Clinical and Translational Science

The Committee on Clinical and Translational Science (CCTS) is a freestanding academic unit housed within the Biological Sciences Division. Our mission is to enhance multidisciplinary training in clinical and translational science at the University of Chicago. We seek to offer high-quality curriculum and mentorship to a new generation of researchers who will synthesize social and biological science to significantly advance medical science and practice.

With joint input from the Center for Health and the Social Sciences (http://chess.bsd.uchicago.edu) (CHeSS) and the Institute for Translational Medicine (http://itm.uchicago.edu), the CCTS mobilizes faculty from across the University to enhance course offerings in clinical and translational science. While most courses offered in CCTS are designed for graduate-level trainees, postdoctoral fellows, and junior faculty, there are also specific courses designed for undergraduate students interested in health and social sciences. For more information contact Kelsey Bogue, Committee Administrator, at kbogue@bsd.uchicago.edu.

Current areas of concentration include:

- Comparative Effectiveness Research
- Translational Informatics
- Health Services Research
- Quality and Safety
- Clinical Research
- Community-Based Research
- Global Health
- Pharmacogenomics

Below is a list of undergraduate courses that have been offered in the past. Refer to the CCTS section of the CHeSS website at chess.uchicago.edu/training-and-education/academic-courses (https://chess.uchicago.edu/training-and-education/academic-courses/) for current course offerings and prerequisites for each course.

**EXAMPLES OF PREVIOUSLY OFFERED CO-UNDERGRADUATE/GRADUATE COURSES**

**CCTS 20400. Health Disparities in Breast Cancer. 100 Units.**
Across the globe, breast cancer is the most common women's cancer. In the last two decades, there have been significant advances in breast cancer detection and treatment that have resulted in improved survival rates. Yet, not all populations have benefited equally from these improvements, and there continues to be a disproportionate burden of breast cancer felt by different populations. In the U.S., for example, white women have the highest incidence of breast cancer but African-American women have the highest breast cancer mortality overall. The socioeconomic, environmental, biological, and cultural factors that collectively contribute to these disparities are being identified with a growing emphasis on health disparities research efforts. In this 10-week discussion-based course students will meet twice weekly and cover major aspects of breast cancer disparities.

Instructor(s): E. Dolan, S. Conzen Terms Offered: Winter
Prerequisite(s): BIOS 25108
Equivalent Course(s): CCTS 40400, GNSE 30408, BIOS 25327, HLTH 20400, GNSE 20408

**CCTS 20500. Machine Learning & Advanced Analytics for Biomedicine. 100 Units.**
The age of ubiquitous data is rapidly transforming scientific research, and advanced analytics powered by sophisticated learning algorithms is uncovering new insights in complex open problems in biology and biomedicine. The goal of this course is to provide an introductory overview of the key concepts in machine learning, outlining the potential applications in biomedicine. Beginning from basic statistical concepts, we will discuss concepts and implementations of standard and state of the art classification and prediction algorithms, and go on to discuss more advanced topics in unsupervised learning, deep learning architectures, and stochastic time series analysis. We will also cover emerging ideas in data-driven causal inference, and demonstrate applications in uncovering etiological insights from large scale clinical databases of electronic health records, and publicly available sequence and omics datasets. The acquisition of hands-on skills will be emphasized over machine learning theory. On successfully completing the course, students will have acquired enough knowledge of the underlying machinery to intuit and implement solutions to non-trivial data science problems arising in biology and medicine.

Instructor(s): Ishanu Chattopadhyay Terms Offered: Winter. Not offered every year
Prerequisite(s): Rudimentary knowledge of probability theory, and basic exposure to scripting languages such as python/R is required. This course does not qualify in the Biological Sciences major.
Equivalent Course(s): BIOS 29208, CCTS 40500
CCTS 21005. The Making of the 'Good Physician': Virtue Ethics and the Development of Moral Character in Medicine. 100.00 Units.
This multi-disciplinary course draws insights from medicine, sociology, moral psychology, philosophy, ethics and theology to explore answers to the unique challenges that medicine faces in the context of late modernity: How does one become a 'good physician' in an era of growing moral pluralism and health care complexity? Students will engage relevant literature from across these disciplines to address issues regarding the legitimate goals of medicine, medical professionalism, the doctor-patient relationship, vocation and calling, the role of religion in medicine, and character development in medical education. The course will first introduce the challenges that moral pluralism in contemporary society presents to the profession of medicine along with the subsequent calls for a renewed pursuit of clinical excellence in today's complex health care system. It will then survey the resurgence of a philosophical discipline (virtue ethics) that has begun to shape contemporary debate regarding what types of 'excellences' are needed for a good medical practice dominated by medical science and technology.
Instructor(s): John Yoon Terms Offered: Autumn Spring Winter
Note(s): This course is limited to those who have been accepted into the Emerging Scholars Cohort in Bioethics (Hyde Park Institute, https://hydeparkinstitute.org/esc). Depending on space availability, other students interested in enrolling will need prior approval from Course instructor(s). This course is a year-long course with several 2-hour lecture discussions throughout the year, 2 all-day Saturday sessions (Fall/Spring), and an off-site practicum. Registration in Autumn, Winter, and Spring Courses is required. The spring quarter course will be worth 50 units.
Equivalent Course(s): CCTS 41005, MEDC 31005

CCTS 21007. Clinical and Health Services Research: Methods and Applications. 100 Units.
This course will introduce the interdisciplinary field of clinically-oriented health services research with a focus on policy-related implications. Through exposure to theoretical foundations, methodologies, and applications, students without significant investigative experience will learn about the design and conduct of research studies. We will cover the integration of research within the stages of translational medicine, and how science conducted across the translational medicine spectrum informs policy through purveyors of clinical services (e.g. physicians, hospitals), government, insurers, and professional societies. We will use the examples of postmenopausal hormone replacement therapy and autologous bone marrow transplantation to illustrate pitfalls in the progression from basic science research to clinical trials leading to diffusion in clinical medicine that can complicate the creation of logical, evidence-based practice guidelines, reimbursement, and clinical practice.
Instructor(s): Greg Ruhnke Terms Offered: Spring
Equivalent Course(s): BIOS 29329, PBPL 23007, CCTS 43007, HLTH 21007

CCTS 21008. Health Systems in Low- and Middle-Income Countries. 100 Units.
Strengthening health systems is imperative to achieving lasting improvements in health. This course provides students with a comprehensive overview of health systems in low- and middle-income countries. We will learn key frameworks and tools to analyze, assess and influence health systems in these contexts. The course is organized around core components of health systems, including service delivery, human resources for health, health financing, supply chain systems, governance, community engagement and information systems. Each class draws upon contemporary case studies from a variety of low- and middle-income countries to illustrate challenges, controversies and opportunities in these contexts. We will examine historical, social and political contexts, and key international, national and local stakeholders that influence health systems presently. We will consider the impact of external shocks, such as conflict, natural disasters, and economic and political crises, on the structure and functioning of health systems. Finally, recognizing the convergence between global and local, we will situate current challenges in the U.S. health system in a global context.
Instructor(s): Veena Sriman Terms Offered: Autumn. Not offered every year.
Prerequisite(s): Open to graduate students and third- and fourth-year undergraduate students. First- and second-year undergraduates interested in taking the course may write to the course instructor for permission.
Equivalent Course(s): CCTS 41008, HLTH 21008

CCTS 33000. Scientists Advancing the Forefront. 000 Units.
In this survey course, leading basic and translational biomedical scientists will review cutting-edge themes that constitute the forefront of medical research. Learners will emerge with a broad understanding of: •
Instructor(s): Erika Claud, Ronald Cohen Terms Offered: Spring Winter. Students who register in fall and spring will earn 50 credit units in spring.
Prerequisite(s): Course open to MS1 students
Note(s): Students should email Kelsey Bogue at kbogue@bsd.uchicago.edu to request permission to enroll.
Equivalent Course(s): MOLM 33000, MEDC 33000

CCTS 40006. Pharmacogenomics: Discovery and Implementation. 100 Units.
Pharmacogenomics is aimed at advancing our knowledge of the genetic basis for variable drug response. Advances in genetic knowledge gained through sequencing have been applied to drug response, and identifying heritable genetic variants that predict response and toxicity is an area of great interest to researchers. The ultimate goal is to identify clinically significant variations to predict the right choice and dose of medications for individuals-'personalizing medicine.' The study of pharmacogenomics is complicated by the fact that response and toxicity are multigenic traits and are often confounded by nongenetic factors (e.g., age, co-morbidities, drug-drug interactions, environment, diet). Using knowledge of an individual's DNA sequence as an integral determinant of drug therapy has not yet become standard clinical practice; however, several genetics-guided
recommendations for physicians have been developed and are highlighted. The ethics and economics of pharmacogenomics are also discussed.
Instructor(s): R. S. Huang, B. Stranger Terms Offered: Spring
Prerequisite(s): Undergraduates (third- and fourth-years only) must have taken BIOS 20187 and are required to email instructors for approval (bstranger@medicine.bsd.uchicago.edu and rhuang@medicine.bsd.uchicago.edu) prior to registering.
Equivalent Course(s): CABI 47510

**CCTS 43100. Topics in Global Health. 100 Units.**
This course is a continuation of Introduction to Global Health (CCTS 43000). It is designed to address specific medical issues of global significance including maternal and child health, communicable and non-communicable diseases, and emerging diseases; the course will also address the impact of population growth, migration, environmental decay, and humanitarian disasters on health. Finally, the course will discuss research and career opportunities within the field of global health.
Instructor(s): C. S. Olopade Terms Offered: Winter
Prerequisite(s): This course does not meet the requirements for the Biological Sciences major.
Equivalent Course(s): BIOS 29279