis, and in developing and defending new ideas about a topic. The sample can review and rework a previously submitted paper or write something completely new. The sample does not need to be communication- or media-related, but it should be an example of the applicant's best work. The applicant must be the sample's sole author.
- For international students where English is not the official language, a TOEFL score of 100 (iBT) or IELTS Overall Band Score of 7.0. For more information regarding international applicant requirements, view the International Students Admissions Information (https://nam10.safelinks.protection.outlook.com/?url=http%3A%2F%2Fdrexel.edu%2Fgrad%2Fresources%2Finternational%2F&data=05%7C01%7Ceah22%40drexel.edu%7C76805e88a8d740182c6f08db62060e0f%7C3664e6fa47bd45a696708c4f080f8ca6%7C0%7C0%7C638211550384197969%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=7WLKIl8ocWCLVmUXOC5l2bRYf65JblEPRrosAv88YOA%3D&reserved=0) page.

GRE scores are optional. If the applicant chooses to submit them, results will be evaluated based on performance in the Analytical Writing and Verbal Reasoning sections. The Admissions Committee will consider all application materials, with or without GRE scores. Applicants are encouraged to submit materials that provide clear evidence of their aptitude for graduate study.

Additional Information

For more information on how to apply, visit the Drexel University Requirements for Admissions (https://drexel.edu/academics/grad-professional-programs/coas/communication-culture-and-media/) page.

Degree Requirements

The PhD coursework is structured around a set of required core courses, a set of required seminars with rotating topics, and electives in graduate communication lecture courses, independent study work, and dissertation credit.

All students in the program take five common core courses. They then take no less than four courses chosen from CCM 800-level seminar offerings. Students are encouraged to take additional seminars after meeting that requirement since seminar courses enable collaborative relationships with professors and introduce students to the scholarly community. In addition to coursework, students will be assigned required teaching and research duties in the fall, winter, and spring terms.

Qualifying Examinations

All students are required to take a qualifying examination, usually at the end of spring of their second year, depending on whether they enter with a master's or bachelor's degree. The qualifying exam includes three parts: theory, methods, and a content area. Students will be given the grade of fail, pass, or high pass on the exam. A grade of pass in all three sections of the exam will be required to qualify for the PhD.

Dissertation Defense

Students should defend the dissertation and graduate towards the end of their fourth or fifth year, depending on whether they entered the program with a master's degree.

Visit the Communication, Culture, and Media (https://drexel.edu/coas/academics/graduate-programs/communication-culture-media/) website for more information.

Program Requirements

Core Courses		
CCM 701	Contemporary Social Theory	3.0
CCM 702	Communication Theory I: Persuasion and Media Effects	3.0
CCM 703	Communication Theory II: Discourse and Semiotics	3.0
CCM 704	Research Methods in Communication, Culture and Media	3.0
CCM 705	Data Analysis in Communication	3.0
Seminars		
Students select 12.0 credits from the five categories of seminars *		12.0
CCM 801	Seminar in Contemporary Theory	
CCM 802	Seminar in Discourse and Semiotics	
CCM 803	Seminar in Structural and Cultural Dynamics	
CCM 804	Seminar in Research Methodology	
CCM 805	Seminar in Communication Ethics	
Communication, Culture & Media Electives **		**27.0**
Dissertation Credits ***		**36.0-135.0**
CCM 998	PhD Dissertation Research in Communication, Culture & Media	
Total Credits		**90.0-189.0**

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There are five categories of seminar: one in which students learn advanced work and influences on a specific theorist or theoretical school; one in which students learn about theories of language, discourse and the sign; one that teaches the paradigm of structural dynamics central to social sciences theory and research; one in which students study a research methods approach; and one that deals with approaches to research ethics. Seminars can be repeated, with a maximum of three courses taken in each area, as long as the subject covered is different each time.

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Elective credits may be chosen from CCM courses at the 500-800 level, including 800-level seminars that are a different topic from earlier courses taken. Students may take up to 6.0 graduate-level credits outside of the Communication, Culture and Media program rubric with approval of the program director.

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For the dissertation, students work with a principal advisor, one of the Communication, Culture and Media Program graduate faculty and no less than two additional faculty from within the department. Students must find one additional outside reader, and students may bring in up to two outside readers.

Sample Plan of Study

Students entering the program with a master’s degree or with some graduate credit will be evaluated by the Graduate Committee as to how many of their courses could possibly be counted toward the PhD. Students entering with an MS in an appropriate field are required by the university to take a minimum of 15.0 credit hours in the PhD program before being eligible to take qualifying exams.

First Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
CCM 702	3.0	CCM 701	3.0	CCM 703	3.0	VACATION	
CCM 704	3.0	CCM 705	3.0	CCM Elective	3.0		
Seminar Elective	3.0	Seminar Elective	3.0	Seminar Elective	3.0		
	9		**9**		**9**		**0**

Second Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
CCM Electives	6.0	CCM Electives	9.0	CCM Electives	9.0	VACATION	
Seminar Elective	3.0						
	9		**9**		**9**		**0**

Third Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
CCM 998	9.0	CCM 998	9.0	CCM 998	9.0	VACATION	
	9		**9**		**9**		**0**

Fourth Year

Fall	Credits
CCM 998*	9.0
	9

Total Credits 90

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Students continue to register for 9.0 credits of CCM 998 each Fall, Winter, and Spring Term until the completion of program requirements, including successful defense of the dissertation.

Program Level Outcomes

- Knowledge of how graduate-level research in Communication, Culture and Media is carried out.
- Knowledge and skills to critically assess a research project in Communication, Culture and Media, and the ability to ask questions that go beyond the work's stated conclusions
- Graduate level understanding of theories to explain and define issues in social media, mass media, convergence, and agency and social change that pertain to Communication, Culture and Media.
- Knowledge and skills to demonstrate their own interest in and capability of pursuing doctoral level study in Communication, Media Studies or other Social Science.
- Demonstrated understanding at the graduate level of how local and global culture affects, shapes, and alters individuals and societies.
- Knowledge and skills to plan and carry out an extended original research project as demonstrated through the successful completion and defense of a doctoral dissertation.

Communication, Culture and Media Faculty

Ronald Bishop, III, PhD *(Temple University)*. Professor. Investigative reporting, sports journalism, journalism history, journalism sourcing patterns, textual narrative and ideological analysis, cultural history of fame.

Mary Ebeling, PhD *(University of Surrey)*. Professor. Science and technology studies; emerging technologies and biocapital; media and democratic cultures; radical social movements; sociology of markets; political sociology; and ethnographic methodologies.

Ernest A. Hakanen, PhD *(Temple University) Director, Graduate Programs in Communication, Culture & Media*. Professor. Telecommunications policy, adolescent media use, communication theory and history, global media, and semiotics.

Nahyun Kim, PhD *(Penn State University)*. Tenure Track Assistant Professor. Strategic communication, organizational communication, political consumerism, quantitative methods (experiments, survey, content analysis, computational text analysis).

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Hyunmin Lee, PhD *(University of Missouri) Director, Undergraduate Programs in Communication*. Associate Professor. Social media strategies for relationship and reputation management in public relations; media messages of public health issues and its psychological and behavioral effects on the public.

Brent Luvaas, PhD *(UCLA)*. Professor. Visual anthropology; photography; social media; digital culture; urban futures; United States and Southeast Asia.

Douglas V. Porpora, PhD *(Temple University)*. Professor. War, genocide, torture, and human rights; macro-moral reasoning in public sphere debate; contemporary social theory moral and political communication; religion.

Rachel R. Reynolds, PhD *(University of Illinois)*. Associate Professor. Sociolinguistics, ethnography of communication and discourse analysis; violence against women in mass media; political economy of migration; semiotics including the textual, the visual and multimodal.

Wesley Shumar, PhD *(University of Pennsylvania)*. Professor. Digital media and learning; culture of higher education; entrepreneurship education; craft culture; semiotic of consumer culture.

Hilde Van den Bulck, PhD *(Katholieke Universiteit Leuven) Department Head of Communication*. Professor. Political economy of media structures; media policies for digitized media ecologies; stakeholders and coalitions in media policies; digitization; convergence and legacy media; public (service) media; celebrity culture and industry; fandom and anti-fandom.

Asta Zelenkauskaite, PhD *(Indiana University)*. Associate Professor. Social media; user-generated content; computer-mediated communication; interactivity; active audience analysis; mobile communication; gender and online identity; prosumer culture; internet of things; quantitative/qualitative research.

Creative Writing MFA

Major: Creative Writing
Degree Awarded: Master of Fine Arts (MFA)
Calendar Type: Quarter
Minimum Required Credits: 45.0
Co-op Option: None
Classification of Instructional Programs (CIP) code: 23.1302
Standard Occupational Classification (SOC) code: 27-3043

About the Program

The Drexel M.F.A. combines the teaching of the craft of creative writing with hands-on exposure to the professional machinery of the publishing industry. As a leader in experiential education, Drexel is uniquely positioned to offer students this experiential MFA in which students are encouraged to engage with the world in order to best reflect upon it, write stories worth telling, and embark upon successful careers. The Drexel M.F.A is the only low-residency M.F.A. located in the city of Philadelphia.

M.F.A. students undertake an intensive two-year process of story creation, critique, revision, and career preparation. Students take part in online workshops, reading tutorials, and one-on-one packet exchanges with notable published writers. Three times during the M.F.A. students gather with professors in intensive residences. The inaugural residency takes place in University City, Philadelphia. Students next convene in New York to meet with publishers, agents, and editors. Accomplished authors give craft talks at all residencies. Students have the opportunity to attend an optional craft retreat in Collioure, France, and all students come to University City for a culminating graduation residency on campus. The MFA curriculum is enriched by a robust schedule of optional remote evening talks by publishing industry professionals and authors.

This degree actively provides students with tools and skills needed to forge professional ties and rewarding careers in creative writing, thus leveraging Drexel’s historical approach to education, which is experiential and career focused. To this end, the Drexel M.F.A. provides select students with opportunities to learn teaching pedagogy for composition and/or creative writing, and to take part in one-of-a-kind, community-based learning experience designed to spark creativity, make a positive impact in the world, and put tools in students’ hands for post-M.F.A. employment.

Graduates will be equipped to create and market their own books. Graduates will also be prepared to seek work in literary magazines, literary marketplace publications and conference organizers, publishing houses, literary retreat centers, community-based writing organizations, and in literary agencies.

Drexel's Creative Writing M.F.A. sets forth as a founding principle that art and industry are essential partners in improving the human condition and that storytellers have key roles to play in effecting positive change for individuals and society at large.

Additional Information

For more information, contact:

Nomi Eve
Director, Drexel MFA in Creative Writing
Department of English and Philosophy
nae28@drexel.edu

Admission Requirements

Admissions Criteria

- A bachelor's degree from a regionally accredited college or university

Required Documents

- A completed application
- Official transcripts (https://www.online.drexel.edu/support/supporting-documents/transcripts.aspx) from all universities or colleges and other post-secondary educational institutions (including trade schools) attended
- Personal statement (400-750 words) addressing:
  - Your experience with creative writing thus far
  - Why you are seeking an MFA
  - Why you are seeking an MFA from Drexel University
- Writing sample - Please provide 20-25 double-spaced pages, in Word or PDF file, of one of the following:
  - Completed short story
  - Collection of flash fiction
  - Novel-in-progress
- Additional requirements for international students (https://www.online.drexel.edu/support/international-students.aspx)

Additional Scholarships and Funding Opportunities

Please follow this hyperlink for information about program scholarships and opportunities (https://duo.online.drexel.edu/mfa-opportunities/) to become a teaching assistant.

Degree Requirements

Required Courses		
CW 500	Reading as a Writer I	3.0
CW 501	Reading as a Writer II	3.0
CW 550	Creative Writing Workshop	3.0
CW 555	Creative Writing Packet Exchange I	3.0
CW 556	Creative Writing Packet Exchange II	3.0
CW 600	Creative Writing Craft Residency	3.0
CW 601	Professional Residency in New York	3.0
CW 602	MFA Creative Writing Graduation Residency	3.0
CW 690	Thesis Development	3.0
CW 691	Thesis Packet Exchange I	3.0
CW 692	Thesis Packet Exchange II	3.0
Electives		**12.0**
Select four of the following:		
CW 510	Prepared to Publish	
CW 610	Novel Writing Intensive	
CW 653	Creative Writing Intensive Course Abroad	
CW 654	Writing Pedagogy	
CW 655	Fiction Writing Workshop II	
CW I599	Independent Study in Creative Writing	
CW I699	Independent Study in Creative Writing	
CW I799	Community Based Learning Independent Study	
CW T580	Special Topics in Creative Writing	
CW T680	Special Topics in Creative Writing	
SCRP 670	Writing for Television	
Total Credits		**45.0**

Sample Plan of Study

First Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
CW 550	3.0	CW 500	3.0	CW 501	3.0	CW 556	3.0
CW 600	3.0	Elective	3.0	CW 555	3.0	Elective	3.0
	6		**6**		**6**		**6**

Second Year

Fall	Credits	Winter	Credits	Spring	Credits
CW 601	3.0	CW 691	3.0	CW 602	3.0
CW 690	3.0	Elective	3.0	CW 692	3.0

Elective	3.0		
	9	**6**	**6**

Total Credits 45

Ecology, Evolution, and Earth Systems MS

Major: Ecology, Evolution, and Earth Systems
Degree Awarded: Master of Science (MS)
Calendar Type: Quarter
Minimum Required Credits: 45.0
Co-op Option: None
Classification of Instructional Programs (CIP) code: 26.1310
Standard Occupational Classification (SOC) code: 11-9121; 19-1031

About the Program

The Ecology, Evolution, and Earth Systems program is multidisciplinary and includes a variety of basic and applied fields including ecology, evolutionary biology, environmental and earth systems science. Potential coursework in the program covers a broad set of fields.

The program's areas of focus include ecology, biodiversity, conservation, environmental chemistry and assessment, and paleoecology-geology. A student may alternatively craft a specialized plan of study outside of these strength areas under the guidance of an academic advisor.

Additional Information

For more information about this major, visit the Ecology, Evolution and Earth Systems (https://drexel.edu/academics/grad-professional-programs/coas/ecology-evolution-and-earth-systems/) web page.

Admission Requirements

Applicants to the MS program are judged on the basis of academic excellence and the alignment of their academic interests with those of the faculty in the department.

Degree Requirements

Core Courses for the Non-thesis MS Curriculum		
ENVS 501	Chemistry of the Environment	3.0
ENVS 506	Biostatistics	3.0
ENVS 511	Evolutionary Ecology	3.0
Research		
ENVS 797	Research	
Graduate electives *		**36.0**
Total Credits		**45.0**

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Graduate electives can be chosen from Biology (BIO), Geoscience (GEO), Environmental Engineering (ENVE), Environmental Policy (ENVP), and Environmental Science (ENVS), including up to 6.0 credits of ENVS 797. Course substitutions may be made with courses from other departments but must receive prior departmental approval to be counted toward the degree.

Core Courses for the MS Curriculum with Thesis		
ENVS 501	Chemistry of the Environment	3.0
ENVS 506	Biostatistics	3.0
ENVS 511	Evolutionary Ecology	3.0
Research *		**12.0**
ENVS 797	Research	
Graduate electives **		**24.0**
Total Credits		**45.0**

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Thesis students may take up to 12.0 credits of research.

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Graduate electives can be chosen from Biology (BIO), Geoscience (GEO), Environmental Engineering (ENVE), Environmental Policy (ENVP), and Environmental Science (ENVS). Course substitutions may be made with courses from other departments but must receive prior departmental approval to be counted toward the degree.

Sample Plan of Study

Without Thesis

First Year

Fall	Credits	Winter	Credits	Spring	Credits
ENVS 501	3.0	ENVS 511	3.0	ENVS 506	3.0
Graduate electives	6.0	Graduate electives	6.0	Graduate electives	6.0
	9		**9**		**9**

Second Year

Fall	Credits	Winter	Credits
Graduate electives	9.0	Graduate electives	9.0
	9		**9**

Total Credits 45

With Thesis

First Year

Fall	Credits	Winter	Credits	Spring	Credits
ENVS 501	3.0	ENVS 511	3.0	ENVS 506	3.0
Graduate electives	6.0	Graduate electives	6.0	ENVS 797	3.0
				Graduate elective	3.0
	9		**9**		**9**

Second Year

Fall	Credits	Winter	Credits	Spring	Credits
ENVS 797	3.0	ENVS 797	3.0	ENVS 797	3.0
Graduate elective	3.0	Graduate elective	3.0	Graduate elective	3.0
	6		**6**		**6**

Total Credits 45

Ecology, Evolution, and Earth Systems PhD

Major: Ecology, Evolution, and Earth Systems
Degree Awarded: Doctor of Philosophy (PhD)
Calendar Type: Quarter
Minimum Required Credits: 90.0
Co-op Option: None
Classification of Instructional Programs (CIP) code: 26.1310
Standard Occupational Classification (SOC) code: 11-9121; 19-1031

About the Program

The Ecology, Evolution, and Earth Systems program is multidisciplinary and includes a variety of basic and applied fields including ecology, evolutionary biology, environmental and earth systems science. Potential coursework in the program covers a broad set of fields.

The program's areas of focus include ecology, biodiversity, conservation, environmental chemistry and assessment, and paleoecology-geology. A student may alternatively craft a specialized plan of study outside of these strength areas under the guidance of an academic advisor.

Additional Information

For more information about this major, visit the Ecology, Evolution and Earth Systems (https://drexel.edu/academics/grad-professional-programs/coas/ecology-evolution-and-earth-systems/) web page.

Admission Requirements

Applicants to the doctoral program are judged on the basis of academic excellence and the alignment of their research interests with those of the faculty in the department. Prospective PhD students are welcome to contact the program to discuss their research interests.

Degree Requirements

Core Courses		
ENVS 501	Chemistry of the Environment	3.0
ENVS 506	Biostatistics	3.0
ENVS 511	Evolutionary Ecology	3.0
Graduate Research Seminar		**12.0-18.0**

ENVS 864	Graduate Research Seminar	
Track Electives		**9.0**
Students will choose one of two tracks below. A minimum of 9.0 credits must be taken from the chosen track.		
Ecology and Evolution Track		
ENVS 512	Systematic Biology	
ENVS 522	Tropical Ecology	
ENVS 528	Conservation Biology	
ENVS 533	Wetland Ecology	
ENVS 538	Biodiversity	
ENVS 552	Ornithology	
ENVS 553	Field Ornithology Lab	
ENVS 554	Ichthyology	
ENVS 562	Urban Ecology	
ENVS 593	Entomology	
ENVS 594	Entomology Lab	
Earth Systems Track		
ENVS 601	Advanced Environmental Chemistry	
ENVS 605	Atmospheric Chemistry	
ENVS 609	Environmental Surveying and GIS	
ENVS 615	Advanced Environmental GIS	
ENVS 618	Coastal Biogeochemistry	
ENVS 670	Advanced Topics in Evolution	
ENVS 708	Environmental GIS	
GEO 520	Invertebrate Paleobiology and Paleoecology	
GEO 522	Vertebrate Paleontology	
GEO 550	Volcanology	
GEO 644	Plate Tectonics	
GEO T680	Special Topics in Geoscience	
Graduate Electives *		**9.0**
Research		**51.0-180.0**
ENVS 797	Research	
GEO 797	Research	
Total Credits		**90.0-225.0**

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Graduate electives may be any graduate Biology (BIO), Geoscience (GEO), Environmental Policy (ENVP), or Environmental Science (ENVS) course. Course substitutions and electives may be made with courses from other departments; however, courses taken outside the department must receive prior departmental approval to be counted toward the degree.

Sample Plan of Study

Post-Bachelor's Plan of Study

First Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
ENVS 501	3.0	ENVS 511	3.0	ENVS 506	3.0	ENVS 797	9.0
ENVS 797	1.5	ENVS 797	1.5	ENVS 797	1.5		
ENVS 864	1.5	ENVS 864	1.5	ENVS 864	1.5		
Track elective	3.0	Track elective	3.0	Track elective	3.0		
	9		**9**		**9**		**9**

Second Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
ENVS 797	4.5	ENVS 797	4.5	ENVS 797	4.5	ENVS 797	9.0
ENVS 864	1.5	ENVS 864	1.5	ENVS 864	1.5		
Graduate elective	3.0	Graduate elective	3.0	Graduate elective	3.0		
	9		**9**		**9**		**9**

Third Year

Fall	Credits	Winter	Credits
ENVS 797	7.5	ENVS 797*	7.5
ENVS 864	1.5	ENVS 864*	1.5
	9		**9**

Total Credits 90

*

Students continue enrolling in ENVS 797 and ENVS 864 until they complete their dissertation requirements, typically resulting in a five-year program with more than the minimum number of required credits.

Post-Master's Plan of Study

First Year							
Fall	**Credits**	**Winter**	**Credits**	**Spring**	**Credits**	**Summer**	**Credits**
ENVS 501	3.0	ENVS 511	3.0	ENVS 506	3.0	ENVS 797	9.0
ENVS 797	1.5	ENVS 797	1.5	ENVS 797	1.5		
ENVS 864	1.5	ENVS 864	1.5	ENVS 864	1.5		
Track elective	3.0	Track elective	3.0	Track elective	3.0		
	9		**9**		**9**		**9**

Second Year	
Fall	**Credits**
ENVS 797*	7.5
ENVS 864*	1.5
	9

Total Credits 45

*

Students continue enrolling in ENVS 797 and ENVS 864 until they complete their dissertation requirements, typically resulting in a five-year program with more than the minimum number of required credits.

Environmental Policy MSEP

Major: Environmental Policy
Degree Awarded: Master of Science in Environmental Policy (MSEP)
Calendar Type: Quarter
Minimum Required Credits: 45.0
Co-op Option: None
Classification of Instructional Programs (CIP) code: 44.0599
Standard Occupational Classification (SOC) code: 19-1031

About the Program

The Master of Science in Environmental Policy (MSEP) spans the disciplines of law, political science, economics, engineering, business, public health, and others. Students in this program take core courses in Public Policy, Environmental Policy, and Economics and tracked courses in Environmental Science or Environmental and Occupational Health. With their electives, students can conduct real-world research writing through a case study thesis, complete a graduate minor tailored to their interests, or complete their degree with research experience. MS in Environmental Policy candidates receive personalized advising, which helps students find the classes and opportunities that will best serve their professional goals.

In addition to the core courses, the program has a focus on case study research as a unifying element of the curriculum. Students are required to choose a specific case study topic that they will work on typically for three terms during the program. By the end of the program, students will have produced a polished, in-depth analysis of a specific case that they can use to demonstrate expertise in a given policy area.

Additional Information

For more information about this program, visit the MS in Environmental Policy (http://drexel.edu/coas/academics/graduate-programs/environmental-policy/) page.

Admission Requirements

Applications are accepted year-round and applicants can expect a decision within one month. Entering students may begin study fall, winter, or spring quarter. Full-time students can complete the program in two years. Part-time students can complete the degree at their own pace.

Additional Information

For more information on how to apply, visit Drexel's Admissions page for Environmental Policy (http://www.drexel.edu/grad/programs/coas/environmental-policy/).

Degree Requirements

Students take 27.0 credits of core classes made up of four Public Policy courses, three Environmental Core courses, and two Economics Core courses. They also take either an Environmental Science, Occupational Health, or Environmental Engineering Track (two 3.0 credit classes). Students may use the remaining 12.0 credits to complete approved electives or research experience. Students wishing to delve deeper into a subject can choose to complete a 9.0 credit case study as part of their 45.0 required credits which they should begin in the first or second quarter.

Program Requirements

Public Policy Core Courses *		**12.0**
PLCY 503	Theory and Practice of Policy Analysis	
PLCY 504	Methods of Policy Analysis	
PLCY 506	Institutional Dynamics of the Policy Process	
PLCY 507	Nonprofit Organizations	
Environmental Core Courses		**9.0**
ENVP 522	Environmental Law	
ENVP 572	Environmental Policy	
ENVS 506	Biostatistics	
Environmental Science or Environmental and Occupational Health Track		**6.0**
Environmental Science Track- 2 of the following courses:		
ENVS 501	Chemistry of the Environment	
ENVS 528	Conservation Biology	
ENVS 538	Biodiversity	
Environmental and Occupational Health Track- EOH 510 and one of the following 600-level EOH courses:		
EOH 510	Principles and Practice of Environmental and Occupational Health	
EOH 605	Evidence Evaluation for Identification of Environmental Hazards	
EOH 610	Environmental and Occupational Toxicology	
EOH 615	Environmental and Occupational Health Policy	
EOH 665	Quantitative Risk Analysis for Environmental Health	
Economics Core		**6.0**
ECON 601	Managerial Economics	
ECON 616	Public Finance and Cost Benefit Analysis	
Research Experience and/or Approved Courses in Environmental Policy		
Approved Electives: The remaining 12.0 credits may be any graduate ENVP or PLCY courses, including the 9.0 credit Case Study Sequence (optional). In some cases, course substitutions may be made with courses from other departments. Elective courses taken outside the department must receive prior departmental approval in order to be counted toward the degree.		12.0
Total Credits		**45.0**

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Within the first quarter of study, a student must meet with an assigned advisor and work out a plan of study.

Sample Plan of Study

First Year				
Fall	**Credits Winter**	**Credits Spring**	**Credits Summer**	**Credits**
ENVP 572	3.0 ECON 601	3.0 ECON 616	3.0 VACATION	
PLCY 504	3.0 PLCY 507	3.0 ENVS 506	3.0	
Track elective	3.0 Approved elective	3.0 PLCY 503	3.0	
	9	**9**	**9**	**0**
Second Year				
Fall	**Credits Winter**	**Credits**		
ENVP 522	3.0 Approved electives	9.0		
PLCY 506	3.0			
Track elective	3.0			
	9	**9**		

Total Credits 45

Program Level Outcomes

- Analyze the sources of environmental controversy with respect to the competing interests and values involved; explain controversial issues from multiple, competing points of view
- Identify and understand the laws, policies, and regulatory approaches applicable to a given environmental issue

- Explain fundamental scientific and social scientific ideas underlying environmental problems and their proposed solutions, as well as the uncertainties, limitations, and values inherent in those ideas
- Anticipate the social justice implications of environmental interventions and propose strategies for making outcomes more equitable
- Synthesize and present available information relevant to an environmental issue in a comprehensible and comprehensive form, such that a non-expert could quickly grasp the nuances of the issue
- Work effectively in multidisciplinary, cross-sector teams to envision policy approaches to addressing environmental problems as they exist in the real world

Environmental Policy Faculty

Richardson Dilworth, PhD *(Johns Hopkins University) Head, Department of Politics*. Professor. American political development, urban politics, public policy.

Christian Hunold, PhD *(University of Pittsburgh) Associate Dean for Faculty Advancement*. Professor. Environmental policy; comparative politics; urban wildlife; political theory.

Alison Kenner, PhD *(Rensselaer Polytechnic Institute)*. Associate Professor. Science, technology, and health; environmental health problems; cities and place; feminist theory; medical anthropology; digital humanities

Gwen Ottinger, PhD *(University of California, Berkeley)*. Professor. Social studies of science and technology, environmental justice, environmental political theory, citizen science, science and engineering ethics.

Diane Sicotte, PhD *(Arizona State University)*. Associate Professor. Sociology of environmental justice; inequalities in the citing of environmental hazards; community-based research in neighborhoods dealing with industrial hazards; sociology of the environment; urban sociology; social inequalities.

Chloe Silverman, PhD *(University of Pennsylvania) Director, Center for Science, Technology & Society*. Associate Professor. Parent advocacy for autism, neurodiversity, and pollinator health research.

Emeritus Faculty

Robert J. Brulle, PhD *(George Washington University)*. Professor Emeritus. Environmental policy and politics, critical theory, marine risk, social movements, environmental sociology.

Mathematics MS

Major: Mathematics
Degree Awarded: Master of Science (MS)
Calendar Type: Quarter
Minimum Required Credits: 45.0
Co-op Option: None
Classification of Instructional Programs (CIP) code: 27.0101
Standard Occupational Classification (SOC) code: 15-2021; 15-2041

About the Program

The Department of Mathematics is a broadly based academic unit offering instructional programs and carrying on research activities in mathematics.

Areas of research specialty among the faculty include applied mathematics, algebraic combinatorics, biomathematics, discrete mathematics, optics, analysis, number theory, numerical analysis, probability and statistics, matrix and operator theory, fluid mechanics and partial differential equations.

Additional Information

For more information about these graduate programs, visit Department of Mathematics (http://drexel.edu/coas/academics/graduate-programs/mathematics/) website.

Admission Requirements

Applicants should hold a BS degree in mathematics or the equivalent and meet the University's graduate admission standards. In particular, the student should have had intensive exposure to proof oriented courses, such as real analysis and abstract algebra. Because many of the core courses are two- or three-term sequences beginning in the fall, new students are typically admitted to the programs only in the fall term.

For additional information on how to apply, visit Drexel University's Graduate Admissions (http://www.drexel.edu/grad/programs/coas/mathematics/) website.

Degree Requirements

Students must complete a minimum of 45.0 graduate credits for the MS degree. Of these 15 courses, the following six are required:

Required Courses		
MATH 504	Linear Algebra & Matrix Analysis	3.0
MATH 505	Principles of Analysis I	3.0
MATH 506	Principles of Analysis II	3.0
MATH 533	Abstract Algebra I	3.0
MATH 630	Complex Variables I	3.0
MATH 633	Real Variables I	3.0

The remaining 9 courses may be any graduate mathematics courses. In some cases, course substitutions may be made with courses from other departments. Elective courses taken outside the department must receive prior departmental approval in order to be counted toward the degree.

There are no thesis, language, or special examination requirements for the master's degree.

Students seeking a dual MS must satisfy core requirements for both degree programs.

Students should note that some departmental courses, such as Advanced Engineering Mathematics, are foundation courses and do not contribute to the departmental requirements for the degree. They do count toward the University requirements for a degree.

Program Level Outcomes

- Develop a thorough understanding of Real Analysis, Linear Algebra, Abstract Algebra and Measure Theory
- Develop a thorough understanding of elective subjects of their choice in graduate mathematics
- Read, analyze and write mathematical proofs.
- Develop problem solving ability using mathematical tools.
- Communicate mathematics effectively, by using both oral and written skills.

Mathematics Faculty

David M. Ambrose, PhD *(Duke University) Associate Department Head, Mathematics*. Professor. Applied analysis and computing for systems of nonlinear partial differential equations, especially free-surface problems in fluid dynamics.

Jason Aran, MS *(Drexel University) Associate Department Head*. Associate Teaching Professor.

Jonah D. Blasiak, PhD *(University of California at Berkeley)*. Associate Professor. Algebraic combinatorics, representation theory, and complexity theory.

Patricia Bobo, ASA *(Temple University)*. Assistant Teaching Professor.

Fernando Carreon, PhD *(University of Texas at Austin)*. Teaching Professor.

Daryl Falco, MS *(Drexel University)*. Associate Teaching Professor. Discrete mathematics and automata theory.

Raymond Favocci, MS *(Drexel University)*. Associate Teaching Professor.

Darij Grinberg, PhD *(Massachusetts Institute of Technology)*. Assistant Professor. Algebraic Combinatorics, Noncommutative Algebra, Symmetric Functions, Hopf Algebras, Enumerative Combinatorics, Invariant Theory

Pavel Grinfeld, PhD *(Massachusetts Institute of Technology)*. Associate Professor. Intersection of physics, engineering, applied mathematics and computational science.

Anatolii Grinshpan, PhD *(University of California at Berkeley)*. Associate Teaching Professor. Function theory and operator theory, harmonic analysis, matrix theory.

Yixin Guo, PhD *(University of Pittsburgh)*. Associate Professor. Biomathematics, dynamical systems, ordinary and partial differential equations and math education.

R. Andrew Hicks, PhD *(University of Pennsylvania) Undergraduate Advisor*. Professor. Geometry; optics; computer vision.

Pawel Hitczenko, PhD *(Warsaw University)*. Professor. Probability theory and its applications to analysis, combinatorics, wavelets, and the analysis of algorithms.

Jeffrey LaComb, PhD *(Duke University)*. Assistant Teaching Professor. Rare Event Simulation, Dynamical Systems, Numerical Analysis and Mathematical Biology

Georgi S. Medvedev, PhD *(Boston University)*. Professor. Ordinary and partial differential equations, mathematical neuroscience.

Cecilia Mondaini, PhD *(Federal University of Rio de Janeiro)*. Assistant Professor. Analysis of Partial Differential Equations, Fluid Dynamics, Stochastic Processes

Shari Moskow, PhD *(Rutgers University)*. Professor. Partial differential equations and numerical analysis, including homogenization theory, numerical methods for problems with rough coefficients, and inverse problems.

Oksana P. Odintsova, PhD *(Omsk State University)*. Teaching Professor. Math education; geometrical modeling.

Dimitrios Papadopoulos, MS *(Drexel University)*. Assistant Teaching Professor.

Joel Pereira, PhD *(University of North Carolina)*. Assistant Teaching Professor. Commutative Algebra

Ronald K. Perline, PhD *(University of California at Berkeley)*. Associate Professor. Applied mathematics, numerical analysis, symbolic computation, differential geometry, mathematical physics.

Adam C. Rickert, MS *(Drexel University)*. Associate Teaching Professor.

Eric Schmutz, PhD *(University of Pennsylvania)*. Professor. Probabilistic combinatorics, asymptotic enumeration.

Li Sheng, PhD *(Rutgers University)*. Associate Professor. Discrete optimization, combinatorics, operations research, graph theory and its application in molecular biology, social sciences and communication networks, biostatistics.

Gideon Simpson, PhD *(Columbia University)*. Associate Professor. Partial differential equations, scientific computing and applied mathematics.

Xiaoming Song, PhD *(University of Kansas)*. Associate Professor. Stochastic Calculus, Large Deviation Theory, Theoretical Statistics, Data Network Modeling and Numerical Analysis.

Jeanne M. Steuber, MS *(Boston University)*. Associate Teaching Professor.

K. Shwetketu Virbhadra, PhD *(Physical Research Laboratory)*. Instructor.

Richard D. White, MS *(Penn State University)*. Assistant Teaching Professor.

Hugo J. Woerdeman, PhD *(Vrije Universiteit, Amsterdam)*. Professor. Matrix and operator theory, systems theory, signal and image processing, and harmonic analysis.

J. Douglas Wright, PhD *(Boston University) Department Head*. Professor. Partial and lattice differential equations, specifically nonlinear waves and their interactions.

Dennis G. Yang, PhD *(Cornell University)*. Associate Teaching Professor. Dynamical systems, neurodynamics.

Thomas (Pok-Yin) Yu, PhD *(Stanford University)*. Professor. Multiscale mathematics, wavelets, applied harmonic analysis, subdivision algorithms, nonlinear analysis, applied differential geometry and data analysis.

Matthew Ziemke, PhD *(University of South Carolina)*. Assistant Teaching Professor. Functional Analysis, Operator Algebras, Semigroups, Mathematical Physics

Emeritus Faculty

Howard Anton, PhD *(Polytechnic Institute of Brooklyn)*. Professor Emeritus.

Loren N. Argabright, PhD *(University of Washington)*. Professor Emeritus. Functional analysis, wavelets, abstract harmonic analysis, the theory of group representations.

Robert P. Boyer, PhD *(University of Pennsylvania)*. Professor Emeritus. Functional analysis, C*-algebras and the theory of group.

Robert C. Busby, PhD *(University of Pennsylvania)*. Professor Emeritus. Functional analysis, C*-algebras and group representations, computer science.

Ewaugh Finney Fields, EdD *(Temple University) Dean Emeritus*. Professor Emeritus. Mathematics education, curriculum and instruction, minority engineering education.

William M.Y. Goh, PhD *(Ohio State University)*. Associate Professor Emeritus. Number theory, approximation theory and special functions, combinatorics, asymptotic analysis.

Patricia Henry Russell, MS *(Drexel University)*. Teaching Professor Emerita.

Bernard Kolman, PhD *(University of Pennsylvania)*. Professor Emeritus. Lie algebras; theory, applications, and computational techniques; operations research.

Charles J. Mode, PhD *(University of California at Davis)*. Professor Emeritus. Probability and statistics, biostatistics, epidemiology, mathematical demography, data analysis, computer-intensive methods.

Marci A. Perlstadt, PhD *(University of California at Berkeley)*. Associate Professor Emerita. Applied mathematics, computed tomography, numerical analysis of function reconstruction, signal processing, combinatorics.

Chris Rorres, PhD *(Courant Institute, New York University)*. Professor Emeritus. Applied mathematics, scattering theory, mathematical modeling in biological sciences, solar-collection systems.

Justin R. Smith, PhD *(Courant Institute, New York University)*. Professor Emeritus. Homotopy theory, operad theory, quantum mechanics, quantum computing.

Jet Wimp, PhD *(University of Edinburgh)*. Professor Emeritus. Applied mathematics, special factors, approximation theory, numerical techniques, asymptotic analysis.

Mathematics PhD

Major: Mathematics
Degree Awarded: Doctor of Philosophy (PhD)
Calendar Type: Quarter
Minimum Required Credits: 90.0
Co-op Option: None
Classification of Instructional Programs (CIP) code: 27.0101
Standard Occupational Classification (SOC) code: 15-2021; 15-2041

About the Program

The Department of Mathematics is a broadly based academic unit offering instructional programs and carrying on research activities in mathematics.

Areas of research specialty among the faculty include applied mathematics, algebraic combinatorics, biomathematics, discrete mathematics, optics, analysis, number theory, numerical analysis, probability and statistics, matrix and operator theory, fluid mechanics and partial differential equations.

Additional Information

For more information about these graduate programs, visit Department of Mathematics (http://drexel.edu/coas/academics/graduate-programs/mathematics/) website.

Admission Requirements

Applicants should hold a BS degree in mathematics or the equivalent and meet the University's graduate admission standards. In particular, the student should have had intensive exposure to proof oriented courses, such as real analysis and abstract algebra. Because many of the core courses are two- or three-term sequences beginning in the fall, new students are typically admitted to the programs only in the fall term.

For additional information on how to apply, visit Drexel University's Graduate Admissions (http://www.drexel.edu/grad/programs/coas/mathematics/) website.

Degree Requirements

Students must complete a minimum of 45 graduate credits for the PhD degree, in addition to the 45.0 required by the MS program for a total of 90.0 credits. Of the 45.0 credits of MS program courses, the following six are required:

Required Courses		
MATH 504	Linear Algebra & Matrix Analysis	3.0
MATH 505	Principles of Analysis I	3.0
MATH 506	Principles of Analysis II	3.0
MATH 533	Abstract Algebra I	3.0
MATH 630	Complex Variables I	3.0
MATH 633	Real Variables I	3.0

The remaining 27.0 credits, comprising the MS segment of the PhD program, may be any graduate mathematics courses. In some cases, course substitutions may be made with courses from other departments. Elective courses taken outside the department must receive prior departmental approval in order to be counted toward the degree.

The student must pass a written qualifying exam. The student is allowed two attempts. Students must take exam at the end of their first year, and have a second opportunity in September of their second year.

Students must take a PhD candidacy exam at the end of their second year. Additional coursework to reach the 90.0 credits required for the PhD will be agreed upon with the student's graduate advisor. Students should note that some departmental courses are foundation courses and do not contribute to the departmental requirements for the degree. They do count toward the University requirements for a degree.

Program Level Outcomes

- Develop a thorough understanding through a range of fundamental graduate level topics in both required courses in analysis and algebra and in elective courses in core and applied mathematics
- Develop in-depth expertise through advanced graduate courses, participation in research seminar, and thesis research
- Develop the ability to work creatively and independently.
- Critically evaluate research articles in mathematics.
- Communicate sophisticated mathematics effectively at a professional level both in writing and in oral presentations.

Mathematics Faculty

David M. Ambrose, PhD *(Duke University) Associate Department Head, Mathematics*. Professor. Applied analysis and computing for systems of nonlinear partial differential equations, especially free-surface problems in fluid dynamics.

Jason Aran, MS *(Drexel University) Associate Department Head*. Associate Teaching Professor.

Jonah D. Blasiak, PhD *(University of California at Berkeley)*. Associate Professor. Algebraic combinatorics, representation theory, and complexity theory.

Patricia Bobo, ASA *(Temple University)*. Assistant Teaching Professor.

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Pavel Grinfeld, PhD *(Massachusetts Institute of Technology)*. Associate Professor. Intersection of physics, engineering, applied mathematics and computational science.

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R. Andrew Hicks, PhD *(University of Pennsylvania) Undergraduate Advisor*. Professor. Geometry; optics; computer vision.

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Eric Schmutz, PhD *(University of Pennsylvania)*. Professor. Probabilistic combinatorics, asymptotic enumeration.

Li Sheng, PhD *(Rutgers University)*. Associate Professor. Discrete optimization, combinatorics, operations research, graph theory and its application in molecular biology, social sciences and communication networks, biostatistics.

Gideon Simpson, PhD *(Columbia University)*. Associate Professor. Partial differential equations, scientific computing and applied mathematics.

Xiaoming Song, PhD *(University of Kansas)*. Associate Professor. Stochastic Calculus, Large Deviation Theory, Theoretical Statistics, Data Network Modeling and Numerical Analysis.

Jeanne M. Steuber, MS *(Boston University)*. Associate Teaching Professor.

K. Shwetketu Virbhadra, PhD *(Physical Research Laboratory)*. Instructor.

Richard D. White, MS *(Penn State University)*. Assistant Teaching Professor.

Hugo J. Woerdeman, PhD *(Vrije Universiteit, Amsterdam)*. Professor. Matrix and operator theory, systems theory, signal and image processing, and harmonic analysis.

J. Douglas Wright, PhD *(Boston University) Department Head*. Professor. Partial and lattice differential equations, specifically nonlinear waves and their interactions.

Dennis G. Yang, PhD *(Cornell University)*. Associate Teaching Professor. Dynamical systems, neurodynamics.

Thomas (Pok-Yin) Yu, PhD *(Stanford University)*. Professor. Multiscale mathematics, wavelets, applied harmonic analysis, subdivision algorithms, nonlinear analysis, applied differential geometry and data analysis.

Matthew Ziemke, PhD *(University of South Carolina)*. Assistant Teaching Professor. Functional Analysis, Operator Algebras, Semigroups, Mathematical Physics

Emeritus Faculty

Howard Anton, PhD *(Polytechnic Institute of Brooklyn)*. Professor Emeritus.

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Robert P. Boyer, PhD *(University of Pennsylvania)*. Professor Emeritus. Functional analysis, C*-algebras and the theory of group.

Robert C. Busby, PhD *(University of Pennsylvania)*. Professor Emeritus. Functional analysis, C*-algebras and group representations, computer science.

Ewaugh Finney Fields, EdD *(Temple University) Dean Emeritus*. Professor Emeritus. Mathematics education, curriculum and instruction, minority engineering education.

William M.Y. Goh, PhD *(Ohio State University)*. Associate Professor Emeritus. Number theory, approximation theory and special functions, combinatorics, asymptotic analysis.

Patricia Henry Russell, MS *(Drexel University)*. Teaching Professor Emerita.

Bernard Kolman, PhD *(University of Pennsylvania)*. Professor Emeritus. Lie algebras; theory, applications, and computational techniques; operations research.

Charles J. Mode, PhD *(University of California at Davis)*. Professor Emeritus. Probability and statistics, biostatistics, epidemiology, mathematical demography, data analysis, computer-intensive methods.

Marci A. Perlstadt, PhD *(University of California at Berkeley)*. Associate Professor Emerita. Applied mathematics, computed tomography, numerical analysis of function reconstruction, signal processing, combinatorics.

Chris Rorres, PhD *(Courant Institute, New York University)*. Professor Emeritus. Applied mathematics, scattering theory, mathematical modeling in biological sciences, solar-collection systems.

Justin R. Smith, PhD *(Courant Institute, New York University)*. Professor Emeritus. Homotopy theory, operad theory, quantum mechanics, quantum computing.

Jet Wimp, PhD *(University of Edinburgh)*. Professor Emeritus. Applied mathematics, special factors, approximation theory, numerical techniques, asymptotic analysis.

Physics MS

Major: Physics
Degree Awarded: Master of Science (MS)
Calendar Type: Quarter
Minimum Required Credits: 45.0
Co-op Option: None
Classification of Instructional Programs (CIP) code: 40.0801
Standard Occupational Classification (SOC) code: 19-2010; 19-2012; 11-9121; 25-1054; 25-2031

About the Program

The Department of Physics offers opportunities for students to study with leading researchers in astrophysics, biophysics, condensed matter, particle physics, and physics education research, as well as to participate in international collaborations. Coursework includes advanced training in core areas of physics and in topics of current research.

Additional Information

To learn more about the graduate program, visit the Department of Physics (http://drexel.edu/coas/academics/graduate-programs/physics/) webpage.

Admission Requirements

For admission to the graduate programs, a bachelor's degree in an approved program is required with a minimum undergraduate GPA of 3.0/4.0.

Although recommended, the GRE general exam is not required. The GRE physics exam is recommended, but not required, and no minimum score is used in evaluations.

TOEFL scores are required for international applicants or applicants who earned a degree outside the US (minimum score 100). IELTS scores may be submitted in lieu of TOEFL scores. The minimum IELTS band score is 7.0. TOEFL or IELTS scores below these levels may be considered, but may require an interview.

Additional Information

Visit the Graduate Admissions (https://drexel.edu/admissions/grad/) website for more information about requirements and deadlines, as well as instructions for applying online.

Degree Requirements

The Department of Physics offers a Master of Science in Physics degree that provides advanced training in core areas of fundamental physics and exposure to the application of physics in areas of current research.

This program is suitable as both a means for professional development and preparation for further graduate study. Students who wish to complete only the MS degree are welcomed and will find that the learning environment will allow them to broaden their professional understanding by exploring current topics and trends of physics in an interdisciplinary setting. The Department of Physics offers two tracks for obtaining the MS degree in Physics: without the MS thesis and with the MS thesis.

Students who intend to pursue the Physics PhD degree should apply directly to that program. The requirements for the Physics PhD include the coursework required for the MS degree in Physics, thus PhD students can earn the MS degree during their PhD study. Students should apply to the program that best aligns with their goals. All MS students who wish to continue study toward the PhD degree must apply for the PhD program on a competitive basis.

Satisfactory completion of a minimum of 45.0 credits of approved physics courses is required. MS students pursuing the MS degree with the MS thesis are required to complete 9.0 credits of PHYS 898 *Master's Thesis* course. Students must maintain a cumulative GPA average for all courses of at least 3.0.

There are no language or special examination requirements for the MS in Physics.

Program Requirements

Core Courses		
PHYS 501	Mathematical Physics I	3.0
PHYS 506	Dynamics I	3.0
PHYS 511	Electromagnetic Theory I	3.0

PHYS 512	Electromagnetic Theory II	3.0
PHYS 516	Quantum Mechanics I	3.0
PHYS 517	Quantum Mechanics II	3.0
PHYS 521	Statistical Mechanics I	3.0
PHYS 522	Statistical Mechanics II	3.0
Topics Courses		**21.0**
PHYS 502	Mathematical Physics II	
PHYS 518	Quantum Mechanics III	
PHYS 531	Galactic Astrophysics	
PHYS 532	Cosmology	
PHYS 540	Big Data Physics	
PHYS 553	Nanoscience	
PHYS 554	Quantum Technology *	
PHYS 558	Quantum Information *	
PHYS 561	Biophysics	
PHYS 562	Computational Biophysics	
PHYS 576	Introduction to Particle Physics	
PHYS 626	Solid State Physics I	
PHYS 627	Solid State Physics II	
PHYS 631	Relativity Theory I	
PHYS 679	The Standard Model	
PHYS 898	Master's Thesis **	
PHYS 997	Research ***	
PHYS T780	Special Topics in Physics	
Total Credits		**45.0**

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Students who complete both PHYS 554 and PHYS 558 in addition to the Core Courses will earn the Post-Baccalaureate Certificate in Quantum Technology and Quantum Information (p. 78).

******

MS students pursuing the MS degree with the MS thesis are required to successfully complete 9.0 credits of PHYS 898. This course is only open to students in the MS Physics thesis track.

****

MS students pursuing the MS degree with the MS thesis should successfully complete at least 3.0 credits of PHYS 997 in their first year.

Sample Plan of Study

MS degree in Physics without the MS Thesis

First Year						
Fall	**Credits**	**Winter**	**Credits**	**Spring**	**Credits**	**Summer**	**Credits**
PHYS 501	3.0	PHYS 511 or 521	3.0	PHYS 512 or 522	3.0	VACATION	
PHYS 506	3.0	PHYS 516	3.0	PHYS 517	3.0		
Topics Course	3.0	Topics Course	3.0	Topics Course	3.0		
	9		**9**		**9**		**0**
Second Year							
Fall	**Credits**	**Winter**	**Credits**	**Spring**	**Credits**		
Topics Courses	6.0	PHYS 521 or 511	3.0	PHYS 522 or 512	3.0		
		Topics Course	3.0	Topics Course	3.0		
	6		**6**		**6**		
Total Credits 45							

MS degree in Physics with the MS Thesis

First Year						
Fall	**Credits**	**Winter**	**Credits**	**Spring**	**Credits**	**Summer**	**Credits**
PHYS 501	3.0	PHYS 511 or 521	3.0	PHYS 512 or 522	3.0	VACATION	
PHYS 506	3.0	PHYS 516	3.0	PHYS 517	3.0		
Topics Course	3.0	Topics Course	3.0	PHYS 997	3.0		
	9		**9**		**9**		**0**

Second Year				
Fall	**Credits**	**Winter**	**Credits**	**Spring**
PHYS 898	3.0	PHYS 521 or 511	3.0	PHYS 522 or 512
Topics Course	3.0	PHYS 898	3.0	PHYS 898
	6		**6**	

Total Credits 45

Facilities

Astrophysics Facilities:

- The Numerical Astrophysics Facility emphasizes theoretical and numerical studies of stars, star formation, planetary systems, star clusters, galaxy distributions, cosmological modeling, gravitational lensing, and the early universe. The facility employs a high-performance Graphics Processing Unit (GPU) compute cluster, each node containing two 6-core, 2.7 GHz Intel Xeon CPUs and 96 Gbytes of RAM, accelerated by 4–6 Nvidia Fermi/Titan GPUs, and connected by QDR infiniband, affording computational speeds of up to 50 trillion floating point operations per second.
- The Joseph R. Lynch Observatory houses a 16-inch Meade Schmidt-Cassegrain telescope equipped with an SBIG CCD camera.
- Drexel is an institutional member of the Legacy Survey of Space and Time (LSST) that will be conducted with the Simonyi Survey Telescope at the Vera C. Rubin Observatory, currently under construction in Chile as a joint project of the National Science Foundation and Department of Energy. Faculty and students are developing LSST-related machine learning tools and analyzing simulated LSST data to prepare for "first light" in 2022.

Biophysics Facilities:

- Bio-manipulation and microscopy laboratories. Four optical tables and six research grade microscopes are configured to perform microscopic spectroscopy and manipulation on solutions and individual cells. A spatial light modulator allows spatial patterns to be encoded on samples and explored; all microscopes are temperature controlled with state of the art cameras, including a 2,000 frame per second high speed system. Each optical table is also equipped with high power lasers for photolysis or fluorescence spectroscopy.
- Wet lab for studies of proteins and biomimetic lipids, and protein purification and characterization. The laboratory has a variety of chromatographic equipment, large and small centrifuges, fume hood, a spectrophotometer and a spectrofluorimeter. In addition, the laboratory houses a small microfluidic fabrication facility.
- The Computational Biophysics facility also includes: (i) a Beowulf cluster with 46 dual Quad-core hyperthreaded Xeon CPU (736 cores) and 12Gb of RAM nodes plus a master with 1Tb of storage and 24Gb of RAM, (ii) a Beowulf cluster with 44 dual-core Xeon CPU (344 cores),(iii) a dual Quad-core hyperthreaded Xeon CPU workstation with 24Gb RAM and 3Tb disk with two Tesla C2050 GPU CUDA-accelerated graphics card, (iv) a dual Quad-core hyperthreaded Xeon CPU workstation with 8Gb RAM and 4Tb disk with an NVIDIA N280 GPU CUDA-accelerated graphics card, (v) a quad 8-core hyperthreaded Xeon CPU workstation with 128Gb RAM and 16Tb total disk, (vi) a 72Tb file server with 12Gb RAM, (vii) a 96Tb quad 6-core file server with 64Gb RAM, (viii) and several Linux workstations connected through a gigabit network.

Condensed Matter Physics Research Facilities:

- The Energy Materials Research Laboratory includes a Variable Temperature UHV Scanning Probe Microscope for studies of 2D correlated electron materials and quantum systems.
- Ultrafast Structural Dynamics Laboratory includes a transient electron diffraction setup with sub-picosecond temporal resolution used in studies of quantum materials.
- Single crystal growth laboratory utilizes different techniques for growing high quality single crystals of strongly correlated materials including dichalcogenides.
- The Magnetic Material Laboratory conducts research on amorphous magnetic thin films and fiber optical sensors.
- The Surface Science Laboratory has several scanning probe microscopy setups to study surface structure interfaces at the atomic level.
- The Ultra-Low Temperature Laboratory has a cryogenic dilution refrigerator and microwave sources and detectors to study quantum phenomena in nano- and microscale devices, superconducting qubits, nanostructures, and quantum fluids and solids.
- The Mesoscale Materials Laboratory investigates light-matter interactions and the extent and effects of ordering of lattice, charge and spin degrees of freedom on electronic phases and functional properties in solids, with an emphasis on bulk and epitaxial film complex oxides. Facilities include instrumentation for pulsed laser deposition of epitaxial complex oxide films, atomic layer deposition, variable-temperature characterization of carrier transport (DC to 20 GHz), and a laser spectroscopy lab enabling high-resolution Raman scattering spectroscopy at temperatures to 1.5 K and under magnetic field to 7 T.
- Condensed Matter Physics group has active collaborations with DOE Argonne National Laboratory near Chicago (visiting faculty Dr. Valentyn Novosad) with numerous experimental capabilities available at the Materials Science Division and Center for Nanoscale Materials. Graduates students in experimental condensed matter physics have an opportunity to conduct part or all of their thesis research at Argonne as part of collaborative projects with the research groups there.
- Local high performance computing facility.
- The Experimental Condensed Matter group is actively utilizing local user facilities at Drexel (Core Research Facilities (https://drexel.edu/core-facilities/facilities/material-characterization (https://drexel.edu/core-facilities/facilities/material-characterization/)), University of Pennsylvania (Singh Center for Nanotechnology (https://www.nano.upenn.edu (https://www.nano.upenn.edu/)), and Temple University (Science and Education and

Research Center (https://cst.temple.edu/research/SERC (https://cst.temple.edu/research/SERC/)) to access top of the line instrumentation for nanoscale fabrication and characterization of materials.

- Faculty in Condensed Matter Physics thrust participate in several large-scale collaborations such as Energy Frontier Research Center (DOE EFRC--CCM), detector development for South Pole Telescope Collaboration and others.

Particle Physics Facilities:

- The Drexel Particle Physics Group researches fundamental neutrino properties with the DUNE long baseline experiment hosted by Fermilab and the PROSPECT short baseline reactor experiment, as well as the planned nEXO neutrinoless double beta decay experiment.
- We are also active in the IceCube neutrino telescope located at the geographic South Pole.
- The Bubble Chamber Laboratory develops superheated-liquid detectors for rare-interaction searches, including the PICO dark matter experiment located at SNOLAB in Canada.

Laboratory for High-Performance Computational Physics:

- In addition to the department computing cluster (15 Linux workstations), high-performance computing resources include a dual-processor server with two Xeon E5-2650 processors (16 cores), 128 GB of RAM, and two Xeon Phi P5110 co-processor cards (480 cores). Department researchers also have access to a cluster of 18 Dell PowerEdge C6145 servers (AMD Opteron 6378 Piledriver CPU's, 64 cores/server, 256 GB RAM/server) with a total of 1152 cores and 4.5TB RAM.

Program Level Outcomes

- Demonstrate advanced knowledge of fundamental principles of Physics in the core areas of classical mechanics, electromagnetism, statistical physics and quantum mechanics
- Demonstrate advanced knowledge of mathematical methods in Physics
- Demonstrate advanced ability in techniques of scientific computing to solve problems in Physics
- Demonstrate advanced knowledge in multiple current areas of physics research such as astrophysics, biophysics, condensed matter and particle physics

Physics Faculty

Eric Brewe, PhD *(Arizona State University)*. Associate Professor. Physics Education Research, introductory course reform, network analysis in learning, neuromechanisms of learning.

Luis R. Cruz Cruz, PhD *(MIT)*. Associate Professor. Computational studies of confinement effects on the folding of amyloidogenic proteins, spatial correlations of neurons in the brain, firing dynamics of neuronal networks, fluid flow through porous media.

N. John DiNardo, PhD *(University of Pennsylvania)*. Professor. Physics education research, surface physics, condensed matter physics, materials science.

Michelle Dolinski, PhD *(University of California, Berkeley) Associate Dean of Graduate Education*. Associate Professor. Neutrino physics, rare nuclear decays, cryogenic detector technologies.

Frank A. Ferrone, PhD *(Princeton University)*. Professor. Experimental and theoretical protein dynamics, kinetics of biological self-assembly, including sickle cell and Alzheimer's disease, sickle cell testing and diagnostic devices.

David M. Goldberg, PhD *(Princeton University) Associate Department Head for Undergraduate Studies*. Professor. Theoretical and computational cosmology, extragalactic astrophysics, gravitational lensing.

Goran Karapetrov, PhD *(Oregon State University)*. Professor. Experimental solid state physics, scanning probe microscopy, nanoscale catalysis, mesoscopic superconductivity.

Rachael M. Kratzer, PhD *(Drexel University)*. Associate Teaching Professor. Quasars, active galactic nuclei

Charles Lane, PhD *(California Institute of Technology)*. Professor. Experimental tests of invariance principles and conservation laws, neutrino oscillations and properties.

Christina Love, PhD *(Temple University)*. Associate Teaching Professor. Educational methods and technology, STEM education, science literacy and outreach, particle physics, astrophysics.

Stephen L. W. McMillan, PhD *(Harvard University) Department Head*. Professor. Stellar dynamics, star cluster formation, large-scale computations of stellar systems, high-performance special-purpose computers

Naoko Kurahashi Neilson, PhD *(Stanford University)*. Associate Professor. Neutrino physics, high energy astro-particle physics.

Russell Neilson, PhD *(Stanford University)*. Associate Professor. Dark matter, neutrino physics.

Gordon T. Richards, PhD *(University of Chicago)*. Professor. Quasars, active galactic nuclei, supermassive black holes, galaxy evolution, sky surveys, infrared/X-ray/radio astronomy

Jonathan E. Spanier, PhD *(Columbia University) Department Head, Mechanical Engineering and Mechanics*. Professor. Light-matter interactions in electronic materials, including ferroelectric semiconductors, complex oxide thin film science; laser spectroscopy, including Raman scattering.

Somdev Tyagi, PhD *(Brigham Young University)*. Professor. Nanobiophysics, Raman spectroscopy, magnetic materials.

Brigita Urbanc, PhD *(University of Ljubljana, Slovenia) Associate Department Head for Graduate Studies*. Professor. Computational and experimental biophysics of protein folding and assembly, relevant to Alzheimer's and Parkinson's disease; discrete molecular dynamics of coarse-grained protein and lipid models.

Jörn Venderbos, PhD *(Leiden University)*. Assistant Professor. Theory of quantum materials: topological Insulators, topological semimetals, materials prediction and design, strongly correlated electron materials, complex electronic ordering phenomena, unconventional superconductors

Michael Vogeley, PhD *(Harvard University)*. Professor. Cosmology; galaxy formation and evolution; statistical analysis of large data sets; active galactic nuclei.

Emeritus Faculty

Shyamalendu Bose, PhD *(University of Maryland)*. Professor Emeritus.

Leonard D. Cohen, PhD *(University of Pennsylvania)*. Professor Emeritus.

Leonard X. Finegold, PhD *(University of London)*. Professor Emeritus.

Robert Gilmore, PhD *(Massachusetts Institute of Technology)*. Professor Emeritus.

Richard D. Haracz, PhD *(Wayne State University)*. Professor Emeritus.

Frederick House, PhD *(University of Wisconsin)*. Professor Emeritus.

Arthur P. Joblin, PhD *(Drexel University)*. Professor Emeritus.

Donald C. Larson, PhD *(Harvard University)*. Professor Emeritus.

Teck-Kah Lim, PhD *(University of Adelaide)*. Professor Emeritus.

Arthur E. Lord, PhD *(Columbia University)*. Professor Emeritus.

Richard I Steinberg, PhD *(Yale University)*. Professor Emeritus.

T. S. Venkataraman, PhD *(Worcester Polytechnic Institute)*. Professor Emeritus.

Jian-Min Yuan, PhD *(University of Chicago)*. Professor Emeritus.

Physics PhD

Major: Physics
Degree Awarded: Doctor of Philosophy (PhD)
Calendar Type: Quarter
Minimum Required Credits: 90.0
Co-op Option: None
Classification of Instructional Programs (CIP) code: 40.0801
Standard Occupational Classification (SOC) code: 19-2010; 19-2012; 11-9121; 25-1054; 25-2031

About the Program

The Department of Physics offers opportunities for students to study with leading researchers in astrophysics, biophysics, condensed matter, particle physics, and physics education research, as well as to participate in international collaborations. Coursework includes advanced training in core areas of physics and in topics of current research. PhD students begin research early in the program, commencing thesis work in their second year of study.

Additional Information

To learn more about the graduate program, visit the Department of Physics (http://drexel.edu/coas/academics/graduate-programs/physics/) webpage.

Admission Requirements

For admission to the graduate programs, a bachelor's degree in an approved program is required with a minimum undergraduate GPA of 3.0/4.0.

Although recommended, the GRE general exam is not required. The GRE physics exam is recommended, but not required, and no minimum score is used in evaluations.

TOEFL scores are required for international applicants or applicants who earned a degree outside the US (minimum score 100). IELTS scores may be submitted in lieu of TOEFL scores. The minimum IELTS band score is 7.0. TOEFL or IELTS scores below these levels may be considered, but may require an interview.

Additional Information

Visit the Graduate Admissions (http://www.drexel.edu/grad/programs/coas/physics/) website for more information about requirements and deadlines, as well as instructions for applying online.

Degree Requirements

90.0 quarter credits

The Department of Physics offers opportunities for students to study with leading researchers in astrophysics, biophysics, condensed matter, particle physics, and physics education research, as well as to participate in international collaborations. Coursework for the PhD degree includes advanced training in core areas of physics and topics of current research. PhD students begin research early in the program, commencing thesis work in their second year of study.

The usual schedule for physics graduate students consists of two years of coursework, candidacy exam, and research training, followed by dissertation research. All PhD students follow a common set of eight core courses during their first two years of study. In addition to these core courses, students also take at least four topics courses.

PhD Students Admitted with Post-master's Status

Students who are admitted for PhD study with “post-master's” status must take 15.0 credits of graduate coursework with a minimum GPA of 3.0 to become doctoral candidates. Courses are to be chosen in consultation with the Graduate Academic Committee. Post-masters students are expected to pass the oral candidacy exam by the end of the spring quarter of their first year of study. To be prepared for the oral exam, post-master's students should begin research as soon as possible.

Program Requirements

Doctoral candidates are required to complete a minimum of 45.0 credits of coursework and research work beyond the master’s requirement of 45.0 credits while maintaining a minimum of 3.0 GPA. Advancement to doctoral candidacy requires a minimum GPA in core courses of 3.0 with no more than two grades below B-.

Core Courses		
PHYS 501	Mathematical Physics I	3.0
PHYS 506	Dynamics I	3.0
PHYS 511	Electromagnetic Theory I	3.0
PHYS 512	Electromagnetic Theory II	3.0
PHYS 516	Quantum Mechanics I	3.0
PHYS 517	Quantum Mechanics II	3.0
PHYS 521	Statistical Mechanics I	3.0
PHYS 522	Statistical Mechanics II	3.0
Research		
PHYS 997	Research	9.0
Topics Courses		
Select four including a minimum of two outside research specialty:		12.0
PHYS 502	Mathematical Physics II	
PHYS 518	Quantum Mechanics III	
PHYS 531	Galactic Astrophysics	
PHYS 532	Cosmology	
PHYS 540	Big Data Physics	
PHYS 553	Nanoscience	
PHYS 554	Quantum Technology *	
PHYS 558	Quantum Information *	
PHYS 561	Biophysics	
PHYS 562	Computational Biophysics	
PHYS 576	Introduction to Particle Physics	

PHYS 626	Solid State Physics I
PHYS 627	Solid State Physics II
PHYS 631	Relativity Theory I
PHYS 679	The Standard Model
PHYS T780	Special Topics in Physics
Total Credits	**45.0**

*

Students who complete both PHYS 554 and PHYS 558 in addition to the Core Courses will earn the Post-Baccalaureate Certificate in Quantum Technology and Quantum Information (p. 78).

Research Training

Students begin research in the spring and summer terms of their first year. The spring project culminates in a poster presented to the department. A two-page proposal for their summer research is also due at the end of the spring term. At the end of the summer, students are required to submit an in-depth written report and give an oral presentation of their summer project. Research during the second year is toward the candidacy exam as described below.

Candidacy Examination

The candidacy exam is based on original research performed by the student, which consists of an oral presentation and a written report of no less than 15 pages, submitted to the examination committee and the Associate Department Head for Graduate Studies at least one week prior to the exam. Immediately after the public presentation, the Examination Committee will privately conduct an oral examination. This exam must be passed by the end of the second year of study.

Dissertation Defense

This dissertation defense includes a final public presentation and defense of the dissertation. The dissertation must be submitted to the Examination Committee at least two weeks prior to the oral defense. The oral presentation involves a public 45-60 minute presentation by the candidate followed by an unspecified period during which the Examination Committee will ask questions. All doctoral dissertations, in addition to originality and scholarly content, must conform to University format requirements.

Sample Plan of Study

The sample plan of study below lists required courses and electives for the first two years of the full-time PhD program, for a minimum of 45.0 credits. During the third year and thereafter, PhD program students must take a minimum of 45.0 additional credits of research (PHYS 998 *Dissertation Research*).

The following is a sample plan of study that includes all required courses for the first two academic years for full-time PhD students entering without a previous Master's degree. Post-master's students should consult the Graduate Academic Committee. Summer terms may be subject to change.

The following is a sample plan of study that includes all required courses for the first two academic years for full-time PhD students entering without a previous Master's degree. Post-master's students should consult the Graduate Academic Committee. Summer terms may be subject to change.

First Year				
Fall	**Credits**	**Winter**	**Credits**	**Spring**	**Credits**	**Summer**	**Credits**
PHYS 501	3.0	PHYS 516	3.0	PHYS 517	3.0	PHYS 997	1.0-9.0
PHYS 506	3.0	PHYS 511 or 521*	3.0	PHYS 512 or 522*	3.0		
Topics Course**	3.0	Topics Course**	3.0	PHYS 997***	3.0		
	9		**9**		**9**		**1-9**
Second Year							
Fall	**Credits**	**Winter**	**Credits**	**Spring**	**Credits**	**Summer**	**Credits**
PHYS 997	6.0	PHYS 521 or 511	3.0	PHYS 522 or 512*	3.0	PHYS 998	1.0-9.0
Topics Course**	3.0	PHYS 997	3.0	PHYS 997	6.0		
		Topics Course**	3.0				
	9		**9**		**9**		**1-9**

Total Credits 56-72

*

Core Course sequences PHYS 511 / PHYS 512 and PHYS 521 / PHYS 522 are offered in alternate years.

**

Topics courses are an introduction to current topics of experimental and theoretical interest. They are offered in alternate years.

***

3.0 credits of PHYS 997: *Research* must be taken by Spring of the first year.

Additional Information

More information for graduate students is available at the Department of Physics (http://drexel.edu/coas/academics/departments-centers/physics/).

Facilities

Astrophysics Facilities:

- The Numerical Astrophysics Facility emphasizes theoretical and numerical studies of stars, star formation, planetary systems, star clusters, galaxy distributions, cosmological modeling, gravitational lensing, and the early universe. The facility employs a high-performance Graphics Processing Unit (GPU) compute cluster, each node containing two 6-core, 2.7 GHz Intel Xeon CPUs and 96 Gbytes of RAM, accelerated by 4–6 Nvidia Fermi/Titan GPUs, and connected by QDR infiniband, affording computational speeds of up to 50 trillion floating point operations per second.
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- The Computational Biophysics facility also includes: (i) a Beowulf cluster with 46 dual Quad-core hyperthreaded Xeon CPU (736 cores) and 12Gb of RAM nodes plus a master with 1Tb of storage and 24Gb of RAM, (ii) a Beowulf cluster with 44 dual-core Xeon CPU (344 cores),(iii) a dual Quad-core hyperthreaded Xeon CPU workstation with 24Gb RAM and 3Tb disk with two Tesla C2050 GPU CUDA-accelerated graphics card, (iv) a dual Quad-core hyperthreaded Xeon CPU workstation with 8Gb RAM and 4Tb disk with an NVIDIA N280 GPU CUDA-accelerated graphics card, (v) a quad 8-core hyperthreaded Xeon CPU workstation with 128Gb RAM and 16Tb total disk, (vi) a 72Tb file server with 12Gb RAM, (vii) a 96Tb quad 6-core file server with 64Gb RAM, (viii) and several Linux workstations connected through a gigabit network.

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- Faculty in Condensed Matter Physics thrust participate in several large-scale collaborations such as Energy Frontier Research Center (DOE EFRC--CCM), detector development for South Pole Telescope Collaboration and others.

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- We are also active in the IceCube neutrino telescope located at the geographic South Pole.
- The Bubble Chamber Laboratory develops superheated-liquid detectors for rare-interaction searches, including the PICO dark matter experiment located at SNOLAB in Canada.

Laboratory for High-Performance Computational Physics:

- In addition to the department computing cluster (15 Linux workstations), high-performance computing resources include a dual-processor server with two Xeon E5-2650 processors (16 cores), 128 GB of RAM, and two Xeon Phi P5110 co-processor cards (480 cores). Department researchers also have access to a cluster of 18 Dell PowerEdge C6145 servers (AMD Opteron 6378 Piledriver CPU's, 64 cores/server, 256 GB RAM/server) with a total of 1152 cores and 4.5TB RAM.

Physics Faculty

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Frank A. Ferrone, PhD *(Princeton University)*. Professor. Experimental and theoretical protein dynamics, kinetics of biological self-assembly, including sickle cell and Alzheimer's disease, sickle cell testing and diagnostic devices.

David M. Goldberg, PhD *(Princeton University) Associate Department Head for Undergraduate Studies*. Professor. Theoretical and computational cosmology, extragalactic astrophysics, gravitational lensing.

Goran Karapetrov, PhD *(Oregon State University)*. Professor. Experimental solid state physics, scanning probe microscopy, nanoscale catalysis, mesoscopic superconductivity.

Rachael M. Kratzer, PhD *(Drexel University)*. Associate Teaching Professor. Quasars, active galactic nuclei

Charles Lane, PhD *(California Institute of Technology)*. Professor. Experimental tests of invariance principles and conservation laws, neutrino oscillations and properties.

Christina Love, PhD *(Temple University)*. Associate Teaching Professor. Educational methods and technology, STEM education, science literacy and outreach, particle physics, astrophysics.

Stephen L. W. McMillan, PhD *(Harvard University) Department Head*. Professor. Stellar dynamics, star cluster formation, large-scale computations of stellar systems, high-performance special-purpose computers

Naoko Kurahashi Neilson, PhD *(Stanford University)*. Associate Professor. Neutrino physics, high energy astro-particle physics.

Russell Neilson, PhD *(Stanford University)*. Associate Professor. Dark matter, neutrino physics.

Gordon T. Richards, PhD *(University of Chicago)*. Professor. Quasars, active galactic nuclei, supermassive black holes, galaxy evolution, sky surveys, infrared/X-ray/radio astronomy

Jonathan E. Spanier, PhD *(Columbia University) Department Head, Mechanical Engineering and Mechanics*. Professor. Light-matter interactions in electronic materials, including ferroelectric semiconductors, complex oxide thin film science; laser spectroscopy, including Raman scattering.

Somdev Tyagi, PhD *(Brigham Young University)*. Professor. Nanobiophysics, Raman spectroscopy, magnetic materials.

Brigita Urbanc, PhD *(University of Ljubljana, Slovenia) Associate Department Head for Graduate Studies*. Professor. Computational and experimental biophysics of protein folding and assembly, relevant to Alzheimer's and Parkinson's disease; discrete molecular dynamics of coarse-grained protein and lipid models.

Jörn Venderbos, PhD *(Leiden University)*. Assistant Professor. Theory of quantum materials: topological Insulators, topological semimetals, materials prediction and design, strongly correlated electron materials, complex electronic ordering phenomena, unconventional superconductors

Michael Vogeley, PhD *(Harvard University)*. Professor. Cosmology; galaxy formation and evolution; statistical analysis of large data sets; active galactic nuclei.

Emeritus Faculty

Shyamalendu Bose, PhD *(University of Maryland)*. Professor Emeritus.

Leonard D. Cohen, PhD *(University of Pennsylvania)*. Professor Emeritus.

Leonard X. Finegold, PhD *(University of London)*. Professor Emeritus.

Robert Gilmore, PhD *(Massachusetts Institute of Technology)*. Professor Emeritus.

Richard D. Haracz, PhD *(Wayne State University)*. Professor Emeritus.

Frederick House, PhD *(University of Wisconsin)*. Professor Emeritus.

Arthur P. Joblin, PhD *(Drexel University)*. Professor Emeritus.

Donald C. Larson, PhD *(Harvard University)*. Professor Emeritus.

Teck-Kah Lim, PhD *(University of Adelaide)*. Professor Emeritus.

Arthur E. Lord, PhD *(Columbia University)*. Professor Emeritus.

Richard I Steinberg, PhD *(Yale University)*. Professor Emeritus.

T. S. Venkataraman, PhD *(Worcester Polytechnic Institute)*. Professor Emeritus.

Jian-Min Yuan, PhD *(University of Chicago)*. Professor Emeritus.

Psychology MS

Major: Psychology
Degree Awarded: Master of Science (MS)
Calendar Type: Quarter
Minimum Required Credits: 45.0 (MS)
Co-op Option: None
Classification of Instructional Programs (CIP) code: 42.2799
Standard Occupational Classification (SOC) code: 19-3031; 19-3032; 19-3039

About the Program

The Master of Science degree in the Department of Psychological and Brain Sciences, College of Arts & Sciences, is ideal for students interested in pursuing graduate education in scientific psychology and research methods. It is designed for students interested in advanced education in scientific psychology in order to obtain further educational or career opportunities.

The program is an opportunity for students to take their first step into graduate education and to begin a path toward further educational and career opportunities. These opportunities may include further graduate-level training leading to a PhD, a career in research, or other educational and administrative opportunities. The curriculum is focused on providing training in a range of research experiences in the neurocognitive and behavioral sciences. In addition to coursework, students are required to complete a minimum of eight hours per week with a research mentor in laboratory activities. These activities culminate with the successful completion of a thesis project.

Additional Information

For more information, visit the website of the Department of Psychological and Brain Sciences (https://drexel.edu/coas/academics/departments-centers/psychology/).

Admission Requirements

Applicants must meet the general University requirements for admission including a minimum 3.0 GPA (on a 4.0 scale) for the last two years of undergraduate study. Applicants to the graduate program in Psychology are not required to submit scores from the Graduate Record Examination (GRE) general tests. Only applications for full-time status are considered.

Various factors are considered in choosing students. These include background in psychology, undergraduate (and, if applicable, graduate) GPA, a personal essay, and letters of recommendation.

Additional Information

For more information on how to apply, visit Drexel's Admissions Requirements for Psychology (http://www.drexel.edu/grad/programs/coas/psychology/) website.

Degree Requirements

The general requirements for earning the MS degree in Psychology are as follows:

- Completion of all required coursework with a minimum grade point average of 3.0 with no grade lower than a B in any required (non-elective) course and no more than two course grades of C or lower
- Successful completion of a minimum of 45.0 course credits. Students take required courses and select additional electives.
- Successful completion of required research laboratory hours (8 hours per week for 2 years)
- Completion of a thesis

Program Requirements

PSY 510	Research Methods I	3.0
PSY 511	Research Methods II	3.0
PSY 512	Cognitive Psychology	3.0
PSY 624	Behavior Analysis	3.0
PSY 680	Data Analysis in Psychology I	3.0
PSY 681	Data Analysis in Psychology II	3.0
PSY 682	Data Analysis in Psychology III	3.0
PSY 898	Master's Thesis in Psychology	3.0
PSY 898	Master's Thesis in Psychology	3.0
PSY 898	Master's Thesis in Psychology	3.0
Additional Electives *		15.0
Total Credits		**45.0**

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Electives can be any graduate Psychology (PSY) course. Other graduate courses outside of Psychology might be taken pending approval from the graduate advisor or program director.

Additional Information

For more information on specific requirements, consult the Master of Science in Psychology (http://drexel.edu/coas/academics/graduate-programs/psychology/) website.

Sample Plan of Study

First Year			
Fall	**Credits Winter**	**Credits Spring**	**Credits**
PSY 512	3.0 PSY 510	3.0 PSY 511	3.0
PSY 680	3.0 PSY 681	3.0 PSY 682	3.0
Elective or Independent Study	3.0 Elective or Independent Study	3.0 Elective or Independent Study*	3.0
	9	**9**	**9**
Second Year			
Fall	**Credits Winter**	**Credits Spring**	**Credits**
PSY 898	3.0 PSY 624	3.0 PSY 898	3.0
Elective or Independent Study	3.0 PSY 898	3.0 Elective or Independent Study	3.0
	6	**6**	**6**

Total Credits 45

Facilities

Computers

Computer resources for student use include more than 20 personal computers (IBM, Macintosh) available in the library and 10 IBM PCs available in the computer laboratory. Both facilities are near the department. In both locations, word processing and biostatistics software is available.

By using computers from their homes or in the library, students have free access to e-mail and a wide array of online services (e.g., the Internet, World Wide Web, and literature databases such as PsychLit and Medline).

Library

Psychology books and journals are located at the Moore Campus Library on Henry Avenue, Queen Lane Library on the Queen Lane Campus, and the W. W. Hagerty Library on the University City Campus. The combined holdings represent one of the best psychology libraries on the East Coast.

Equipment

Testing equipment for classroom instruction is available to psychology graduate students. The program also has videotape and audiotape equipment available for classroom instruction and research activities.

Program Level Outcomes

- Conduct research in an ethical manner
- Conduct independent psychological research
- Become proficient in a content area of psychology.
- Develop scientific writing skills
- Present a research project to a scientific audience

Psychology Faculty

Meghan Butryn, PhD *(Drexel University)*. Professor. Treatment and prevention of obesity and eating disorders, behavioral treatment, acceptance and commitment therapy.

Dorothy Charbonnier, PhD *(State University of New York at Stony Brook)*. Associate Teaching Professor. The nature of the creative process and writing.

Evangelia Chrysikou, PhD *(Temple University) Director, PhD Program in Applied Cognitive and Brain Sciences*. Associate Professor. Cognitive neuroscience, neuropsychology, neural basis of language, memory, and executive functions, neurocognitive processes associated with problem solving and flexible thought

Brian Daly, PhD *(Loyola University, Chicago) Department Head*. Associate Professor. Pediatric neuropsychology, intervention with at-risk youth.

David DeMatteo, PhD, JD *(MCP Hahnemann University; Villanova University School of Law) Director of the JD-PhD Program in Law and Psychology*. Professor. Psychopathy, forensic mental health assessment, drug policy; offender diversion.

Evan M. Forman, PhD *(University of Rochester) Director WELL Center*. Professor. Clinical psychology: mechanisms and measurement of psychotherapy outcome, cognitive-behavioral and acceptance based psychotherapies, the development and evaluation of acceptance-based interventions for health behavior change (for problems of obesity and cardiac disease) as well as mood and anxiety disorders; neurocognition of eating.

Pamela Geller, PhD *(Kent State University) Director, Clinical Training*. Associate Professor. Stressful life events and physical and mental health outcomes, particularly in the area of women's reproductive health (e.g. pregnancy, pregnancy loss, infertility, medical education).

Maureen Gibney, PsyD *(Widener University)*. Teaching Professor. Clinical psychopathology; neuropsychological evaluation and intervention with the elderly.

Naomi Goldstein, PhD *(University of Massachusetts) Co-Director of the JD-PhD Program; Stoneleigh Foundation Fellow*. Professor. Forensic psychology; juvenile justice; Miranda rights comprehension; false confessions; juvenile justice treatment outcome research; anger management intervention development; child and adolescent behavior problems.

Kirk Heilbrun, PhD *(University of Texas at Austin)*. Professor. Forensic psychology, juvenile and adult criminality, violence risk assessment, forensic psychological assessment, treatment of mentally disordered offenders, academic-sports mentoring.

Adrienne Juarascio, PhD *(Drexel University)*. Associate Professor. Enhancing treatment outcomes for eating disorders and obesity; Acceptance-based behavioral treatments; Evaluating mechanisms of action in behavioral treatments

Marlin Killen, PhD *(Trident University International)*. Teaching Professor. Authentic teaching methods in Psychology as well as student persistence behavior.

John Kounios, PhD *(University of Michigan) Director, PhD Program in Applied Cognitive and Brain Sciences*. Professor. Cognitive neuroscience, especially creativity, problem solving, and cognitive enhancement.

Aaron Kucyi, PhD *(York University)*. Assistant Professor. Brain networks, mental health, spontaneous thought, attention, experience sampling, fMRI, intracranial EEG.

Michael Lowe, PhD *(Boston College)*. Professor. Prevention and treatment of eating disorders and obesity; effects of appetitive responsiveness and dietary restraint on eating regulation; psychobiology of obesity-proneness; empirical foundations of unconscious processes.

Stephanie Manasse, PhD *(Drexel University) Director, MS and Accelerated BS/MS in Psychology Programs*. Assistant Professor. Novel treatments for adolescents and adults with eating disorders, Momentary drivers of binge eating, Self-regulation, Ecological momentary assessment.

John Medaglia, PhD *(The Pennsylvania State University)*. Associate Professor. Applying models and methods developed in neuropsychology, cognitive neuroscience and graph theory to understand and treat brain dysfunction and enhance healthy functioning

Megan Meyer, PhD *(Temple University)*. Assistant Teaching Professor. Influences on preferred body type; changes in body image, self-esteem, and self-efficacy in females as a function of strength training; Sensation and Perception

Danette Morrison, PhD *(University of Maryland - College Park)*. Associate Teaching Professor. Social and academic motivation within school context; Social relationships and identity development; Educational attainment of ethnic minorities

Arthur Nezu, PhD, DHLL, ABPP *(State University of New York at Stony Brook)*. Distinguished University Professor of Psychology, Professor of Medicine, Professor of Community Health and Prevention. Behavioral medicine applications of problem-solving therapy and other cognitive-behavior therapies (e.g., to decrease emotional and psychosocial risk factors; improve adherence), particularly with regard to patients with cardiovascular disease; assessment.

Christine Maguth Nezu, PhD *(Fairleigh Dickinson University)*. Professor of Psychology, Professor of Medicine. Cognitive-behavioral assessment and treatment for mood, anxiety, personality disorders, and coping with chronic illness; mind/body studies; stress and coping; developmental disabilities and comorbid behavioral and emotional disorders; spirituality and psychology.

Nancy Raitano Lee, PhD *(University of Denver)*. Associate Professor. Neuropsychological and neuroanatomic correlates of intellectual and developmental disabilities; Verbal memory and language difficulties in Down syndrome and other genetic disorders; Comorbid autism spectrum disorder symptoms in youth with genetic disorders; Neuroanatomic correlates of individual differences in typical and atypical cognition

Diana Robins, PhD *(University of Connecticut) Director, AJ Drexel Autism Institute*. Professor. Autism screening, early detection of autism

Leeland Loew Rogers, PhD *(University of Delaware)*. Assistant Teaching Professor. Incidental learning, statistical learning, attention.

Ludo Scheffer, PhD *(University of Pennsylvania) Director of Undergraduate Studies*. Teaching Professor. Meta-cognitive development, writing, and computers; Language and literacy development in the early years in the context of family and schooling; Youth-at-risk; School violence and bullying; Program/intervention effectiveness

Maria Schultheis, PhD *(Drexel University)*. Professor. Clinical Neuropsychology and rehabilitation following neurological compromise (brain injury, stroke, multiple sclerosis), application of technologies in psychology. Specialization in the use of virtual reality (VR) simulation, and evaluation of the demands of driving after disability.

Julia Sluzenski, PhD *(Temple University)*. Associate Teaching Professor. Spatial and episodic memory, memory loss across the lifespan, developmental psychology.

Alexa Tompary, PhD *(University of New York)*. Assistant Professor. Neural bases of episodic memory and conceptual knowledge, systems memory consolidation theories, functional neuroimaging, transcranial magnetic stimulation.

Fengqing (Zoe) Zhang, PhD *(Northwestern University)*. Associate Professor. Neuroimaging data analysis; Data mining; Bayesian inference; High dimensional data analysis

Eric A Zillmer, PsyD *(Florida Institute of Technology) Carl R. Pacifico Professor of Neuropsychology and the Director of Athletics*. Professor. Psychological assessment (neuropsychological, cognitive, personality), psychiatric and neurological disorders, behavioral medicine, neurogerontology, mathematical modeling, sports psychology, psychology of genocide.

Emeritus Faculty

James Calkins, PhD. Professor Emeritus.

Mary Spiers, PhD *(University of Alabama at Birmingham)*. Professor Emeritus. Clinical neuropsychology and medical psychology; memory and practical applications for memory disorders in the elderly; cognitive health of women.

Applied Cognitive and Brain Sciences PhD

Major: Applied Cognitive and Brain Sciences
Degree Awarded: Doctor of Philosophy (PhD)
Calendar Type: Quarter
Minimum Required Credits: 91.0 (PhD)

Co-op Option: None
Classification of Instructional Programs (CIP) code: 42.2799
Standard Occupational Classification (SOC) code: 19-3031; 19-3032; 19-3039

About the Program

The Department of Psychological and Brain Science's program in Applied Cognitive and Brain Sciences (ACBS) is a research-oriented, non-clinical program in experimental psychology and cognitive neuroscience. The program places emphasis on psychological questions of real-world significance, grounded in fundamental issues and rigorous methods of basic science.

Additional Information

Please visit the ACBS program website (https://drexel.edu/academics/grad-professional-programs/coas/psychology-phd-applied-cognitive-and-brain-sciences/) for more information on the ACBS program and the Department of Psychological and Brain Science's website for details on the PhD program requirements.

Admission Requirements

Drexel University is seeking applicants with a strong academic record, as evidenced by their GRE scores (a quantitative plus verbal sum of 1250 or greater is desirable), strength of undergraduate institution, and GPA (3.5 or greater is preferred). In addition, applicants should have outstanding letters of recommendation (from doctoral-level academic, research-oriented psychologists, if possible), high-quality research experience, and include a statement of purpose that convinces Drexel that a potential student is an excellent match for one or more of our research groups.

Additional Information

For more details on how to apply to this program, please visit the Graduate Admissions Psychology (http://www.drexel.edu/grad/programs/coas/psychology-phd-applied-cognitive-and-brain-sciences/) page.

Degree Requirements

The PhD program curriculum requires students to earn a minimum of 91.0 credits. Students completing the Applied Cognitive and Brain Science program take all or most of their core courses within the first two years. The third and fourth years, following the receipt of the master's degree, successful passing of the qualifying examinations, and advancement to doctoral candidacy, will be spent in enrichment or specialization courses negotiated with their research supervisor and in research activities.

Program Requirements

Required courses		
PSY 530	Neuroanatomy and Behavior	3.0
GRAD T580	Special Topics	1.0
PSY 709	Data Analysis in Psychology I	3.0
PSY 710	Data Analysis in Psychology II	3.0
PSY 711	Data Analysis in Psychology III	3.0
PSY 810	Behavioral Data Mining [*]	3.0
or PSY 811	Multilevel Regression	
PSY 812	Cognitive Neuroscience	3.0
Topics course		**15.0-21.0**
PSY 600	Current Topics in Applied Cognitive and Brain Sciences [**]	
PSY electives		**21.0**
Master's thesis [***]		**9.0-27.0**
PSY 898	Master's Thesis in Psychology	
Dissertation credits		**27.0-45.0**
PSY 998	Ph.D. Dissertation in Psychology	
Total Credits		**91.0-133.0**

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Or any other statistics course approved by the program director.

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This is a required course for all ACBS students every single term the class is offered, regardless of a student's year in the program. If PSY 600 is offered any given term, ACBS students are required to take it.

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The actual number of credits required will vary dependent upon student's thesis and research topic.

Sample PSY electives		
PSY 512	Cognitive Psychology	3.0
PSY 516	Developmental Psychology	3.0
PSY 601	Introduction to Data Science for Psychology	1.0
PSY 615	Judgment & Decision-making	3.0
PSY 616	Motivation and Emotion	3.0
PSY 712	History and Systems	3.0
PSY 809	Statistical Programming and Modeling with R for Psychology	3.0
PSY 814	Neuroimaging & Physiology of Behavior	3.0
PSY I899	Independent Study in PSY	3.0-12.0
PSY I999	Independent Study in PSY	3.0-12.0

Sample Plan of Study

First Year				
Fall	**Credits Winter**	**Credits Spring**	**Credits Summer**	**Credits**
GRAD T580	1.0 PSY 530	3.0 PSY 711	3.0 VACATION	
PSY 600	3.0 PSY 600	3.0 PSY Electives	6.0	
PSY 709	3.0 PSY 710	3.0		
PSY 812	3.0			
	10	**9**	**9**	**0**
Second Year				
Fall	**Credits Winter**	**Credits Spring**	**Credits Summer**	**Credits**
PSY 810 or 811*	3.0 PSY 898	3.0 PSY 600	3.0 VACATION	
PSY Electives	6.0 PSY Electives	6.0 PSY 898	6.0	
	9	**9**	**9**	**0**
Third Year				
Fall	**Credits Winter**	**Credits Spring**	**Credits Summer**	**Credits**
PSY 600	3.0 PSY 998	6.0 PSY 998	9.0 VACATION	
PSY 998	6.0 PSY electives	3.0		
	9	**9**	**9**	**0**
Fourth Year				
Fall	**Credits**			
PSY 600	3.0			
PSY 998	6.0			
	9			

Total Credits 91

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Or any other statistics course approved by the program director.

In years four and five, students continue to register for 9.0 credits of PSY 998 (or 3.0 credits of PSY 600 and 6.0 credits of PSY 998 in terms when PSY 600 is offered) each Fall, Winter, and Spring Term until the completion of program requirements, including successful defense of the dissertation.

Program Level Outcomes

Upon completion of the program, graduates will be prepared to:

- Have a good general understanding of human cognition and its neural basis.
- Conduct independent research in an ethical manner.
- Achieve good scientific writing skills.
- Achieve good presentation skills.
- Acquire superior statistical skills.
- Acquire computer skills for experimental control, data analysis, and modeling.

Applied Cognitive and Brain Sciences Faculty

Evangelia Chrysikou, PhD *(Temple University) Director, PhD Program in Applied Cognitive and Brain Sciences*. Associate Professor. Cognitive neuroscience, neuropsychology, neural basis of language, memory, and executive functions, neurocognitive processes associated with problem solving and flexible thought

John Kounios, PhD *(University of Michigan) Director, PhD Program in Applied Cognitive and Brain Sciences*. Professor. Cognitive neuroscience, especially creativity, problem solving, and cognitive enhancement.

Aaron Kucyi, PhD *(York University)*. Assistant Professor. Brain networks, mental health, spontaneous thought, attention, experience sampling, fMRI, intracranial EEG.

Michael Lowe, PhD *(Boston College)*. Professor. Prevention and treatment of eating disorders and obesity; effects of appetitive responsiveness and dietary restraint on eating regulation; psychobiology of obesity-proneness; empirical foundations of unconscious processes.

John Medaglia, PhD *(The Pennsylvania State University)*. Associate Professor. Applying models and methods developed in neuropsychology, cognitive neuroscience and graph theory to understand and treat brain dysfunction and enhance healthy functioning

Nancy Raitano Lee, PhD *(University of Denver)*. Associate Professor. Neuropsychological and neuroanatomic correlates of intellectual and developmental disabilities; Verbal memory and language difficulties in Down syndrome and other genetic disorders; Comorbid autism spectrum disorder symptoms in youth with genetic disorders; Neuroanatomic correlates of individual differences in typical and atypical cognition

Maria Schultheis, PhD *(Drexel University)*. Professor. Clinical Neuropsychology and rehabilitation following neurological compromise (brain injury, stroke, multiple sclerosis), application of technologies in psychology. Specialization in the use of virtual reality (VR) simulation, and evaluation of the demands of driving after disability.

Patricia A. Shewokis, PhD *(University of Georgia)*. Professor. Roles of cognition and motor function during motor skill learning; role of information feedback frequency on the memory of motor skills, noninvasive neural imaging techniques of functional near infrared spectroscopy(fNIRS) and electroencephalography (EEG) and methodology and research design.

Alexa Tompary, PhD *(University of New York)*. Assistant Professor. Neural bases of episodic memory and conceptual knowledge, systems memory consolidation theories, functional neuroimaging, transcranial magnetic stimulation.

Fengqing (Zoe) Zhang, PhD *(Northwestern University)*. Associate Professor. Neuroimaging data analysis; Data mining; Bayesian inference; High dimensional data analysis

Psychology: Clinical Psychology PhD

Major: Psychology
Degree Awarded: Doctor of Philosophy (PhD)
Calendar Type: Quarter
Minimum Required Credits: 90.0 (PhD)
Co-op Option: None
Classification of Instructional Programs (CIP) code: 42.2799
Standard Occupational Classification (SOC) code: 19-3031; 19-3032; 19-3039

About the Program

The PhD program in Clinical Psychology program is a scientist-practitioner-oriented program that is fully accredited by the American Psychological Association (APA). The program places equal emphasis on clinical research and the application of scientific principles. It encompasses five years of full-time study and provides graduate students with a strong foundation in relevant psychological theory, experience in the practice of psychological assessment and intervention, experience in conducting meaningful clinical research, and opportunities to develop teaching competencies.

The program in Clinical Psychology curriculum follows the scientist-practitioner model and APA guidelines on accreditation of doctoral clinical psychology programs. It also considers state licensing guidelines and various publications that have been written on the topic of doctoral education, training, and credentialing in clinical psychology, as well as the specialty areas of clinical neuropsychology, clinical health psychology, clinical child psychology, and/or forensic psychology.

Additional Information

See the Clinical Psychology program's website (https://drexel.edu/coas/academics/graduate-programs/psychology/doctorate-clinical-psychology/) for more information.

Admission Requirements

All students are admitted with the expectation that they intend to complete the PhD degree; however, before advancing to doctoral-level studies, students must earn the MS including completion of a master's thesis. Admitted students who hold a bachelor's degree are expected to complete both the master's degree and post-master's portions of the Drexel curriculum. Applicants who already hold a master's from another university may be admitted with post-master's status if their graduate-level preparation is deemed equivalent to the master's portion of the Drexel curriculum.

Requirements for Students Enrolling with a Bachelor’s Degree

For those entering with a bachelor’s degree, the PhD program requires approximately five years to complete. The first two years of training correspond to the master’s-level studies: focusing on clinical areas such as entry-level assessment and intervention skills, psychopathology, and specialized study in clinical neuropsychology, clinical health psychology, cognitive and behavioral psychology, clinical child psychology, and/or forensic psychology. These two years also include a major focus on research skills involving statistics, research design, and supervised research experience with the mentor. Entry-level assessment, intervention, and teaching skills are also developed.

By the end of the first two years of study, students should have completed 45.0 credits of coursework, maintained a GPA of at least 3.5, developed and defended a thesis, passed comprehensive examinations, and completed practicum experience, both internally (Psychological Service Center) and external clinical practicum experiences. Students demonstrating satisfactory performance in these areas will be admitted to post-master’s status.

Requirements for Students Who Already Hold a Master’s Degree

Students entering with a master’s degree from another university complete the PhD requirements in four to five years. The master’s degree should have included an experimental thesis. Students lacking this prerequisite will still be considered for admission, but such students will be required to complete a research project equivalent to the Drexel master’s thesis. In addition, students must demonstrate a GPA of at least 3.5 in master’s-level courses in order to be accepted for post-master’s status.

Additional Information

For more information on how to apply, visit Drexel's Admissions Requirements for Psychology (http://www.drexel.edu/grad/programs/coas/psychology-phd/) page.

Degree Requirements

The following section outlines the courses required for graduation for entering bachelor's-level students. The PhD program curriculum requires the student to earn a minimum of 90.0 credits. Typically, students enroll in 27.0 credits during the first year, 22.0 credits during the second and third years, 12.0 credits in the fourth year, and 8.0 credits during the fifth/final internship year. Drexel University operates on a calendar of four 11-week terms. Students in the program do not take courses during summer term in order to complete research projects and continue clinical practicum training.

All coursework can be divided into two major components: (1) foundations of psychology, which is the evolving body of knowledge in the discipline of psychology, and (2) clinical and professional training, which focuses on the application of theory and empirical research to the practice of psychology. Listed below are all required and elective courses offered within the Drexel psychology curriculum followed by specific requirements for each major area of study. Credit levels listed are set at the minimum required.

Program Requirements

Required Courses		
Foundations of Psychology		
PSY 516	Developmental Psychology	3.0
PSY 712	History and Systems	3.0
Statistics/Research Methods		
PSY 510	Research Methods I	3.0
PSY 709	Data Analysis in Psychology I	3.0
PSY 710	Data Analysis in Psychology II	3.0
PSY 711	Data Analysis in Psychology III	3.0
PSY 898	Master's Thesis in Psychology	1.0-3.0
PSY 998	Ph.D. Dissertation in Psychology	6.0
Biological Bases of Behavior		
PSY 630	Biological Basis of Behavior and Treatment	3.0
Select the following or a relevant PSY elective:		
PSY 530	Neuroanatomy and Behavior	3.0
Cognitive/Affective Bases of Behavior		
PSY 812	Cognitive Neuroscience	3.0
Select one of the following:		3.0
PSY 512	Cognitive Psychology	
PSY 616	Motivation and Emotion	
Social Bases of Behavior		
PSY 518	Social Psychology	3.0
PSY 550	Multicultural Perspectives in Psychology	3.0
Clinical and Professional Training General Foundations of Practice		
PSY 520	Psychopathology	3.0
PSY 524	Professional Issues and Ethics	3.0
PSY 560	Clinical Supervision and Consultation in Psychology *	2.0-3.0

Foundations of Psychological Evaluation/Measurement		
PSY 515	Clinical Case Conceptualization	3.0
PSY 522	Psychological and Intellectual Assessment	3.0
PSY 620	Personality Assessment	3.0
Foundations of Intervention		
PSY 721	Principles of Psychotherapy	3.0
PSY 722	Theories of Intervention	3.0
PSY 820	Cognitive-Behavioral Therapy	3.0
PSY 999	Internship	6.0
Advanced Professional Training Electives		
Select at least five of the following:		15.0
PSY 542	Neuropsychological Assessment	
PSY 648	Forensic Assessment I	
PSY 649	Forensic Assessment II	
PSY 650	Child Psychopathology & Treatment	
PSY 675	Mindfulness and Acceptance-based Treatments	
PSY 720	Health Psychology	
PSY 742	Neuropsychological Case Analysis and Integration	
PSY 810	Behavioral Data Mining	
PSY 811	Multilevel Regression	
PSY 814	Neuroimaging & Physiology of Behavior	
PSY 815	Evidence-Based Psychotherapy	
PSY 822	Pediatric Psychology	
PSY 823	Substance Use	
PSY 827	Behavioral Stress Management	
PSY 828	Weight and Eating Disorders	
PSY 830	Advanced Topics in Health Psychology	
PSY 840	Advanced Cognitive-Behavioral Therapy	
PSY 854	Psychology of Rehabilitation	
PSY T880	Special Topics in Psychology	
Total Credits		**90.0-93.0**

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Taken for 1 credit in Fall and 2 credits in Spring.

Major Areas of Study

Clinical Neuropsychology

The clinical neuropsychology concentration includes courses, research, and clinical experiences designed to train the students for professional practice in neuropsychology. Clinical neuropsychology involves the application of psychological assessment and intervention to the problems encountered by people with brain injury or illness. The knowledge of brain-behavior functioning and the incorporation of neuropsychological conceptualizations with traditional clinical conceptualizations of functioning are aimed at providing the student with a wider perspective regarding the range of human functioning and disability. The student is able to pursue specific interests in geriatrics, pediatrics, traumatic brain injury, and rehabilitation.

In addition to the core curriculum:

- One neuropsychology practicum (800 hours)
- A neuropsychology-focused thesis and dissertation
- At least two years of research in an area related to clinical neuropsychology
- Five courses from the following list: Neuroanatomy and Behavior, Neuropsychological Assessment, Biological Basis of Behavior and Treatment, Neuropsychological Case Analysis and Integration, Cognitive Neuroscience, Psychology of Rehabilitation

Forensic Psychology

Forensic psychology involves the application of assessment and intervention techniques to informing legal decision-makers and attorneys on questions in criminal, civil, and family law. Those who concentrate in forensic psychology will be trained in relevant law, behavioral science research, and assessment and intervention approaches with a particular focus on juvenile and criminal issues.

In addition to the core curriculum:

- One forensic psychology practicum (800 hours)
- A forensic psychology-focused thesis and dissertation
- At least two years of research in an area related to forensic psychology
- Required classes: Forensic Assessment I and II, Mental Health Law

- At least two electives from the following list: Neuropsychological Assessment, Neuropsychological Case Analysis and Integration, Child Psychopathology and Treatment, Mindfulness and Acceptance-Based Treatments, Multilevel Regression, Evidence-Based Psychotherapy, Substance Use, Advanced Cognitive-Behavioral Therapy, Psychology of Rehabilitation

Clinical Health Psychology

Clinical Health Psychology adopts a broad-based biopsychosocial perspective in order to: (1) better understand the interplay among behavioral, emotional, cognitive, social and biological factors regarding health, wellness, and physical disease; (2) promote and maintain wellness and positive physical health; (3) prevent, treat, and rehabilitate illness and disability, and (4) improve the health care delivery system. The clinical health psychology MAS aims to provide students with specialty training to prepare them for academic, clinical, and/or administrative positions where the primary focus is on medical and physical health problems.

In addition to the core curriculum:

- One clinical health psychology practicum (800 hours)
- Clinical health psychology-focused thesis and dissertation
- At least two years of research in an area related to clinical health psychology
- Required classes: Health Psychology, Evidence-Based Psychotherapy, Biological Basis of Behavior and Treatment, Behavioral Stress Management
- At least two electives from the following list: Advanced Topics in Health Psychology, Advanced Cognitive-Behavioral Therapy, Mindfulness and Acceptance-Based Treatments, Psychology of Rehabilitation, Substance Use, Weight and Eating Disorders

Clinical Child Psychology

The clinical child psychology major area of study is designed for students who have strong clinical and/or research interests in working with children and adolescents. Students in this major area of study will complete the required courses taken by all clinical psychology students and will also enroll in child-related elective courses designed to help them develop a greater degree of expertise in working with child and adolescent populations. It is expected that students completing this specialization will develop an appreciation of the research literature in the clinical child area and will possess specialty skills that enable them to function as competent practitioners in the child/adolescent area upon graduation.

In addition to the core curriculum:

- One pediatric, child or adolescent practicum (800 hours)
- A Clinical Child Psychology-focused thesis and dissertation
- At least two years of research in an area related to clinical child psychology
- Required classes: Child Psychopathology and Treatment, Pediatric Psychology
- At least two additional electives from the following list: Neuropsychological Case Analysis and Integration, Forensic Assessment I, Behavioral Analysis

Additional Information

For more information on the PhD program requirements, contact the Clinical Psychology PhD program (https://drexel.edu/academics/grad-professional-programs/coas/psychology-phd/).

Sample Plan of Study

First Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
PSY 520	3.0	PSY 522	3.0	PSY 510	3.0	VACATION	
PSY 709	3.0	PSY 710	3.0	PSY 711	3.0		
PSY 722	3.0	PSY 721	3.0	PSY 820	3.0		
	9		**9**		**9**		**0**

Second Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
PSY 515	3.0	PSY 524	3.0	PSY 550	3.0	VACATION	
PSY 898 (or PSY Elective)	3.0	PSY 898 (or PSY Elective)	3.0	PSY 898 (or PSY Elective)	3.0		
PSY Elective	3.0	PSY Electives	3.0	PSY Elective	3.0		
	9		**9**		**9**		**0**

Third Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
PSY 630	3.0	PSY 620	3.0	PSY 516	3.0	VACATION	
PSY 898 or 998 (or PSY Elective)	3.0	PSY 898 or 998 (or PSY Elective)	3.0	PSY 518	3.0		
PSY Elective	3.0	PSY Elective	3.0	PSY 560	2.0-3.0		

		PSY 898 or 998	1.0	
	9	**9**	**9-10**	**0**
Fourth Year				
Fall	**Credits Winter**	**Credits Spring**	**Credits Summer**	**Credits**
PSY 998	6.0 PSY 712	3.0 PSY 998	6.0 VACATION	
PSY Elective	3.0 PSY 998	6.0 PSY Elective	3.0	
	9	**9**	**9**	**0**
Fifth Year				
Fall	**Credits Winter**	**Credits Spring**	**Credits**	
PSY 998	7.0 PSY 998	7.0 PSY 998	7.0	
PSY 999	2.0 PSY 999	2.0 PSY 999	2.0	
	9	**9**	**9**	

Total Credits 135-136

Facilities

Computers

Computer resources for student use include more than 20 personal computers (IBM, Macintosh) available in the library and 10 IBM PCs available in the computer laboratory. Both facilities are near the department. In both locations, word processing and biostatistics software is available.

By using computers from their homes or in the library, students have free access to email and a wide array of online services (e.g., the Internet, World Wide Web, and literature databases such as PsychLit and Medline).

Library

Psychology books and journals are located at the Moore Campus Library on Henry Avenue, Queen Lane Library on the Queen Lane Campus, and the W. W. Hagerty Library on the University City Campus. The combined holdings represent one of the best psychology libraries on the East Coast.

Equipment

Testing equipment for classroom instruction is available to psychology graduate students. The program also has videotape and audiotape equipment available for classroom instruction and research activities.

Program Level Outcomes

- Have a solid understanding of theories and application of psychological assessment and intervention
- Conduct basic applied research in an ethical manner
- Completion of year 1 and 2 coursework in the PhD curriculum
- Completion of practicum rotation in the Psychological Service Clinic
- Propose, conduct, and defend an empirical thesis that addresses some aspect of psychology
- Successfully complete the comprehensive examination

Psychology Faculty

Meghan Butryn, PhD *(Drexel University)*. Professor. Treatment and prevention of obesity and eating disorders, behavioral treatment, acceptance and commitment therapy.

Dorothy Charbonnier, PhD *(State University of New York at Stony Brook)*. Associate Teaching Professor. The nature of the creative process and writing.

Evangelia Chrysikou, PhD *(Temple University) Director, PhD Program in Applied Cognitive and Brain Sciences*. Associate Professor. Cognitive neuroscience, neuropsychology, neural basis of language, memory, and executive functions, neurocognitive processes associated with problem solving and flexible thought

Brian Daly, PhD *(Loyola University, Chicago) Department Head*. Associate Professor. Pediatric neuropsychology, intervention with at-risk youth.

David DeMatteo, PhD, JD *(MCP Hahnemann University; Villanova University School of Law) Director of the JD-PhD Program in Law and Psychology*. Professor. Psychopathy, forensic mental health assessment, drug policy; offender diversion.

Evan M. Forman, PhD *(University of Rochester) Director WELL Center*. Professor. Clinical psychology: mechanisms and measurement of psychotherapy outcome, cognitive-behavioral and acceptance based psychotherapies, the development and evaluation of acceptance-based interventions for health behavior change (for problems of obesity and cardiac disease) as well as mood and anxiety disorders; neurocognition of eating.

Pamela Geller, PhD *(Kent State University) Director, Clinical Training*. Associate Professor. Stressful life events and physical and mental health outcomes, particularly in the area of women's reproductive health (e.g. pregnancy, pregnancy loss, infertility, medical education).

Maureen Gibney, PsyD *(Widener University)*. Teaching Professor. Clinical psychopathology; neuropsychological evaluation and intervention with the elderly.

Naomi Goldstein, PhD *(University of Massachusetts) Co-Director of the JD-PhD Program; Stoneleigh Foundation Fellow*. Professor. Forensic psychology; juvenile justice; Miranda rights comprehension; false confessions; juvenile justice treatment outcome research; anger management intervention development; child and adolescent behavior problems.

Kirk Heilbrun, PhD *(University of Texas at Austin)*. Professor. Forensic psychology, juvenile and adult criminality, violence risk assessment, forensic psychological assessment, treatment of mentally disordered offenders, academic-sports mentoring.

Adrienne Juarascio, PhD *(Drexel University)*. Associate Professor. Enhancing treatment outcomes for eating disorders and obesity; Acceptance-based behavioral treatments; Evaluating mechanisms of action in behavioral treatments

Marlin Killen, PhD *(Trident University International)*. Teaching Professor. Authentic teaching methods in Psychology as well as student persistence behavior.

John Kounios, PhD *(University of Michigan) Director, PhD Program in Applied Cognitive and Brain Sciences*. Professor. Cognitive neuroscience, especially creativity, problem solving, and cognitive enhancement.

Aaron Kucyi, PhD *(York University)*. Assistant Professor. Brain networks, mental health, spontaneous thought, attention, experience sampling, fMRI, intracranial EEG.

Michael Lowe, PhD *(Boston College)*. Professor. Prevention and treatment of eating disorders and obesity; effects of appetitive responsiveness and dietary restraint on eating regulation; psychobiology of obesity-proneness; empirical foundations of unconscious processes.

Stephanie Manasse, PhD *(Drexel University) Director, MS and Accelerated BS/MS in Psychology Programs*. Assistant Professor. Novel treatments for adolescents and adults with eating disorders, Momentary drivers of binge eating, Self-regulation, Ecological momentary assessment.

John Medaglia, PhD *(The Pennsylvania State University)*. Associate Professor. Applying models and methods developed in neuropsychology, cognitive neuroscience and graph theory to understand and treat brain dysfunction and enhance healthy functioning

Megan Meyer, PhD *(Temple University)*. Assistant Teaching Professor. Influences on preferred body type; changes in body image, self-esteem, and self-efficacy in females as a function of strength training; Sensation and Perception

Danette Morrison, PhD *(University of Maryland - College Park)*. Associate Teaching Professor. Social and academic motivation within school context; Social relationships and identity development; Educational attainment of ethnic minorities

Arthur Nezu, PhD, DHLL, ABPP *(State University of New York at Stony Brook)*. Distinguished University Professor of Psychology, Professor of Medicine, Professor of Community Health and Prevention. Behavioral medicine applications of problem-solving therapy and other cognitive-behavior therapies (e.g., to decrease emotional and psychosocial risk factors; improve adherence), particularly with regard to patients with cardiovascular disease; assessment.

Christine Maguth Nezu, PhD *(Fairleigh Dickinson University)*. Professor of Psychology, Professor of Medicine. Cognitive-behavioral assessment and treatment for mood, anxiety, personality disorders, and coping with chronic illness; mind/body studies; stress and coping; developmental disabilities and comorbid behavioral and emotional disorders; spirituality and psychology.

Nancy Raitano Lee, PhD *(University of Denver)*. Associate Professor. Neuropsychological and neuroanatomic correlates of intellectual and developmental disabilities; Verbal memory and language difficulties in Down syndrome and other genetic disorders; Comorbid autism spectrum disorder symptoms in youth with genetic disorders; Neuroanatomic correlates of individual differences in typical and atypical cognition

Diana Robins, PhD *(University of Connecticut) Director, AJ Drexel Autism Institute*. Professor. Autism screening, early detection of autism

Leeland Loew Rogers, PhD *(University of Delaware)*. Assistant Teaching Professor. Incidental learning, statistical learning, attention.

Ludo Scheffer, PhD *(University of Pennsylvania) Director of Undergraduate Studies*. Teaching Professor. Meta-cognitive development, writing, and computers; Language and literacy development in the early years in the context of family and schooling; Youth-at-risk; School violence and bullying; Program/intervention effectiveness

Maria Schultheis, PhD *(Drexel University)*. Professor. Clinical Neuropsychology and rehabilitation following neurological compromise (brain injury, stroke, multiple sclerosis), application of technologies in psychology. Specialization in the use of virtual reality (VR) simulation, and evaluation of the demands of driving after disability.

Julia Sluzenski, PhD *(Temple University)*. Associate Teaching Professor. Spatial and episodic memory, memory loss across the lifespan, developmental psychology.

Alexa Tompary, PhD *(University of New York)*. Assistant Professor. Neural bases of episodic memory and conceptual knowledge, systems memory consolidation theories, functional neuroimaging, transcranial magnetic stimulation.

Fengqing (Zoe) Zhang, PhD *(Northwestern University)*. Associate Professor. Neuroimaging data analysis; Data mining; Bayesian inference; High dimensional data analysis

Eric A Zillmer, PsyD *(Florida Institute of Technology) Carl R. Pacifico Professor of Neuropsychology and the Director of Athletics*. Professor. Psychological assessment (neuropsychological, cognitive, personality), psychiatric and neurological disorders, behavioral medicine, neurogerontology, mathematical modeling, sports psychology, psychology of genocide.

Emeritus Faculty

James Calkins, PhD. Professor Emeritus.

Mary Spiers, PhD *(University of Alabama at Birmingham)*. Professor Emeritus. Clinical neuropsychology and medical psychology; memory and practical applications for memory disorders in the elderly; cognitive health of women.

Public Policy MS

Major: Public Policy
Degree Awarded: Master of Science (MS)
Calendar Type: Quarter
Minimum Required Credits: 45.0
Co-op Option: None
Classification of Instructional Programs (CIP) code: 44.0501
Standard Occupational Classification (SOC) code: 11-1031

About the Program

Drexel's MS in Public Policy (MPP) is similar in its core curriculum to a Master of Public Administration (MPA) as it is designed for people who work, or who would like to work, for government or a nonprofit organization. It is innovative and distinct in at least two key respects: Its focus on case study research and its distinct tracks of specialization.

The program has a required core curriculum of nine courses specifically designed for students to:

- Develop an understanding of the social, political, and ethical context of policy research
- Conceptualize, design, and conduct research for policy purposes, as well as comprehensively analyze existing research
- Understand the history of public policy institutions in America and the management and governance of nonprofit organizations

In addition to the core courses, the program has a focus on case study research as a unifying element of the curriculum. Students are required to choose a specific case study topic that they will work on typically for three terms during the program. By the end of the program, students will have produced a polished, in-depth analysis of a specific case that they can use to demonstrate expertise in a given policy area.

Specialization Tracks: With the approval and support of the program director, students can craft a specialized course of study with their three electives or they can take courses in the following:

- Economic Policy
- Education Policy
- Environmental Policy
- Health Policy
- Information Policy
- Nonprofit Management

Additional Information

For more information, view the Center for Public Policy (http://drexel.edu/coas/academics/departments-centers/public-policy/) page on the College of Arts and Sciences website. For current Drexel Thomas Kline School of Law students, please see the page on joint JD-MS Public Policy degrees (http://drexel.edu/law/academics/jointDegrees/JD-MSPP/) for more information.

Admission Requirements

Acceptance for graduate study at Drexel University requires a four-year bachelor's degree from an accredited institution in the United States or an equivalent international institution. There is no pre-requisite undergraduate major or specific coursework. Although admission requirements vary by program, regular acceptance typically requires a minimum grade point average (GPA) of 3.0 for the last two years of undergraduate work. The GPA for any graduate work must be at least 3.0.

The admission committee evaluates all credentials submitted by applicants to determine a student's ability and potential to succeed in graduate study. Applicants to this program should also include their intended area of focus (see the admissions page for the essay prompt) and are often contacted for an information interview. The committee is interested in the applicant's ability to contribute to their program of study and to the University community as a whole.

Drexel is extending the same scholarship opportunities to Master of Science in Public Policy students who enroll in 8.0 credits that are usually only available for full-time programs (minimum enrollment of 9.0 credits for full-time status).

Additional Information

Visit the Graduate Admissions (http://www.drexel.edu/grad/programs/coas/) website for more information about requirements and deadlines, as well as instructions for applying online.

Degree Requirements

Students take required courses for the MS in Public Policy from multiple schools within Drexel University, including the Center for Public Policy in the College of Arts and Sciences, the LeBow College of Business, and the College of Computing and Informatics.

Students are required to receive a grade of "B" or better in all core coursework in order to fulfill the requirements of the MS in Public Policy degree and be eligible for graduation. This policy is in addition to the Drexel University Graduate College policy that requires all graduate students to maintain a minimum cumulative 3.0 GPA per term as well as an overall 3.0 GPA for graduation purposes.

Core Courses		
PLCY 503	Theory and Practice of Policy Analysis	3.0
PLCY 504	Methods of Policy Analysis	3.0
PLCY 506	Institutional Dynamics of the Policy Process	3.0
PLCY 507	Nonprofit Organizations	3.0
Economics		
ECON 601	Managerial Economics	3.0
ECON 616	Public Finance and Cost Benefit Analysis	3.0
or ECON 650	Business & Economic Strategy: Game Theory & Applications	
Statistics		
URBS 530	Quantitative Methods & Reasoning for Urban Strategists	3.0
or COM 500	Reading & Research in Communication	
Choose from the following Statistics Electives:		3.0
BSAN 601	Business Analytics for Managers	
CCM 705	Data Analysis in Communication	
ECON 540	Intro to Econometrics and Data Analysis	
ECON 550	Econometrics	
STAT 601	Business Statistics	
STAT 610	Statistics for Business Analytics	
Case Study Courses		**9.0**
PLCY 510	Introduction to Case Study Research	
PLCY 516	Case Study Research II	
PLCY 517	Case Study Final Project	
Graduate Electives*		**12.0**
Total Credits		**45.0**

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Public Policy students can select up to 12.0 credits of graduate-level electives (500-799) in the following subject areas: AADM, AAML, ACCT, BUSN, CCM, CHP, COM, CRTV, CW, DIGM, ECON, EDAM, EDHE, EDLT, EDUC, ENTP, ENVP, ENVS, EOH, HMP, HRM, INFO, LING, MGMT, MKTG, MUSL, NPM, ORGB, PBHL, PLCY, PROJ, PRST, RMER, SCRP, SCTS, SMT, TVMN. Other graduate courses outside these areas might be taken pending approval from the graduate advisor or program director. These 12.0 credits of graduate-level electives can be used towards a graduate minor (https://catalog.drexel.edu/graduateminors/) or graduate certificate program (https://catalog.drexel.edu/certificates/postbaccalaureate/).

Sample Plan of Study

Face to face sample plan of study

First Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
PLCY 503	3.0	ECON 601	3.0	ECON 616	3.0	VACATION	
URBS 530	3.0	PLCY 506	3.0	PLCY 507	3.0		
Graduate Elective	3.0	Graduate Elective	3.0	PLCY 510	3.0		
	9		**9**		**9**		**0**

Second Year

Fall	Credits	Winter	Credits
PLCY 504	3.0	PLCY 517	3.0
PLCY 516	3.0	Graduate Elective	3.0
Statistics Elective	3.0	Graduate Elective	3.0
	9		**9**

Total Credits 45

Face to face part time sample plan of study

First Year (Part-Time)

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
PLCY 503	3.0	ECON 601	3.0	ECON 616	3.0	VACATION	
URBS 530	3.0	PLCY 506	3.0	PLCY 507	3.0		
	6		**6**		**6**		**0**

Second Year (Part-Time)

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
PLCY 504	3.0	Statistics Elective	3.0	PLCY 510	3.0	VACATION	
Graduate Elective	3.0	Graduate Elective	3.0	Graduate Elective	3.0		
	6		**6**		**6**		**0**

Third Year (Part-Time)

Fall	Credits	Winter	Credits
PLCY 516	3.0	PLCY 517*	3.0
Graduate Elective	3.0		
	6		**3**

Total Credits 45

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Note: This term is less than the 4.5-credit minimum required (considered half-time status) of graduate programs to be considered financial aid eligible. As a result, aid will not be disbursed to students this term.

Online sample plan of study

First Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
COM 500	3.0	ECON 601	3.0	PLCY 507	3.0	VACATION	
PLCY 503	3.0	PLCY 506	3.0	PLCY 510	3.0		
Statistics Elective	3.0	Graduate Elective	3.0	Graduate Elective	3.0		
	9		**9**		**9**		**0**

Second Year

Fall	Credits	Winter	Credits
ECON 650	3.0	PLCY 517	3.0
PLCY 504	3.0	Graduate Elective	3.0
PLCY 516	3.0	Graduate Elective	3.0
	9		**9**

Total Credits 45

Online part time sample plan of study

First Year (Part-Time)

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
COM 500	3.0	ECON 601	3.0	PLCY 507	3.0	VACATION	
PLCY 503	3.0	PLCY 506	3.0	Graduate Elective	3.0		
	6		**6**		**6**		**0**

Second Year (Part-Time)

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
ECON 650	3.0	Graduate Elective	3.0	PLCY 510	3.0	VACATION	
PLCY 504	3.0	Statistics Elective	3.0	Graduate Elective	3.0		
	6		**6**		**6**		**0**

Third Year (Part-Time)

Fall	Credits	Winter	Credits
PLCY 516	3.0	PLCY 517*	3.0
Graduate Elective	3.0		
	6		**3**

Total Credits 45

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Note: This term is less than the 4.5-credit minimum required (considered half-time status) of graduate programs to be considered financial aid eligible. As a result, aid will not be disbursed to students this term.

Program Level Outcomes

- Have a detailed understanding of the dynamics of the policy development and implementation processes and how this dynamic varies across and within local, national, and international jurisdictions.
- Understand how to evaluate and provide guidance on both non-profit and governmental programs and policies.
- Produce a thesis that demonstrates expertise in a specific policy area and in the relevant qualitative or quantitative research design.
- Graduate with the ability to competently perform and critically interpret statistical analyses.

Public Policy Faculty

Rebecca Clothey, PhD *(University of Pittsburgh) Department Head, Global Studies and Modern Languages*. Professor. Comparative and international education, education of ethnic and linguistic minorities, refugees, China studies.

Richardson Dilworth, PhD *(Johns Hopkins University) Head, Department of Politics*. Professor. American political development, urban politics, public policy.

Christian Hunold, PhD *(University of Pittsburgh) Associate Dean for Faculty Advancement*. Professor. Environmental policy; comparative politics; urban wildlife; political theory.

Franco Montalto, PhD *(Cornell University)*. Professor. Water in the built environment; planning, design, and restoration of natural and nature-based systems, including green stormwater infrastructure; urban ecohydrology; hydrologic and hydraulic modeling; urban flooding; urban sustainability; and climate change and climate resilience.

Gwen Ottinger, PhD *(University of California, Berkeley)*. Professor. Social studies of science and technology, environmental justice, environmental political theory, citizen science, science and engineering ethics.

Mark Stehr, BS, PhD *(University of California at Berkeley) Director, School of Economics*. Professor. Department of Health Management and Policy. School of Economics in the LeBow College of Business. Health policy, health economics; data analysis methods.

Publishing MA

Major: Publishing
Degree Awarded: Master of Arts (MA)
Calendar Type: Quarter
Minimum Required Credits: 45.0
Co-op Option: None
Classification of Instructional Programs (CIP) code: 09.1001
Standard Occupational Classification (SOC) code: 27-3041

About the Program

***Please note that applications for this program are NOT being accepted at this time, pending programmatic review.**

Students are given a broad scope view of the Publishing Industry via courses taught by publishing professionals and experts in their fields. In addition to the ten required courses, students will take an additional five courses in the aspect of publishing that best suits their interests. Courses will be taught in traditional classrooms, as well as online in both synchronized and asynchronized sessions; special projects can occur in day and evening hours.

The required course list contains seven courses specific to the Publishing program, and three by other disciplines (Law, Business, and Digital Design). The elective list contains three courses specific to the program, and then a wide-range of courses from Communication, Visual Arts and Design, Business, and Law.

Independent Projects are encouraged and are limited only by the student's imagination or area of interest. Opportunities abound at Drexel itself, as well as many other area publishers with whom we've built relationships.

Additional Information

For more information, contact Dr. J. Roger Kurtz, English and Philosophy Department Head, at jrk353@drexel.edu

Degree Requirements

Required courses		
MKTG 601	Marketing Strategy & Planning	3.0
PUB 504	Drexel Publishing Group Special Projects	3.0
PUB 530	The Publishing Environment	3.0
PUB 631	Publication Design: Print and Digital	3.0
PUB 635	Periodicals Publishing	3.0
PUB 720	The Ebook and Online Magazines	3.0
PUB 730	Book Publishing	3.0
PUB 750	Small Press Development	3.0
WEST 500	Introduction to Digital Design Tools	3.0
Graduate Electives:		**18.0**
COM 500	Reading & Research in Communication	
COM 520	Science Writing	
COM 525	Document Design and Usability	
COM 610	Theories of Communication and Persuasion	
COM T680	Special Topics in Communication	
MGMT 601	Managing the Total Enterprise	
MKTG 630	Global Marketing	
ORGB 625	Leadership and Professional Development	
PUB 701	Independent Project in Publishing	
PUB I599	Independent Study in Publishing	
PUB T680	Special Topics in Publishing	
Total Credits		**45.0**

First Year

Fall	Credits Winter	Credits Spring	Credits
PUB 530	3.0 MKTG 601	3.0 PUB 720	3.0
PUB 631	3.0 PUB 635	3.0 PUB 750	3.0
Graduate elective	3.0 PUB 730	3.0 Graduate elective	3.0
	9	**9**	**9**

Second Year

Fall	Credits Winter	Credits
PUB 504	3.0 WEST 500	3.0
Graduate electives	6.0 Graduate electives	6.0
	9	**9**

Total Credits 45

Program Level Outcomes

- Learn about the publishing history, from its history to contemporary issues around e-publishing
- Obtain a broad base of critical interdisciplinary information and skill in media law, marketing, design,
- Learn about e-publishing, academic, small press, self-publishing; trade publishing through faculty who work in these industries, guest speakers, and their own projects
- Create book proposals and do market analysis in most rhetorical modes, such as literary, medical, and young adult
- Focus on their specific interest within the publishing industry via elective courses and independent projects, thereby sharpening their skills in the various arms of the publishing industry
- Collaborate with undergraduates and other team members on Drexel Publishing Group special projects, participating in the daily operations of DPG’s three publications.

- Have opportunities to work with local publishing houses and publishing venues and hone skills such as copy-editing, author contact, communicating via social media, participation in design, and writing.

Science, Technology, and Society MS

Major: Science, Technology, and Society
Degree Awarded: Master of Science (MS)
Calendar Type: Quarter
Minimum Required Credits: 45.0
Co-op Option: None
Classification of Instructional Programs (CIP) code: 30.1501
Standard Occupational Classification (SOC) code: 11-9121

About the Program

Note - This program is not accepting applications for the 2024-25 Academic year.

The Science, Technology, and Society (STS) program systemically investigates the social dimensions of science, technology, and medicine. Faculty from a range of disciplines contribute to a curriculum that features a broad set of perspectives, all grounded in a foundation of social theory, research methods, and writing and presentation skills. The STS program emphasizes three interrelated areas: environment and sustainability; health and medicine; and information, identities and networks. The STS Lab course is a unique feature of the curriculum—it prepares students to work as a team to address meaningful science- and technology-related topics. Working with a faculty advisor, graduate students develop an individualized plan of study that allows them to pursue their interests in depth.

STS students are independent thinkers who are dedicated to understanding the intersections of society, science, medicine, and technology. While STS students vary widely in their professional and educational backgrounds and career ambitions, they share a common commitment to a critical approach to our world's most pressing technoscientific challenges.

Prospective students for the MS in STS see this educational opportunity as a crucial factor in their skill development and career advancement. They are college graduates in engineering, the humanities, social sciences, and natural sciences; professionals in businesses, city, and state government offices and area hospitals; and middle and high school teachers.

This is a full-time, low-residency program which means students must attend an in person residency during the first week of Fall quarter in Year 1 and Year 2. The remaining courses will be offered in an online format.

Additional Information

For more information, please contact:

Kristene Unsworth, PhD
Director, Center for Science, Technology and Society
ku26@drexel.edu
215.895.0277

Admission Requirements

Applicants to the program must meet the general requirements for admission to graduate studies at Drexel University.

Prospective students must also submit a 500-word essay explaining why they want to enter the program and some of the issues related to science, technology, and society that they would like to study. These statements are read carefully by the faculty screening committee to evaluate each applicant's sense of purpose. Entering students typically begin during the fall quarter; however, students are able to start the program during any quarter.

Visit the Graduate Admissions (https://drexel.edu/grad/programs/coas/) website for more information about requirements and deadlines, as well as instructions for applying online.

Degree Requirements

The program requires 45.0 credits of coursework. Required courses total 24.0 credits. Remaining credits are chosen from a list of electives.

Basic Requirements		
SCTS 501	Introduction to Science, Technology and Society	3.0
SCTS 502	Research Methods	3.0
SCTS 503	Advanced Research Methods	3.0
SCTS 504	Science, Technology & Society Theories	3.0
SCTS 700	Graduate STS Residency	3.0

SCTS 701	MS in STS Professional Residency	3.0
Advanced Requirements		
Ethics, Values, Identities, and Culture		
SCTS 612	Medical and Healthcare Ethics	3.0
SCTS 575	Digital Power and Resistance	3.0
Science, Technology & Society Lab		
SCTS 550	Special Topics in STS Lab	3.0
Research		
SCTS 798	Master's Research	6.0
Suggested Electives *		**12.0**
CHP 516	History of Public Health	
CHP 561	Overview of Issues in Global Health	
CHP 607	Public Health Ethics	
CHP 660	Global Health Ethics	
CHP 683	Intersectional Perspectives	
CHP 684	Sexual Orientations And Health	
CHP 692	Migration and Health	
CHP 705	Religion, Spirituality, and Health	
COM 615	Media Environments in a Digital World	
EOH 550	Introduction to Urban Health	
EOH 562	Global Air Pollution and Health	
EOH 642	Healthy Housing & Built Environment	
HSAD 500	Historical Influences on the US Healthcare System	
MGMT 602	Innovation Management	
MGMT 676	Sustainability and Value Creation	
PLCY 504	Methods of Policy Analysis	
PSY 712	History and Systems	
SCTS 640	STS Perspectives on Risk and Disaster	
SCTS 641	Risk and Disaster Policy	
SCTS 665	Advanced Topics in Philosophy of Science	
SCTS 697	Internship in Science, Technology and Society	
SCTS I799	Independent Study in Science, Technology and Society	
SCTS T780	Special Topics in Science Technology and Society	
URBS 640	Sanctuary Cities	
Total Credits		**45.0**

*

Additional electives may be taken from other schools and colleges in the University with approval from the Director of the MS in Science, Technology & Society program.

Sample Plan of Study

First Year							
Fall	**Credits**	**Winter**	**Credits**	**Spring**	**Credits**	**Summer**	**Credits**
SCTS 501	3.0	SCTS 503	3.0	SCTS 550	3.0	VACATION	
SCTS 502	3.0	SCTS 504	3.0	Electives	6.0		
SCTS 700	3.0						
	9		**6**		**9**		**0**
Second Year							
Fall	**Credits**	**Winter**	**Credits**	**Spring**	**Credits**		
SCTS 575	3.0	SCTS 798	3.0	SCTS 798	3.0		
SCTS 612	3.0	Elective	3.0	Elective	3.0		
SCTS 701	3.0						
	9		**6**		**6**		

Total Credits 45

Program Level Outcomes

- Use interdisciplinary theoretical and methodological tools to systematically analyze the social dimensions of science, medicine and technology.
- Investigate how individual, institutional and national values and cultural contexts impact technology and science innovation and use.
- Understand which stakeholders help create particular science and technology policies, how policies are implemented, and the political effects of policy implementation.

- Analyze the societal impact of new technologies and scientific knowledge, with the ability to identify differential impact on stakeholders (e.g. race, age, gender, class differences).
- Work effectively in interdisciplinary teams to identify, research and address pressing issues in technology, medicine and science.
- Communicate research findings in a clear, concise manner.

Science, Technology and Society Faculty

Lloyd Ackert, PhD *(Johns Hopkins University)*. Teaching Professor. History of science and technology; ecology; Russian science.

Jesse Ballenger, PhD *(Case Western Reserve University)*. Clinical Professor. Healthcare, medicine and ethics; aging and neurodegenerative diseases; Science and Technology Studies.

Susan E. Bell, PhD *(Brandeis University)*. Professor. Sociology of health and illness; global and transnational health; reproductive health, rights, and justice; experience of illness; narrative; visual sociology

Mary Ebeling, PhD *(University of Surrey)*. Professor. Science and technology studies; emerging technologies and biocapital; media and democratic cultures; radical social movements; sociology of markets; political sociology; and ethnographic methodologies.

Christian Hunold, PhD *(University of Pittsburgh) Associate Dean for Faculty Advancement*. Professor. Environmental policy; comparative politics; urban wildlife; political theory.

Jordan Hyatt, PhD, JD *(University of Pennsylvania, Villanova University School of Law) Director, Center for Public Policy*. Associate Professor. Community corrections; drug treatment; homelessness; probation/parole; re-entry; risk assessment; sentencing.

Kelly Joyce, PhD *(Boston College)*. Professor. Science, medicine and technology; aging and technology; qualitative social science methods; healthcare and medicine.

Anil Kalhan, MPPM, JD *(Yale School of Management; Yale Law School)*. Professor. Immigration and citizenship law, constitutional law, comparative law and criminal law.

Alison Kenner, PhD *(Rensselaer Polytechnic Institute)*. Associate Professor. Science, technology, and health; environmental health problems; cities and place; feminist theory; medical anthropology; digital humanities

Brent Luvaas, PhD *(UCLA)*. Professor. Visual anthropology; photography; social media; digital culture; urban futures; United States and Southeast Asia.

Dali Ma, PhD *(University of Chicago)*. Associate Professor. Social hierarchy; Social networks; Sociology of entrepreneurship; Sociology of transitional China

Amanda McMillan Lequieu, PhD *(University of Wisconsin-Madison)*. Assistant Professor. Environmental sociology, political economy, place and space, rural-urban interface, qualitative and historical methodologies.

Gwen Ottinger, PhD *(University of California, Berkeley)*. Professor. Social studies of science and technology, environmental justice, environmental political theory, citizen science, science and engineering ethics.

Flavia Padovani, PhD *(University of Geneva)*. Associate Professor. History and philosophy of science, feminist epistemology, science and technology studies.

Sharrona Pearl, PhD *(Harvard University)*. Associate Teaching Professor. Medical ethics; science studies; history of science and medicine; critical race, gender, and disability studies; media studies.

Elizabeth Polcha, PhD *(Northeastern University)*. Assistant Professor. English and Digital Humanities. Black Atlantic Literature; digital humanities; early American studies; postcolonial and settler colonial studies; gender sexuality studies; environmental studies; history of science; history of the book.

Nic John Ramos, PhD *(University of Southern California)*. Assistant Professor. African American History, history of Medicine, History of Psychiatry, urban History, 20th Century US History, History of Racial Capitalism, History of Sexuality

Jonathan Seitz, PhD *(University of Wisconsin) Assistant Department Head, History*. Teaching Professor. History of religion, science, medicine, witchcraft, early modern Europe, Italy.

Chloe Silverman, PhD *(University of Pennsylvania) Director, Center for Science, Technology & Society*. Associate Professor. Parent advocacy for autism, neurodiversity, and pollinator health research.

Andrew Frederick Smith, PhD *(SUNY, Stony Brook)*. Associate Professor. Environmental philosophy/environmental humanities, food justice, climate justice, social and political philosophy, decolonization.

Kelly Underman, PhD *(University of Illinois at Chicago)*. Associate Professor. Medical education, the social construction of bodies and emotions and the politics of scientific knowledge production.

Kristene Unsworth, PhD *(University of Washington) Director, Center for Science, Technology, & Society*. Assistant Teaching Professor. Intersections between information technology, people, and justice, information policy, ethics of data use, data analytics.

Asta Zelenkauskaite, PhD *(Indiana University)*. Associate Professor. Social media; user-generated content; computer-mediated communication; interactivity; active audience analysis; mobile communication; gender and online identity; prosumer culture; internet of things; quantitative/qualitative research.

Emeritus Faculty

Robert J. Brulle, PhD *(George Washington University)*. Professor Emeritus. Environmental policy and politics, critical theory, marine risk, social movements, environmental sociology.

Strategic and Digital Communication MS

Major: Strategic and Digital Communication
Degree Awarded: Master of Science (MS)
Calendar Type: Quarter
Minimum Required Credits: 45.0
Co-op Option: graduate co-op available for full-time on-campus students
Classification of Instructional Programs (CIP) code: 09.0909
Standard Occupational Classification (SOC) code: 11-2011

About the Program

Drexel's Master of Science in Strategic and Digital Communication prepares students for careers in a wide range of professional activities relating to communication in media environments and communication contexts that are characterized by advanced digitization.

With a robust core curriculum consisting of seven courses (21.0 credits), the program provides a strong foundation in theoretical approaches to communication, ethics and media/communication policy. This theoretical basis is designed to ensure that, as the field changes, students will continue to have an intellectual framework for evaluating and implementing new technology and changing media environments. Furthermore, the program trains students in leadership skills that will help them to lead teams to be innovative communication professionals in digitized media environments and different organizational communication contexts.

The program emphasizes flexibility, encouraging each student, in consultation with a faculty advisor, to craft an individual course of study tailored to the student's individual interests and career goals. Throughout the curriculum students use four Communication electives (12.0 credits) to increase communication skills or to further develop areas of specialization. An additional four free elective courses (12.0 credits) can be taken in Communication or in other departments across the university. This allows students to continue to tailor their plan of study, to add on a graduate minor, or to complete a certificate program.

In order to gain valuable practical experience outside the classroom, students are expected to complete the equivalent of a six-month non-credit bearing internship. To complete the internship component, students can either enroll in Drexel's graduate coop option (for full-time on-campus students only, more details available from the Steinbright Career Development Center (https://nam10.safelinks.protection.outlook.com/?url=http%3A%2F%2Fdrexel.edu%2Fscdc%2Fco-op%2Fgraduate%2F&data=05%7C01%7Cjh378%40drexel.edu%7Cf1211c39fc564dcb998f08db50c3c708%7C3664e6fa47bd45a696708c4f080f8ca6%7C0%7C0%7C638192574033418722%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=2DjyZ1KlXAgjS2L2pMeOeOw0qPR26kdTMJrxv%2Fv%2FlM4%3D&reserved=0)), or they can work in one or several full-time or part-time communication positions of their choosing. Students entering the program already possessing significant communication-related experience and thereby meeting the internship requirement can apply for an internship waiver. The program director works with each student on an individual basis to see what option best meets their needs.

The program specializes in two areas:

- Strategic Communication (public relations)
- Digital and Social Media Communication

Strategic Communication

Strategic Communication has much to offer for those looking to work in public relations as well as for-profit and nonprofit organizations. Students typically choose from courses such as PR Writing and Planning courses, Crisis Communication, Media Relations, Nonprofit Communication, and others.

Digital Communication

With Communication being an area characterized by ongoing digitization, the program offers courses such as Strategic Social Media Communication, Digital Publishing, Digital Media Environments, Social Media Concepts That Matter, and others.

Students can attend classes on campus, full-time or part-time, or fully online on a part-time basis. They can begin the program in any academic quarter, and they can complete all required coursework in the evening. The degree requires 45.0 credits of graduate coursework and can be completed part-time in as little as two years or full-time in five quarters (just over a year).

Additional Information

For more information, visit the MS in Strategic and Digital Communication webpage (https://drexel.edu/coas/academics/graduate-programs/communication/).

Contact Julia May, Director of the MS in Strategic and Digital Communication program, at julia.may@drexel.edu for more information.

Admission Requirements

Applicants must meet the general requirements for admission to graduate studies. Prospective students must also submit:

- A 750-1,000-word statement explaining why they want to enter the program. The statement will be reviewed to evaluate each applicant's writing skills and sense of purpose.
- Two letters of recommendation from either academic instructors or professional supervisors
- Transcripts of all college-level coursework
- A current resume

GRE scores are not required but are recommended for applicants with an undergraduate GPA of less than 3.0. GRE scores are evaluated based on the applicant's performance in the verbal reasoning and analytical writing sections. If GRE scores are not available, you are still encouraged to apply as applications will be looked at holistically with consideration to the applicant's writing skills, relevant professional experience, and academic aptitude.

For international students for whom English is not the official language, a TOEFL score of 100 (iBT) or IELTS Overall Band Score of 7.0 is required.

Degree Requirements

Required Core Courses		
COM 500	Reading & Research in Communication	3.0
COM 574	Organizational Communication in Project Management	3.0
COM 610	Theories of Communication and Persuasion	3.0
COM 613	Ethics for Professional Communication	3.0
COM 615	Media Environments in a Digital World	3.0
COM 651	Media and Communication Policy in a Digitized World	3.0
COM 698	Managing Communication Professionals' Identities in a Digital Age	3.0
Program Electives		**12.0**
Choose four of the following courses:		
COM 516	Campaigns for Health and Environment	
COM 518	Communicating Health and Risk in a 'Fake News' World	
COM 520	Science Writing	
COM 525	Document Design and Usability	
COM 533	Modern Desktop Publishing	
COM 535	Digital Publishing	
COM 536	Strategic Social Media Communication	
COM 538	Copy Editing	
COM 541	Foundations of Public Relations	
COM 542	Public Relations Writing	
COM 543	Public Relations Planning	
COM 544	Media Relations in a Digital Age	
COM 545	Crisis Communication	
COM 551	Creative Content Production	
COM 561	Fundamentals of Journalism & Newswriting	
COM 562	International Negotiations	
COM 563	Event Planning	
COM 575	Grant Writing	
COM 576	Nonprofit Communication	
COM 577	Communication for Civic Engagement	

COM 578	Focus Groups	
COM 586	Strategic International Communication	
COM 600	Graduate Seminar in Communication	
COM 614	Social Media Concepts that Matter	
COM 660	Investigative Journalism	
COM I599	Independent Study in COM	
COM I699	Independent Study in COM	
COM T580	Special Topics in Communication	
COM T680	Special Topics in Communication	
Graduate Electives *		**12.0**
Optional Co-op Experience **		0-1
COOP 500	Career Management and Professional Development for Master's Degree Students	
Total Credits		**45.0-46.0**

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Students can select up to 12.0 credits of graduate-level electives (500-799) in the following subject areas: AADM, AAML, ACCT, BUSN, CCM, CHP, COM, CRTV, CW, DIGM, ECON, EDAM, EDHE, EDLT, EDUC, ENTP, ENVP, ENVS, EOH, HMP, HRM, LING, MGMT, MKTG, MUSL, NPM, ORGB, PBHL, PLCY, PROJ, PRST, RMER, SCRP, SCTS, SMT, TVMN. Other graduate courses outside these areas might be taken pending approval from the graduate advisor or program director. These 12.0 credits of graduate-level electives can be used towards a graduate minor (https://catalog.drexel.edu/graduateminors/) or a graduate certificate program (https://catalog.drexel.edu/certificates/postbaccalaureate/) outside the COM discipline.

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Co-op is an option for this degree for full-time on-campus students. To prepare for the 6-month co-op experience, students will complete: COOP 500.
The total credits required for this degree with the co-op experience is 46.0
Students not participating in the co-op experience will need 45.0 credits to graduate.

Sample Plan of Study

Option 1: Full-time with Internship

First Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
COM 500	3.0	COM 610	3.0	COM 698	3.0	COM 574	3.0
COM 613	3.0	COM 651	3.0	Graduate Elective	3.0	Graduate Elective	3.0
Program Elective	3.0	Program Elective	3.0	Program Elective	3.0	Program Elective	3.0
	9		**9**		**9**		**9**

Second Year

Fall	Credits	Winter	Credits	Spring	Credits
INTERNSHIP*		INTERNSHIP*		COM 615	3.0
				Graduate Electives	6.0
	0		**0**		**9**

Total Credits 45

*****

Internships are required but are non-credit bearing. Some students complete two 3-month internships; other students complete 12 months part time. Six months of full-time experience is required.The terms in which internships are taken will vary depending on the student's plan of study. Students who come in to the program with relevant prior professional experience can get the internship waived.
Students are only eligible for financial aid during terms in which they enroll for a minimum of 4.5 credits that count toward degree completion.

Option 2: Full-time with Graduate Co-Op

First Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
COM 500	3.0	COM 574	3.0	COM 698	3.0	COM 651	3.0
COM 613	3.0	COM 610	3.0	Graduate Elective	3.0	Graduate Elective	3.0
COOP 500*	1.0	Program Elective	3.0	Program Elective	3.0	Program Elective	3.0
Program Elective	3.0						
	10		**9**		**9**		**9**

Second Year

Fall	Credits	Winter	Credits	Spring	Credits
COOP EXPERIENCE**		COOP EXPERIENCE**		COM 615	3.0

				Graduate Electives	6.0		
0		**0**		**9**			

Total Credits 46

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COOP 500 is a non-billable course that does not count towards the academic requirement of the MS program. It is a required course for those students who choose the Graduate Co-op option.

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Students earn Drexel Co-op Units to remain financial aid eligible while on Graduate Co-op. In case no suitable Co-op position is found, students must register for full-time classes to remain financial aid eligible and also need to begin to look for an alternative internship position.

Option 3: Part-time with Internship

First Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
COM 613	3.0	COM 615	3.0	COM 651	3.0	COM 574	3.0
Program Elective	3.0	Program Elective	3.0	Program Elective	3.0	Program Elective	3.0
	6		**6**		**6**		**6**

Second Year

Fall	Credits	Winter	Credits	Spring	Credits	Summer	Credits
COM 500	3.0	Graduate Electives	6.0	COM 610	3.0	Graduate Elective	3.0
COM 698	3.0	INTERNSHIP*		Graduate Elective	3.0	INTERNSHIP*	
INTERNSHIP*				INTERNSHIP*			
	6		**6**		**6**		**3**

Total Credits 45

*****

Internships are required but are non-credit bearing. Some students complete two 3-month internships; other students complete 12 months part time. Six months of full-time experience is required.The terms in which internships are taken will vary depending on the student's plan of study. Students who come in to the program with relevant prior professional experience can get the internship waived.
Students are only eligible for financial aid during terms in which they enroll for a minimum of 4.5 credits that count toward degree completion.

Strategic & Digital Communication Faculty

Ronald Bishop, III, PhD *(Temple University)*. Professor. Investigative reporting, sports journalism, journalism history, journalism sourcing patterns, textual narrative and ideological analysis, cultural history of fame.

Karen Cristiano, MS *(Temple University) Assistant Department Head of Communication*. Teaching Professor. Journalism, medical writing, feature writing, copy editing, mass media and society.

Richard Forney Assistant Teaching Professor. Broadcast journalism technology and the effects of new technologies on personal and corporate communication skills.

Ernest A. Hakanen, PhD *(Temple University) Director, Graduate Programs in Communication, Culture & Media*. Professor. Telecommunications policy, adolescent media use, communication theory and history, global media, and semiotics.

Hyunmin Lee, PhD *(University of Missouri) Director, Undergraduate Programs in Communication*. Associate Professor. Social media strategies for relationship and reputation management in public relations; media messages of public health issues and its psychological and behavioral effects on the public.

Julia May, PhD *(Drexel University) Director, Strategic and Digital Communication MS Program*. Associate Teaching Professor. Political communication; international politics and its news coverage; public opinion; transatlantic relations; war, torture and human rights; debate in the public sphere.

Alexander Nikolaev, PhD *(Florida State University)*. Associate Professor. Public relations, political communication, organizational communication, mass communication, international communications and negotiations, communications theory.

Douglas V. Porpora, PhD *(Temple University)*. Professor. War, genocide, torture, and human rights; macro-moral reasoning in public sphere debate; contemporary social theory moral and political communication; religion.

Rachel R. Reynolds, PhD *(University of Illinois)*. Associate Professor. Sociolinguistics, ethnography of communication and discourse analysis; violence against women in mass media; political economy of migration; semiotics including the textual, the visual and multimodal.

Rosemary Rys, MA *(Rowan University)*. Assistant Teaching Professor. Public relations and marketing.

Wesley Shumar, PhD *(University of Pennsylvania)*. Professor. Digital media and learning; culture of higher education; entrepreneurship education; craft culture; semiotic of consumer culture.

Scott Tattar, BA *(York College of Pennsylvania) Faculty Advisor, Drexel PRSSA, Communication Department Recruitment Liaison*. Instructor. Public relations

Hilde Van den Bulck, PhD *(Katholieke Universiteit Leuven) Department Head of Communication*. Professor. Political economy of media structures; media policies for digitized media ecologies; stakeholders and coalitions in media policies; digitization; convergence and legacy media; public (service) media; celebrity culture and industry; fandom and anti-fandom.

Asta Zelenkauskaite, PhD *(Indiana University)*. Associate Professor. Social media; user-generated content; computer-mediated communication; interactivity; active audience analysis; mobile communication; gender and online identity; prosumer culture; internet of things; quantitative/qualitative research.

Emeritus Faculty

Alexander Friedlander, PhD *(Carnegie Mellon University)*. Associate Professor. Rhetorical theory and practice, document design, writing and technology.

Lawrence Souder, PhD *(Temple University) Director, Drexel Edits*. Teaching Professor. Science and technical writing, communication ethics, nonprofit communication.

Graduate Minor in Communication

About the Graduate Minor

A graduate minor in Communication is open to all graduate students at Drexel University. Minoring in Communication allows you to establish a foundation in professional communication and further develop your professional skills. Enhance your major by adding this cross-cutting credential.

The Communication graduate minor requires 12.0 credits; 6.0 credits are completed through required classes, while you have have flexibility in selecting the remaining 6.0 credits. You can select any two 3.0-credit graduate courses from the Communication discipline.

Program Requirements

COM 500	Reading & Research in Communication	3.0
COM 610	Theories of Communication and Persuasion	3.0
Any two 3.0-credit graduate courses in Communication (COM)		6.0
Total Credits		**12.0**

Additional Information

For more information or to add the Communication minor to your plan of study, contact:

Dr. Julia May, Program Director
jh378@drexel.edu
Phone: 215.895.5804

Nicole Pearson, Program Coordinator
nmp39@drexel.edu
Phone: 215.895.2524

Graduate Minor in Communication, Culture and Media

About the Graduate Minor

The graduate minor in Communication, Culture & Media (CCM) is a great choice for academically oriented students who wish to learn the basics of research and theory in communication and media studies, possibly to test the waters for further study, or to explore a personal fascination with mass media, mediated communication, cultural studies, social change and media. The CCM program also encourages interdisciplinary approaches to the study of communication and media through faculty strengths in anthropology, communication, linguistics and sociology.

Admission Requirements

Must be enrolled in a Drexel University graduate program.

Program Requirements

Choose one of the following courses:		**3.0**
CCM 701	Contemporary Social Theory	
CCM 702	Communication Theory I: Persuasion and Media Effects	
CCM 703	Communication Theory II: Discourse and Semiotics	
CCM 704	Research Methods in Communication, Culture and Media	
CCM 705	Data Analysis in Communication	
Electives *		9.0
Total Credits		**12.0**

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Any three 3.0-credit graduate courses in Communication, Culture and Media (CCM)

Additional Information

For more information or to schedule an appointment, students should contact the Communication, Culture, and Media academic advisor and program coordinator:

Nicole Pearson
Phone: 215.895.2524 | Office: 3201 Arch Street, 151
Email: nmp39@drexel.edu

Graduate Minor in Interdisciplinary Team-Oriented Creativity

About the Graduate Minor

The graduate minor in Interdisciplinary Team-Oriented Creativity aims to train graduate students to be creative, innovative problem solvers through evidence-based pedagogies with demonstrated effectiveness in interdisciplinary team-based research. The heart of the graduate minor lies in two core courses and two electives, at least one of which must be outside a student's home department. The two courses, AS-I 501 *Creative Interdisciplinary Team Research: Principles and Practice* (Course I) and AS-I 502 *Enhancing the Creativity of a Research Project* (Course II), ground students in evidence-based creativity while providing an opportunity to practice interdisciplinary teamwork. The graduate minor in Interdisciplinary Team-Oriented Creativity can be tailored to any discipline.

Admission Requirements

Student must be a matriculated graduate student.

Program Requirements

AS-I 501	Creative Interdisciplinary Team Research: Principles and Practice	3.0
AS-I 502	Enhancing the Creativity of a Research Project	3.0
Select two of the following electives:		6.0
AADM 520	Creative Enterprise and Innovation	
AAML 550	Management Techniques in Arts and Cultural Organizations	
AAML 575	Revenue Development in Arts and Cultural Orgs.	
BLAW 646	Legal Issues in New Ventures	
BUSN 501	Measuring and Maximizing Financial Performance	
CAEE 501	Community-Based Design	
CIVE 542	Incorporating Sustainability Principles in Design	
CCM 703	Communication Theory II: Discourse and Semiotics	
CCM 777	Communication Network Analysis	
CMGT 515	Risk Management in Construction	
COM 520	Science Writing	
COM 575	Grant Writing	
COM 576	Nonprofit Communication	
CRTV 501	Foundations in Creativity	
CRTV 502	Tools and Techniques in Creativity	
CRTV 503	Creativity in the Workplace	
CRTV 610	Creativity and Change Leadership	
CRTV 620	Research Methods and Assessment of Creative and Innovative Thinking	
CRTV 630	Global Perspectives on Creativity	
CRTV 650	Current Trends in Creativity & Innovation	
CRTV 660	Diagnostic Creative Intervention	
DSRE 620	Design Problem Solving	
DSRE 625	Technologies of Making	
DSRE 635	Translational Design Research	
ENTP 501	Entrepreneurship Practice & Mindset	
ENTP 611	Learning from Failure	
ENTP 621	Innovation & Ideation	
ENTP 631	Building Internal & External Relationships	
ENTP 641	Innovation in Established Companies	
ENTP 660	Early Stage Venture Funding	
MATE 504	The Art of Being a Scientist	
MGMT 640	Strategic Human Resource Management	
MGMT 655	Knowledge Management	
MKTG 638	New Product Planning, Strategy, and Development	
PENG 545	Introduction to Peacebuilding for Engineers	
PENG 550	Conflict Management for Engineers	
SCED 501	Collaborative Laboratory I	
SCTS 501	Introduction to Science, Technology and Society	
SCTS 502	Research Methods	
SCTS 504	Science, Technology & Society Theories	
SCTS 550	Special Topics in STS Lab	
SCTS 561	Mobilities Lab	
SCTS 562	Identity and Intersectionality Lab	

SYSE 685	Systems Engineering Management	
Total Credits		**12.0**

Graduate Minor in Public Policy

About the Graduate Minor

The graduate minor in Public Policy provides students with a foundation in the American policy process, applied practice in policy research, analysis and nonprofit management. The minor consists of four courses for a total of 12.0 credits.

Note: This minor is not available to students pursuing or holding an MS in Public Policy or Environmental Policy.

Program Requirements

PLCY 503	Theory and Practice of Policy Analysis	3.0
PLCY 504	Methods of Policy Analysis	3.0
PLCY 506	Institutional Dynamics of the Policy Process	3.0
PLCY 507	Nonprofit Organizations	3.0
Total Credits		**12.0**

Post-Baccalaureate Certificate in Public Relations

Certificate Level: Graduate
Admission Requirements: Bachelor's degree
Certificate Type: Post-Baccalaureate
Number of Credits to Completion: 12.0
Instructional Delivery: Online
Calendar Type: Quarter
Expected Time To Completion: 1 year
*Financial Aid Eligibility: Aid eligible**
Classification of Instructional Program (CIP) Code: 09.0900
Standard Occupational Classification (SOC) Code: 11-2011

***The current plan of study for this program would not allow for federal financial aid (including Federal Direct Student Loans) since Department of Education requires a minimum of 4.5 credits per term for graduate courses and 6.0 credits per term for undergraduate courses.**

About the Program

Note - This program will not accept applications after Fall Term 2024.

The professional certificate in Public Relations is a post-baccalaureate certificate. It introduces students to the fundamentals of public relations as a professional field. Students will learn about the importance of public relations as a strategic tool to interact with different audiences using different types of media. Courses cover relevant strategies and tactics such as strategic social media communication, reputation management, crisis communication and media relations while teaching students applied skills in public relations planning and public relations writing.

Admission Requirements

- Official transcript showing a bachelor’s degree (or higher) from a regionally accredited institution or its foreign equivalent.
- Overall undergraduate GPA of 2.5. For applicants not meeting this minimum GPA, we recommend submitting a 400-word statement summarizing their professional experience as it relates to public relations. Ideally, this statement will illustrate at least five years of professional experience pertaining to public relations.
- A 500-word statement of purpose explaining why the applicant wants to enter the program. The statement will be reviewed to evaluate each applicant's writing skills.
- A current resume
- TOEFL/IELTS or DuoLingo scores are required for international applicants or applicants who earned a degree outside the U.S. at a non-English speaking academic institution.

Additional Information

For more information, review the Public Relations Certificate page (https://www.online.drexel.edu/online-degrees/arts-and-science-degrees/cert-public-relations/) or contact Dr. Julia May, Program Director, at julia.may@drexel.edu.

Program Requirements

Program Requirements		
COM 536	Strategic Social Media Communication	3.0
COM 541	Foundations of Public Relations	3.0
COM 542	Public Relations Writing	3.0
COM 543	Public Relations Planning	3.0
Total Credits		**12.0**

Sample Plan of Study

First Year

Fall	Credits Winter	Credits Spring	Credits Summer	Credits
COM 541	3.0 COM 542	3.0 COM 543	3.0 COM 536	3.0
	3	**3**	**3**	**3**

Total Credits 12

Post-Baccalaureate Certificate in Quantum Technology and Quantum Information

Certificate Level: Graduate

Admission Requirements: Bachelor's degree
Certificate Type: Post-Baccalaureate
Minimum Number of Credits to Completion: 12.0
Instructional Delivery: Online; Face-to-face
Calendar Type: Quarter
Expected Time To Completion: 1 year
Financial Aid Eligibility: Not aid eligible
Classification of Instructional Program (CIP) Code: 14.1201
Standard Occupational Classification (SOC) Code: 19-2012

About the Program

Note - This program will not accept applications after Fall Term 2024.

The post-baccalaureate certificate in Quantum Technology and Quantum Information accepts applicants who hold bachelor's degrees in Physics, Chemistry, Materials Science and Engineering, and Electrical and Computer Engineering, and offers them opportunities to learn the fundamentals of quantum technology and quantum information. The aim is to provide a strong foundation in this emerging area with a focus on quantum mechanical foundations, technological advances on quantum level, and real-world applications. The certificate program may also serve as an onramp to a Master of Science in Physics and Master of Materials Science and Engineering if completed with predetermined grade requirements.

The program consists of two required courses with two electives for a total of 12.0 credits. A student must receive a grade of C or higher in a course to receive credit towards the certificate. If completed with B or higher grades for all courses, students will be given the option to apply to the MS in Physics or the MS in Materials Science and Engineering, provided that they comply with the additional admission requirements in those MS programs. Students who wish to advance to those MS programs will be given the option to transfer up to 12.0 credits towards their MS degree.

Admission Requirements

The post-baccalaureate certificate in Quantum Technology and Quantum Information accepts applicants who hold bachelor's degrees in Physics, Chemistry, Materials Science and Engineering, and Electrical and Computer Engineering from an accredited university and offers them an opportunity to learn a variety of foundational and applied topics in materials and technologies related to contemporary quantum computing.

- Graduate application
- A four-year bachelor's degree in any major from a regionally accredited institution in the United States or an equivalent international institution.
- 3.0 GPA in a prior completed degree, BA/BS and above
- Official final transcripts including a bachelor's degree conferred from a regionally accredited institution and/or World Education Services (WES) Course-by-Course Evaluation of foreign transcripts
- One (1) letter of recommendation required, two (2) suggested (academic, professional, or both)
- Essay/statement of purpose: In approximately 500 words, describe what professional goals you hope to achieve, how an advanced degree facilitates that success, and anything else you want the Admissions Review Committee to know about you.
- Current resume
- Additional requirements for International Students

Additional Information

For more information about this program, please visit the Certificate in Quantum Technology and Quantum Information (https://drexel.edu/coas/academics/graduate-programs/physics/certificate-quantum-technology/) web page.

Program Requirements

Required Core Courses		
PHYS 554	Quantum Technology	3.0
PHYS 558	Quantum Information	3.0
Elective Courses (Select two)		**6.0**
MATE 512	Introduction to Solid State Materials	
MATE 514	Structure, Symmetry, and Properties of Materials	
PHYS 516	Quantum Mechanics I	
PHYS 517	Quantum Mechanics II	
PHYS 553	Nanoscience	
PHYS 626	Solid State Physics I	
PHYS 627	Solid State Physics II	
Total Credits		**12.0**

Sample Plan of Study

First Year

Fall	Credits	Winter	Credits	Spring	Credits
PHYS 558	3.0	PHYS 554	3.0	Elective	3.0
Elective	3.0				
	6		**3**		**3**

Total Credits 12

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