

ANSCHUTZ MEDICAL CAMPUS GRADUATE SCHOOL

The following courses, listed alphabetically by department, have been approved for graduate credit. Please see the Interdepartmental (IDPT) section for courses which are taught cooperatively by individual departments.

BIOCHEMISTRY AND MOLECULAR GENETICS

- BMGN 7620 Genomics** **2.0+1.0 cr.**
Dr. D. Pollock - (Spring) Permission of primary instructor.
An introduction to the theory and practice of genomics. Topics include sequencing and mapping, overview of genomes, transcriptomes, bioinformatics and statistics, population-level variation, ethics, evolutionary genomics, proteomics, metagenomics, and functional genomics.
- BMGN 7650 Research in Biochemistry and Molecular Genetics** **1.0-10.0 cr.**
Dr. P. Megee - (Fall, Spring, Summer) Prereq: Consent of instructor.
Research work in biochemistry and molecular genetics.
- BMGN 7660 Biochemistry Seminar** **1.0 cr.**
Dr. P. Megee - (Fall, Spring)
Seminar series provides a forum for the presentation of scientific experiments and information in biochemistry by faculty, postdoctoral fellows graduate students, and invited outside guest speakers.
- BMGN 8990 Doctoral Thesis** **1.0-10.0 cr.**
Dr. P. Megee - (Spring, Summer, Fall) Prereq: Consent of instructor.
Doctoral thesis work in biochemistry and molecular genetics.

BIOMOLECULAR STRUCTURE

- BMST 7350 Proteins** **3.0 cr.**
Dr. R. Hodges - (Spring) Crosslisted: PHSC 7350.
Provide chemical/physical basis for protein structure, folding, function and stability. Presents methods/principles of protein/peptide purification and enzyme catalysis including electron transfer and mutagenesis. The role of molecular dynamics and use of molecular simulations in the investigations of protein-ligand/protein-protein interactions.
- BMST 7354 Structural Analysis of Biomolecules I** **2.0 cr.**
Dr. R. Hodges - (Spring) Crosslisted: PHSC 7354.
Describes fundamentals of spectroscopic methods used to study protein structure/function. These techniques include optical methods (CD spectroscopy, fluorescence and absorbance) vibrational methods (IR and EST), analytical ultracentrifugation, mass spectrometry, calorimetry, light scattering and Biacore analysis. Taught alternate years.
- BMST 7454 Structural Analysis of Biomolecules II** **2.0 cr.**
Dr. R. Hodges - (Spring) Crosslisted: PHSC 7454.
Methods and strategies for determination of the primary and 3-dimensional structures of biologically important molecules. Crystallography, nuclear magnetic resonance spectroscopy and mass spectrometry will be taught in structural determination of proteins, nucleic acids complex carbohydrates, and lipid molecules.
- BMST 7650 Research in Biomolecular Structure** **1.0-10.0 cr.**
Dr. R. Hodges - (Fall, Spring, Summer) Prereq: Consent of instructor.
Research work in Biomolecular Structure.
- BMST 7660 Biomolecular Structure Seminar** **1.0 cr.**
Dr. R. Hodges - (Fall, Spring)
Seminar series provides a forum for the presentation of scientific experiments and information in structural biology by faculty, postdoctoral fellows and graduate students.
- BMST 8990 Doctoral Thesis** **1.0-10.0 cr.**
Dr. R. Hodges - (Fall, Spring, Summer)
Doctoral thesis work in Biomolecular Structure.

CANCER BIOLOGY

- CANB 7600 Cancer Biology** **3.0 cr.**
Dr. S. Nordeen - (Spring) Prereq: IDPT 7811, IDPT 7812, IDPT 7813, IDPT 7814 and IDPT 7815
This course integrates the examination of cancer at molecular, cellular, tissue and organismal levels. Course open to all graduate students from any program with an interest in mechanisms and models of cancer and will give broad appreciation for current issues/problems.
- CANB 7610 Pathobiology of Cancer Mini-Course** **1.0 cr.**
Dr. R. Low - (Spring) Prereq: IDPT 7811, IDPT 7812, IDPT 7813, IDPT 7814 and IDPT 7815

Provide understanding of clinical issues associated with human cancer. Contains both didactic and laboratory components. The latter will focus on pathology of human tumors at macroscopic/microscopic levels. Students will gain understanding of cancer diagnosis/epidemiology/treatment through study of specific tumor types.

CANB 7613 [Research Seminars and Journal Club](#) 1.0 cr.

Dr. R. Evans – (Fall, Spring)

Current research topics in experimental pathology, virology, and tumor biology. Graduate students and faculty presentations.

CANB 7620 [Histophysiology](#) 3.0 cr.

Dr. D. Orlicky - (Spring)

Discussions of cell interactions, tissue physiology, and renewal based upon the histologic cell types and structures present. Where pertinent, pathologic alterations will be introduced to facilitate identification of the important normal functions/structures.

CANB 7650 [Research in Cancer Biology](#) 1.0-10.0 cr.

Dr. S. K. Nordeen - (Fall, Spring, Summer) Prereq: Consent of instructor.

Research work in cancer biology.

CANB 7680 [Hypothesis Development & Experimental Design](#) 2.0 cr.

Dr. A. Thorburn - (Fall, Spring) Prereq: CANB 7600, IDPT 7811, IDPT 7812, IDPT 7813, IDPT 7814. Coreq: IDPT 7815

Students will discuss recent research papers and develop new hypotheses that extend the findings in the papers. Research proposals to test the hypothesis will be written and an oral defense of the proposal will be performed.

CANB 8990 [Doctoral Thesis](#) 1.0-10.0 cr.

Dr. S. Nordeen - (Fall, Spring, Summer) Prereq: Consent of instructor.

Doctoral thesis work in cancer biology.

CANDIDATE FOR DEGREE

CAND 6940 [Candidate for Degree](#) 1.0 cr.

F. Osterberg - (Fall, Spring, Summer) Prereq: Consent of instructor.

CLINICAL SCIENCE

CLSC 6060 [Systems Analysis and Design](#) 3.0 cr.

Dr. J. Karimi - (Fall, Spring, Summer) Crosslisted: ISMG 6040. Offered as a collaborative offering with Denver Campus.

Offered as collaborative offering with the Denver Campus, emphasizing information requirements analysis, logical system specification, detailed system design. Topics include structured system development methodologies, prototyping, file design, systems architecture, systems testing, software design strategies. Students use case tool to develop system specifications.

CLSC 6080 [Database Management Systems](#) 3.0 cr.

Dr. W. Zhiping - (Fall, Spring, Summer) Crosslisted: ISMG 6080.

Offered as a collaborative offering with the Denver Campus, this course focuses on the development and management of database systems to support business operations. Important subjects include semantic data modeling, normalization, SQL, fourth generation languages, and client-server database applications.

CLSC 6120 [Data Communications](#) 3.0 cr.

Dr. S. Walczak – (Fall, Spring, Summer) Crosslisted: ISMG 6120 Prereq: Knowledge of computer programming.

Offered as a collaborative offering with the Denver Campus. Course introduces the basic concepts of data transmission, principles governing the design and administration of both wide and local area networks, and technical issues pertaining to client server computing and open system interconnection.

CLSC 6210 [Research Seminars in Clinical Science](#) 1.0 cr.

Dr. L. Cicutto – (Fall, Spring, Summer)

This course provides an overview of the types of clinical translational studies being conducted by senior CLSC doctoral students. The interactive seminar series structure allows for interdisciplinary scientific dialogue among students at various stages of training, mentors and faculty.

CLSC 6211 [Immersion in Community Engagement](#) 3.0 cr.

Dr. L. Cicutto – (Summer) Restrictions: Students need to contact the CLSC program prior to registering.

This course focuses on community-based participatory research, community engagement and understanding health disparities through a community immersion experience.

CLSC 6251 [Assistive Technology: Advanced Practices in AT Assessment](#) 3.0 cr.

Dr. C. Bodine - (Fall, Spring, Summer)

Students will learn to use family-centered, trans-disciplinary methods of assistive technology assessment for individuals with low-incidence disabilities. Observations, videotaped learning activities, and supervised assessment sessions will facilitate understanding of best practice in this field.

- CLSC 6260 Conducting Clinical Trials for Investigators** **2.0 cr.**
 Dr. Y. Kellar-Guenther - (Summer)
 Course is for investigators conducting clinical trials. Course covers good clinical practices/regulations that surround setting up and running clinical trials. Clinical studies and popular press articles highlighting what can go wrong in clinical trials will be reviewed and discussed.
- CLSC 6261 Assistive Technology: Implementation for Low Incidence Disabilities** **3.0 cr.**
 Dr. C. Bodine - (Fall, Spring, Summer)
 This course provides an overview of low incidence populations (including intellectual, hearing, and vision impairments), relevant research, and implementation strategies in early childhood and classroom settings. Emphasis is on implementation techniques, and working with trans-disciplinary teams, supporting agencies, and families.
- CLSC 6270 Clinical Appraisal Seminars in Clinical Science** **1.0 cr.**
 Dr. L. Cicutto - (Fall)
 This course provides an overview of the approaches for critically appraising common study designs published in the clinical and translational sciences literature, as well as other sources of information.
- CLSC 6271 Assistive Technology: Advanced Fieldwork Experience in AT** **2.0 cr.**
 Dr. C. Bodine - (Fall, Spring, Summer)
 Students participate in fieldwork experiences offering individually-tailored opportunities to engage in AT assessments, implementation of AT in various settings, family-centered Individual Educational Planning meetings, report-writing, outcomes-measurement, data-collection, practice, research-based methodologies. Peer-reviewed submission must be coordinated before grade assigned for course.
- CLSC 6281 Assistive Technology: Engineering and Biotechnology: Principles & Emerging Technologies** **3.0 cr.**
 Dr. C. Bodine - (Fall)
 Course brings together engineers, AT students in other health-care related areas. The students develop an understanding of engineering principles, technical design process, emerging technologies relevant to assistive technology in the context of support for children with low-incidence disabilities.
- CLSC 6300 Scientific Grant Review Process: GCRC Proposals** **1.0 cr.**
 Dr. R. Eckel - (Fall, Spring) Prereq: BIOS 6601, BIOS 6602 (or BIOS 6611-BIOS 6612) & CLSC 7500.
 Intended for second year students. Students will understand and participate in the process of scientific review of human subject research protocols submitted to the University of Colorado Anschutz Medical Campus GCRCs (both Adult and Pediatric GCRCs).
- CLSC 6550 Applications of Biostatistics to Clinical Research Questions** **1.0 cr.**
 Dr. L. Cicutto - (Fall, Spring)
 Introduction to allow clinician-scientists to be critical consumers of medical literature by improving their ability to discuss statistical issues about their own research and research of others. Familiarity will be gained with commonly used statistical methods and statistical terms.
- CLSC 6608 Statistics for the Basic Sciences – CLSC Supplement** **1.0 cr.**
 Dr. L. Cicutto - (Spring) Co-requisites: CLSC 6606 (BIOS 6606) Course Restrictions: Enrollment in CLSC graduate program or permission of the instructor.
 This course provides an overview of epidemiology, logistic regression, and survival analysis, techniques that apply to many areas of clinical research.
- CLSC 6650 Guided Research Tutorial – General** **1.0-3.0 cr.**
 Dr. L. Cicutto - (Fall, Spring, Summer).
 Students perform research projects during rotations under the direction of a mentor. Required of graduate students in the Clinical Sciences program.
- CLSC 6653 Key Concepts in Neurodevelopmental Disabilities I** **2.0 cr.**
 Dr. L. Cicutto - (Spring, Fall) Prereq: A degree in health care profession or related field or instructor consent.
 Course represents part one of two-part interdisciplinary course series focused on systems, options for diagnosis/assessment and alternatives for service provision related to children/youth/young adults with neurodevelopmental and related disabilities and their families to address this population's special health care needs.
- CLSC 6654 Key Concepts in Neurodevelopmental Disabilities II** **2.0 cr.**
 Dr. L. Cicutto - (Spring, Summer, Fall) Prereq: A degree in health care profession or related field or instructor consent, and completion of CLSC 6653.
 This course represents part two of a two-part interdisciplinary course series focused on service provision, intervention strategies and service provision related to children/youth/young adults with neurodevelopmental and related disabilities and their families to address this population's special health care needs.
- CLSC 6657 Cultural Factors in Healthcare** **1.0 cr.**
 Dr. S. Manson- (Fall, Spring, Summer) Prereq: A degree in health care profession or related field or instructor consent.

Online course will introduce the subject of cultural/social determinants of maternal and child health in the present society, including worldviews on health perspectives (wellness versus illness), and address the impact of emerging demographic changes on systems of care.

CLSC 6658 [Interdisc. Approach to Promoting Early Parent Child Relationships-Part 1 Theory](#) [2.0 cr.](#)

Dr. C. Robinson - (Fall) Prereq: A degree in health care profession or related field or instructor consent.

Part one of a two-part course series that will examine the theory and research relevant to the assessment of early parent-child relationships as well as the clinical application for interventions across disciplines that are intended to promote/improve child health outcomes.

CLSC 6659 [Interdisciplinary Approach to Promoting Early Parent Child Relationships – Part II: Measurement](#) [3.0 cr.](#)

Dr. C. Robinson - (Spring) Prereq: A degree in health care profession or related field or instructor consent. Completion of CLSC 6658.

Part two of a two-part course that will examine research relevant to assessment of early parent/child relationships, identify intervention strategies by analyzing observational findings, as well as evaluate effectiveness of interventions across disciplines intended to promote/improve child health outcomes.

CLSC 6661 [Leadership Dialogues I](#) [2.0 cr.](#)

Dr. K. Kennedy - (Fall) Prereq: A degree in health care profession or related field or instructor consent.

This interdisciplinary leadership course focuses on leadership strategies needed for providing family-centered, culturally competent, community-based services for children with special needs and their families.

CLSC 6662 [Leadership Dialogues II](#) [2.0 cr.](#)

Dr. K. Kennedy - (Fall, Spring) Prereq: A degree in health care profession or related field or instructor consent. CLSC 6661.

This interdisciplinary leadership course focuses becoming change agents to better provide family-centered, culturally competent, community-based services for children with special needs and their families.

CLSC 6663 [Evidence-based Interventions for Youth with Autism and Other Neurodevelopmental Disorders](#) [3.0 cr.](#)

Dr. S. Hepburn - (Fall, Spring, Summer) Prereq: Degree in health care profession or related field or consent of instructor.

This interdisciplinary course reviews evidence-based practices in intervention for children with autism and other neurodevelopmental disorders, presented through lectures, critical readings of the literature, case discussions and case presentations.

CLSC 6664 [Leadership Dialogues III](#) [1.0 cr.](#)

Dr. C. Robinson - (Fall) Prereq: Degree in health care profession or related field or consent of instructor.

This interdisciplinary leadership course focuses on leadership strategies needed for providing family-centered, culturally competent, community-based services for children with special needs and their families. (Nursing only)

CLSC 6665 [Leadership Dialogues IV](#) [1.0 cr.](#)

Dr. C. Robinson - (Spring) Prereq: Degree in health care profession or related field or consent of instructor and CLSC6664.

Leadership Dialogues IV builds upon skills addressed in Leadership Dialogues III with the addition of content that integrates critical and systems thinking and ethical decision making with the leadership and team concepts and skills developed in LD III. (Nursing only)

CLSC 6666 [Transdisciplinary Model of Early Intervention Service Delivery](#) [3.0 cr.](#)

Dr. C. Robinson - (Fall, Spring, Summer). Prereq: Degree in health care profession or related field or consent of instructor. Course Restrictions: Course participants accepted by course instructor approval only.

This course provides instruction about the ENRICH model of community-based, family-driven, trans-disciplinary service delivery and will target service coordination/collaboration throughout Part C supports and services, best practice implementation of intervention strategies, and techniques for transferring out of Part C.

CLSC 6668 [Screening/Assessment for Children/Youth with Autism & Neurodevelopmental Disabilities](#) [3.0 cr.](#)

Dr. S. Hepburn - (Fall, Spring, Summer).

This interdisciplinary course presents best practices in screening/assessment for autism, focusing on: identification of symptoms of autism; differentiation of autism from other disorders; recognition of symptoms; examination of culture on clinical presentation; and approaches to share observations.

CLSC 6699 [Masters Research Project: Publishable Paper](#) [1.0-6.0 cr.](#)

Dr. L. Cicutto - (Fall, Spring, Summer). Prereq: Consent of program BIOS 6601 and 6602 OR BIOS 6611 and BIOS 6612, CLSC 7150, EPID 6630.

During course students working with his/her research mentor and research project committee to plan, execute, write Final Research Project in form of a publishable paper. In addition, students prepare for Final Research Project Examination. This is a capstone course.

CLSC 6800 [Introduction to Health Information Technology](#) [3.0 cr.](#)

Dr. L. Cicutto - (Spring)

Course intended as overview to the dynamic environment of healthcare informatics. Goal of course is to prepare healthcare professionals to better utilize/manage the emerging communication technologies. A brief introduction to e-health, telehealth, electronic medical records, telecommunications, and bio-informatics is provided.

CLSC 6820 Fundamentals of Health Information Technology Management **3.0 cr.**

Dr. H. Haugen - (Fall). Crosslisted: HLTH 6072.

This course will provide an introduction to management of information technology in healthcare. A description of information processing, the origin, content and evolution of healthcare information systems and the methodologies deployed to acquire and manage information requirements will be discussed.

CLSC 6830 Practicum in Developmental Disabilities **1.0-4.0 cr.**

Dr. C. Robinson - (Spring, Summer, Fall) Prereq: Consent of instructor.

Practicum in developmental disabilities individually designed to give students and post-graduates observational experiences in clinical, teaching, or research service settings and systems for persons with developmental disabilities of all ages.

CLSC 6831 Practicum in Developmental Disabilities II **3.0 cr.**

Dr. C. Robinson - (Spring) Prereq: Instructor consent and CLSC 6830.

Practicum in developmental disabilities individually designed to give students and post graduates hands-on experiences in clinical, teaching, or research service settings and systems for persons with developmental disabilities of all ages.

CLSC 6950 Masters Research Project: Thesis **1.0-6.0 cr.**

Dr. L. Cicutto - (Fall, Spring, Summer) Prereq: Consent of program, BIOS 6601, BIOS 6602, CLSC 7150, EPID 6630.

During this course students plan, execute and write the Final Research Project in the form of a Masters thesis. In addition, students will prepare for the Final Research Project Examination. This is a capstone course.

CLSC 7101 Grant Writing I **1.0 cr.**

Dr. M. Taylor/ Dr. L. Cicutto- (Spring) Prereq: BIOS 6601 and EPID 6630. Restrictions: CLSC students unless written approval of Course Director

The purpose of this course is to develop and improve your skills in writing successful grant applications and participating in the critique and review process of grants.

CLSC 7102 Grant Writing II **1.0 cr.**

Dr. L. Cicutto – (Spring) Prereq: BIOS 6601, EPID 6630, CLSC 7101. Restrictions: CLSC students, unless written approval of Course Director.

The purpose of this course is to develop and improve your skills in writing successful grant applications and participating in the critique and review process of grants.

CLSC 7150 Ethics and Regulation in Human Subjects Review **1.0 cr.**

Dr. A. Prochazka - (Fall, Spring, Summer) Crosslisted: PHSC 7339

Course provides overview of the field of ethics in clinical research. Students will learn historical background, current regulations, IRB requirements related to human subjects protection issues. This course requires attendance at IRB sessions for CLSC PhD and Certificate students enrolled.

CLSC 7151 Lectures in Ethics and Regulation in Human Subjects Review **1.0 cr.**

Dr. A. Prochazka - (Fall, Spring, Summer)

Course will provide overview of the field of ethics in clinical research. It is designed for non-Clinical Science degree students, certificate students, investigators who will be conducting research involving human subjects. Topics include historical background, current regulations, and IRB requirements.

CLSC 7200 Clinical Outcomes Assessment **2.0 cr.**

Dr. L. Cicutto - (Fall, Spring, Summer).

Course provides overview of field of clinical outcomes assessment, prepares student to identify patient risk factors which may influence outcomes, to select outcomes appropriate to use in situation based on critical appraisal of literature in context of research project's goals/objectives.

CLSC 7300 Scientific Grant Review Process: Doctoral **1.0 cr.**

Dr. R. Eckel - (Fall, Spring) Prereq: BIOS 6601, BIOS 6602, (or BIOS 6611- 6612).

Students will understand and participate in the process of scientific review of human subject research protocols submitted to the University of Colorado Denver Clinical Translational Research Centers at University Hospital and The Children's Hospital.

CLSC 7500 Practical Application of Molecular and Cell Biology Techniques for the Clinical Investigator **3.0 cr.**

Dr. J. Tentler and Dr. A. Bradford – (Summer)

Designed to teach clinical investigators basic molecular and cellular biology techniques. Format will be hands-on with lectures designed to illustrate significance and clinical application of techniques. Weekly special topics lectures will cover cutting-edge technologies and their application.

CLSC 7650 Guided Research Tutorial – Doctoral **1.0-3.0 cr.**

Dr. L. Cicutto - (Fall, Spring, Summer) Prereq: Consent of program, approved course plan. This course is closed registration.

This is an independent study course developed by student and appropriate faculty member based on the area of study. Students meet regularly with selected course instructor. Student and course instructor will develop course plan prior to registration of the course.

CLSC 7890 [Research in Clinical Science for Doctoral Students](#)

[1.0-6.0 cr.](#)

Dr. L. Cicutto - (Fall, Spring, Summer)

The performance of research activities in clinical science having direct relevance to the completion of the final research project required for the graduate degree in Clinical Science where student is working under mentor's guidance and direction.

CLSC 8990 [Doctoral Thesis](#)

[1.0-10.0 cr.](#)

Dr. L. Cicutto - (Fall, Spring, Summer) Prerequisite: Program consent. BIOS 6601 or BIOS 6611, BIOS 6602 OR BIOS 6680 and HSMP 6617, CLSC 7150, EPID 6630, BIOS 6648 or EPID 6626 or HSMP 6670. Restrictions: Only CLSC PhD students or collaborative CLSC and CSPH Health Services Research Students.

This course involves the student working with his/her research mentor and research project committee develop, design and execute a clinical science doctoral study as well as to write up the project as a thesis.

COMPUTATIONAL BIOSCIENCE

CPBS 7605 [Ethics in Bioinformatics](#)

[1.0 cr.](#)

Dr. L. Hunter (Fall, Spring) Offered every other year.

Discussions of professional conduct, social implications of research and questions raised by biomedical research, with an emphasis on topics relevant to computational biologists. Active student participation is required.

CPBS 7606 [Statistics for the Basic Sciences](#)

[3.0 cr.](#)

Dr. D. Everett (Fall, Spring) Cross-listed: BIOS 6606.

This course provides an overview of fundamental concepts in statistics such as hypothesis testing and estimation and it provides an overview of statistical methods (for example, regression and analysis of variance) that apply to many areas of science.

CPBS 7620 [Genomics](#)

[2.0+1.0 cr.](#)

Dr. D. Pollock (Spring) Prereq: Permission of Primary Instructor

An introduction to the theory and practice of genomics. Topics include sequencing and mapping, overview of genomes, transcriptomes, bioinformatics and statistics, population-level variation, ethics, evolutionary genomics, epigenomics, proteomics, metagenomics and function genomics.

CPBS 7650 [Research in Computational Bioscience](#)

[1.0 cr.](#)

Dr. L. Hunter (Fall, Spring, Summer) Prereq: Consent of Instructor
Research work in Computational Bioscience.

CPBS 7655 [Statistical Methods in Genetic Association Studies](#)

[3.0 cr.](#)

Dr. T. Fingerlin (Fall) Cross-listed: BIOS 6655. Prereq: BIOS 6612 or permission of instructor.

This course is designed to give an introduction to statistical methods in genetic association studies. Topics include an introduction to population genetics topics relevant to genetic association studies, design strategies and analysis methods for case-control and family data.

CPBS 7659 [Statistical Methods in Genomics](#)

[2.0 cr.](#)

Dr. K. Kechris (Fall) Prereq: BIOS 6611 or equivalent graduate level statistics course with consent of instructor. Crosslisted Course: BIOS 6659 (sponsoring department) / BIOS 7659

This course will give an introduction to statistical methods for analyzing molecular sequences and genomic data. Topics include hidden Markov models for sequence alignment, molecular evolution and gene expression data analysis.

CPBS 7660 [Analysis of High-Throughput Data](#)

[2.0 cr.](#)

Dr. T. Phang (Fall) Prereq: BIOS 6611 or equivalent. Cross-listed: BIOS 6660 (sponsoring Department)

This course provides students with hands on experience in analyzing full-scale microarray data using the statistical software, R, and its packages from the Bioconductor consortium.

CPBS 7711 [Methods and Tools in Biomedical Informatics](#)

[4.0 cr.](#)

Dr. L. Hunter (Fall) Prereq: Permission of instructor. Crosslisted: PHCL 7611 (non-sponsor).

An introduction to the theory and practice of bioinformatics and computational biology. Topics include: the analysis of macromolecular sequences, structures, gene expression arrays, proteomics, and management of the biological literature.

CPBS 7712 [Research Methods in Biomedical Informatics](#)

[4.0 cr.](#)

Dr. L. Hunter (Spring) Prereq: Permission of Instructor Crosslisted: PHCL 7612 (non-sponsor)

The CPBS faculty members will present lectures on the research currently being conducted in their laboratories. Students will plan, execute and report on their own research project. This course is beginning transition from well-educated students to independent researchers.

CPBS 7785 Independent Study in Computational Bioscience 1-3 cr.

Dr. L. Hunter (Spring, Summer, Fall) Prereq: Permission of Instructor.

This course is listed for the benefit of the advanced student who desires to pursue one or more topics in considerable depth. Supervision by a full-time faculty member is necessary.

CPBS 7791 Readings in Computational Bioscience 1.0 cr.

Dr. L. Hunter (Spring, Summer, Fall) Prereq: Permission of instructor.

A seminar style course in which students read and present recent publications from the primary computational bioscience literature.

CPBS 7792 Special Topics in Computational Bioscience 1-3 cr.

Dr. L. Hunter (Spring, Summer, Fall) Prereq: Permission of Instructor.

Topic varies by semester. Designed to give students a chance to evaluate critically some practical or theoretical problem under faculty supervision and to present results of their thinking to fellow students and instructors for critical evaluation.

CPBS 8990 Doctoral Thesis 1-10 cr.

Dr. L. Hunter (Spring, Summer, Fall) Prereq: Permission of instructor.

Doctoral thesis work in Computational Bioscience.

CELL BIOLOGY, STEM CELLS & DEVELOPMENT

CSDV 7605 Stem Cells and Development: an Integrated Approach 4.0 cr.

Dr. D. Clouthier – (Spring) Prereq: IDPT 7811, IDPT 7812, IDPT 7813, IDPT 7814 and IDPT 7815

Integrative introductory course, incorporating related fields of Cell Biology/Developmental Biology/Stem Cells/Regenerative Medicine. Through lectures, discussions of current literature, student presentations; enrollees will gain a sophisticated understanding of basic cell biological concepts/experimental approaches underlying our current understanding of developmental/stem cell biology

CSDV 7650 Research: CSDV 1-5 cr.

Dr. L. Barlow – (Fall, Spring, Summer) Prereq: Consent of Instructor

Research work in Cell Biology, Stem Cells and Development.

CSDV 7670 Advanced Topics: CSDV 1.0 cr.

Dr. L. Barlow – (Fall, Spring) Prereq: IDPT 7811, IDPT 7812, IDPT 7813, IDPT 7814 and IDPT 7815

Topics covered in course vary from year to year. First topic offering: "Cell Signaling and its regulation in cancer" by Drs. Reyland and Schedin. Second topic offering is "Neural stem cells in development and disease" by Drs. Artinger & Barlow.

CSDV 7850 Independent Study: CSDV 1-5 cr.

Dr. L. Barlow – (Fall, Spring, Summer) Prereq: IDPT 7811, IDPT 7812, IDPT 7813, IDPT 7814 and IDPT 7815, CSDV 7605

Independent Study is to allow students to take professional school course for credit or to gain a defined expertise with faculty mentor other than thesis advisor. Consent of faculty member offering the independent study and Program Director required.

CSDV 8990 Doctoral Thesis 1-10 cr.

Dr. L. Barlow – (Fall, Spring, Summer) Prereq: Consent of the instructor

Doctoral Thesis work in Cell Biology, Stem Cells and Development.

GENETIC COUNSELING

GENC 6101 Psychosocial Aspects of Genetic Counseling I 2.0 cr.

C. Walton, M.S. – (Fall) Coreqs: GENC 6105, GENC 6110. Course Restrictions: Matriculated student in Genetic Counseling M.S. Program

This is the first course in a two-semester sequence addressing basic psychosocial and counseling theories, approaches, and resources necessary for the provision of genetic counseling to clients and their families in prenatal, pediatric and adult clinical settings.

GENC 6102 Psychosocial Aspects of Genetic Counseling II 2 cr.

C. Walton, M.S. – (Spring) Prereq: GENC 6101 Coreqs: GENC 6105, GENC 6110. Course Restrictions: Matriculated student in Genetic Counseling M.S. Program

This is the second course in a two-semester sequence addressing basic psychosocial and counseling theories, approaches, and resources necessary for the provision of genetic counseling to clients and their families in prenatal, pediatric and adult clinical settings.

GENC 6105 Basic Interviewing Skills 1.0 cr.

C. Walton, M.S. – (Fall) Coreqs: GENC 6101, GENC 6110. Course Restrictions: Matriculation as genetic counseling M.S. student.

This course covers fundamental theories and principles of effective patient/client interviewing in genetic counseling practice. Lectures are combined with hands-on role plays and interviews so that students may gain applied experience and receive feedback to foster skills development throughout course.

GENC 6110 Topics in Medical Genetics I **3.0 cr.**

C. Walton, M.S. – (Fall) Course Restrictions: Matriculated student in Genetic Counseling M.S. Program.

First course in a two-course sequence regarding principles of clinical genetics and genetic counseling, and development of clinical skills used in various medical genetics settings. Fall semester focuses on principles important in pediatric and general genetics settings.

GENC 6111 Topics in Medical Genetics II **2.0 cr.**

C. Walton, M.S. – (Spring) Prereq: GENC 6110. Course Restrictions: Matriculated student in Genetic Counseling M.S. Program

Second course in two-course sequence regarding principles of clinical genetics and genetic counseling used in various medical genetics settings, and development of clinical skills. Spring semester focuses on prenatal and adult genetics clinic settings.

GENC 6120 Clinical Cytogenetics and Molecular Genetics **3.0 cr.**

C. Walton, M.S. – (Fall) Coreq: GENC 6121 Laboratory in Clinical Cytogenetics & Molecular Genetics. Course Restrictions: Matriculation into M.S. Genetic Counseling Program or Permission of Instructors.

This course provides integrated instruction regarding human cytogenetic and molecular genetic principles, techniques, and diagnostic testing approaches used in clinical evaluation and risk assessment for genetic disorders/predispositions in prenatal and postnatal patient populations.

GENC 6121 Laboratory in Clinical Cytogenetics and Molecular Genetics **2.0 cr.**

C. Walton, M.S. – (Fall) Coreq: GENC 6120 Clinical Cytogenetics & Molecular Genetics. Course Restrictions: Matriculation into M.S. Genetic Counseling program or Permission of Instructors.

Course provides introduction to specific methodologies and interpretation of studies used in diagnostic cytogenetics and molecular genetics laboratories. Principles discussed in the co-requisite clinical cytogenetics and molecular genetics course will be applied through demonstrations, hands-on experiments, discussion of illustrative cases.

GENC 6122 Seminar in Clinical Cytogenetics and Molecular Genetics **1.0 cr.**

C. Walton, M.S. – (Spring) Prereq: GENC 6120, GENC 6121. Course Restrictions: Matriculation into M.S. Genetic Counseling Program or Permission of Instructors.

Course requires students to apply theories/principles of cytogenetics and molecular genetics to analysis of cases that present in daily operations of diagnostic laboratories and formal critique of current research literature. Additionally, students present formal seminar integrating cytogenetic/ molecular genetic principles.

GENC 6130 Cancer Genetics and Genetic Counseling **2.0 cr.**

C. Walton, M.S. – (Spring) Prereq: GENC 6110, GENC 6120. Course Restrictions: Matriculation in MS Genetic Counseling Program.

Course in providing genetic counseling services to clients with or at risk for hereditary cancer predisposition. Topics include clinical oncology, epidemiology, molecular biology of cancer, risk assessment, genetic testing, ethical/legal issues, clinical research considerations, psychosocial impact/support, specific genetic counseling approaches.

GENC 6140 Human Inborn Errors of Metabolism **2.0 cr.**

C. Walton, M.S. – (Spring) Course Restrictions: Matriculated student in Genetic Counseling M.S. Program or instructor permission.

Course provides systematic review of major metabolic disorders, including their clinical phenotypes, diagnosis, and management. Physiological and laboratory testing principles important to understanding these disorders will be reviewed. Psychosocial impact of metabolic disorders and genetic counseling approaches will be discussed.

GENC 6150 Congenital Malformations and Disorders of the Newborn **1.0 cr.**

C. Walton, M.S. – (Spring) Prereq: GENC 6110. Coreq: GENC 6111. Course Restrictions: Matriculated student in Genetic Counseling M.S. Program or instructor permission.

This survey course covers common major malformations and non-metabolic genetic disorders identified by newborn screening programs. Clinical phenotypes, diagnosis, management and etiology are addressed. Psychosocial impact of these conditions and genetic counseling approaches will be discussed.

GENC 6201 Advanced Psychosocial Genetic Counseling **2.0 cr.**

C. Walton, M.S. – (Fall) Prereq: GENC 6101 and GENC 6102. Course Restrictions: Matriculated second year student in Genetic Counseling M.S. Program

This course examines advanced genetic counseling techniques as they relate to psychosocial theories, specific client characteristics and the client/counselor dynamic. Critical discussion of core topics and readings and case analysis will be used for instruction.

GENC 6210 Professional Issues in Genetic Counseling I **2.0 cr.**

C. Walton, M.S. – (Fall) Prereq: GENC 6101, GENC 6105, GENC 6110. Course Restrictions: Second year student in Genetic Counseling M.S. Program..

First course in a two course sequence regarding professional practice issues of master's level genetic counselors. The fall semester course focuses on professional standards, professional ethics, legal principles and health systems and policy issues relevant to genetic counselors.

GENC 6211 Professional Issues in Genetic Counseling II

2.0 cr.

C. Walton, M.S. – (Spring) Prereq: GENC 6210. Course Restrictions: Second year student in Genetic Counseling M.S. Program.

Second course in a two course sequence regarding professional practice issues of master's level genetic counselors. The Spring semester course focuses on disability issues, cultural competency, public health genetics, research methods in genetic counseling, and professional roles.

GENC 6250 Risk Calculation in Genetic Counseling

1.0 cr.

C. Walton, M.S. – (Fall) Prereq: GENC 6110. GENC 6120. Course Restrictions: Matriculation in M.S. Genetic Counseling Program.

This course covers pedigree analysis and risk calculation principles used by genetic counselors in clinical practice.

GENC 6910 Applied General Genetics Clinic

3.0 cr.

C. Walton, M.S. – (Fall, Spring, Summer) Prereq: GENC 6101. GENC 6105, GENC 6110. Course Restrictions: Matriculation as M.S. Genetic Counseling Student.

This is a clinical rotation for Genetic Counseling M.S. students through a general genetics clinic serving a variety of referral indications. Students will learn and practice case management, history taking, risk assessment, counseling, and client advocacy skills.

GENC 6911 Applied Prenatal Genetics Clinic

3.0 cr.

C. Walton, M.S. – (Fall, Spring, Summer) Prereq: GENC 6101, GENC 6105, GENC 6110. Course Restrictions: Matriculation as M.S. Genetic Counseling Student.

This is a clinical rotation for genetic counseling students through a prenatal diagnosis and genetics clinic. Students will learn/practice history taking, risk assessment, patient education and genetic counseling, case management, as well as observe prenatal diagnosis and ART procedures.

GENC 6912 Applied Metabolic Genetics Clinic

3.0 cr.

C. Walton, M.S. – (Fall, Spring, Summer) Prereq: GENC 6101, GENC 6105, GENC 6110. Course Restrictions: Matriculation as M.S. Genetic Counseling Student.

This is a clinical rotation for genetic counseling students through a genetics clinic for inborn errors of metabolism. Students will work with patients referred for diagnostic evaluation, medical/nutritional management of specific conditions, follow-up of positive newborn metabolic screening results.

GENC 6913 Applied Regional & Specialties Genetics Clinics

1.0-2.0 cr.

C. Walton, M.S. – (Fall, Spring, Summer) Prereq: GENC 6101, GENC 6105, GENC 6110. Course Restrictions: Matriculation as M.S. Genetic Counseling Student.

This is a clinical rotation for genetic counseling students through regional outreach genetics clinics and specialty/multidisciplinary clinics serving patients with various genetic conditions.

GENC 6914 Applied Hereditary Cancer Clinic

1.0 cr.

C. Walton, M.S. – (Fall, Spring, Summer) Prereq: GENC 6110, PEDS 6601, PEDS 6602. Course Restrictions: Matriculation as M.S. Genetic Counseling Student.

This is a clinical rotation for genetic counseling students through a hereditary cancer clinic for individuals seeking genetic counseling and testing for genetic cancer predisposition syndromes.

GENC 6915 Applied Adult Medical Genetics Clinic

1.0 cr.

C. Walton, M.S. – (Fall, Spring, Summer) Prereq: GENC 6101, GENC 6105, GENC 6110. Course Restrictions: Matriculation as M.S. Genetic Counseling Student.

This is a clinical rotation for genetic counseling students through a medical genetics clinic and clinical research settings providing diagnosis, management, risk assessment and genetic counseling for adults.

GENC 6919 Applied Medical Genetics Clinic – Clinical Elective

1.0-3.0 cr.

C. Walton, M.S. – (Fall, Spring, Summer) Prereq: GENC 6101, GENC 6105, GENC 6110. Course Restrictions: Matriculation as M.S. Genetic Counseling Student.

This is an elective clinical rotation for genetic counseling students desiring to arrange training in settings outside of core required clinical rotations or an additional, advanced rotation.

GENC 6920 Applied Medical Genetics – Laboratory Genetic Counseling Elective

1.0 cr.

C. Walton, M.S. – (Fall, Spring, Summer) Prereq: GENC 6120, GENC 6121, GENC 6122. Course Restrictions: Matriculated student in GENC program who has completed required prerequisite courses listed; Permission of instructor..

This is an elective clinical rotation for genetic counseling students desiring to arrange training in settings outside of core required clinical rotations or an additional, advanced rotation.

GENC 6940 Capstone Genetic Counseling

1.0-2.0 cr.

Dr. K. Swisshelm. – (Fall, Spring, Summer) Prereq: GENC 6120, GENC 6121, GENC 6122. Course Restrictions: Matriculated student in GENC program who has completed at least two semesters of required coursework; Permission of instructor.

Students will develop a proposal and complete an individualized scholarly project that contributes to the knowledge and/or practice of genetic counseling.

GENC 6950 Masters Thesis**1.0-6.0 cr.**

C. Walton, M.S. – (Fall, Spring, Summer). Course Restrictions: Matriculated student in Genetic Counseling M.S. Program
Masters thesis research to be arranged with prior approval of the Graduate Program in Genetic Counseling.

HUMAN MEDICAL GENETIC**HMGP 7600 Survey of Human Genetics****3.0 cr.**

Dr. R. Spritz - (Spring)

Survey of human genetics, including Mendelian and other types of inheritance, chromosomes and cytogenetics, molecular and biochemical basis of genetic disease, quantitative genetics and gene mapping, developmental and cancer genetics, clinical genetics, and genetic screening and prenatal diagnosis.

HMGP 7610 Topics in Human Genetics**1.0 cr.**

Dr. R. Spritz - (Fall, Spring) Prereq: Graduate standing.

Two-semester course based on weekly HMGP seminar series. Students meet with speakers and discuss seminar or related topics and arranged readings. Grade based on class participation and required paper and presentation. Required for 1st and 2nd year HMGP students.

HMGP 7620 Genomics**2.0+1.0 cr.**

Dr. D. Pollock - (Spring) Crosslisted: CPBS 7792 Prereq: Permission of primary instructor. Restrictions: Permission of instructor for lab section, 15 students max.

An introduction to the theory and practice of genomics. Topics include sequencing and mapping, overview of genomes, transcriptomes, bioinformatics and statistics, population-level variation, ethics, evolutionary genomics, epigenomics, proteomics, metagenomics, and functional genomics.

HMGP 7630 Independent Study in Human Medical Genetics**1.0-2.0 cr.**

Dr. R. Spritz - (Fall, Spring, Summer) Prereq: Consent of the faculty member offering the independent study and the

Independent study is intended to permit students to carry out directed reading and discussion with a specific faculty member other than their thesis advisor. program director are required.

HMGP 7650 Research in Human Medical Genetics**1.0-10.0 cr.**

Dr. R. Spritz - (Fall, Spring, Summer) Prereq: Consent of Instructor

Research work in human medical genetics.

HMGP 8990 Doctoral Thesis**1.0-10.0 cr.**

Dr. R. Spritz - (Fall, Spring, Summer) Prereq: Consent of Instructor.

Doctoral thesis work in human medical genetics.

INTERDEPARTMENTAL**IDPT 5600 Topics in Biomedical Science and Research****4.0 cr.**

Dr. S. Flores - (Summer)

Research internship for undergraduate fellows in Graduate Experiences for Multicultural Students (GEMS) program.

IDPT 7160 Philosophical Foundations of Research Ethics**2.0 cr.**

Dr. M. Yarborough - (Spring) Crosslisted: CLSC 7160.

This course will examine the philosophical basis for current research ethics practices, address current ethical issues and controversies in biomedical research and provide students with knowledge and analytical skills to address the ethical dimensions of biomedical research.

IDPT 7200 Scientific Writing for Doctoral Students**2.0 cr.**

Dr. D. Wilkerson - (Spring)

Scientific writing course for students engaged in research. Focuses on critical thinking, analytical writing, and oral presentation. Taught as a writing workshop, the course emphasizes effective communication with both professional and non-technical audiences.

IDPT 7301 Introduction to Life Science Technology Commercialization**1.0 cr.**

Dr. A. Meyers - (Spring) Prereq: Must have passed preliminary examination; permission of instructor.

Scientific writing course for students engaged in research. Focuses on critical thinking, analytical writing, and oral presentation. Taught as a writing workshop, the course emphasizes effective communication with both professional and non-technical audiences.

This course is designed to familiarize graduate level engineering, business, law and science students with the fundamentals of life science technology commercialization including drugs, devices, diagnostics, healthcare IT and platform applications.

IDPT 7305 Hands On Proteomics Workshop**1.0 cr.**

Dr. N. Reisdorph - (Fall, Spring, Summer) Prerequisite: IDPT 7811, IDPT 7812, IDPT 7813, IDPT 7814, IDPT 7815 and Instructor permission.

4-day intensive hands-on workshop designed to provide comprehensive view of proteomics. Appropriate for individuals with little/no experience in mass spectrometry and/or high performance liquid chromatography. Participants learn introductory proteomics science and applicable protocols/technologies through extensive hands-on experience.

IDPT 7645 MSTP Seminar 1.0 cr.

Dr. A. Ribera - (Fall, Spring, Summer)

Designed to expose MSTP and physician scientist students to research programs and opportunities in biomedical sciences at the Anschutz Medical campus and selected departments of the UC Boulder campus.

IDPT 7646 Tissue Biology and Disease Mechanism 3.0 cr.

Dr. J. Hooper - (Fall) Prerequisite: IDPT 7811, IDPT 7812, IDPT 7813, IDPT 7814, IDPT 7815

This course provides an overview of organ systems and disease through 1) a survey of the major systems, including the cellular and molecular mechanisms underlying their function and repair, integrated with 2) common diseases, current therapies, and their mechanistic basis.

IDPT 7650 Research in Biomedical Sciences 1.0-3.0 cr.

Dr. D. Bentley - (Fall, Spring, Summer) Prereq: Consent of instructor.

Research rotation for students in the biomedical sciences Ph.D. program.

IDPT 7651 MSTP Summer Research Rotation 1.0-3.0 cr.

Dr. A. Gutierrez-Hartmann - (Summer) Prereq: Acceptance into the MST Program and permission of MSTP Director.

This course is an 8-10 week laboratory rotation experience in an MSTP training laboratory.

IDPT 7652 MSTP Advanced Topics 1.0-5.0 cr.

Dr. A. Ribera - (Fall, Spring) Prereq: IDPT 7811, IDPT 7812, IDPT 7813, IDPT 7814 and IDPT 7815; permission of instructor.

This course is designed for students in the MSTP and consists of in-depth small group (1-7 students) sessions that provide in-depth didactic and/or paper readings on subjects related to research rotations or thesis projects.

IDPT 7655 Thesis Years – Foundations of Doctoring 1.0-5.0 cr.

Dr. A. Gutierrez-Hartmann - (Fall, Spring, Summer) Prereq: All Phase I and II SOM courses. Course Restrictions: Permission of Instructor.

This course intended for MD or MD-PhD students who have successfully completed all coursework for Phases I and II of SOM curriculum, are on leave of absence from SOM and wish to maintain clinical exposure and training during the leave.

IDPT 7805 Case Studies: Molecules to Medicine 3.2 cr.

Dr. A. Ribera – (Fall) Crosslisted: IDPT 5002 Prereq: IDPT 7811, 7812, 7813, 7814, 7815 (BIOM Sci Core Courses)

This course is targeted for first year MSTP/Physician-Scientist students. Clinical cases will be presented/discussed by faculty and students to provide clinical context for basic science principles taught in the graduate core courses (IDPT 7811, IDPT 7812, IDPT 7813, IDPT 7814 and IDPT 7815).

IDPT 7811 Biomedical Sciences Core Course I 2.0 cr.

Dr. J. Kieft - (Fall)

Unified presentation of fundamental principles of biochemistry, cell biology, genetics, and molecular biology. Designed for all first-year basic sciences graduate students. Block 1: Building blocks and guiding biophysical principles.

IDPT 7812 Biomedical Sciences Core Course II 2.5 cr.

Dr. R. Davis - (Fall)

Unified presentation of fundamental principles of biochemistry, cell biology, genetics, and molecular biology. Designed for all first-year basic sciences graduate students. Block 2: Generating the blocks: Replication, transcription and translation maintenance.

IDPT 7813 Biomedical Sciences Core Course III 2.5 cr.

Dr. R. Evans - (Fall)

Unified presentation of fundamental principles of biochemistry, cell biology, genetics, and molecular biology. Designed for all first-year basic sciences graduate students. Block 3: Building a cell: Cell structure and function.

IDPT 7814 Biomedical Sciences Core Course IV 1.5 cr.

Dr. A. Bradford - (Fall)

Unified presentation of fundamental principles of biochemistry, cell biology, genetics, and molecular biology. Designed for all first-year basic sciences graduate students. Block 4: How does it function: Cell signaling.

IDPT 7815 Biomedical Sciences Core Course V 1.5 cr.

Dr. K. Artinger - (Fall)

Unified presentation of fundamental principles of biochemistry, cell biology, genetics, and molecular biology. Designed for all first-year basic sciences graduate students. Block 5: Putting it all together: Development, organs and systems.

IDPT 7850 [Independent Study in Bioethics, Medical Humanities or Health Law](#) **[1.0-6.0 cr.](#)**
Dr. M. Yarborough - (Fall, Spring, summer) Course Restrictions: Permission of the instructor. Repeatable for credit within the degree program, but not within the same term Maximum credits -6.

Course is designed to meet the needs of students interested in conducting advanced studies of issues and topics in bioethics, medical humanities, or health law. Students will work under the direction of the course director on a specific research topic.

IDPT 8890 [Clinical Experience for CTSI PhD Students](#) **[1.0 cr.](#)**
Dr. C. Sladek - (Fall, Spring, summer) Prereq: IDPT 7805 and IDPT 7646, EPID 6630, BIOS 6601 or equivalent. Course Restrictions: PhD Grad Students

Each student will identify a clinician mentor who will develop/direct a clinical experience tailored to student's thesis research. It may include participation in relevant clinical conference, a direct clinical experience, clinical research, preparation of clinical research protocol.

IMMUNOLOGY

IMMU 7602 [Special Topics in Tumor Immunology](#) **[1.0 cr.](#)**
Dr. J. Slansky - (Spring) Prereq: IMMU 7662.
This interactive course, elucidates mechanisms and paradigms relevant to the immune response to tumors. Current research and future directions in the field are discussed. Students are assessed via presentations, participation, and an exam.

IMMU 7603 [Special Topics – Immunologic Basis of Human Disease](#) **[1.0 cr.](#)**
Dr. L. Dragone and Dr. D. Graham– (Spring) Prereq: IMMU 7662
Perform translational studies, as they either test hypotheses established in mouse models or lead to new testable hypotheses that will advance understanding of pathogenesis of human disease. Greater understanding of disease pathogenesis will allow for development of new treatment options.

IMMU 7604 [Special Topics in Signal Transduction in the Immune System](#) **[1.0 cr.](#)**
Dr. A-L Perraud - (Spring) Prereq: IMMU 7662
In-depth course, designed primarily for immunology graduate students in their second year, who have completed IMMU 7602. The course covers selected topics (8 in all) encompassing wide range of topics in signal transduction through receptors important in the immune system.

IMMU 7607 [Science as a Profession](#) **[1.0 cr.](#)**
Dr. P. Marrack - (Fall)
This course discusses ethical issues, conflicts of interest, and regulations for working with humans or animals. It also includes instruction on writing papers and grants, giving effective presentations and advice on finding jobs in academia and industry.

IMMU 7630 [Overview of Immunology](#) **[2.0 cr.](#)**
Dr. J.J. Cohen - (Fall)
An overview course in immunology for non-Immunology-program graduate students. The focus is human relevance and the practical use of immunology in a variety of fields. Students gain experience applying immunological knowledge to their own area of interest.

IMMU 7650 [Research in Immunology](#) **[1.0-5.0 cr.](#)**
Dr. R. Torres – (Fall, Spring, Summer) Prereq: Consent of instructor.
Research work in immunology.

IMMU 7662 [Immunology](#) **[6.0 cr.](#)**
Dr. D. Riches - (Spring)
This course covers the basic principles of the immune system. Included are discussions on (i) the innate and adaptive immune responses, (ii) the molecular and cellular basis of immune specificity and (ii) aspects of clinical immunology.

IMMU 8990 [Doctoral Thesis](#) **[1.0-10.0 cr.](#)**
Dr. R. Torres – (Fall, Spring, Summer). Prereq: Consent of instructor
Doctoral thesis work in immunology.

MICROBIOLOGY

MICB 7650 [Research in Microbiology](#) **[1.0-10.0 cr.](#)**
Dr. J. Schaack - (Fall, Spring, Summer) Prereq: Consent of instructor.
Research work in microbiology.

MICB 7701 [Molecular Virology and Pathogenesis](#) **[4.0 cr.](#)**
Dr. K. Holmes - (Spring) Prereq: MICB 7706, MICB 7705 are desirable but not required. Course Restrictions: Permission of Instructor.

Topics in this course include viral structure and genome organization, replication and expression of viral genomes, mechanism of action of tumor viruses, molecular aspects of virus-host cell interactions, animal models of infectious diseases and pathogenesis of human viruses.

MICB 7702 Molecular Mechanisms of Bacterial Disease 3.0 cr.

Dr. M. Schurr - (Spring) Course Restrictions: Permission of the instructor.

Course focuses on molecular processes that bacteria utilize to cause disease in humans. The course content will use specific examples from pathogenic bacteria to illustrate common virulence mechanisms utilized to initiate, maintain and survive interactions with host cells.

MICB 7704 Host Response to Infectious Disease 2.0 cr.

Dr. L. VanDyk - (Spring) Prereq: IDPT 7803 or consent of instructor.

This interactive graduate course, which provides an overview and specific examples of the host response to infectious disease. Current research and future directions in the field are discussed. Students are assessed via presentations, participation, and an exam.

MICB 7705 Medical Microbiology 4.0 cr.

Dr. M. Schurr - (Spring) Prereq: Recommended Fundamentals of Microbiology. Course Restrictions: Permission of the Instructor. Crosslisted: IDPT 6004.

The course will focus on Microbiology, Infectious Diseases. Course content will focus on: pathogenic bacteria, viruses, fungi, parasites; emphasis on microbial virulence determinants, host-pathogen interactions emphasizing host immune responses, signs, symptoms of disease presentation, epidemiology, and diagnosis of infectious diseases.

MICB 7706 Fundamentals of Microbiology and Infectious Diseases 2.0 cr.

Dr. M. Schurr - (Fall) Course Restrictions: Permission of the Instructor.

Fundamentals of Microbiology is a course designed to introduce first year graduate students to the discipline of microbiology. The basics of microbiology will be presented to prepare the student for courses in medical microbiology, advanced bacteriology and advanced virology.

MICB 8990 Doctoral Thesis 1.0-10.0 cr.

Dr. J. Schaack - (Fall, Spring, Summer)

Doctoral thesis work in microbiology.

MOLECULAR BIOLOGY

MOLB 7616 Topics in Molecular and Cellular Biology 1.0 cr.

Dr. J. Kieft - (Spring) Prereq: IDPT 7811, IDPT 7812, IDPT 7813, IDPT 7814, IDPT 7815.

Various topics in molecular and cellular biology will be selected every year. Each topic will be studied by a faculty lecture and group presentations by graduate students of research papers.

MOLB 7650 Research in Molecular Biology 1.0-10.0 cr.

Dr. J. Kieft - (Fall, Spring, Summer) Prereq: Consent of the instructor.

Research work in molecular biology.

MOLB 7661 Molecular Biology Seminar 1.0 cr.

Dr. J. Kieft - (Fall, Spring)

Seminar series provides a forum for the presentation of scientific experiments and information in molecular biology by faculty, postdoctoral fellows, graduate students and invited outside guest speakers.

MOLB 7800 Advanced Topics in Molecular Biology 4.0 cr.

Dr. J. Kieft - (Spring) Prereq: IDPT 7811, IDPT 7812, IDPT 7813, IDPT 7814, IDPT 7815. Course Restrictions: Permission of instructor. Course offered in 4 blocks of 1 hour of credit each.

Course instructs graduate students how to critically evaluate scientific literature. Course in 4 blocks, topics include nucleic acid, chromatin structure, DNA replication, RNA transcription, RNA processing, cell cycle control, genetics of model organisms. Papers chosen by instructors, presentations by students.

MOLB 8990 Doctoral Thesis 1.0-10.0 cr.

Dr. J. Kieft - (Fall, Spring, Summer)

Doctoral thesis work in molecular biology. Prerequisite: Consent of Instructor

NEUROSCIENCE

NRSC 7600 Cellular & Molecular Neurobiology 3.0 cr.

Dr. W Sather - (Fall)

A comprehensive, in-depth, discussion-based course intended for candidates for the PhD in Neuroscience. Topics include ion channel structure and function, ionic basis of the resting and action potential, and the biochemistry and physiology of direct and indirect synaptic transmission.

NRSC 7610 Fundamentals of Neurobiology 4.0 cr.

Dr. T. Finger - (Spring) Prereq: NRSC 7600 or equivalent at the discretion of the instructors.

This course will provide basic knowledge on the structure and function of the nervous system. The lectures will be supplemented by discussion of primary research literature in neurobiology.

NRSC 7614 [Biological Basis of Psychiatric & Neurological Disorders](#) [2.0 cr.](#)

Dr. J. Tregellas - (Spring) Prereq: IDPT 7812 or BMGN 5000/CSBI 5001.

This elective, for basic sciences graduate students and medical students, provides a survey of current clinical and molecular aspects of human neuropsychiatric disorders. Both movement disorders and DSMIV diagnoses will be covered. Contact Course Director for a list of topics.

NRSC 7615 [Developmental Neurobiology](#) [3.0 cr.](#)

Dr. A. Ribera and Dr. K. Artinger- (Spring) Prereq: IDPT 5004, NRSC 7600 & NRSC 7610.

This course will cover fundamental principles regarding development of the nervous system. The format of the course will consist of lecture plus reading of primary literature.

NRSC 7616 [Introduction to Biomedical Photonics](#) [3.0 cr.](#)

Dr. D. Restrepo - (Spring) Prereq: EE 5802 Optical Engineering. Crosslisted: Electrical Engineering EE 5804.

The course introduces several principles of applying optical techniques to biomedical applications. Current development of biophotonic research, such as microscopy, optical coherence tomography, optical spectroscopic techniques in tissues, will be discussed.

NRSC 7650 [Research in Neuroscience](#) [1.0-5.0 cr.](#)

Dr. A. Ribera – (Fall, Spring, Summer) Prereq: Consent of instructor.

Research work in neuroscience.

NRSC 7661 [Grant Proposal Writing Workshop](#) [1.0 cr.](#)

Dr. D. Tollin - (Spring) Prereq: NRSC 7610. Restriction: Students with adequate neuroscience background.

Course is practical workshop in grant-writing culminating in a mock review panel including course participants. Students will examine various proposal types/formats, then write their own proposal in the format of NRSA fellowship application.

NRSC 7670 [Advanced Topics in Neuroscience](#) [1.0-2.0 cr.](#)

Dr. A. Ribera – (Fall, Spring, Summer) Prereq: NRSC 7600 or permission from instructor.

The course will consist of discussion of manuscripts relevant to a specific topic in neuroscience

NRSC 7675 [Neuroscience, Ethics, and Philosophy](#) [1.0 cr.](#)

Dr. S. Vijayaraghavan – (Fall) Prereq: Successful completion of 1st year Graduate Courses.

Elective course provides overview of issues at the intersection of philosophy/ethics/neuroscience. Format involves lecture, student presentations, and relies heavily on student discussion. Topics focus on arguments relevant to the philosophy of mind along with their implications for the individual /society.

NRSC 7800 [Teaching Neuroscience](#) [1.0 cr.](#)

Dr. D. Restrepo – (Spring) Prereq: NRSC 7610 Course Restrictions: Second year students in neuroscience or above.

Students will be guided in developing two class sessions in systems neuroscience to be presented in the Systems Neuroscience course, NRSC 7610. Each session will include a practice presentation and post-mortem critique.

NRSC 8990 [Doctoral Thesis](#) [1.0-10.0 cr.](#)

Dr. A. Ribera - (Fall, Spring, Summer) Prereq: Consent of instructor

Doctoral thesis work in neuroscience.

PHARMACOLOGY

PHCL 7560 [Drug Metabolism & Pharmacogenetics I](#) [1.0 cr.](#)

Dr. V. Vasiliou - (Fall) Crosslisted: TXCL 7560.

Course will focus on reactions that exogenous compounds undergo in mammalian systems and mechanisms of these reactions. Enzyme kinetics and unusual (idiosyncratic) drug responses that have a hereditary basis and the interrelationship between genes and drug metabolism will be discussed.

PHCL 7561 [Drug Metabolism and Pharmacogenetics](#) [2.0 cr.](#)

Dr. V. Vasiliou - (Spring) Crosslisted TXCL 7561.

Course will focus on reactions that exogenous compounds undergo in mammalian systems and mechanisms of these reactions. Enzyme kinetics and unusual (idiosyncratic) drug responses that have a hereditary basis and the interrelationship between genes and drug metabolism will be discussed.

PHCL 7600 [Frontiers in Pharmacology](#) [1.0 cr.](#)

Dr. T. Kutateladze - (Fall)

Course is intended to introduce students to cutting-edge pharmacology research and to the range of research opportunities available within the Pharmacology Training Program. Pharmacology Department faculty presentations will focus on cellular signaling, molecular mechanisms of drug actions, structure-based drug design.

PHCL 7605 [Ethics in Research](#) [1.0 cr.](#)

Dr. D. Port – (Fall)

The Department of Pharmacology in the CU School of Medicine organizes and offers an interactive course entitled "Ethics in Research". The course is designed to inform/sensitize students, trainees, faculty to problems of fraud, misconduct and unethical practices in scientific research.

PHCL 7606 [Receptors and Cell Signaling](#) [3.0 cr.](#)

Dr. M. Dell'Acqua - (Spring) Prereq: IDPT 7811, IDPT 7812, IDPT 7813, IDPT 7814 and IDPT 7815.

This elective course presents an in-depth treatment of the role of receptors and signal transduction systems in the regulation of cell functions through faculty-presented lectures and student-led discussions of current literature.

PHCL 7609 [Statistical Methods in Pharmacology](#) [3.0 cr.](#)

Dr. D. Everett – (Fall) Crosslisted: BIOS 6606. Course Restrictions: Restricted to Pharmacology PhD Students.

Introduction to basic statistical methods utilized to analyze scientific data. The goal of course is to provide students in the biological/health sciences with the knowledge/skills necessary to analyze/interpret data which is essential for communicating scientific results.

PHCL 7610 [Survey of Bioinformatics Methods](#) [2.0 cr.](#)

Dr. L. Hunter - (Fall) Crosslisted: CPBS 7710.

What is Bioinformatics and why study it? How is large-scale molecular biology data generated, where and how can researchers gain access to it, and what computational analyses are possible?

PHCL 7611 [Bioinformatics I](#) [4.0 cr.](#)

Dr. L. Hunter - (Fall) Crosslisted: CPBS 7711 Prereq: Bioinformatics PhD students or consent of instructor.

What is Bioinformatics and why study it? How is large-scale molecular biology data generated, where and how can researchers gain access to it, what computational analyses are possible and computational techniques for solving inference problems in molecular biology?

PHCL 7612 [Bioinformatics II](#) [4.0 cr.](#)

Dr. L. Hunter - (Spring) Crosslisted: CPBS 7712. Prereq: CPBS 7711

Inference problems and computational techniques for molecular biology, with emphasis on machine learning approaches. Use of computational induction techniques focused on information extraction from biomedical literature, inference of biochemical networks from high-throughput data, and prediction of protein function.

PHCL 7614 [Membrane Biophysics](#) [2.0 cr.](#)

Dr. T. Benke - (Spring) Crosslisted: NRSC 7614. Prereq: NRSC 7600 or equivalent. Course Restrictions: 2nd year students with approval of Instructor.

Lectures and homework on ionic mechanisms underlying cellular excitability, especially in the central nervous system. Descriptive mathematics, pharmacology and molecular biology will be stressed. An introductory application to real-life problems using the NEURON simulation environment will be taught.

PHCL 7615 [Grant Proposals in Pharmacology](#) [1.0 cr.](#)

Dr. K. Bayer - (Fall) Prereq: IDPT 7811, IDPT 7812, IDPT 7813, IDPT 7814, IDPT 7815. Restrictions: Pharmacology students only.

We will learn principles of good grants(wo)manship, and hone our skills in homework assignments and discussions. Our goal is to enable a better learning experience during comps proposal writing, by gaining the tools for optimized self-assessment.

PHCL 7620 [Principles of Pharmacology](#) [6.0 cr.](#)

Dr. W. Sather – (Spring) Prereq: IDPT 7811, IDPT 7812, IDPT 7813, IDPT 7814, IDPT 7815, Restrictions: Consent of course directors.

Lectures are provided in the general areas of pharmacokinetics, receptor theory, structure-activity relationships, drug metabolism, basic pharmacological mechanisms with a particular emphasis on systems such as the nervous system and cardiovascular system, as well as cancer and microbial chemotherapy.

PHCL 7622 [Principles of Pharmacology for MSTP Students](#) [1.0 cr.](#)

Dr. W. Sather – (Spring) Prereq: IDPT 7811, IDPT 7812, IDPT 7813, IDPT 7814, IDPT 7815, PHCL 6000. Restrictions: Consent of course directors.

Lectures are provided in the general areas of pharmacokinetics, receptor theory, structure-activity relationships, drug metabolism, and basic pharmacological mechanisms with a particular emphasis on systems such as the nervous system and cardiovascular system, as well as cancer and microbial chemotherapy.

PHCL 7650 [Research in Pharmacology](#) [1.0-5.0 cr.](#)

Dr. D. Port – (Fall, Spring, Summer) Prereq: Consent of instructor.

Research work in pharmacology.

PHCL 7660 [Advanced Topics in Pharmacology](#) [1.0 cr.](#)

Dr. D. Port – (Fall, Spring, Summer) Prereq: PHCL 7600, PHCL 7606, PHCL 7609, PHCL 7620, PHCL 7650. Coreq: IDPT 7811, IDPT 7812, IDPT 7813, IDPT 7814, IDPT 7815.

An in-depth discussion-oriented course for advanced students focusing each term on specific topics associated with pharmacological studies including new insights about drug addiction; alcohol actions and alcoholism memory models and LTP; rational approaches to cancer chemotherapy; cardiovascular physiology.

PHCL 8990 [Doctoral Thesis](#) [1.0-10.0 cr.](#)

Dr. D. Port – (Fall, Spring, Summer) Prereq: Consent of instructor.
Doctoral thesis work in pharmacology.

PHARMACEUTICAL SCIENCES

PHSC 7300 Applied Statistics in Research & Development **3.0 cr.**

Dr. D. Clough - (Fall) Crosslisted : CHEN 5128. Prereq: Undergraduate course in probability and statistics.
Students learn statistical methods that are appropriate to experimentation in research and development activities. Statistical design of experiments and model fitting are emphasized. Students apply methods using spreadsheets and statistical software.

PHSC 7310 Fundamentals of Pharmaceutical Sciences **3.0 cr.**

Dr. D. Bain - (Fall) Crosslisted TXCL 7310
Core course explores key aspects of Pharmaceutical Sciences. Major themes will focus on macromolecular interactions, pharmaceuticals, pharmacokinetics, pharmacodynamics, apoptosis, signal transduction and immunology. Critical thinking and problem solving skills will be emphasized via lectures, discussions, and computer-based data analyses.

PHSC 7325 Pharmaceutical Development: Evaluating the External Environment **2.0 cr.**

Dr. R. Valuck - (Summer)
An overview of pharmaceutical industry in U.S. and the environment in which it exists. Material covered includes epidemiology/classification of disease, trends in health care costs/expenditures, organization/financing of health care, pharmaceutical industry characteristics, drug product marketing and introduction to pharmaceutical outcomes/economics.

PHSC 7330 Issues in Drug Development **2.0 cr.**

Dr. J. Carpenter - (Spring) Prereq: Permission from instructor.
A multidisciplinary approach to educating students about all aspects of drug development including federal drug regulatory issues, natural product screening, combinatorial chemistry, high throughput screening, in vitro and in vivo pharmacology models, preclinical/clinical toxicology, dosage forms, and clinical trials design.

PHSC 7339 Human Subjects Ethics **1.0 cr.**

Dr. A. Prochazka - (Spring) Crosslisted: CLSC 7150.
An overview of the field of ethics in clinical research. It is designed for non-Clinical Science degree students and certificate students and investigators who will be conducting research involving human subjects. Topics include the historical background and current regulations.

PHSC 7345 Nanotechnology and Drug Delivery **2.0 cr.**

Dr. U. Kompella - (Spring) Restriction: Student should be enrolled in a graduate or equivalent program. Crosslisted: BIOE 7345.
Course presents physicochemical and biological principles of drug delivery including drug delivery system design for various applications. In addition, it will address principles of nanotechnology related to the design of nanosize delivery systems intended for drug delivery, imaging and diagnosis.

PHSC 7350 Proteins **3.0 cr.**

Dr. R. Hodges – (Spring) Crosslisted: BMST 7350.
Chemical and physical basis for protein structure, folding, function and stability; role of molecular dynamics, use of molecular simulations in investigations of protein-ligand and protein interactions; methods and principles of protein/peptide purification and enzyme catalysis, including electron transfer and mutagenesis.

PHSC 7354 Structural Analysis of Biomolecules I **2.0 cr.**

Dr. R. Hodges – (Spring) Crosslisted: BMST 7354 Restriction: Taught Alternate Years
This course describes the fundamentals of spectroscopic methods used to study protein structure and function. These techniques include optical methods (CD spectroscopy, fluorescence and absorbance), vibrational methods (IR and ESR), analytical ultracentrifugation, mass spectrometry, calorimetry, light scattering and Biacore analysis.

PHSC 7400 Ethical Issues in Toxicology & Pharmaceutical Sciences **1.0 cr.**

Dr. R. Agarwal - (Fall) Crosslisted: TXCL 7400.
The purpose of this course is to expose students to ethical issues in the fields of toxicology and pharmaceutical sciences. Emphasis will be placed on research conduct, animal use, and other timely issues relevant in these fields.

PHSC 7450 Protein Chemistry 2 **2.0 cr.**

Dr. J. Carpenter - (Spring) Crosslisted: BMST 7450.
This course represents methods/principles of protein/peptide purification and enzyme catalysis, including electron transfer/mutagenesis. In addition, the investigation of protein and enzyme structure/function, the role of molecular dynamics, and use of molecular stimulations in investigations of protein-ligand interactions will be presented.

PHSC 7454 Structural Analysis of Biomolecules 2 **2.0 cr.**

Dr. R. Hodges – (Spring) Crosslisted: BMST 7454.
Methods and strategies for determination of the primary and 3-dimensional structures of biologically important molecules. Crystallography, nuclear magnetic resonance spectroscopy and mass spectrometry will be taught in structural determination of proteins, nucleic acids complex carbohydrates, and lipid molecules.

- PHSC 7530 Cancer: Experimental and Medical Aspects** **2.0 cr.**
 Dr. A. Malkinson - (Spring) Prereq: Permission of course coordinator.
 This is an interactive seminar course on recent topics in cancer biology. Topics include biochemical/morphological description of tumors and tumor behavior, such as metastasis and angiogenesis, and tumor development. This course also covers aspects of carcinogenesis: mechanisms, modulation, testing/epidemiology, chemotherapy.
- PHSC 7561 Pharmacology of Anticancer Agents** **2.0 cr.**
 Dr. G Eckhardt - (Fall)
 This is a course that will examine the principles behind the pharmacological treatment of cancer. Focus will be on the agents currently used in the clinic as well as developing therapies. Mechanistic aspects and therapeutic strategies will be emphasized.
- PHSC 7568 Seminar in the Pharmaceutical Sciences** **1.0-3.0 cr.**
 Dr. D. Bain - (Fall, Spring)
 Discusses current literature and research in the pharmaceutical sciences.
- PHSC 7570 Special Topics in Outcomes Research** **1.0 cr.**
 Dr. R. Valuck - (Fall, Spring) Prereq: Graduate Standing & Consent of instructor.
 This course involves identification, analysis and discussion of contemporary issues in the field of pharmaceutical outcomes research. Format and topics vary depending on the focus of the course for each semester.
- PHSC 7610 Cost-Effectiveness Theory** **3.0 cr.**
 Dr. P. Sullivan - (Fall)
 The theoretical and methodological foundational course of a two-course sequence in cost-effectiveness analysis, this course will provide an overview of cost-effectiveness theory and methodology in health and medicine. It will also introduce patient-reported outcomes and health-related quality of life measurement.
- PHSC 7611 Applied Cost-Effectiveness** **3.0 cr.**
 Dr. P. Sullivan - (Spring) Prereq: PHSC 7610. Restrictions: Successful completion of PHSC 7610.
 The final course of a two-course sequence in cost-effectiveness analysis, this course will apply the theory and methods learned in PHSC 7610 to develop competency in conducting cost-effectiveness analysis in health and medicine. Students will complete their own cost-effectiveness model.
- PHSC 7613 Pharmaceutical and Drug Related Policy** **4.0 cr.**
 Dr. K. Nair - (Fall).
 Will examine payer, provider and consumer issues related to pharmaceutical use in the US. Using data from the Medicare Expenditure Panel Survey students will model the impact of various pharmaceutical based policies under healthcare reform.
- PHSC 7615 Pharmacoepidemiology** **2.0-4.0 cr.**
 Dr. R. Valuck - (Fall) Crosslisted: EPID 7615. Prereq: EPID 6630, 2-course biostatistics series (either BIOS 6601-6602 or BIOS 6611-6612) Consent of instructor to determine level of credit to be taken.
 This course builds upon fundamental concepts and methods of epidemiology, applied to the study of pharmaceuticals. Topics include: the FDA approved process, mechanisms of adverse drug effects, methods and data systems for studying drug-effect relationships, and evaluating published pharmacoepidemiology studies.
- PHSC 7620 Research Design & Methodology in Pharmaceutical Outcomes Research** **2.0 cr.**
 Dr. K. Nair - (Spring) Prereq: Biostatistics and Epidemiology.
 Examining the research methods used in conducting Pharmaceutical Outcomes Research.
- PHSC 7621 Database Research Methods** **2.0 cr.**
 Dr. M. McCollum - (Fall) Course Restrictions: Currently enrolled in a graduate-level program of study.
 This course, the first of a two-course sequence, will cover theoretical and methodological foundations of database research. Topics will include observational research methods, data management and analysis considerations, and an overview of databases available for use in health services research.
- PHSC 7622 Applied Database Research** **3.0 cr.**
 Dr. M. McCollum - (Spring) Prereq: PHSC 7621, BIOS 6611/6602 or approval of course director. Restrictions: Currently enrolled in a graduate-level program of study.
 Course is second of two-course sequence in database research, providing students opportunity to apply theory and methods learned in PHSC7621 to develop competency in conducting research using secondary datasets. Students conduct their own database project and complete manuscript describing findings.
- PHSC 7650 Research Rotation in the Pharmaceutical Sciences** **1.0-10.0 cr.**
 Dr. D. Bain - (Fall, Spring, Summer) Prereq: Consent of instructor.
 Research work in pharmaceutical sciences.
- PHSC 7651 Pharmaceutical Biotechnology** **3.0 cr.**
 Dr. T. Randolph - (Fall) Crosslisted: CU Boulder CHEN 5900.
 Course covers role of bioengineering in development of pharmaceutical biotechnology products.

In particular, the student will learn to apply solution thermodynamics as well as mass and heat transfer concepts to the stabilization/formulation of macromolecules and production of drug delivery systems.

PHSC 7652 Principles of Medicinal Chemistry 2.0 cr.

Dr. J. Ruth - (Fall) Prereq: One-year organic chemistry with lab..

This survey course covers organic chemistry of drugs with respect to drug action: mechanism of action, structure-activity relationships, metabolism, dosage forms and rational drug design. Course encompasses traditional therapeutic categories of drugs as well as selected topics from current literature.

PHSC 7653 Protein Formulation 2.0 cr.

Dr. J. Carpenter - (Spring)

This course will provide instruction in rational design of stable therapeutic protein formulations with emphasis on the practical and mechanistic aspects of developing aqueous solution and freeze-dried formulations. Students will read papers from the literature and participate in critical discussions.

PHSC 7654 Advanced Topics in Pharmacology 1.0-5.0 cr.

Dr. D. Bain - (Fall, Spring) Course Restrictions: Permission from Instructor/Program Director.

Considers special topic of current interest in pharmacology. Course may be repeated for credit with the instructor's approval.

PHSC 7657 Advanced Topics in Medicinal Chemistry 1.0-5.0 cr.

Dr. J. Ruth - (Fall, Spring) Restriction: Permission from instructor.

Considers special topic of current interest in medicinal chemistry. Course may be repeated for credit with the instructor's approval.

PHSC 7658 Advanced Topics in Pharmaceutical Sciences 1.0-5.0 cr.

Dr. D. Bain - (Fall, Spring). Restriction: Permission from instructor

Considers special topic of current interest in pharmaceutical sciences. Course may be repeated for credit with instructor's approval.

PHSC 7660 Membrane Dynamics 2.0 cr.

Dr. D. Bain - (Spring)

This course will cover the basics of membrane bioenergetics in biological systems. The physical properties of membranes are described based on studies with liposomes, and the course further explores the use of liposomes as drug delivery vehicles.

PHSC 7831 Case Studies in Biotechnology 2.0 cr.

Dr. D. Kompala – (Spring) Crosslisted: CU Boulder CHEN 5831.

Course is required of all graduate students in interdisciplinary graduate biotechnology certificate program and those supported on NIH training grants. Reviews molecular genetics, product synthesis/purification, economics, intellectual property, and business planning. Working in teams, students present a biotechnology product plan.

PHSC 7911 Pharmaceutical Outcomes Research Practicum 2.0 cr.

Dr. A. Libbey – (Fall, Spring) Prereq: EPID 6630, 2-course biostatistics series (either BIOS 6601-6602, or BIOS 6611-6612), completion of preliminary exams. Restrictions: Consent of instructor to determine completion of prerequisite coursework and readiness for practicum.

This course focuses on team-based research in pharmaceutical outcomes, building on prior didactic courses. Specific attention is given to the procedures, methods, and measurement specific to conducting successful empirical pharmaceutical outcomes research. Research topics will vary.

PHSC 8990 Doctoral Thesis 1.0-10.0 cr.

Dr. D. Bain - (Fall, Spring, Summer) Prereq: Consent of instructor.

Doctoral thesis work in pharmaceutical sciences.

PHYSIOLOGY

PHSL 6001 Human Physiology 4.0 cr.

Dr. S. Vijayaraghavan – (Spring) Restrictions: BA or BS including Biology, Chemistry, Physics. Crosslisted: DSBS 5508

This course in Physiology is designed to provide an understanding of the functions of cells, tissues and organs in the human body and the overall integration of organ functions in the body as a whole.

PHSL 7650 Research in Physiology and Biophysics 1.0-10.0 cr.

Dr. S. Vijayaraghavan – (Fall, Spring, Summer) Prereq: Consent of instructor.

Research work in Physiology and Biophysics

PHSL 7840 Advanced Topics in Cell Signaling 1.0 cr.

Dr. N. Schoppa – (Fall, Spring, Summer) Prereq: Consent of instructor.

Students select topics of interest in the area of cell signaling and receive one-on-one instruction from expert faculty. Each one-credit topic will be taught for 5 weeks. Course work will include reading and discussing papers, as well as practical exercises.

REHABILITATION SCIENCE**RHSC 7000 Foundations in Rehabilitation Science****2.0 cr.**

Dr. K. Mauluf – (Fall) Restriction: Instructor permission required for students not enrolled in RHSC Program.

This course provides an overview of the field of Rehabilitation Science and an introduction to disablement frameworks with an emphasis on biopsychosocial models of the enabling-disabling process across the life span.

RHSC 7001 Rehabilitation Science Seminar**1 cr.**

Dr. K. Mauluf – (Fall, Spring) Prereq: RHSC 7000 or Instructor Permission. Restriction: Instructor permission required for students not enrolled in RHSC Program.

Students will attend contemporary research seminars presented by established scientists and will participate in group discussions to assess the implications of seminar topics on the full spectrum of disablement constructs in Rehabilitation Science ranging from pathophysiology to community participation.

RHSC 7002 Professional Skills in Academia**2.0 cr.**

Dr. K. Mauluf – (Spring) Restriction: Instructor permission required for students not enrolled in RHSC Program.

This course provides an overview of instructional methods and professional skills for academic educators and scientists. Topics include instructional methods for graduate education, and development of professional skills in communication, management, networking, and promotion for academic careers in Rehabilitation Science.

RHSC 7910 Research Practicum in Rehabilitation Science I**3.0 cr.**

Dr. K. Mauluf – (Fall, Spring, Summer) Prereq: Instructor Permission. Restriction: Instructor permission required for students not enrolled in RHSC Program.

This research practicum exposes students to a variety of experimental tools and techniques available to Rehabilitation scientists. Mentored practicum experiences are selected by each student with permission from the faculty mentor(s).

RHSC 7911 Research Practicum in Rehabilitation Science II**3.0 cr.**

Dr. K. Mauluf – (Fall, Spring, Summer) Prereq: Instructor Permission. Restriction: Instructor permission required for students not enrolled in RHSC Program.

This research practicum exposes students to a variety of experimental tools and techniques available to Rehabilitation scientists. Mentored practicum experiences are selected by each student with permission from the faculty mentor(s).

RHSC 8900 Independent Study in Rehabilitation Science**1.0-3.0 cr.**

Dr. K. Mauluf – (Fall, Spring, Summer) Prereq: Instructor Permission. Restriction: Instructor permission required for students not enrolled in RHSC Program.

This course is designed for the advanced student to pursue one or more Rehabilitation Science topics in considerable depth. Faculty supervision is required.

RHSC 8990 Doctoral Thesis**1.0-10.0 cr.**

Dr. K. Mauluf – (Fall, Spring, Summer) Prereq: Instructor Permission. Restriction: Enrollment in RHSC Program.

Doctoral thesis work in Rehabilitation Science.

REPRODUCTIVE SCIENCES**RPSC 7650 Research in Reproductive Science****1.0-5.0 cr.**Dr. A. Bradford - (Fall, Spring, Summer) Prereq: Consent of the Instructor
Research work in Reproductive Science**RPSC 7652 Special Topics in Reproductive Science****1.0-3.0 cr.**

Dr. A. Bradford - (Fall, Spring, Summer) Prereq: Enrollment in PhD Program in Graduate School

This course provides instruction in a specialized area of Reproductive Science. Course content and the extent of the course varies from year to year.

RPSC 7801 Molecular Mechanisms of Reproductive Endocrinology and Metabolism**3.0 cr.**

Dr. A. Bradford - (Spring) Prereq: Core Courses IDPT 7811, IDPT 7812 ,IDPT 7813, IDPT 7814, IDPT 7815. Restrictions: CU-AMC grad students; others by permission of the Course Director

Endocrine systems will be covered from the molecule to the systems level. Pituitary secretions actions/regulation, regulation of water, ion, calcium balance, regulation of metabolism including insulin secretion/action will be discussed, the context of normal physiology, the mechanisms of endocrine dysfunction.

RPSC 7802 Reproductive Development**1.0 cr.**

Dr. A. Bradford - (Spring) Prereq: Core Courses IDPT 7811, IDPT 7812 ,IDPT 7813, IDPT 7814, IDPT 7815.

Focus of course is developmental biology of reproductive systems. Sex determination, fertilization, implantation, development of placenta and mammary glands will be covered in lectures and discussions of current literature. Course is designed to follow Endocrinology and Metabolism in Spring semester.

RPSC 8990 Doctoral Thesis**1.0-10.0 cr.**

Dr. A. Bradford - (Fall, Spring, Summer) Prereq: Consent of the Instructor
Doctoral thesis work in Reproductive Science

TOXICOLOGY

TXCL 7310 Fundamentals of Pharmaceutical Sciences

3.0 cr.

Dr. D. Petersen - (Fall) Crosslisted: PHSC 7310

This core course explores key aspects of Pharmaceutical Sciences. Major themes will focus on macromolecular interactions, pharmaceuticals, pharmacokinetics, pharmacodynamics, apoptosis, signal transduction and immunology. Critical thinking and problem solving skills will be emphasized via lectures discussions, and computer-based data analyses.

TXCL 7322 Molecular and Target Organ Toxicology

3.0 cr.

Dr. D. Ross - (Fall) Prereq: Need discussion with and consent of Instructor.

The course is designed to provide a foundation in molecular mechanisms of toxicity. Biochemical mechanisms underlying toxicity will be analyzed and integrated with discussions of reactive metabolites, oxidative stress, signal transduction, cell death and organ specific toxicity.

TXCL 7323 Environmental and Target Organ Toxicology

2.0 cr.

Dr. D. Fariss - (Spring) Prereq: Need discussion with and consent of Instructor.

The course is designed to provide a fundamental understanding of environmental-related toxicants (e.g. solvents, pesticides, metals, radiation) with emphases on the molecular mechanisms underlying their organ specific toxicity and on risk assessment.

TXCL 7325 Current Topics in Toxicology Research

2.0 cr.

Dr.C. Ju - (Fall, Spring)

This is a mandatory 2-credit hour course for Toxicology program graduate students. Each student is expected to lead one discussion per year, papers discussed will be authored by the upcoming Toxicology seminar series speaker. Grade given after Spring semester.

TXCL 7326 Current Concepts & Comprehensive Review of Physiology

4.0 cr.

Dr. R. Radcliffe - (Spring)

This course will consist of a comprehensive overview of the physiology of nervous cardiovascular, respiratory, renal, gastrointestinal, endocrine, and reproductive systems. Graduate students enrolled in this course will receive assignments concerning organ-specific, cell-cell interactions in overall physiology.

TXCL 7330 Issues in Drug Development

2.0 cr.

Dr. J. Carpenter - (Fall) Prereq: Permission from instructor.

Multidisciplinary approach to educating students about aspects of drug development including federal drug regulatory issues, natural product screening, combinatorial chemistry, high throughput screening, in vitro and in vivo pharmacology models, drug metabolism, preclinical/clinical toxicology, dosage forms and clinical trials design.

TXCL 7400 Ethical Issues in Toxicology and Pharmaceutical Sciences

1.0 cr.

Dr. R. Agarwal - (Fall)

The purpose of this course is to expose students to ethical issues in the fields of Toxicology and Pharmaceutical Sciences. Emphasis will be placed on research conduct, animal use, and other timely issues relevant in these fields.

TXCL 7475 Advanced Topics in Toxicology

1.0-6.0 cr.

Dr. V. Vasiliou - (Fall) Prereq: Permission of instructor/Program Director.

Considers special topic of current interest in toxicology. Course may be repeated for credit with instructor's consent.

TXCL 7555 Evidenced-Based Toxicology

2.0 cr.

P. Guzelian - (Fall, Spring)

Students perform literature research to address actual ongoing consultations made to a private practice of environmental toxicology. Questions of occupational/environmental safety, product safety, regulatory compliance, personal injury, medical monitoring are addressed by writing conclusions formed using principles of Evidence-Based Toxicology.

TXCL 7560 Drug Metabolism & Pharmacogenetics 1

2.0 cr.

Dr. V. Vasiliou - (Fall) Crosslisted: PHCL 7561

Course focuses on reactions that exogenous compounds undergo in mammalian systems and mechanisms of reactions. Enzyme kinetics/unusual drug responses that have hereditary basis is discussed. Interrelationship between genes/drug metabolism along with studies on polymorphic differences in genes encoding drug-metabolizing enzymes.

TXCL 7561 Drug Metabolism & Pharmacogenetics

3.0 cr.

Dr. V. Vasiliou - (Spring) Crosslisted: PHCL 7561

This course will focus on the reactions that the exogenous compounds undergo in mammalian systems and the mechanisms of these reactions. Enzyme kinetics and unusual (idiosyncratic) drug responses that have a hereditary basis will be discussed.

TXCL 7562 Analytical Basis of Forensic Toxicology

2.0 cr.

Dr. V. Vasiliou - (Summer, Fall)

Principles of analysis of abused drugs in biological samples within framework of legal requirements. Considerations include type of sample, routes/kinetics of metabolism, analytical methodology, possible interferences of physiological impairment. Agents include ethanol, cocaine, cannabinoids, amphetamines, opiates, phencyclidine, and anabolic steroids.

TXCL 7564 Environmental Risk Assessment and Applied Toxicology

2.0 cr.

Dr. D. Pyatt - (Spring)

Provides students with experience in risk assessment, environmental toxicology for public health and regulatory decision making. Topics include comprehensive human health risk assessments, baseline/probabilistic statistics, ecological risk assessment activities associated with emergency action, medical monitoring, role toxicology plays in courtroom.

TXCL 7575 Drug Development for the Toxicologist

2.0 cr.

Dr. V. Vasiliou - (Spring) Prerequisites TXCL 7322

Overview of drug development process. Course will provide understanding of regulatory obligations required for submitting an N.D.A. as well as discussions related to additional corporate roles including activities for in vivo study conduct & due diligence review for licensing opportunities.

TXCL 7650 Research Rotation in Toxicology

1.0-5.0 cr.

Dr. V. Vasiliou - (Fall, Spring, Summer)

Research work in toxicology.

TXCL 7655 Pharmacokinetics and Toxicokinetics

2.0 cr.

Dr. V. Vasiliou - (Fall) (even years)

This is a course on the pharmacokinetic analysis of xenobiotics. Absorption, distribution, metabolism and elimination of drugs will be discussed with focus on mathematical descriptions.

TXCL 7670 Methods in Molecular Toxicology

2.0 cr.

Dr. V. Vasiliou - (Spring)

This is a laboratory-based course that involves the carrying out of biochemical, molecular and analytical based experiments in the laboratories of toxicology faculty. Requirements for each laboratory assignment will be at the discretion of the instructor for that section.

TXCL 8990 Doctoral Thesis

1.0-10.0 cr.

Dr. V. Vasiliou - (Fall, Spring, Summer) Prereq: Consent of the instructor.

Doctoral thesis work in toxicology.