Course Bulletin

100005	Graduate Research
Subject: CMDB	Catalog Nbr: 0298
These courses provide guided research on a topic suitable for a doctoral thesis.	

100015	Graduate Research
Subject: CMDB	Catalog Nbr: 0299
2021 SUMR Primary Brent Cochran brent.cochran@tufts.edu	
These courses provide guided research on a topic suitable for a doctoral thesis.	

100025	Masters Degree Only
Subject: CMDB	Catalog Nbr: 0402

100047	PhD Degree Only
Subject: CMDB	Catalog Nbr: 0403
Students are enrolled in this course when they receive permission to write from their thesis committee, and represents the effort in the final preparation and writing of the doctoral thesis. A grade of “S” is automatically awarded upon completion of the thesis.	

100060	PhD Degree Only
Subject: CMDB	Catalog Nbr: 0404
Students are enrolled in this course when they receive permission to write from their thesis committee, and represents the effort in the final preparation and writing of the doctoral thesis. A grade of “S” is automatically awarded upon completion of the thesis.	

100078	PhD Degree Only
Subject: CMDB	Catalog Nbr: 0405
Students are enrolled in this course when they receive permission to write from their thesis committee, and represents the effort in the final preparation and writing of the doctoral thesis. A grade of “S” is automatically awarded upon completion of the thesis.	

102889	Membranes & Trafficking

Course Bulletin

Subject:	Catalog Nbr:			
ISP	209A			
	2021 FALL	Primary	Peter Juo	Peter.Juo@tufts.edu
	2021 FALL	Secondary	Michael Forgac	michael.forgac@tufts.edu
	2021 FALL	Secondary	Ralph Isberg	ralph.isberg@tufts.edu
	2021 FALL	Secondary	Gerard Reijmers	Leon.Reijmers@tufts.edu
	2021 FALL	Secondary	Jamie Maguire	Jamie.Maguire@tufts.edu
	2021 FALL	Secondary	Christopher Dulla	Chris.Dulla@tufts.edu
	2021 FALL	Secondary	Alan Kopin	alan.kopin@tufts.edu
	2021 FALL	Secondary	Karl Munger	Karl.Munger@tufts.edu
	2021 FALL	Secondary	Malavika Raman	Malavika.Raman@tufts.edu

This course provides a thorough survey of major topics in cell biology, including membrane structure and function; transport systems, ion channels, and membrane excitability; protein trafficking and organelle biogenesis.

102982 **Cell & Molecular Genetics**

Subject:	Catalog Nbr:			
ISP	210A			
	2021 FALL	Primary	Brent Cochran	brent.cochran@tufts.edu
	2021 FALL	Secondary	Victor Hatini	Victor.Hatini@tufts.edu
	2021 FALL	Secondary	Peter Juo	Peter.Juo@tufts.edu
	2021 FALL	Secondary	Pamela Yelick	Pamela.Yelick@tufts.edu
	2021 FALL	Secondary	Claudette Gardel	Claudette.Gardel@tufts.edu
	2021 FALL	Secondary	Gordon Huggins	Gordon.Huggins@tufts.edu
	2021 FALL	Secondary	Steven Munger	Steven.Munger@tufts.edu

This course covers molecular genetics and basic concepts in developmental biology.

103003 **Molecular Cell Biology of Development**

Subject:	Catalog Nbr:
ISP	210B

This course introduces students to the basic cellular and molecular mechanisms involved in gametogenesis, fertilization, early embryonic development, pattern formation, and organogenesis. The course emphasizes how human disease often recapitulates development.

104392 **Qualifying Exam**

Subject:	Catalog Nbr:
CTS	0000

Students present and defend a proposal for research consisting of a statement of an original research problem in which a scientific question is asked and the experimental approach to answering the question is explained in a written proposal. The proposal is presented orally to the faculty.

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104467	PhD Degree Only
Subject:	Catalog Nbr:
CTS	0404

Students are enrolled in this course when they receive permission to write from their thesis committee, and represents the effort in the final preparation and writing of the doctoral thesis. A grade of "S" is automatically awarded upon completion of the thesis.

104503	Study Design Seminar			
Subject:	Catalog Nbr:			
CTS	0500			
2020 Fall		Primary	Karen Freund	Karen.Freund@tufts.edu
2021 FALL		Primary	David Kent	david.kent@tufts.edu
2021 FALL		Primary	Gordon Huggins	Gordon.Huggins@tufts.edu
2021 SPRG		Primary	Angie Rodday	Angie.Rodday@tufts.edu
2021 SPRG		Primary	Mihaela Stefan	Mihaela.Stefan@tufts.edu

These seminars use proposed and ongoing research projects to explore issues in study design. The course provides investigators and trainees the opportunity to present a research-related problem they are encountering and engages students in a discussion of the approach to the problem and an appropriate plan of action.

104524	Translational & Molecular Epidemiology
Subject:	Catalog Nbr:
CTS	0501

This course aims to address some of the main challenges of current translational research in the interface of epidemiology and molecular medicine.

104542	Bridging the Bench-To-Bedside Gap
Subject:	Catalog Nbr:
CTS	0502

This course seeks to diminish the "bench-to-bedside" gap by exposing clinical graduate students to basic science research. Students focus on major questions that are ready for future scientific investigation, how scientific discoveries have influenced clinical practice, and how clinical practice has affected basic research. Examination of active projects at Tufts Medical Center introduces students to translational science in action.

104602	Introduction to Biostatistical Methods I			
Subject:	Catalog Nbr:			
CTS	0506			
2021 SUMR		Primary	Sarah Pagni	Sarah.Pagni@tufts.edu

This course is the first half of a two-part course which presents the practical application of biostatistical

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methods for exploring and analyzing health data. Methods for working with data and exploring basic associations are presented through case examples and clinical research projects. CTS 0506 and 0507 are considered equivalent to 0527.

104617	Introduction To Biostatistics II

Subject:	Catalog Nbr:			
CTS	0507			
2021 FALL		Primary	Sarah Pagni	Sarah.Pagni@tufts.edu

This course is the second half of a two-part course which presents the practical application of biostatistical methods for exploring and analyzing health data. Methods for working with data and exploring basic associations are presented through case examples and clinical research projects. CTS 0506 and 0507 are considered equivalent to 0527.

104658	Predictive Models

Subject:	Catalog Nbr:			
CTS	0510			
2021 FALL		Primary	David Kent	david.kent@tufts.edu
2021 FALL		Secondary	Jason Nelson	Jason.Nelson@tufts.edu

This course explores the use of statistical models to predict clinical outcomes for retrospective review and as prospective decision aids. Emphasis is placed on integrating statistical and clinical thinking to construct models that are both statistically and clinically sound and that give accurate predictions when generalized to other populations.

104676	Machine Learning in Predictive Medicine

Subject:	Catalog Nbr:
CTS	0511

This course introduces computer science students and clinicians to practical applications of machine learning to solving problems in clinical medicine through creation of collaborative research teams working on unsolved problems with a clinical researcher. The short-term goal is for each team to produce a report presented at the end of the course. The long-term goal is to build collaborative relationships and the advancement of interdisciplinary work between computer scientists and clinical researchers.

104693	Comparative Effectiveness Research Survey

Subject:	Catalog Nbr:
CTS	0512

The course describes the current state of CER and evidence-based medicine (EBM). The tools of this kind of work are defined including various forms of CER from clinical trials, registry and observational research, technology assessments, and evidence reports. Methodologies used are explained, for example effectiveness trials, decision analysis, cost-effectiveness analysis, systematic review, and meta-analysis.

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104708	Clinical Research Project-Certificate Candidates			
Subject:	Catalog Nbr:			
CTS	0514			
2021 SPRG	Primary	Angie Rodday	Angie.Rodday@tufts.edu	
2021 SPRG	Primary	David Kent	david.kent@tufts.edu	
Students develop mentored research plans with mentors (or mentoring teams) that permits them to demonstrate these skills through the development of a protocol, a report, or research manuscript. The mentoring teams are required to have at least one member who is on the faculty of the GSBS CTS program. The project design is led by students, so they learn the role of principal investigator. This course is required for the Certificate Program, and is not available to non-certificate students.				

104768	Clinical Research Project/Thesis Research- First Year
Subject:	Catalog Nbr:
CTS	0515
First year master's students begin to learn how to complete comprehensive independent clinical research project, which includes framing a research question and specific project aims, identifying useful data sources, developing appropriate methods, identifying and defending against sources of bias, implementing/managing a project, and writing up a thesis in the form of a publishable article or monograph.	

104826	Clinical Research Project/Thesis Research- Second Year			
Subject:	Catalog Nbr:			
CTS	0516			
2021 SUMR	Primary	David Kent	david.kent@tufts.edu	
Second year master's students continue and complete their independent clinical research projects. Students gain additional skills in framing a research question and specific project aims, identifying useful data sources, developing appropriate methods, identifying and defending against sources of bias, implementing/managing the project, and writing up the thesis in the form of a publishable article or monograph.				

104881	Clinical Research Project/Thesis Research- PhD Candidates			
Subject:	Catalog Nbr:			
CTS	0517			
2021 SUMR	Primary	David Kent	david.kent@tufts.edu	
PhD students complete comprehensive independent clinical research doctoral-level project, which includes framing a research question and specific project aims, identifying useful data sources, developing appropriate methods, identifying and defending against sources of bias, implementing/managing the project and writing up the thesis in the form of a publishable article and PhD thesis.				

104898	Advanced Thesis Research
Subject:	Catalog Nbr:

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CTS	0518			
2021 FALL		Primary	Karen Freund	Karen.Freund@tufts.edu

The course is for students who do not complete their theses in the customary timeframe and wish to pursue further research. The Program Director, in consultation with the student's thesis committee and program mentor, determines the number of credits.

104915	**Concentration Practicum**			
Subject:	Catalog Nbr:			
CTS	0519			
2020 Fall		Primary	Mihaela Stefan	Mihaela.Stefan@tufts.edu
2020 Fall		Primary	Carroll Ann Trotman	Carroll_Ann.Trotman@tufts.edu
2020 Fall		Secondary	Angie Rodday	Angie.Rodday@tufts.edu
2021 SPRG		Primary	Jessica Paulus	Jessica.Paulus@tufts.edu
2021 SPRG		Secondary	David Kent	david.kent@tufts.edu

This course is an independent mentored experience for students interested in advanced study and skill development in a particular area. This course requires written approval of the Program Director in order to register.

104952	**Introduction to Clinical Epidemiology**			
Subject:	Catalog Nbr:			
CTS	0523			
2020 Fall		Primary	Jessica Paulus	Jessica.Paulus@tufts.edu
2021 FALL		Primary	Angie Rodday	Angie.Rodday@tufts.edu
2021 FALL		Primary	Robert Goldberg	robert.goldberg@tufts.edu

This course provides students with an overview of the epidemiologic approach to the study of disease causation, its natural history, and epidemiologic methods. This course reviews the application of various observational and experimental research designs and strategies utilized in clinical and epidemiological research. Didactic instruction, readings, and problem sets are used to create each module: investigation of disease outbreaks, sources of health information, observational studies, randomized clinical trials, measures of morbidity and mortality, sources of and controls for bias evaluation of diagnostic and screening tests, and development of surveillance studies.

104969	**Introduction to Clinical Care Research**			
Subject:	Catalog Nbr:			
CTS	0525			
2020 SUMR		Primary	Jessica Paulus	Jessica.Paulus@tufts.edu
2020 SUMR		Secondary	Lori Price	Lori.Price@tufts.edu
2020 SUMR		Secondary	Karen Freund	Karen.Freund@tufts.edu
2020 SUMR		Secondary	Robin Ruthazer	robin.ruthazer@tufts.edu
2020 SUMR		Secondary	Harmon Jordan	harmon.jordan@tufts.edu
2021 SUMR		Primary	Angie Rodday	Angie.Rodday@tufts.edu

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2021 SUMR	Primary	David Kent	david.kent@tufts.edu
2021 SUMR	Primary	Robert Goldberg	robert.goldberg@tufts.edu
2021 SUMR	Secondary	Tara Lavelle	Tara.Lavelle@tufts.edu
2021 SUMR	Secondary	Alysse Wurcel	Alysse.Wurcel@tufts.edu
2021 SUMR	Secondary	Robert Sege	rsege01@tufts.edu
2021 SUMR	Secondary	Jonathan Garlick	Jonathan.Garlick@tufts.edu
2021 SUMR	Secondary	Anastassios Pittas	anastassios.pittas@tufts.edu
2021 SUMR	Secondary	Harry Selker	harry.selker@tufts.edu
2021 SUMR	Secondary	Ronald Perrone	ronald.perrone@tufts.edu
2021 SUMR	Secondary	Thomas Concannon	Thomas.Concannon@tufts.edu
2021 SUMR	Secondary	Raveedhara Bannuru	Raveendhara.Bannuru@tufts.edu
2021 SUMR	Secondary	Jonathan Davis	Jonathan.Davis@tufts.edu
2021 SUMR	Secondary	Gordon Huggins	Gordon.Huggins@tufts.edu
2021 SUMR	Secondary	Jenica Upshaw	Jenica.Upshaw@tufts.edu
2021 SUMR	Secondary	Keren Ladin	Keren.Ladin@tufts.edu
2021 SUMR	Secondary	Denise Daudelin	Denise.Daudelin@tufts.edu
2021 SUMR	Secondary	John Wong	john_b.wong@tufts.edu
2021 SUMR	Secondary	Andreas Klein	Andreas.Klein@tufts.edu
2021 SUMR	Secondary	James Chambers	James.Chambers@tufts.edu
2021 SUMR	Secondary	Pei-Jung Lin	plin@tufts.edu
2021 SUMR	Secondary	William Harvey	William.Harvey@tufts.edu
2021 SUMR	Secondary	Janis Breeze	Janis.Breeze@tufts.edu
2021 SUMR	Secondary	David Kim	dd.kim@tufts.edu

This course, meeting three hours daily over a four-week summer session, teaches students how to formulate a clinical research hypothesis and to develop it into a clinical research project. Students acquire an understanding of basic and advanced principles of study design and issues in conducting biomedical research involving human subjects.

104985	**Biostatistics I**			
Subject:	Catalog Nbr:			
CTS	0527			
2021 FALL	Primary	Angie Rodday	Angie.Rodday@tufts.edu

This course introduces basic principles and applications of statistics to problems in clinical research. Topics covered include descriptive statistics, probability and random variation, sampling, hypothesis testing, proportions, measures of frequency, t-tests, chi-square tests, one-way analysis of variance, correlation, linear regression and nonparametric statistics.

105046	**Scientific Manuscript Writing**		
Subject:	Catalog Nbr:		
CTS	0537		
2020 Fall	Primary	Jessica Paulus	Jessica.Paulus@tufts.edu
2021 FALL	Primary	David Kent	david.kent@tufts.edu

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	2021 FALL	Primary	Robert Goldberg	robert.goldberg@tufts.edu

This course focuses on principles of scientific manuscript writing. The student learns how to develop a manuscript by reviewing the specific issues of style, authorship and volume of information that should be incorporated into a research paper.

105065	**Scientific Grant Writing**			
Subject:	Catalog Nbr:			
CTS	0538			
	2021 FALL	Primary	David Kent	david.kent@tufts.edu
	2021 FALL	Primary	Robert Goldberg	robert.goldberg@tufts.edu

The purpose of this course is to teach the principles of clinical research grant writing. Participants learn the importance of, and how to select, investigators and co-investigators as well as the identification of potential funding sources and other important aspects of grant writing.

105102	**Scientific Writing, Peer Review & Presentations**			
Subject:	Catalog Nbr:			
CTS	0539			
	2021 FALL	Primary	David Kent	david.kent@tufts.edu
	2021 FALL	Primary	Robert Goldberg	robert.goldberg@tufts.edu

Students focus on principals of scientific review and grant peer review. This involves critiquing manuscripts and reviewing research grants for mock study section meetings. Students are encouraged and given an opportunity to present their scientific writings and oral presentations for critique on an ongoing basis.

105120	**Ethics of Clinical Investigation**			
Subject:	Catalog Nbr:			
CTS	0540			
	2021 SPRG	Primary	Robert Sege	rsege01@tufts.edu
	2021 SPRG	Secondary	Angie Rodday	Angie.Rodday@tufts.edu
	2021 SPRG	Secondary	David Kent	david.kent@tufts.edu

The goal of this course is to increase awareness of research ethics and their practical applications by medical practitioners and researchers – specifically with regard to clinical investigations. The curriculum addresses the interrelationships between ethics, law and professional practice standards and explores the role and workings of Institutional Review Boards.

105158	**Principles of Drug Development**
Subject:	Catalog Nbr:
CTS	0555

This course examines the important economic, political, legal and scientific issues that face academic clinical investigators who work in partnership with industry sponsors and government regulators to design and conduct clinical studies.

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105251	Introduction To Clinical Trials			
Subject:	Catalog Nbr:			
CTS	0561			
2021 FALL	Primary	Anastassios Pittas	anastassios.pittas@tufts.edu	
2021 FALL	Secondary	Ellen Vickery	No Email on file.	

This course considers the various problems and options available in the design and conduct of clinical trials, including classical efficacy trials and "effectiveness trials." Issues to be covered include ethics, experimental design, coordination and operations, database development, interim analysis, safety monitoring and analysis, and reporting.

105271	Topics in Clinical Trials
Subject:	Catalog Nbr:
CTS	0562

This is a seminar course that explores special topics in clinical trials. Topics include internet-based clinical trials, N of 1 trials, trials in special populations and overseas, industry sponsored trials and multicenter trials.

105306	Introduction to Health Services Research			
Subject:	Catalog Nbr:			
CTS	0566			
2021 SPRG	Primary	Amy Almerico-LeClair	Amy.LeClair@tufts.edu	
2021 SPRG	Secondary	Pei-Jung Lin	plin@tufts.edu	
2021 SPRG	Secondary	Elena Byhoff	Elena.Byhoff@tufts.edu	

This course introduces students to the concepts and methods that distinguish health services and health policy research from other fields. Faculty cover major topics in health services/health policy research including outcomes research design and methods, health economics, pharmacoeconomics, access and payment for health services, healthcare quality and quality improvement.

105457	Introduction to Evidence Based-Medicine			
Subject:	Catalog Nbr:			
CTS	0581			
2021 SPRG	Primary	Raveedhara Bannuru	Raveendhara.Bannuru@tufts.edu	
2021 SPRG	Primary	James Chambers	James.Chambers@tufts.edu	

This course covers the principles of systematic review processes, evaluation of studies and bodies of evidence as used in the conduct of systematic reviews, meta-analyses and the development of evidence-based clinical practice guidelines. The course focuses on studies of treatment efficacy.

105474	Genetic Epidemiology
Subject:	Catalog Nbr:

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CTS	0582

This course is an introduction to the concepts and methodology of genetic epidemiology, including novel methods of molecular biology, quantitative genetics, study design for genetic traits, segregation analysis and linkage analysis.

105491	**Introduction to Decision Analysis**

Subject:	Catalog Nbr:
CTS	0584

2021 SPRG	Primary	John Wong	john_b.wong@tufts.edu

This course is a working overview of the principles of decision analysis as applied to medicine, making optimal choices in the face of uncertainty. Formal decision analysis has become a well-recognized and accepted research discipline for examining clinical options facing patients, physicians and policymakers.

105533	**Special Topics in Clinical and Translational Science**

Subject:	Catalog Nbr:
CTS	0593

In-depth information is provided on selected topics. Students may also pursue guided individual study of an approved topic.

105554	**Special Topics in Clinical and Translational Science**

Subject:	Catalog Nbr:
CTS	0594

In-depth information is provided on selected topics. Students may also pursue guided individual study of an approved topic. {COIRRECT CREDITS}

108388	**Graduate Biochemistry**

Subject:	Catalog Nbr:
BCHM	0223

2021 FALL	Primary	Alex Bohm	Andrew.Bohm@tufts.edu
2021 SPRG	Secondary	James Baleja	jim.baleja@tufts.edu
2021 SPRG	Secondary	Peter Bullock	peter.bullock@tufts.edu
2021 SPRG	Secondary	Brian Schaffhausen	brian.schaffhausen@tufts.edu
2021 SPRG	Secondary	William Bachovchin	william.bachovchin@tufts.edu
2021 SPRG	Secondary	Michael Forgac	michael.forgac@tufts.edu
2021 SPRG	Secondary	Albert Tai	albert.tai@tufts.edu
2021 SPRG	Secondary	Alexei Degterev	Alexei.Degterev@tufts.edu
2021 SPRG	Secondary	Ekaterina Heldwein	Katya.Heldwein@tufts.edu
2021 SPRG	Secondary	Claudette Gardel	Claudette.Gardel@tufts.edu
2021 SPRG	Secondary	Marta Gaglia	Marta.Gaglia@tufts.edu

This course provides a graduate-level discussion of the structure and function of biologically important

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molecules. Problems of protein and nucleic acid biochemistry are emphasized.

108410	**Advanced Graduate Biochemistry**
Subject: BCHM	Catalog Nbr: 0224
Advanced Graduate Biochemistry is intended to allow students with strong biochemistry backgrounds to explore areas of biochemistry relevant to their interests in a more detailed way. It is offered in parallel with BCHM223 Graduate Biochemistry. It is intended for MD/PhD students who have taken Medical Foundations I and for PhD students coming to the Sackler School with a substantial background in biochemistry. PhD students are allowed to transfer to this course after the first BCHM223 examination if they meet the performance requirements set by the Course Director.	

108532	**Biochemistry of Gene Expression & Signal Transduction**
Subject: BCHM	Catalog Nbr: 0230
This course covers the molecular mechanisms of gene expression and signal transduction. The fundamental mechanisms underlying transcription, RNA processing, translation, and DNA replication are highlighted, and the integration of these fundamental mechanisms into molecular and cellular regulation of proliferation and signal transduction is discussed. Current literature is emphasized.	

108657	**Graduate Seminar**
Subject: BCHM	Catalog Nbr: 0291
Visiting speakers from the Boston community and beyond present their scientific research to all members of the program, including faculty, students, and post-doctoral fellows.	

108697	**Graduate Seminar**
Subject: BCHM	Catalog Nbr: 0292
Visiting speakers from the Boston community and beyond present their scientific research to all members of the program, including faculty, students, and post-doctoral fellows.	

108770	**Journal Club**
Subject: BCHM	Catalog Nbr: 0295
Students select articles from the current literature, analyze their significance, and present them for discussion in a seminar group.	

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108787	Journal Club
Subject: BCHM	Catalog Nbr: 0296
Students select articles from the current literature, analyze their significance, and present them for discussion in a seminar group.	

108810	Graduate Research
Subject: BCHM	Catalog Nbr: 0297
These courses provide guided research on a topic suitable for a doctoral thesis.	

108837	Graduate Research
Subject: BCHM	Catalog Nbr: 0298
These courses provide guided research on a topic suitable for a doctoral thesis.	

108863	Graduate Research
Subject: BCHM	Catalog Nbr: 0299
These courses provide guided research on a topic suitable for a doctoral thesis.	

108885	Masters Degree Only
Subject: BCHM	Catalog Nbr: 0402

108909	PhD Degree Only
Subject: BCHM	Catalog Nbr: 0403
Students are enrolled in this course when they receive permission to write from their thesis committee, and represents the effort in the final preparation and writing of the doctoral thesis. A grade of “S” is automatically awarded upon completion of the thesis	

108938	PhD Degree Only
Subject: BCHM	Catalog Nbr: 0404
Students are enrolled in this course when they receive permission to write from their thesis committee, and represents the effort in the final preparation and writing of the doctoral thesis. A grade of “S” is automatically	

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awarded upon completion of the thesis

108962	PhD Degree Only
Subject: BCHM	Catalog Nbr: 0405
Students are enrolled in this course when they receive permission to write from their thesis committee, and represents the effort in the final preparation and writing of the doctoral thesis. A grade of “S” is automatically awarded upon completion of the thesis	

109050	Biochemistry of Gene Expression
Subject: BCHM	Catalog Nbr: 230A
The fundamental mechanisms underlying transcription, RNA processing, translation, and DNA replication are highlighted in this course. Current literature is emphasized. This course represents the first part of Biochemistry 230 and may be taken as a separate course.	

109079	Biochemistry of Signal Transduction
Subject: BCHM	Catalog Nbr: 230B
The integration of fundamental mechanisms into molecular and cellular regulation of proliferation and signal transduction is discussed. Current literature is emphasized. This course represents the second part of Biochemistry 230 and may be taken as a separate course.	

109102	Molecular Recognition in Biology
Subject: BCHM	Catalog Nbr: 231A
This course builds on graduate biochemistry, providing detailed instruction on how to design and interpret binding experiments, how to visualize and analyze macromolecular structures, and how to apply these techniques in laboratory research.	

109123	Drug Design
Subject: BCHM	Catalog Nbr: 231B
Survey and critical analysis of selected case histories of drug design, discovery, and development, including issues related to commercialization such as market size, patents, and licenses.	

109312	Pathobiology
Subject:	Catalog Nbr:

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CMP	0230
This is a discussion-based course that introduces graduate students to human disease, familiarizes them with pathological specimens and patients, provides examples of how scientific discovery and clinical practice have influenced each other, and uses clinical problems as a starting point for hypothesis-driven research.	

109384	**Graduate Seminar**
Subject:	Catalog Nbr:
CMP	0291
Visiting speakers from the Boston community and beyond present their scientific research to all members of the program, including faculty, students, and post-doctoral fellows.	

109405	**Graduate Seminar**
Subject:	Catalog Nbr:
CMP	0292
Visiting speakers from the Boston community and beyond present their scientific research to all members of the program, including faculty, students, and post-doctoral fellows.	

109497	**Journal Club**
Subject:	Catalog Nbr:
CMP	0295
Students select articles from the current literature, analyze their significance, and present them for discussion in a seminar group.	

109519	**Journal Club**
Subject:	Catalog Nbr:
CMP	0296
Students select articles from the current literature, analyze their significance, and present them for discussion in a seminar group.	

109541	**Graduate Research**
Subject:	Catalog Nbr:
CMP	0297
These courses provide guided research on a topic suitable for a doctoral thesis.	

109568	**Graduate Research**
Subject:	Catalog Nbr:
CMP	0298
These courses provide guided research on a topic suitable for a doctoral thesis.	

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109587	Graduate Research
Subject:	Catalog Nbr:
CMP	0299
These courses provide guided research on a topic suitable for a doctoral thesis.	

109603	Masters Degree Only
Subject:	Catalog Nbr:
CMP	0402

109623	PhD Degree Only
Subject:	Catalog Nbr:
CMP	0403
Students are enrolled in this course when they receive permission to write from their thesis committee, and represents the effort in the final preparation and writing of the doctoral thesis. A grade of “S” is automatically awarded upon completion of the thesis	

109641	PhD Degree Only
Subject:	Catalog Nbr:
CMP	0404
Students are enrolled in this course when they receive permission to write from their thesis committee, and represents the effort in the final preparation and writing of the doctoral thesis. A grade of “S” is automatically awarded upon completion of the thesis.	

109661	PhD Degree Only
Subject:	Catalog Nbr:
CMP	0405
Students are enrolled in this course when they receive permission to write from their thesis committee, and represents the effort in the final preparation and writing of the doctoral thesis. A grade of “S” is automatically awarded upon completion of the thesis	

110372	Qualifying Exam
Subject:	Catalog Nbr:
CMDB	0000
Students present and defend a proposal for research consisting of a statement of an original research problem in which a scientific question is asked and the experimental approach to answering the question is explained in a written proposal. The proposal is presented orally to the faculty.	

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110452	Medical Histology
Subject: CMDB	Catalog Nbr: 0203
This elective Medical School course introduces the student to the organization of a variety of cells, tissues, and organ systems. The lectures present information on the relationships between structure and function (i.e., physiology, biochemistry, and development), while the laboratories involve tissue and organ identification, providing both a practical background in cell and tissue biology.	

110619	Developmental Biology		
Subject: CMDB	Catalog Nbr: 0235		
2020 Fall	Primary	Victor Hatini	Victor.Hatini@tufts.edu
2020 Fall	Secondary	James Schwob	jim.schwob@tufts.edu
2020 Fall	Secondary	Charlotte Kuperwasser	Charlotte.Kuperwasser@tufts.edu
2020 Fall	Secondary	Peter Juo	Peter.Juo@tufts.edu
2020 Fall	Secondary	Pamela Yelick	Pamela.Yelick@tufts.edu
This course introduces students to modern developmental biology with an emphasis on the cellular and molecular mechanisms involved. General topic areas include fertilization and early development, mechanisms of cell determination and differentiation, and cell-cell and cell-matrix interactions.			

110876	Graduate Seminar		
Subject: CMDB	Catalog Nbr: 0291		
2021 FALL	Primary	Malavika Raman	Malavika.Raman@tufts.edu
Visiting speakers from the Boston community and beyond present their scientific research to all members of the program, including faculty, students, and post-doctoral fellows.			

110897	Graduate Seminar		
Subject: CMDB	Catalog Nbr: 0292		
2021 SPRG	Primary	Malavika Raman	Malavika.Raman@tufts.edu
Visiting speakers from the Boston community and beyond present their scientific research to all members of the program, including faculty, students, and post-doctoral fellows.			

110931	Journal Club		
Subject: CMDB	Catalog Nbr: 0295		
2020 Fall	Primary	Victor Hatini	Victor.Hatini@tufts.edu

Course Bulletin

2021 FALL	Primary	James Baleja	jim.baleja@tufts.edu
2021 FALL	Primary	Alex Bohm	Andrew.Bohm@tufts.edu
2021 FALL	Primary	Peter Juo	Peter.Juo@tufts.edu
2021 FALL	Primary	Philip Hinds	Phil.Hinds@tufts.edu
2021 FALL	Primary	Malavika Raman	Malavika.Raman@tufts.edu

Subject: Catalog Nbr:
CMDB 0295

Students select articles from the current literature, analyze their significance, and present them for discussion in a seminar group

110961 **Journal Club**

Subject: Catalog Nbr:
CMDB 0296

2021 SPRG	Primary	Alex Bohm	Andrew.Bohm@tufts.edu
2021 SPRG	Primary	Victor Hatini	Victor.Hatini@tufts.edu
2021 SPRG	Primary	Philip Hinds	Phil.Hinds@tufts.edu

Subject: Catalog Nbr:
CMDB 0296

Students select articles from the current literature, analyze their significance, and present them for discussion in a seminar group

110981 **Graduate Research**

Subject: Catalog Nbr:
CMDB 0297

2021 FALL	Primary	Brent Cochran	brent.cochran@tufts.edu

These courses provide guided research on a topic suitable for a doctoral thesis.

120717 **Probability and Statistics for Basic Sciences**

Subject: Catalog Nbr:
ISP 0220

This course provides an introduction to the principles of probability and statistics and emphasizes the application of these disciplines to the analysis of basic science biomedical research data. Topics include: summarizing data, testing for differences between means, analysis of variance, laws of probability, common probability distributions, the analysis of categorical data, correlation, linear regression, nonlinear curve fitting, and exponential processes.

120748 **Laboratory Rotations**

Subject: Catalog Nbr:
ISP 0234

2021 FALL	Primary	Brent Cochran	brent.cochran@tufts.edu

Course Bulletin

8-10 week laboratory rotations for first-year students are designed to provide experience with experimental design and theoretical aspects of the diverse research problems under investigation in various laboratories

120763	**Laboratory Rotations**			
Subject:	Catalog Nbr:			
ISP	0235			
2021 SPRG	Primary	Brent Cochran	brent.cochran@tufts.edu	
8-10 week laboratory rotations for first-year students are designed to provide experience with experimental design and theoretical aspects of the diverse research problems under investigation in various laboratories.				

120784	**Laboratory Rotations**			
Subject:	Catalog Nbr:			
ISP	0236			
2021 SUMR	Primary	Brent Cochran	brent.cochran@tufts.edu	
8-10 week laboratory rotation for first-year students are designed to provide experience with experimental design and theoretical aspects of the diverse research problems under investigation in various laboratories				

120859	**Journal Club**		
Subject:	Catalog Nbr:		
ISP	0295		
2021 FALL	Primary	Brent Cochran	brent.cochran@tufts.edu
2021 FALL	Primary	Amy Yee	amy.yee@tufts.edu
Students select articles from the current literature, analyze their significance, and present them for discussion in a seminar group.			

120875	**Journal Club**
Subject:	Catalog Nbr:
ISP	0296
Students select articles from the current literature, analyze their significance, and present them for discussion in a seminar group.	

121168	**Cell Behavior**
Subject:	Catalog Nbr:
ISP	209B
This course covers major topics in cell biology, including cell motility and mitosis; cell-cell and cell-matrix interactions; and receptor-mediated endocytosis.	

123526	**Qualifying Exam**

Course Bulletin

Subject:	Catalog Nbr:
GENE	0000

Students present and defend a proposal for research consisting of a statement of an original research problem in which a scientific question is asked and the experimental approach to answering the question is explained in a written proposal. The proposal is presented orally to the faculty.

123606	**Introduction to Genetics**
Subject:	Catalog Nbr:
GENE	0201

Basic principles and current issues in genetics are the subject of the course. The focus will be on basic genetic principles. Topics will include Mendelian analysis, linkage, recombination/gene conversion, chromosomal abnormalities, crossover and segregation, developmental genetics and differentiation, chromosome structure, chromatin, position effects, meiosis and mitosis. Student presentations of research papers are used to familiarize the class with the manner in which genetic approaches can be applied experimentally.

123650	**Cancer Genetics**
Subject:	Catalog Nbr:
GENE	0203

2021 SPRG	Primary	Brent Cochran	brent.cochran@tufts.edu
2021 SPRG	Primary	Karl Munger	Karl.Munger@tufts.edu
2021 SPRG	Secondary	James Baleja	jim.baleja@tufts.edu
2021 SPRG	Secondary	Ira Herman	ira.herman@tufts.edu
2021 SPRG	Secondary	Stephen Bunnell	Stephen.Bunnell@tufts.edu
2021 SPRG	Secondary	Charlotte Kuperwasser	Charlotte.Kuperwasser@tufts.edu
2021 SPRG	Secondary	Alexei Degterev	Alexei.Degterev@tufts.edu
2021 SPRG	Secondary	Rachel Buchsbaum	rachel.buchsbaum@tufts.edu
2021 SPRG	Secondary	Philip Hinds	Phil.Hinds@tufts.edu
2021 SPRG	Secondary	Dominique Michaud	Dominique.Michaud@tufts.edu
2021 SPRG	Secondary	Andreas Klein	Andreas.Klein@tufts.edu
2021 SPRG	Secondary	Jeffrey Arnold	Jeffrey.Arnold@tufts.edu
2021 SPRG	Secondary	Suriya Jeyapalan	No Email on file.

The course reviews widely-held ideas and current research on the genetic aspects of carcinogenesis. An introduction to cancer concepts is followed by a focus on specific mechanisms and models illustrating the ways in which normal cellular processes are disrupted in particular types of cancers. The course emphasizes problem solving and readings from the current literature.

123720	**Mammalian Genetics**
Subject:	Catalog Nbr:
GENE	0205

2021 SUMR	Primary	Christopher Baker	Christopher.Baker614610@tufts.edu

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2021 SUMR	Primary	Bethany Dumont	Bethany.Dumont@tufts.edu
2021 SUMR	Secondary	Gregory Carter	Gregory.Carter@tufts.edu
2021 SUMR	Secondary	Robert Burgess	Robert.Burgess@tufts.edu
2021 SUMR	Secondary	Gregory Cox	Gregory.Cox@tufts.edu
2021 SUMR	Secondary	Steven Munger	Steven.Munger@tufts.edu
2021 SUMR	Secondary	Shengdong Ke	Shengdong.Ke@tufts.edu
2021 SUMR	Secondary	Ryan Tewhey	Ryan.Tewhey@tufts.edu
2021 SUMR	Secondary	Laura Reinholdt	Laura.Reinholdt@tufts.edu
2021 SUMR	Secondary	Martin Pera	Martin.Pera@tufts.edu
2021 SUMR	Secondary	Stephen Murray	Stephen.Murray640409@tufts.edu
2021 SUMR	Secondary	Elissa Chesler	Elissa.Chesler@tufts.edu

The course reviews the genetic principles that apply to mammals, including genetic mechanisms of sex determination, genetic imprinting, and mitochondrial inheritance. Attention is focused on the ways in which mutation is manifested in disease phenotypes in humans, and the methodologies that are currently used to perform genetic analysis of mammals.

123785	**Medical & Experimental Mammalian Genetics**

Subject: GENE — Catalog Nbr: 0208

2021 SUMR	Primary	Jennifer Trowbridge	Jennifer.Trowbridge@tufts.edu
2021 SUMR	Primary	Ryan Tewhey	Ryan.Tewhey@tufts.edu

The course is an intensive, two-week immersion into mammalian genetics with presenters providing background and current research in important areas of mammalian genetics and its impact on health and disease. This course is offered at The Jackson Laboratory, Bar Harbor, ME. Students in the Mammalian Genetics Track have priority for this course; a limited number of slots are available for other GSBS students with permission from the Genetics program and the Dean's Office.

123914	**Laboratory Rotations**

Subject: GENE — Catalog Nbr: 0234

2021 FALL	Primary	Pamela Yelick	Pamela.Yelick@tufts.edu

8-10 week laboratory rotations for first-year students are designed to provide experience with experimental design and theoretical aspects of the diverse research problems under investigation in various laboratories.

123936	**Laboratory Rotations**

Subject: GENE — Catalog Nbr: 0235

2021 SPRG	Primary	Henry Wortis	henry.wortis@tufts.edu
2021 SPRG	Primary	Pamela Yelick	Pamela.Yelick@tufts.edu
2021 SPRG	Primary	Gareth Howell	Gareth.Howell@tufts.edu

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8-10 week laboratory rotations for first-year students are designed to provide experience with experimental design and theoretical aspects of the diverse research problems under investigation in various laboratories.

123953	**Laboratory Rotations**			
Subject:	Catalog Nbr:			
GENE	0236			
2021 SUMR		Primary	Henry Wortis	henry.wortis@tufts.edu
2021 SUMR		Primary	Pamela Yelick	Pamela.Yelick@tufts.edu
Subject:	Catalog Nbr:			
GENE	0236			
8-10 week laboratory rotations for first-year students are designed to provide experience with experimental design and theoretical aspects of the diverse research problems under investigation in various laboratories.				

123972	**Research Presentations**			
Subject:	Catalog Nbr:			
GENE	0289			
2021 FALL		Primary	Pamela Yelick	Pamela.Yelick@tufts.edu
Students present progress reports on their research for questions and constructive criticism as well as gain experience in presenting data and leading discussion.				

123991	**Research Presentations**			
Subject:	Catalog Nbr:			
GENE	0290			
2021 SPRG		Primary	Pamela Yelick	Pamela.Yelick@tufts.edu
Students present progress reports on their research for questions and constructive criticism as well as gain experience in presenting data and leading discussion.				

124062	**Graduate Seminar**			
Subject:	Catalog Nbr:			
GENE	0291			
2021 FALL		Primary	Pamela Yelick	Pamela.Yelick@tufts.edu
Visiting speakers from the Boston community and beyond present their scientific research to all members of the program, including faculty, students, and post-doctoral fellows.				

124097	**Graduate Seminar**			
Subject:	Catalog Nbr:			
GENE	0292			
2021 SPRG		Primary	Pamela Yelick	Pamela.Yelick@tufts.edu
Visiting speakers present their scientific research to all members of the program, including faculty, students,				

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and post-doctoral fellows. Fall and Spring.

124116	Special Topics in Genetics
Subject: GENE	Catalog Nbr: 0293
In-depth information is provided on selected topics. Students may also pursue guided individual study of an approved topic.	

124144	Special Topics in Genetics
Subject: GENE	Catalog Nbr: 0294
In-depth information is provided on selected topics. Students may also pursue guided individual study of an approved topic.	

124194	Journal Club			
Subject: GENE	Catalog Nbr: 0295			
	2021 FALL	Primary	Pamela Yelick	Pamela.Yelick@tufts.edu
	2021 FALL	Primary	Karl Munger	Karl.Munger@tufts.edu
Students select articles from the current literature, analyze their significance, and present them for discussion in a seminar group.				

124231	Journal Club			
Subject: GENE	Catalog Nbr: 0296			
	2021 SPRG	Primary	Pamela Yelick	Pamela.Yelick@tufts.edu
	2021 SPRG	Primary	Karl Munger	Karl.Munger@tufts.edu
Students select articles from the current literature, analyze their significance, and present them for discussion in a seminar group.				

124255	Graduate Research
Subject: GENE	Catalog Nbr: 0297
These courses provide guided research on a topic suitable for a doctoral thesis.	

124275	Graduate Research
Subject: GENE	Catalog Nbr: 0298

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These courses provide guided research on a topic suitable for a doctoral thesis.

124293	Graduate Research
Subject: GENE	Catalog Nbr: 0299
2021 SUMR Primary Pamela Yelick Pamela.Yelick@tufts.edu	
These courses provide guided research on a topic suitable for a doctoral thesis.	

124323	Masters Degree Only
Subject: GENE	Catalog Nbr: 0402

124347	PhD Degree Only
Subject: GENE	Catalog Nbr: 0403
Students enroll in this course when they receive permission to write and defend their theses from their thesis committees. This course represents the effort in the final preparation of the doctoral thesis. A grade of “S” is automatically awarded upon completion of the thesis.	

124365	PhD Degree Only
Subject: GENE	Catalog Nbr: 0404
Students enroll in this course when they receive permission to write and defend their theses from their thesis committees. This course represents the effort in the final preparation of the doctoral thesis. A grade of “S” is automatically awarded upon completion of the thesis.	

124386	PhD Degree Only
Subject: GENE	Catalog Nbr: 0405
Students enroll in this course when they receive permission to write and defend their theses from their thesis committees. This course represents the effort in the final preparation of the doctoral thesis. A grade of “S” is automatically awarded upon completion of the thesis.	

124411	Systems Genetics
Subject: GENE	Catalog Nbr: 0410
This one-week course covers computational and experimental approaches to genetic studies that utilize whole	

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genome approaches. Individuals interested in statistical and computational methods as well as biological problems are welcome. Topics include genetic mapping, gene expression microarray analysis and computational modeling of complex systems. This course is offered at The Jackson Laboratory, Bar Harbor, ME. Students in the Mammalian Genetics Track have priority for this course; a limited number of slots are available for other Sackler students with permission from the program and the Dean's Office.

124436	Experimental Models of Human Cancer
Subject: GENE	Catalog Nbr: 0450
2021 SUMR Primary Gareth Howell	Gareth.Howell@tufts.edu

This ten-day graduate-level genetics course is designed for individuals entering the field of mouse genetics. The course focuses on the mouse as an experimental tool in cancer research. This course is offered at The Jackson Laboratory, Bar Harbor, ME. Students in the Mammalian Genetics Track have priority for this course; a limited number of slots are available for other GSBS students with permission from the Genetics program and the Dean's Office.

124459	Mammalian Genetics I
Subject: GENE	Catalog Nbr: 205A

The course reviews the genetic principles that apply to mammals, including genetic mechanisms of sex determination, genetic imprinting, and mitochondrial inheritance. Attention is focused on the ways in which mutation is manifested in disease phenotypes in humans.

124475	Mammalian Genetics II
Subject: GENE	Catalog Nbr: 205B

The course explores the methodologies that are currently used to perform genetic analysis of mammals.

125165	Qualifying Exam
Subject: MMB	Catalog Nbr: 0000

Students present and defend a proposal for research consisting of a statement of an original research problem in which a scientific question is asked and the experimental approach to answering the question is explained in a written proposal. The proposal is presented orally to the faculty.

125406	Host Pathogen Interface
Subject: MMB	Catalog Nbr: 0210
2021 SUMR Primary Joan Mecsas	joan.mecsas@tufts.edu

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The goal of this course is to critically read and evaluate the scientific literature on bacterial pathogens and host defenses, with particular but not exclusive emphasis on innate immune defenses. Students are required to read at least two papers per topic and discuss them in the group.

125430	Bacterial-Host Cell Interaction

Subject:	Catalog Nbr:			
MMB	0211			
2021 SUMR		Primary	Ralph Isberg	ralph.isberg@tufts.edu

The goal of this course is to critically read and evaluate the scientific literature on the cellular biology of bacterial pathogens, with particular emphasis on cultured cell models of microbial diseases. Students are required to read at least two papers per topic and discuss them in the group.

125473	Animal Virology

Subject:	Catalog Nbr:
MMB	0214

Molecular aspects of viral replication and host-cell interactions are emphasized. Topics include virion structure; mechanisms of nucleic acid replication, transcription, and translation; virion assembly and release; genetics; mechanisms of transformation by oncogenic viruses; responses of the host to viral infection, tumor viruses and tumor cells; and mechanisms of persistent and slow virus infections. Prerequisites: a course in molecular biology or working knowledge of molecular techniques.

125598	Introduction to Infectious Diseases

Subject:	Catalog Nbr:			
MMB	0223			
2021 SUMR		Primary	Ralph Isberg	ralph.isberg@tufts.edu
2021 SUMR		Primary	Linden Hu	linden.hu@tufts.edu
2021 SUMR		Primary	Geneve Allison	Geneve.Allison@tufts.edu

This course is comprised of three integrated components; a Medical Microbiology Tutorial designed to introduce students to pathogens and pathophysiology of infectious diseases, Infectious Diseases Problem-Based Learning designed to introduce students to clinical cases, and a Teaching Clinic designed to expose students to real clinical cases and treatment options.

125630	Laboratory Rotations

Subject:	Catalog Nbr:			
MMB	0234			
2021 FALL		Primary	Ekaterina Heldwein	Katya.Heldwein@tufts.edu

8-10 week laboratory rotations for first-year students are designed to provide experience with experimental design and theoretical aspects of the diverse research problems under investigation in various laboratories.

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125651	Laboratory Rotations			
Subject:	Catalog Nbr:			
MMB	0235			
2021 SPRG		Primary	Ekaterina Heldwein	Katya.Heldwein@tufts.edu
8-10 week laboratory rotations for first-year students are designed to provide experience with experimental design and theoretical aspects of the diverse research problems under investigation in various laboratories.				

125665	Laboratory Rotations			
Subject:	Catalog Nbr:			
MMB	0236			
2021 SUMR		Primary	Ekaterina Heldwein	Katya.Heldwein@tufts.edu
8-10 week laboratory rotations for first-year students are designed to provide experience with experimental design and theoretical aspects of the diverse research problems under investigation in various laboratories.				

125685	Microbial Genetics & Microbiology			
Subject:	Catalog Nbr:			
MMB	0241			
2021 FALL		Primary	Andrew Camilli	andrew.camilli@tufts.edu
2021 SPRG		Secondary	Michael Malamy	michael.malamy@tufts.edu
2021 SPRG		Secondary	Claudette Gardel	Claudette.Gardel@tufts.edu
The goal of this course is to learn about the structure, growth, and genetics of bacteria and lambda bacteriophage. This course consists of text book reading, lectures and presentation and discussion of journal articles. Students are required to read one or two papers per topic and be prepared to discuss them in the group.				

125712	Applied Ethics for Scientists			
Subject:	Catalog Nbr:			
MMB	0275			
2021 SPRG		Primary	Shumin Tan	Shumin.Tan@tufts.edu
This course is a discussion/seminar course that treats selected topics related to ethical behavior in scientific work. Topics covered include fraud, plagiarism, data selection and analysis, record keeping, animal welfare, personnel issues, genetic screening and gene therapy, and conflict of interest. Enrollment is restricted to third and fourth year graduate students.				

125727	Graduate Seminar			
Subject:	Catalog Nbr:			
MMB	0291			
2021 FALL		Primary	Ekaterina Heldwein	Katya.Heldwein@tufts.edu
Visiting speakers present their scientific research to all members of the program, including faculty, students, and post-doctoral fellows.				

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125748	Graduate Seminar
Subject:	Catalog Nbr:
MMB	0292
2021 SPRG	Primary Ekaterina Heldwein Katya.Heldwein@tufts.edu
Visiting speakers present their scientific research to all members of the program, including faculty, students, and post-doctoral fellows.	

125769	Special Topics in Molecular Microbiology
Subject:	Catalog Nbr:
MMB	0293
In-depth information is provided on selected topics. Students may also pursue guided individual study of an approved topic.	

125789	Special Topics in Molecular Microbiology
Subject:	Catalog Nbr:
MMB	0294
In-depth information is provided on selected topics. Students may also pursue guided individual study of an approved topic.	

125805	Journal Club
Subject:	Catalog Nbr:
MMB	0295
2021 FALL	Primary Ekaterina Heldwein Katya.Heldwein@tufts.edu
These courses provide in-depth study and discussion of specific topics involving the critical review of current literature in a small group format. Given by faculty and graduate students (years two through four) and attended by all program members.	

125836	Journal Club
Subject:	Catalog Nbr:
MMB	0296
2021 SPRG	Primary Ekaterina Heldwein Katya.Heldwein@tufts.edu
These courses provide in-depth study and discussion of specific topics involving the critical review of current literature in a small group format. Given by faculty and graduate students (years two through four) and attended by all program members.	

125856	Graduate Research
Subject:	Catalog Nbr:

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MMB	0297
These courses provide guided research on a topic suitable for a doctoral thesis.	

125868	Graduate Research
Subject:	Catalog Nbr:
MMB	0298
These courses provide guided research on a topic suitable for a doctoral thesis.	

125887	Graduate Research
Subject:	Catalog Nbr:
MMB	0299
2021 SUMR Primary Ekaterina Heldwein Katya.Heldwein@tufts.edu	
These courses provide guided research on a topic suitable for a doctoral thesis.	

125908	Masters Degree Only
Subject:	Catalog Nbr:
MMB	0402

125927	PhD Degree Only
Subject:	Catalog Nbr:
MMB	0403
Students enroll in this course when they receive permission to write and defend their theses from their thesis committees. This course represents the effort in the final preparation of the doctoral thesis. A grade of "S" is automatically awarded upon completion of the thesis.	

125955	PhD Degree Only
Subject:	Catalog Nbr:
MMB	0404
Students enroll in this course when they receive permission to write and defend their theses from their thesis committees. This course represents the effort in the final preparation of the doctoral thesis. A grade of "S" is automatically awarded upon completion of the thesis.	

125976	PhD Degree Only
Subject:	Catalog Nbr:
MMB	0405
Students enroll in this course when they receive permission to write and defend their theses from their thesis committees. This course represents the effort in the final preparation of the doctoral thesis. A grade of "S" is	

Course Bulletin

automatically awarded upon completion of the thesis.

126450	Qualifying Exam
Subject: IMM	Catalog Nbr: 0000

Students present and defend a proposal for research consisting of a statement of an original research problem in which a scientific question is asked and the experimental approach to answering the question is explained in a written proposal. The proposal is presented orally to the faculty.

126717	Introduction to Immunology
Subject: IMM	Catalog Nbr: 0212

2021 FALL	Primary	Henry Wortis	henry.wortis@tufts.edu
2021 SPRG	Secondary	Peter Brodeur	peter.brodeur@tufts.edu
2021 SPRG	Secondary	Stephen Bunnell	Stephen.Bunnell@tufts.edu
2021 SPRG	Secondary	John Iacomini	John.Iacomini@tufts.edu
2021 SPRG	Secondary	Pedram Hamrah	Pedram.Hamrah@tufts.edu
2021 SPRG	Secondary	Xudong Li	Xudong.Li@tufts.edu
2021 SPRG	Secondary	Shruti Sharma	Shruti.Sharma@tufts.edu
2021 SPRG	Secondary	Marta Rodriguez Garcia	Marta.Rodriguez_Garcia@tufts.edu

This is a survey based on lectures, texts, problem-solving and small group tutorials. Topics include the cellular basis of innate and adaptive immune responses, the mechanism of antigen receptor gene rearrangement, principles of tissue transplantation and the genetic and mechanistic problems underlying autoimmune and hypersensitivity diseases.

126797	Imm Mechs of Disease I
Subject: IMM	Catalog Nbr: 0215

The course covers the pathogenesis of major infectious diseases including current knowledge of immune responses and approaches to prevention, diagnosis and treatment. Current studies of autoimmunity, hypersensitivity, leukemia and lymphoma are also covered.

126840	Immunological Mechanisms In Disease
Subject: IMM	Catalog Nbr: 0216

The course covers the pathogenesis of major infectious diseases including current knowledge of immune responses and approaches to prevention, diagnosis and treatment. Current studies of autoimmunity, hypersensitivity, leukemia and lymphoma are also covered.

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126857	1st Year Journal Club			
Subject:	Catalog Nbr:			
IMM	0217			
2021 FALL		Primary	Henry Wortis	henry.wortis@tufts.edu
2021 SPRG		Secondary	Peter Brodeur	peter.brodeur@tufts.edu
2021 SPRG		Secondary	Stephen Bunnell	Stephen.Bunnell@tufts.edu
2021 SPRG		Secondary	John Iacomini	John.Iacomini@tufts.edu
2021 SPRG		Secondary	Xudong Li	Xudong.Li@tufts.edu
First-year students meet with the course director to discuss articles essential for an understanding of contemporary immunology. The development of analytic skills is emphasized.				

127114	Scientific & Grant Wtng
Subject:	Catalog Nbr:
IMM	0233
This course provides graduate students with the opportunity to develop the basic skills essential to the effective oral and written communication of scientific findings and research proposals. The course is a combination of lectures, writing assignments, and oral communication practice sessions with feedback provided by the faculty.	

127136	Laboratory Rotations			
Subject:	Catalog Nbr:			
IMM	0234			
2020 Fall		Primary	Alexander Poltorak	Alexander.Poltorak@tufts.edu
2021 FALL		Primary	Maria Alcaide Alonso	Pilar.Alcaide@tufts.edu
8-10 week laboratory rotations for first-year students are designed to provide experience with experimental design and theoretical aspects of the diverse research problems under investigation in various laboratories.				

127165	Laboratory Rotations			
Subject:	Catalog Nbr:			
IMM	0235			
2021 SPRG		Primary	Alexander Poltorak	Alexander.Poltorak@tufts.edu
2021 SPRG		Primary	Maria Alcaide Alonso	Pilar.Alcaide@tufts.edu
8-10 week laboratory rotations for first-year students are designed to provide experience with experimental design and theoretical aspects of the diverse research problems under investigation in various laboratories.				

127179	Laboratory Rotations			
Subject:	Catalog Nbr:			
IMM	0236			
2021 SUMR		Primary	Maria Alcaide Alonso	Pilar.Alcaide@tufts.edu
8-10 week laboratory rotations for first-year students are designed to provide experience with experimental				

Course Bulletin

design and theoretical aspects of the diverse research problems under investigation in various laboratories.

127217	**Research Presentations**			
Subject:	Catalog Nbr:			
IMM	0289			
2020 Fall	Primary	Maria Alcaide Alonso	Pilar.Alcaide@tufts.edu	
2021 FALL	Primary	Marta Rodriguez Garcia	Marta.Rodriguez_Garcia@tufts.edu	
Students present progress reports on their research for questions and constructive criticism as well as gain experience in presenting data and leading discussion.				

127238	**Research Presentations**			
Subject:	Catalog Nbr:			
IMM	0290			
2021 SPRG	Primary	Maria Alcaide Alonso	Pilar.Alcaide@tufts.edu	
2021 SPRG	Primary	Marta Rodriguez Garcia	Marta.Rodriguez_Garcia@tufts.edu	
Students present progress reports on their research for questions and constructive criticism as well as gain experience in presenting data and leading discussion.				

127260	**Graduate Seminar**			
Subject:	Catalog Nbr:			
IMM	0291			
2021 FALL	Primary	Maria Alcaide Alonso	Pilar.Alcaide@tufts.edu	
Visiting speakers present their scientific research to all members of the program, including faculty, students, and post-doctoral fellows.				

127291	**Graduate Seminar**			
Subject:	Catalog Nbr:			
IMM	0292			
2021 SPRG	Primary	Maria Alcaide Alonso	Pilar.Alcaide@tufts.edu	
Visiting speakers present their scientific research to all members of the program, including faculty, students, and post-doctoral fellows.				

127310	**Special Topics in Immunology**
Subject:	Catalog Nbr:
IMM	0293
In-depth information is provided on selected topics. Students may also pursue guided individual study of an approved topic.	

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127329	Special Topics in Immunology
Subject:	Catalog Nbr:
IMM	0294
In-depth information is provided on selected topics. Students may also pursue guided individual study of an approved topic.	

127347	Journal Club			
Subject:	Catalog Nbr:			
IMM	0295			
2021 FALL	Primary	Stephen Bunnell	Stephen.Bunnell@tufts.edu	
Students in the research portion of their training meet to present and discuss recent papers of importance.				

127367	Journal Club			
Subject:	Catalog Nbr:			
IMM	0296			
2021 SPRG	Primary	Stephen Bunnell	Stephen.Bunnell@tufts.edu	
Students in the research portion of their training meet to present and discuss recent papers of importance.				

127391	Graduate Research
Subject:	Catalog Nbr:
IMM	0297
These courses provide guided research on a topic suitable for a doctoral thesis.	

127403	Graduate Research
Subject:	Catalog Nbr:
IMM	0298
These courses provide guided research on a topic suitable for a doctoral thesis.	

127430	Graduate Research			
Subject:	Catalog Nbr:			
IMM	0299			
2020 SUMR	Primary	Alexander Poltorak	Alexander.Poltorak@tufts.edu	
2021 SUMR	Primary	Maria Alcaide Alonso	Pilar.Alcaide@tufts.edu	
These courses provide guided research on a topic suitable for a doctoral thesis.				

127436	Qualifying Exam
Subject:	Catalog Nbr:

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NRSC	0000
Students present and defend a proposal for research consisting of a statement of an original research problem in which a scientific question is asked and the experimental approach to answering the question is explained in a written proposal. The proposal is presented orally to the faculty.	

127448	**Masters Degree Only**
Subject:	Catalog Nbr:
IMM	0402

127451	**Cellular and Molecular Tutorials in Neuroscience**			
Subject:	Catalog Nbr:			
NRSC	0200			
	2021 FALL	Primary	Christopher Dulla	Chris.Dulla@tufts.edu
	2021 SPRG	Secondary	Elizabeth Byrnes	elizabeth.byrnes@tufts.edu
	2021 SPRG	Secondary	Michele Jacob	michele.jacob@tufts.edu
	2021 SPRG	Secondary	Peter Juo	Peter.Juo@tufts.edu
	2021 SPRG	Secondary	Philip Haydon	Philip.Haydon@tufts.edu
	2021 SPRG	Secondary	Gerard Reijmers	Leon.Reijmers@tufts.edu
	2021 SPRG	Secondary	Jamie Maguire	Jamie.Maguire@tufts.edu
These small group tutorial sessions will introduce students to key principles in cellular and molecular neuroscience, provide students with the historical context in which key advances have been made, and engage students and faculty in informal, one-on-one discussions to deepen understanding of the material.				

127475	**PhD Degree Only**
Subject:	Catalog Nbr:
IMM	0403
Students enroll in this course when they receive permission to write and defend their theses from their thesis committees. This course represents the effort in the final preparation of the doctoral thesis. A grade of “S” is automatically awarded upon completion of the thesis.	

127491	**PhD Degree Only**
Subject:	Catalog Nbr:
IMM	0404
Students enroll in this course when they receive permission to write and defend their theses from their thesis committees. This course represents the effort in the final preparation of the doctoral thesis. A grade of “S” is automatically awarded upon completion of the thesis.	

127512	**Developmental Neurobiology**

Course Bulletin

Subject:	Catalog Nbr:
NRSC	0205

This is a small group, interactive course exploring the mechanisms underlying the formation of the differentiated nervous system. Morphological, biochemical, immunological, and molecular approaches are examined, with an emphasis on the utility of experimental model systems.

127521	**PhD Degree Only**
Subject:	Catalog Nbr:
IMM	0405

Students enroll in this course when they receive permission to write and defend their theses from their thesis committees. This course represents the effort in the final preparation of the doctoral thesis. A grade of "S" is automatically awarded upon completion of the thesis.

127621	**Systems Neuroscience**
Subject:	Catalog Nbr:
NRSC	0310

This course, a cross-listing with Tufts University School of Medicine, focuses on the structural and functional organization of the integrated nervous system with significant exposure to neurological disease processes.

127641	**Synapse Neurobiology**			
Subject:	Catalog Nbr:			
NRSC	0213			
2020 Fall		Primary	Michele Jacob	michele.jacob@tufts.edu
2020 Fall		Primary	Gerard Reijmers	Leon.Reijmers@tufts.edu
2020 Fall		Secondary	Peter Juo	Peter.Juo@tufts.edu
2020 Fall		Secondary	Jamie Maguire	Jamie.Maguire@tufts.edu
2020 Fall		Secondary	Christopher Dulla	Chris.Dulla@tufts.edu

This small group discussion course provides students with an in-depth understanding of how synapses function, how activity modulates function, and how synaptic ensembles coordinate simple behaviors.

127741	**Scientific Communication and Writing Principles**			
Subject:	Catalog Nbr:			
NRSC	0220			
2021 FALL		Primary	Paul Davies	Paul.Davies@tufts.edu

A discussion and workshop-style course underscoring the fundamental principles underlying expository writing. This course centers on the improvement of each student's existing skills through interactive writing exercises. Enrollment is limited to 10 students.

127752	**Neuroscience Laboratory Techniques**

Course Bulletin

Subject:	Catalog Nbr:			
NRSC	0233			
2021 FALL		Primary	Jamie Maguire	Jamie.Maguire@tufts.edu
2021 FALL		Secondary	F Jackson	rob.jackson@tufts.edu
2021 FALL		Secondary	Gregory Carter	Gregory.Carter@tufts.edu
2021 FALL		Secondary	Robert Burgess	Robert.Burgess@tufts.edu
2021 FALL		Secondary	Gregory Cox	Gregory.Cox@tufts.edu
2021 FALL		Secondary	Catherine Kaczorowski	Catherine.Kaczorowski@tufts.edu
2021 SPRG		Secondary	Selene Lomoio	Selene.Lomoio@tufts.edu
2021 SPRG		Secondary	Vivek Kumar	No Email on file.
2021 SPRG		Secondary	Elissa Chesler	Elissa.Chesler@tufts.edu

The series of workshops exposes student to fundamental laboratory techniques, including tissue culture, genotyping, microscopy, immunohistochemistry, rodent handling, protein quantification, and experimental design. Restricted to first-year Neuroscience students.

127776	**Laboratory Rotation**			
Subject:	Catalog Nbr:			
NRSC	0234			
2021 FALL		Primary	Christopher Dulla	Chris.Dulla@tufts.edu
2021 FALL		Primary	Robert Burgess	Robert.Burgess@tufts.edu

8-10 week laboratory rotations for first-year students are designed to provide experience with experimental design and theoretical aspects of the diverse research problems under investigation in various laboratories.

127803	**Laboratory Rotations**			
Subject:	Catalog Nbr:			
NRSC	0235			
2021 SPRG		Primary	Christopher Dulla	Chris.Dulla@tufts.edu
2021 SPRG		Primary	Robert Burgess	Robert.Burgess@tufts.edu

8-10 week laboratory rotations for first-year students are designed to provide experience with experimental design and theoretical aspects of the diverse research problems under investigation in various laboratories.

127822	**Laboratory Rotation**			
Subject:	Catalog Nbr:			
NRSC	0236			
2021 SUMR		Primary	Christopher Dulla	Chris.Dulla@tufts.edu

8-10 week laboratory rotations for first-year students are designed to provide experience with experimental design and theoretical aspects of the diverse research problems under investigation in various laboratories.

127830	**Biochemical Foundations in Neuroscience**
Subject:	Catalog Nbr:

Course Bulletin

NRSC 0251				
	2021 FALL	Primary	Maribel Rios	Maribel.Rios@tufts.edu
	2021 FALL	Primary	Alex Bohm	Andrew.Bohm@tufts.edu
	2021 SPRG	Primary	F Jackson	rob.jackson@tufts.edu
	2021 SPRG	Secondary	James Baleja	jim.baleja@tufts.edu
	2021 SPRG	Secondary	Peter Bullock	peter.bullock@tufts.edu
	2021 SPRG	Secondary	Larry Feig	larry.feig@tufts.edu
	2021 SPRG	Secondary	Brian Schaffhausen	brian.schaffhausen@tufts.edu
	2021 SPRG	Secondary	William Bachovchin	william.bachovchin@tufts.edu
	2021 SPRG	Secondary	Michael Forgac	michael.forgac@tufts.edu
	2021 SPRG	Secondary	Albert Tai	albert.tai@tufts.edu
	2021 SPRG	Secondary	Gerard Reijmers	Leon.Reijmers@tufts.edu
	2021 SPRG	Secondary	Christopher Dulla	Chris.Dulla@tufts.edu
	2021 SPRG	Secondary	Yongjie Yang	Yongjie.Yang@tufts.edu
	2021 SPRG	Secondary	Marta Gaglia	Marta.Gaglia@tufts.edu

This course covers fundamental biochemical principles, with special emphasis on mechanisms of particular importance to nervous system function, including neural signaling and non-equilibrium processes. Students will also be exposed to quantitative molecular approaches to studying the nervous system.

127868	**Neurogenetics**
Subject:	Catalog Nbr:
NRSC	0263

The course reviews principles of forward and reverse genetics, presents several animal model systems that are employed in neurogenetics research, and provides examples of genetic approaches that are used to study the molecules and neural circuits that regulate distinct neurobiological processes or are known to be altered in neurological disease states.

127898	**Research Presentations**
Subject:	Catalog Nbr:
NRSC	0289

2021 FALL	Primary	Michele Jacob	michele.jacob@tufts.edu

Students present progress reports on their research for questions and constructive criticism as well as gain experience in presenting data and leading discussion.

127942	**Research Presentations**
Subject:	Catalog Nbr:
NRSC	0290

2021 SPRG	Primary	Michele Jacob	michele.jacob@tufts.edu

Students present progress reports on their research for questions and constructive criticism as well as gain experience in presenting data and leading discussion.

Course Bulletin

127981	Graduate Seminar
Subject: NRSC	Catalog Nbr: 0291
2021 FALL	Primary Yongjie Yang Yongjie.Yang@tufts.edu
Visiting speakers present their scientific research to all members of the program, including faculty, students, and post-doctoral fellows.	

128024	Graduate Seminar
Subject: NRSC	Catalog Nbr: 0292
2021 SPRG	Primary Yongjie Yang Yongjie.Yang@tufts.edu
Visiting speakers present their scientific research to all members of the program, including faculty, students, and post-doctoral fellows.	

128062	Special Topics in Neuroscience
Subject: NRSC	Catalog Nbr: 0293
In-depth information is provided on selected topics. Students may also pursue guided individual study of an approved topic.	

128101	Special Topics in Neuroscience
Subject: NRSC	Catalog Nbr: 0294
In-depth information is provided on selected topics. Students may also pursue guided individual study of an approved topic.	

128157	Journal Club		
Subject: NRSC	Catalog Nbr: 0295		
2021 FALL	Primary	Christopher Dulla	Chris.Dulla@tufts.edu
2021 FALL	Secondary	Michele Jacob	michele.jacob@tufts.edu
2021 FALL	Secondary	F Jackson	rob.jackson@tufts.edu
2021 FALL	Secondary	Gerard Reijmers	Leon.Reijmers@tufts.edu
2021 FALL	Secondary	Dong Kong	Dong.Kong@tufts.edu
Students select articles from the current literature, analyze their significance, and present them for discussion in a seminar group.			

128193	Journal Club

Course Bulletin

Subject:	Catalog Nbr:			
NRSC	0296			
2021 SPRG	Primary	Christopher Dulla		Chris.Dulla@tufts.edu

Students select articles from the current literature, analyze their significance, and present them for discussion in a seminar group.

128216	**Graduate Research**
Subject:	Catalog Nbr:
NRSC	0297

These courses provide guided research on a topic suitable for a doctoral thesis.

128237	**Graduate Research**			
Subject:	Catalog Nbr:			
NRSC	0298			
2021 SPRG	Primary	Christopher Dulla		Chris.Dulla@tufts.edu

These courses provide guided research on a topic suitable for a doctoral thesis.

128248	**Graduate Research**			
Subject:	Catalog Nbr:			
NRSC	0299			
2021 SUMR	Primary	Christopher Dulla		Chris.Dulla@tufts.edu
2021 SUMR	Primary	Robert Burgess		Robert.Burgess@tufts.edu

These courses provide guided research on a topic suitable for a doctoral thesis.

128272	**Masters Degree Only**
Subject:	Catalog Nbr:
NRSC	0402

128290	**PhD Degree Only**
Subject:	Catalog Nbr:
NRSC	0403

Students enroll in this course when they receive permission to write and defend their theses from their thesis committees. This course represents the effort in the final preparation of the doctoral thesis. A grade of “S” is awarded upon completion of the thesis.

128311	**PhD Degree Only**
Subject:	Catalog Nbr:

Course Bulletin

NRSC	0404
Students enroll in this course when they receive permission to write and defend their theses from their thesis committees. This course represents the effort in the final preparation of the doctoral thesis. A grade of "S" is awarded upon completion of the thesis.	

128330	**PhD Degree Only**
Subject:	Catalog Nbr:
NRSC	0405
Students enroll in this course when they receive permission to write and defend their theses from their thesis committees. This course represents the effort in the final preparation of the doctoral thesis. A grade of "S" is awarded upon completion of the thesis.	

128378	**Biochemical Foundations in Neuroscience Receptor/Channel Mechanisms**		
Subject:	Catalog Nbr:		
NRSC	251B		
2021 FALL	Primary	Maribel Rios	Maribel.Rios@tufts.edu
2021 SPRG	Primary	F Jackson	rob.jackson@tufts.edu
2021 SPRG	Primary	Gerard Reijmers	Leon.Reijmers@tufts.edu
2021 SPRG	Secondary	Larry Feig	larry.feig@tufts.edu
2021 SPRG	Secondary	Christopher Dulla	Chris.Dulla@tufts.edu
2021 SPRG	Secondary	Yongjie Yang	Yongjie.Yang@tufts.edu
This course is the middle section of the Biochemical Foundations in Neuroscience course, focusing predominantly on mechanisms of enzyme, receptor, and channel function in the nervous system.			

130459	**Clinical Implications of Basic Research**		
Subject:	Catalog Nbr:		
GBMD	0210		
2021 SPRG	Primary	Michael Chin	Michael.Chin614279@tufts.edu
This journal club course for MD/PhD students is organized around the "Clinical Implications of Basic Research" column published in the New England Journal of Medicine. Students read a primary paper(s) highlighted in the column or one that is similar to those highlighted and discuss the work. The primary goal of this required course, which meets for one hour every other week, is to encourage and teach students to continually ask how basic research can impact clinical medicine. The format also encourages students to sharpen their communication skills in a relaxed atmosphere.			

136161	**Structural Biology**
Subject:	Catalog Nbr:
CMDB	0202
This course covers the basic theory and practice of Macromolecular Crystallography and NMR	

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136175	Tissue Engineering
Subject:	Catalog Nbr:
GSBS	0203
This course covers Stem Cell Biology and Tissue Scaffolds, the Principles of Bioreactor Design and Integrative Approaches to Tissue Engineering.	

136203	Imaging Techniques
Subject:	Catalog Nbr:
GSBS	0204
This course covers Light Microscopy/Immunofluorescence, Confocal Microscopy and Electron Microscopy. Computer-based image analysis is incorporated into these modules. The samples generated during the Tissue Engineering module are used.	

136219	Mentored Undergrad Teaching
Subject:	Catalog Nbr:
GSBS	0205
This course offers an opportunity for GSBS students to obtained mentored teaching experience. Each GSBS student collaborates with a TUSM and a Friedman student to develop a syllabus and three lectures on one of five disease topics (osteoporosis, breast cancer, asthma, metabolic syndrome, heart disease). Lectures are delivered to undergraduate Biology majors at Pine Manor College, Chestnut Hill, MA. Prerequisites: Year 3 or above.	

136275	Applied Ethics for Scientists			
Subject:	Catalog Nbr:			
GSBS	0275			
	2021 FALL	Primary	Jamie Maguire	Jamie.Maguire@tufts.edu
	2021 FALL	Secondary	Daniel Jay	daniel.jay@tufts.edu
The course is built around case study reading material and requires highly interactive discussion in which students analyze specific scenarios of ethical issues encountered in a research environment. Topics include: academic integrity issues/ fraud and misconduct/plagiarism/ data handling/notebooks, mentoring and conflict resolution and ethical use of animals and human subjects.				

136292	Biomedical Techniques & Research			
Subject:	Catalog Nbr:			
GSBS	0299			
	2021 FALL	Primary	Brian Schaffhausen	brian.schaffhausen@tufts.edu
	2021 FALL	Primary	Maria Alcaide Alonso	Pilar.Alcaide@tufts.edu
This course includes research with selected advisor. Visiting Students Only.				

Course Bulletin

136304	Clinical Implications of Basic Research
Subject: GBMD	Catalog Nbr: 0209
2021 FALL	Primary Michael Chin Michael.Chin614279@tufts.edu
This journal club course for MD/PhD students is organized around the "Clinical Implications of Basic Research" column published in the New England Journal of Medicine. Students read a primary paper(s) and discuss the work. The primary goal of this required course, is to encourage and teach students to continually ask how basic research can impact clinical medicine. The format also encourages students to sharpen their communication skills in a relaxed atmosphere.	

136336	Laboratory Rotations
Subject: GBMD	Catalog Nbr: 0299
2021 SUMR	Primary Daniel Jay daniel.jay@tufts.edu
6-8 week laboratory rotations are designed to provide experience with experimental design and theoretical aspects of the diverse research problems under investigation in various laboratories.	

137576	Qualifying Exam
Subject: PPET	Catalog Nbr: 0000
Students present and defend a proposal for research consisting of a statement of an original research problem in which a scientific question is asked and the experimental approach to answering the question is explained in a written proposal. The proposal is presented orally to the faculty.	

137616	Translational Pharmacology I
Subject: PPET	Catalog Nbr: 0211
2021 FALL	Primary Najla Fiaturi Najla.Fiaturi@tufts.edu
This course is a survey of some of the major classes of drugs, with particular emphasis on mechanisms of action and relevant organ systems and cellular physiology. Students are introduced to the central concepts, models and techniques in pharmacology.	

137629	Clinical Pharmacology
Subject: PPET	Catalog Nbr: 0212
This course is devoted to the discussion and presentation of therapeutic topics and the basic principles of therapeutic pharmacology. Subjects that are highlighted include: therapeutic drug monitoring, evaluation of side effects and toxicity, critical evaluation of clinical trial data, pharmacokinetic design of dose regimens, drugs in special populations and medical and legal issues in clinical pharmacology. A mixture of lecture,	

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readings and clinical case-oriented problem-solving is used. Extensive independent study and reading is required.

137645	Addiction Medicine			
Subject: PPET	Catalog Nbr: 0213			
2021 SUMR	Primary	Emmanuel Pothos	emmanuel.pothos@tufts.edu	
2021 SUMR	Secondary	Bryan Ho	Bryan.Ho@tufts.edu	
2021 SUMR	Secondary	Beverly Rubin	beverly.rubin@tufts.edu	
2021 SUMR	Secondary	Sarah Dodwell	Sarah.Dodwell@tufts.edu	
2021 SUMR	Secondary	Dena Whitesell	Dena.Whitesell@tufts.edu	

This course is offered in conjunction with the Medical School. It provides an overview of the mechanisms of action of drugs of abuse and their treatment, as well as the fundamentals of treatment of addiction in clinical practice.

137683	Principles of Immunopharmacology			
Subject: PPET	Catalog Nbr: 0218			
2020 Fall	Primary	Theoharis Theoharides	theoharis.theoharides@tufts.edu	

This course investigates the appraisal of molecular mechanisms by which drugs can affect cellular processes underlying clinical syndromes such as hypersensitivity, rejection, autoimmunity and neuroimmune disorders. Emphasis is placed on select cases of how certain compounds were chosen for drug development and why many such promising drugs failed.

137698	Behavioral Pharmacology
Subject: PPET	Catalog Nbr: 0219

This course is an in-depth examination of the mechanisms by which selected psychoactive agents alter mood and behavior with emphasis on the role of neurotransmitters and their receptors.

137710	Advances in Neurochem
Subject: PPET	Catalog Nbr: 0220

This course focuses on the problem-based approach to the actions of neurotransmitters and neuromodulators and related drugs at the molecular and cellular level.

137724	Pharmacokinetics in Biological Systems
Subject: PPET	Catalog Nbr: 0221

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	2020 Fall	Primary	David Greenblatt	dj.greenblatt@tufts.edu
	2020 Fall	Secondary	Jerold Harmatz	jerold.harmatz@tufts.edu
This course focuses on the uptake and clearance of drugs, using problem-solving exercises and computer modeling to analyze data from original experiments				

137735	Toxicology
Subject:	Catalog Nbr:
PPET	0222
This course is an in-depth examination of the basic principles of toxicology based on discussion and presentation of selected examples. Subjects considered include apoptosis/necrosis, molecular mechanisms of neurotoxicities, species difference in toxicities, and chemical mutagenesis.	

137756	Neuropeptides
Subject:	Catalog Nbr:
PPET	0224
This course entails detailed reading and critical review of the classical and modern literature on the discovery, chemistry, anatomical distribution, biosynthesis, physiology, pharmacology and current and possible future clinical uses of neuropeptides.	

137777	Introduction to Drug Metabolism
Subject:	Catalog Nbr:
PPET	0225
This is a readings and presentation course designed to illustrate the processes involved with drug metabolism, to describe the non-drug (non-substrate) factors influencing drug metabolism, and to review and critique methods used for the study of drug metabolism.	

137850	Translational Pharmacology II
Subject:	Catalog Nbr:
PPET	0232
This course continues with the topics covered in Translational Pharmacology I. It covers major classes of drugs and the concepts, models and techniques in pharmacology.	

137860	Scientific Writing and Presentation Skills			
Subject:	Catalog Nbr:			
PPET	0233			
	2021 FALL	Primary	Emmanuel Pothos	emmanuel.pothos@tufts.edu
This course provides graduate students with the opportunity to develop the basic skills essential to the effective oral and written communication of scientific findings and research proposals. The course is a combination of lectures, writing assignments, and oral communication practice sessions.				

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137871	Laboratory Rotations
Subject:	Catalog Nbr:
PPET	0234
8-10 week laboratory rotations for first-year students are designed to provide experience with experimental design and theoretical aspects of the diverse research problems under investigation in various laboratories.	

137881	Laboratory Rotations
Subject:	Catalog Nbr:
PPET	0235
8-10 week laboratory rotations for first-year students are designed to provide experience with experimental design and theoretical aspects of the diverse research problems under investigation in various laboratories.	

137889	Laboratory Rotations
Subject:	Catalog Nbr:
PPET	0236
8-10 week laboratory rotations for first-year students are designed to provide experience with experimental design and theoretical aspects of the diverse research problems under investigation in various laboratories.	

137918	Graduate Seminar			
Subject:	Catalog Nbr:			
PPET	0291			
2021 FALL	Primary	Emmanuel Pothos	emmanuel.pothos@tufts.edu	
Visiting speakers present their scientific research to all members of the program, including faculty, students, and post-doctoral fellows.				

137928	Graduate Seminar			
Subject:	Catalog Nbr:			
PPET	0292			
2021 SPRG	Primary	Emmanuel Pothos	emmanuel.pothos@tufts.edu	
Visiting speakers present their scientific research to all members of the program, including faculty, students, and post-doctoral fellows.				

137939	Special Topics in Pharmacology
Subject:	Catalog Nbr:
PPET	0293
In-depth information is provided on selected topics. Students may also pursue guided individual study of an approved topic.	

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137959	Special Topics in Pharmacology
Subject:	Catalog Nbr:
PPET	0294
In-depth information is provided on selected topics. Students may also pursue guided individual study of an approved topic.	

137978	Journal Club			
Subject:	Catalog Nbr:			
PPET	0295			
2021 FALL	Primary	Najla Fiaturi	Najla.Fiaturi@tufts.edu	
2021 FALL	Secondary	Jerold Harmatz	jerold.harmatz@tufts.edu	
Students select articles from the current literature, analyze their significance, and present them for discussion in a seminar group.				

137989	Journal Club		
Subject:	Catalog Nbr:		
PPET	0296		
2021 SPRG	Primary	Najla Fiaturi	Najla.Fiaturi@tufts.edu
2021 SPRG	Secondary	Jerold Harmatz	jerold.harmatz@tufts.edu
2021 SPRG	Secondary	Emmanuel Pothos	emmanuel.pothos@tufts.edu
Students select articles from the current literature, analyze their significance, and present them for discussion in a seminar group.			

138000	Graduate Research		
Subject:	Catalog Nbr:		
PPET	0297		
2021 FALL	Primary	Emmanuel Pothos	emmanuel.pothos@tufts.edu
These courses provide guided research on a topic suitable for a doctoral thesis.			

138007	Graduate Research		
Subject:	Catalog Nbr:		
PPET	0298		
2021 SPRG	Primary	Emmanuel Pothos	emmanuel.pothos@tufts.edu
These courses provide guided research on a topic suitable for a doctoral thesis.			

138017	Graduate Research
Subject:	Catalog Nbr:

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PPET	0299			
2021 SUMR	Primary	Emmanuel Pothos		emmanuel.pothos@tufts.edu
These courses provide guided research on a topic suitable for a doctoral thesis.				

138026	**Masters Degree Only**
Subject:	Catalog Nbr:
PPET	0402

138033	**PhD Degree Only**
Subject:	Catalog Nbr:
PPET	0403
Students enroll in this course when they receive permission to write and defend their theses from their thesis committees. This course represents the effort in the final preparation of the doctoral thesis. A grade of “S” is awarded upon completion of the thesis.	

138043	**PhD Degree Only**
Subject:	Catalog Nbr:
PPET	0404
Students enroll in this course when they receive permission to write and defend their theses from their thesis committees. This course represents the effort in the final preparation of the doctoral thesis. A grade of “S” is awarded upon completion of the thesis.	

138052	**PhD Degree Only**
Subject:	Catalog Nbr:
PPET	0405
Students enroll in this course when they receive permission to write and defend their theses from their thesis committees. This course represents the effort in the final preparation of the doctoral thesis. A grade of “S” is awarded upon completion of the thesis.	

138644	**Transfer Credit**
Subject:	Catalog Nbr:
TRAN	9999

138797	**Tutorial in Neural Systems and Disease Mechanisms**
Subject:	Catalog Nbr:
NRSC	0312

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This tutorial is designed as a companion course to NRSC 0310, in order to expand students' understanding of research approaches to common neurological diseases. In preparation for each discussion, students will read historical and recent publications relevant to the class topic, followed by critical discussions of past research advances made and future approaches that might prove most effective in translational research efforts.

139088	Advanced Cellular Immunology

Subject:	Catalog Nbr:			
IMM	0245			
2021 FALL		Primary	John Iacomini	John.Iacomini@tufts.edu
2021 SPRG		Secondary	Henry Wortis	henry.wortis@tufts.edu
2021 SPRG		Secondary	Stephen Bunnell	Stephen.Bunnell@tufts.edu
2021 SPRG		Secondary	Alexander Poltorak	Alexander.Poltorak@tufts.edu
2021 SPRG		Secondary	Xudong Li	Xudong.Li@tufts.edu
2021 SPRG		Secondary	Shruti Sharma	Shruti.Sharma@tufts.edu

This course is designed to give students a solid background in contemporary Cellular Immunology. The course will be based on a lecture series supplemented by extensive readings from the current literature. Thirty minutes of each course is dedicated to discuss the assigned reading material, which is two papers per lecture. Prerequisite: IMM 0212 or equivalent.

139091	System Approaches to Immunology

Subject:	Catalog Nbr:
IMM	0252

The course introduces mouse as the main model for studies of human biology. It starts with the mouse genetics, continues with classical genetic analysis in the mouse, and moves to genetic basis of immunological phenomena such as receptor editing, B-cell tolerance and autoimmunity. At the end, two lectures and hands-on workshops familiarize students with the basics of microarray analysis and next generation sequencing.

139092	Immunochemistry- Signaling and Dynamics

Subject:	Catalog Nbr:			
IMM	0250			
2021 SUMR		Primary	Stephen Bunnell	Stephen.Bunnell@tufts.edu

The course covers the genetic basis for lymphocyte differentiation, receptor gene rearrangement, T and B cell antigen-receptor diversity and selection, tolerance, autoimmunity and gene expression.

139171	Laboratory Research Experience

Subject:	Catalog Nbr:			
PPET	0134			
2021 FALL		Primary	Emmanuel Pothos	emmanuel.pothos@tufts.edu

16-20 week laboratory rotations for Master's students are designed to provide experience with experimental

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design and theoretical aspects of the diverse research problems under investigation in various laboratories.

139172	**Laboratory Research Experience**
Subject: PPET	Catalog Nbr: 0135
2021 SPRG	Primary Emmanuel Pothos emmanuel.pothos@tufts.edu
16-20 week laboratory rotations for Master's students are designed to provide experience with experimental design and theoretical aspects of the diverse research problems under investigation in various laboratories.	

139204	**Teaching Infectious Diseases**
Subject: GSBS	Catalog Nbr: 0115
The course provides the background to teach about infectious disease in high school classrooms. The course is based on a 10th – 12th grade (Biology II) curriculum that has been developed by a partnership between a group of Boston teachers and infectious disease specialists from Tufts Medical School. The goal of the course is to teach the key scientific concepts underlying the curriculum - how bacteria, viruses, and parasites cause infectious diseases and how the immune system defends the body against the attack, as well as the pedagogical strategies to deliver the content in the classroom using a variety of inquiry-based constructivist approaches.	

139290	**Rotation**
Subject: GSBS	Catalog Nbr: 0236

139373	**Applying Quality Improvement Methods in Healthcare and Public Health**
Subject: CTS	Catalog Nbr: 0231
2021 SPRG	Primary Denise Daudelin Denise.Daudelin@tufts.edu
This course aims to provide a broad overview of current trends, core concepts, and methods in quality improvement (QI) and demonstrate their application to healthcare, clinical research and public health. The course focuses on application, and includes didactic instruction, group discussions, and a small group QI project. The semester long QI project involves collaboration with hospital staff or public health practitioners.	

139453	**Special Topics in Cell, Molecular, and Developmental Biology**
Subject: CMDB	Catalog Nbr: 0293
In-depth information is provided on selected topics. Students may also pursue guided individual study of an approved topic. Fall and Spring.	

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139454	Special Topics in Cell, Molecular, and Developmental Biology
Subject:	Catalog Nbr:
CMDB	0294

139463	Macromolecular Structural Determination
Subject:	Catalog Nbr:
BCHM	0202
This is an intensive workshop covering the basic theory and practice of modern protein crystallography and NMR. The course alternates between lectures, hands-on demos, and computer exercises.	

139466	Post-placement Rotation
Subject:	Catalog Nbr:
GSBS	0234

139467	Post-placement Rotation
Subject:	Catalog Nbr:
GSBS	0235
Subject:	Catalog Nbr:
SK	0235

139826	Advanced Scientific Ethics
Subject:	Catalog Nbr:
GSBS	0375
2021 FALL Primary Jamie Maguire	Jamie.Maguire@tufts.edu
This is an NIH-mandated refresher course for responsible conduct of research (RCR) for 5th year students. It builds on SK 0275, Scientific Ethics; students will work in teams to develop a new case study addressing an RCR issue, provide a written in depth analysis and teach the case study to a small group of students enrolled in SK 0275 under the supervision of the course director. The class provides opportunities for team building, writing, ethical analysis and teaching; grading will be based on the quality of case study and analysis, teaching, effort and participation.	

140064	Advanced Topics in Biostatistics
Subject:	Catalog Nbr:
CTS	0533

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2021 FALL	Primary	Angie Rodday	Angie.Rodday@tufts.edu
2021 FALL	Primary	Farzad Noubary	Farzad.Noubary@tufts.edu
2021 FALL	Secondary	Norma Terrin	norma.terrin@tufts.edu

This course provides background in advanced applied statistical methods in clinical research. Topics in the course include Poisson, multinomial, and ordinal regression, competing risk survival models, longitudinal data analysis, and hierarchical mixed models. The course provides students with the statistical foundations of these methods and their applications in clinical research.

140127	**Advanced Epidemiology & Regression Methods: An Integrated Approach**

Subject:	Catalog Nbr:			
CTS	0575			
2021 SPRG		Primary	Angie Rodday	Angie.Rodday@tufts.edu
2021 SPRG		Primary	Jessica Paulus	Jessica.Paulus@tufts.edu
2021 SPRG		Primary	Farzad Noubary	Farzad.Noubary@tufts.edu

This course serves as an introduction to more advanced topics in epidemiologic study design and biostatistical modeling with a focus on multivariate regression methods. It begins with the randomized clinical trial as a paradigm, and proceed to examine observational designs in depth, including prospective and retrospective cohorts, and those sampling from an underlying cohort (i.e. case-control). Design, sampling and analysis strategies and the biases that are specific to each study design will be discussed.

140320	**Design and Analysis of Bioequivalence Studies**

Subject:	Catalog Nbr:
PPET	0281

A generic drug is bioequivalent to a brand name drug when their bioavailabilities (assessed by the respective plasma concentration time curves) after administration in the same molar dose are essentially the same. The comparison of the bioavailabilities is examined by conducting a bioequivalence study. The course will train the students in the design and data analysis of bioequivalence studies.

140762	**Basic Skills for Scientists I**

Subject:	Catalog Nbr:			
GSBS	0101			
2021 FALL		Primary	Henry Wortis	henry.wortis@tufts.edu
2021 FALL		Secondary	Maribel Rios	Maribel.Rios@tufts.edu

This three-module course is designed to give trainees basic skills in oral and written presentation, in approaches to the reading of the scientific literature, and designing experiments and interpreting quantitative data.

140763	**Basic Skills for Scientists II**

Subject:	Catalog Nbr:
GSBS	0102

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This three module course is designed to give trainees basic skills in in presenting data and in writing grant applications.

141543	Translational Medicine - Drug Discovery to Clinical Development			
Subject:	Catalog Nbr:			
PPET	0205			
2021 SPRG	Primary	Emmanuel Pothos	emmanuel.pothos@tufts.edu	
2021 SPRG	Primary	Chandrasekhar Natarajan	Chandrasekhar.Natarajan@tufts.edu	

This comprehensive course covers key processes from drug discovery to development, including the progression and translation of scientific information through different development stages and the transition to clinical studies, to increase the probability of creating a successful therapeutic product The goal is to impart sufficient background to provide an overall understanding of Translational Medicine that is integral to scientific rationale in Drug Research and Development.

141547	Mouse Transgenic Model
Subject:	Catalog Nbr:
CMDB	0350

This course provides an overview of using the mouse to develop transgenic models of gene expression and gene targeting. In the first half of this course, students will discuss basic transgenic and gene targeting construct design, methods to generate transgenic mice by microinjection methods, and conditional and inducible systems. In the second half of the course, the focus will be on genome editing techniques such as CRISPR/Cas9, zinc finger nucleases, and TALENs, as well as their applications.

141552	Introduction to Infectious and Inflammatory Diseases			
Subject:	Catalog Nbr:			
IMM	0223			
2021 SUMR	Primary	Andrew Plaut	andrew.plaut@tufts.edu	
2021 SUMR	Primary	Maria Alcaide Alonso	Pilar.Alcaide@tufts.edu	
2021 SUMR	Secondary	Ralph Isberg	ralph.isberg@tufts.edu	

This course is comprised of three integrated components; 1) a Medical Microbiology and Inflammation/Immunology Tutorial designed to introduce students to pathogens and pathophysiology of infectious and inflammatory diseases, 2) Infectious and Inflammatory Diseases Problem-Based Learning designed to introduce students to clinical cases, and 3) Teaching Clinics designed to expose students to real clinical cases and treatment options.

141613	Survey of Clinical Care Research
Subject:	Catalog Nbr:
CTS	0125

This course offers an introduction to contemporary topics and instruments in clinical care research, with a focus on the role of outcomes research, health economics, systematic reviews and clinical decision making in

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clinical and translational science. Foundational concepts in clinical trial design (pragmatic and explanatory), meta-analysis and systematic review, health services research, bench-to-bedside translational research, decision analysis, pharmaco-economics and prediction models are surveyed by program faculty. This course also reinforces and applies core concepts in biostatistics and epidemiology by illustrating how study designs and statistical approaches may be applied in the context of these designs and analytic approaches, as well as highlighting pitfalls to certain applications.

141614	**Principles of Biostatistics for Clinical Research**
Subject:	Catalog Nbr:
CTS	0127

This course introduces the basic principles and applications of statistics, as they are applied to problems in clinical research. The emphasis is on developing an understanding of the assumptions, limitations, practical considerations and critical thinking in the use of statistical methods in data arising from continuous, binary, and time-to-event data. This course will also introduce biostatistical modeling with a focus on multivariate regression methods. Through webinars, the course will include data exercises and class discussion of articles from the scientific literature that apply methods covered in lectures.

141615	**Elements of Epidemiology for Clinical Research**
Subject:	Catalog Nbr:
CTS	0123

This course serves as an introduction to topics in epidemiologic study design and analysis, with a focus on those relevant to clinical epidemiology and comparative effectiveness research. After examining the randomized clinical trial as a paradigm, the course proceeds to review the major observational designs, including ecologic, cross-sectional, cohort, and case-control studies. For each study design, relevant sampling and analytical strategies, measures of association and the attendant biases will be covered. Principles and methods will be illustrated through several interactive webinars that include discussion of articles from the literature, data analytic exercises, and causal diagrams.

141715	**Health Economics**
Subject:	Catalog Nbr:
CTS	0557

This course aims to introduce health care professionals and clinical researchers to key economic concepts and their relation to health care. The course is designed for students with no or rudimentary understanding of economics. In addition to providing students with a foundation in economics, the course will provide students with an understanding of the structure and performance of the US health care system, and an introduction to methods for the economic evaluation of medical technology. The course will also include lectures on the regulation of medical technology, health care innovation, and emerging health policy trends. Coursework will include a workshop in which students will gain hands-on experience manipulating economic evaluations for medical technology.

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142318	Inflammation and Chronic Inflammatory Diseases
Subject: IMM	Catalog Nbr: 0230
The course focuses on reading primary literature about the role of inflammation in several chronic diseases. The emphasis is on understanding the role of the immune response during the initiation and progression of chronic inflammatory diseases. The course will explore human diseases and delve into available animal models for such conditions, discuss the beneficial vs pathological aspects of inflammation in various diseases, and ongoing therapies and clinical trials for such conditions.	

142319	Clinical Trial Practicum
Subject: CTS	Catalog Nbr: 0520
This course is designed to explore how to design and run real-world clinical trials. Course activities will include hands-on activities in the CTRC with clinical trial principal investigators and staff, invitations to attend IRB and Scientific Review Committees, and meetings with the CTRC Scientific Director and administrative leadership. Through these activities, students will be exposed to some of the cornerstones of launching and implementing a clinical trial. Topics to be covered include cohort identification, patient recruitment, protection of human subjects, disease registries (especially for rare diseases), data collection (biological samples and patient questionnaires) and organizing and managing patient visits at the Clinical and Translational Research Center at Tufts Medical Center.	

142383	Foundations in Biostatistics and Computational Biology
Subject: CMDB	Catalog Nbr: 0320
Introduction to biostatistics with application to the biomedical sciences and genetics, and introduction to computational biology.	

142483	Building Diversity in Biomedical Sciences Summer Research Experience
Subject: GSBS	Catalog Nbr: 0099
Summer residential research program designed to develop interest and talent in underrepresented minority students in STEM.	

142496	CNS Drug Discovery
Subject: NRSC	Catalog Nbr: 0277
This course covers the process of bringing a new pharmaceutical treatment against disorders of the central nervous system (CNS) to the market, starting at the conception of a novel idea. Compared to other disease areas, CNS drug discovery faces – literally – several additional barriers. Most importantly, therapeutics need to cross the blood-brain-barrier in order to reach their site of action. This provides unique challenges throughout	

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	the discovery and development stages, especially for large molecules like antibodies. Moreover, CNS drug discovery has a high need for innovation in areas such as biomarker development and drug delivery. Students will gain an understanding of pre-clinical research, including molecular, biological, neuroanatomical, electrophysiological, and behavioral techniques; biomarker development and strategy, as well as proof of mechanism and concept testing in volunteers and patients.

142692	**Advanced Topics in Microbiology O**			
Subject:	Catalog Nbr:			
MMB	026O			
2021 SPRG	Primary	Marta Gaglia	Marta.Gaglia@tufts.edu	
2021 SPRG	Secondary	Michael Malamy	michael.malamy@tufts.edu	
2021 SPRG	Secondary	Ralph Isberg	ralph.isberg@tufts.edu	
2021 SPRG	Secondary	Bree Aldridge	Bree.Aldridge@tufts.edu	
2021 SPRG	Secondary	Aimee Shen	Aimee.Shen@tufts.edu	
This collection of lectures of four trending topics in Microbiology is offered in odd years.				

142693	**Advanced Topics in Microbiology E**
Subject:	Catalog Nbr:
MMB	026E
This collection of lectures of four trending topics in Microbiology is offered in even years.	

143029	**Special Topics in Genetics A**
Subject:	Catalog Nbr:
GENE	293A
In-depth information is provided on selected topics. Students may also pursue guided individual study of an approved topic.	

143078	**Design and Execution of Clinical Trials**			
Subject:	Catalog Nbr:			
PPET	0261			
2021 SPRG	Primary	Emmanuel Pothos	emmanuel.pothos@tufts.edu	
2021 SPRG	Primary	Paul Beninger	Paul.Beninger@tufts.edu	
2021 SPRG	Primary	Orest Hurko	Orest.Hurko@tufts.edu	
This course will provide graduate students with an understanding of the basic principles and methodology by which a putative therapeutic agent that has been proven safe and effective in preclinical animal models can be developed into one that is suitable for marketing for clinical use in human patients.				

143189	**Externship**
Subject:	Catalog Nbr:

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GSBS	0899
Summer internship experience in biotech, pharmaceutics, and other biomedical industry. Requires application, program consent, mentor consent, and dean's office approval; must have completed 2 complete academic years and the Qualifying Exam.	

143441	**Master's Continuation**
Subject:	Catalog Nbr:
PPET	0103
Student who have not completed their Master's Research by the end of the 2-year program enroll in this course during their third fall term. There is no tuition charge for this course, but all enrolled students must pay the laboratory fee.	

143846	**External Cross-Registration**
Subject:	Catalog Nbr:
GBCR	0550
External Cross Registration (BC, BR, or BU)	

144162	**Introduction to Genetics**
Subject:	Catalog Nbr:
GENE	0301

This course serves as an introduction to genetics, building on student prior knowledge of Mendelian Genetics Principles, to provide a solid knowledge and understanding of the basic principles of Genetics for research in eukaryotes, and how they have developed as the field has matured.
The goal of this course is to teach students modern methods of genetic analysis of model organisms, ranging from simple eukaryotic yeast to humans. Students will learn how to use molecular genetics to answer biological questions and read current literature in genetics.
The second part of the course will introduce mouse as the main model for studies of human biology, development and disease. It will start with mouse genetics, will continue with classical genetic analyses in the mouse, and will move to genetic basis of immunological phenomena such as receptor editing, B-cell tolerance and autoimmunity. Experience with reading current primary literature in the field will also be included. At the completion of the course, two lectures and hands-on workshops will have familiarized students with the basics of microarray analysis and next generation sequencing (NGS).

144163	**Health Care Activism, Community Health, and Patient-Centered Research**			
Subject:	Catalog Nbr:			
CTS	0549			
	2021 SPRG	Primary	Peter Levine	Peter.Levine@tufts.edu
	2021 SPRG	Primary	Carolyn Rubin	Carolyn.Rubin@tufts.edu
	2021 SPRG	Primary	Thomas Concannon	Thomas.Concannon@tufts.edu
	2021 SPRG	Primary	Marisha Palm	mpalm@tuftsmedicalcenter.or

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This introductory course focuses on principles and methods that can be used to support the involvement of stakeholders in research. The course will examine three approaches to stakeholder and community engagement that have addressed theory, principles, challenges, and potential benefits.
The three approaches include patient-centered research in which researchers collaborate with the public to make research more useful, community-based health research in which researchers and communities work together to co-create research, and health care activism in which individuals come together to influence stewards of publicly-funded research.

144228	**Glia-Neuron Interactions in Development and Disease**
Subject:	Catalog Nbr:
NRSC	0248

This course will introduce and discuss development of different glial cell types in several model systems and how they distinctly interact with neurons and the physiological and pathological significance of their interactions will be discussed. In addition, unique experimental approaches to study glia will also be included.

144398	**Brandeis Cross Registration**
Subject:	Catalog Nbr:
SKBR	0550

Brandeis Cross Registration

144636	**Special Topics GSBS-wide**
Subject:	Catalog Nbr:
GSBS	0294

144915	**Communities of Practice and Management in Academia and Industry**			
Subject:	Catalog Nbr:			
BIOM	0180			
2020 Fall		Primary	Daniel Jay	daniel.jay@tufts.edu
2020 Fall		Primary	Stefan Gross	Stefan.Gross@tufts.edu

This course will introduce concepts of management skills and provide talks by alumni in differing careers who will discuss what the community of practice is for their workplace. As academic and industry workplaces have different unwritten rules of conduct we will have talks on academic (research intensive and primarily undergraduate), industrial (start-up, biotech and big pharma) and non-bench science careers (venture, IP, policy). Students will present based on their analysis of one specific workplace with regard to its community of practice.

145056	**Introduction to Genetics**

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Subject:	Catalog Nbr:			
GENE	0212			
	2021 FALL	Primary	Pamela Yelick	Pamela.Yelick@tufts.edu
	2021 FALL	Primary	Gregory Cox	Gregory.Cox@tufts.edu
	2021 FALL	Primary	Philip Hinds	Phil.Hinds@tufts.edu
	2021 FALL	Secondary	Brent Cochran	brent.cochran@tufts.edu
	2021 FALL	Secondary	Victor Hatini	Victor.Hatini@tufts.edu
	2021 FALL	Secondary	Peter Juo	Peter.Juo@tufts.edu
	2021 FALL	Secondary	Claudette Gardel	Claudette.Gardel@tufts.edu
	2021 FALL	Secondary	Gordon Huggins	Gordon.Huggins@tufts.edu
	2021 FALL	Secondary	Steven Munger	Steven.Munger@tufts.edu

The goal of the first part of the course is to provide a common foundation for all students in the major principles of molecular genetics upon which they can base more advanced studies. By the end of this course students are expected to understand the major principles of molecular genetics and the underlying processes by which cells and organisms replicate, repair, read, and translate their genetic codes. Students should achieve an advanced understanding of these topics that will allow them to read the primary research literature, understand the biological processes examined, and interpret the results in the larger context of molecular genetics. The goal of the second part is to build upon the first to provide a solid knowledge and understanding of the basic principles of Genetic model organisms, ranging from research in eukaryotes, and how they have developed as the field has matured. The goal of this course is to teach students modern methods of genetic analysis of model organisms, ranging from simple eukaryotic yeast to humans. Students will learn how to use molecular genetics to answer biological questions and read current literature in genetics. Experience with reading current primary literature in the field, and with the basics of microarray analysis and next generation sequencing (NGS).

145141	**Neural Systems and Disease Mechanisms**			
Subject:	Catalog Nbr:			
NRSC	0311			
	2021 SUMR	Primary	Maribel Rios	Maribel.Rios@tufts.edu
	2021 SUMR	Primary	Giuseppina Tesco	Giuseppina.Tesco@tufts.edu
	2021 SUMR	Secondary	Larry Feig	larry.feig@tufts.edu
	2021 SUMR	Secondary	Michele Jacob	michele.jacob@tufts.edu
	2021 SUMR	Secondary	Klaus Miczek	klaus.miczek@tufts.edu
	2021 SUMR	Secondary	Gerard Reijmers	Leon.Reijmers@tufts.edu
	2021 SUMR	Secondary	Jamie Maguire	Jamie.Maguire@tufts.edu
	2021 SUMR	Secondary	Christopher Dulla	Chris.Dulla@tufts.edu
	2021 SUMR	Secondary	Yongjie Yang	Yongjie.Yang@tufts.edu

The goals of this course are two-fold: (i) to provide an overview of nervous system structure and function and (ii) to expose students to some of the clinical consequences of associated with neural dysfunction.
NRSC 0311 is a series of small group discussions with faculty experts. In preparation for each discussion, students will read historical and recent publications relevant to the class topic, followed by critical discussions of past research advances made and future approaches that might prove most effective in translational research efforts. Students will emerge with an enhanced mechanistic understanding of the most common neurological diseases and the experimental approaches that are informing clinical treatments.

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145200	Introduction to Bioinformatics Using RNA Sequencing
Subject:	Catalog Nbr:
GENE	0320

RNA-seq is a commonly used method for analyzing gene expression. This course will provide 1) hands-on experience processing and analyzing high-throughput sequencing data and 2) exposure to NGS and RNA-Seq processes, applications and terminology.

145215	Biology of Aging			
Subject:	Catalog Nbr:			
CMDB	0247			
2021 SPRG		Primary	Allen Taylor	allen.taylor@tufts.edu
2021 SPRG		Primary	Mitch McVey	Mitch.McVey@tufts.edu
2021 SPRG		Secondary	Henry Wortis	henry.wortis@tufts.edu

This course is an in-depth examination of current topics in aging research, with a focus on human aging. Topics to be discussed include theories of aging; physiological, cellular, and epigenetic changes that occur with aging; biochemical and energetic processes that affect healthspan and lifespan; and interventions that may affect the aging process. The themes for this course vary each time it is offered. This year there will be an emphasis on protein quality control pathways and their roles in homeostasis, aging, and age-related diseases, along with drugs to exploit those capacities. Students will help direct the course by presenting and critiquing papers selected from a curated list of current aging research literature.

145282	Introduction to Health Economics and Outcomes Research			
Subject:	Catalog Nbr:			
CTS	0157			
2021 FALL		Primary	James Chambers	James.Chambers@tufts.edu
2021 FALL		Primary	David Kim	dd.kim@tufts.edu
2021 SPRG		Secondary	Tara Lavelle	Tara.Lavelle@tufts.edu
2021 SPRG		Secondary	Peter Neumann	Peter.Neumann@tufts.edu
2021 SPRG		Secondary	Joshua Cohen	Joshua_T.Cohen@tufts.edu
2021 SPRG		Secondary	Natalia Olchanski	Natalia.Olchanski@tufts.edu

This course introduces the fundamentals of Health Economics and Outcomes Research (HEOR). We begin with an overview of the issues addressed by HEOR – including the measurement of health benefits in terms that can be compared across disease domains, and the inclusion of cost impacts across time and over multiple societal sectors that extend beyond health care itself. The first part of the course examines key economic concepts and their relation to health care, including the demand for health care, the structure and consequences of health insurance, and markets for pharmaceutical products. The second part of the course focuses on understanding health economic analysis based on recommendations issued by the Second Panel on Cost Effectiveness in Medicine and Health for the US. The lectures include measuring preferences for health outcomes, estimating costs, simulation modeling, and ethical issues in cost-effectiveness analysis. Finally, through a series of case studies, the course introduces students to important sources of data for the HEOR field.

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145310	Essentials in Biomedical Statistics and Computational Biology			
Subject:	Catalog Nbr:			
CMDB	0220			
2021 SUMR	Primary	Heber Nielsen	heber.nielsen@tufts.edu	
An introduction to biostatistics with application to the biomedical sciences and genetics, and introduction to computational biology. Introduction to the use of R and RStudio for biostatistical computations.				

145381	Laboratory Research Experience			
Subject:	Catalog Nbr:			
PPET	0136			
2021 SUMR	Primary	Emmanuel Pothos	emmanuel.pothos@tufts.edu	
Laboratory rotations for Master's students are designed to provide experience with experimental design and theoretical aspects of the diverse research problems under investigation in various laboratories.				

145392	Real World Evidence			
Subject:	Catalog Nbr:			
CTS	0150			
2021 FALL	Primary	David Kent	david.kent@tufts.edu	
This course serves as an introduction to topics in the use of real world evidence (RWE) to inform healthcare decision making. While randomized controlled trials remain the gold standard for establishing treatment efficacy, RWE offers many advantages including the availability of timely data at reasonable cost, large sample sizes that enable analysis of subgroups and rare outcomes, and increased generalizability to real-world clinical practice and more representative patients. Enthusiasm for RWE is tempered by concerns including those related to misclassification or data quality, the lack of randomization and other biases, and spurious data-driven findings. This course will introduce the foundational study designs and analytic approaches that are integral to the valid and efficient analysis of RWE, including those relevant to "big data." RWE frameworks and approaches to be discussed will include limiting bias in observational big data, harnessing RWE for predictive analytics, identification of heterogeneity of treatment effects, pragmatic trial designs and the role of RWE for various stakeholders, including regulators. The potential role of RWE for the regulatory approval of novel therapies will also be discussed. Topics will be illustrated through the use of contemporary case studies representing both the promise and limitations of using RWE to inform healthcare decision making.				

145393	Introduction to Health Technology Assessment			
Subject:	Catalog Nbr:			
CTS	0152			
2021 FALL	Primary	Joshua Cohen	Joshua_T.Cohen@tufts.edu	
2021 FALL	Primary	Daniel Ollendorf	Daniel.Ollendorf@tufts.edu	
This course describes the practice of health technology assessment, as conducted by major agencies and other organizations in the United States and elsewhere, and introduces the technical tools used to project				

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health benefits and costs. For the United States, the course reviews guidelines promulgated by the Second Panel on Cost Effectiveness Analysis in Health, and value assessment frameworks developed in the United States, with a focus on the Institute for Clinical and Economic Review (ICER). The review of HTA in other countries focuses on the National Institute for Health and Care Excellence (NICE) and also reviews approaches used by agencies in other countries. Finally, the course introduces the use of computer simulation to estimate value when empirical data alone will not suffice.

145548	**Introduction to Biomedical Research**
Subject: BIOM	Catalog Nbr: 0212

This course will introduce students to biomedical research from fundamental discovery to therapeutic target identification/translation to clinical development and approval of a new drug. At the beginning of the course, students will attend the first 8 lectures of Graduate Biochemistry (BCHM 0223) to gain familiarity with biomedical laboratory procedures and principles. Subsequently, the process of drug discovery and development will be illustrated through presentation of specific examples beginning with historical work in basic biomedical research labs through development in biotech/pharma. Three examples will be presented by course director/content experts. The course will end with students identifying a drug candidate in clinical trials (any stage), researching the target/lead/candidate history, and presenting their findings in the final two meetings.