DATA SCIENCE

Leadership and Responsible Conduct

TSCI 6201	Data Science Leadership in Healthcare	1

Research Design and Analysis

CSAT 6095	Analysis and Visualization of Genomic Data	2
TSCI 5050	Introduction to Data Science	1
TSCI 5073	Integrated Molecular Biology With Patient-Oriented Clinical Research	1
TSCI 5074	Data Management, Quality Control And Regulatory Issues	2
TSCI 5076	Applied Healthcare Informatics and Analytics	2
TSCI 5201	Statistical Principles of Machine Learning for Biomedical Data	3
TSCI 5230	Analytical Programming for Biomedical Data Science	3
TSCI 6060	Patient-Oriented Clinical Research Methods-2	2
TSCI 6061	Patient-Oriented Clinical Research Biostatistics-2	2
TSCI 6065	Health Services Research	2
TSCI 6067	Genomic Healthcare	1
TSCI 6202	Data Visualization and Building Applications	2
TSCI 6203	Practicum in Biomedical Data Science	1

Courses available at The University of Texas at San Antonio

DS 5003- Introduction to Data Science

DS 5013- Programming for Data Science

DS 5023- Data Organization and Visualization

DS 5033- Data Mining and Machine Learning

STA 6003- Statistical Methods in Research and in Practice

Courses available at The University of Texas at Austin

PGS 383Q- Statistics in Translational Science

PGS 384S- Introduction to Epidemiology

PGS 384T- Advanced Epidemiology

PGS 385W- Bioinformatics in Infectious Diseases

PGS 390J- Data Analysis in Healthcare

Responsible Conduct

TSCI 5070	Responsible Conduct of Research	2
TSCI 6100	Practicum In IACUC Procedures	1
TSCI 6102	Practicum In IRB Procedures	1

Scientific Communication

TSCI 5075	Scientific Communication	2
TSCI 6064	Grantsmanship and Peer Review	1

Courses

TSCI 5050. Introduction to Data Science. 1 Credit Hour.
This elective course is designed to train participants to use programming languages such as R and SQL to extract, prepare, and analyze data. This course is designed to be self-contained: statistical methods and theory relevant to analyzing large datasets will be covered with the computer-related course content providing tangible applications and motivating examples. In addition, the course will include organizational skill training and best practices needed to run a successful collaboration between researchers conducting patient oriented clinical research and the researchers in the computational fields.

TSCI 5070. Responsible Conduct of Research. 2 Credit Hours.
This foundational course introduces students to core ethical content necessary for responsible research conduct. Through interactive seminars, students will learn about (1) scientists as responsible members of society (contemporary ethical issues in biomedical research and environmental/social impacts of research), (2) policies for research with human subjects and vertebrate animals, (3) collaborative research, (4) conflicts of interest (personal, professional, financial), (5) data acquisition and laboratory tools (management, sharing, ownership), (6) responsible authorship and publication, (7) mentor/trainee responsibilities and relationships, (8) peer review (9) research misconduct (forms of misconduct and management policies) (10) informed consent, privacy regulations, good clinical practice, and special populations in clinical investigations.

TSCI 5071. Patient-Oriented Clinical Research Methods-1. 2 Credit Hours.
This interdisciplinary course is the first in a two-semester sequence designed to train participants in the conduct of patient-oriented clinical research. Students will have the opportunity to learn to and, by the end of the course, be required to: (1) define a research question; (2) effectively conduct a systematic review of the scientific literature; (3) design strategies for recruitment into a study; (4) delineate strategies for minimizing bias in cross-sectional and retrospective studies; and (5) read and interpret research reports of cross-sectional and case-control investigations.

TSCI 5072. Patient-Oriented Clinical Research Biostatistics-1. 2 Credit Hours.
This interdisciplinary course is the first in a two-semester sequence designed to train participants in the analysis and biostatistics of patient-oriented clinical research. Students will have the opportunity to learn to and, by the end of the course, be required to: (1) identify and summarize different categories of data; (2) set up and perform tests of hypotheses; (3) estimate sample sizes for survey and case-control studies; and (4) use statistical software packages to enter, summarize, graph, visualize, and analyze data.

TSCI 5073. Integrated Molecular Biology With Patient-Oriented Clinical Research. 1 Credit Hour.
This interdisciplinary course is designed to train participants on integrating molecular biology methods into patient-oriented clinical research. Students will have the opportunity to learn to: (1) appropriately use molecular terms in clinical investigation; (2) describe the events involved in protein synthesis; (3) describe the principles involved in molecular techniques (e.g., polymerase chain reactions, southern blots); (4) identify the appropriate specimens, collection, and handling requirements for each molecular technique; (5) identify and correct common sources of error in performing molecular techniques; (6) cite examples of clinical applications of molecular techniques in clinical medicine; and (7) apply molecular techniques in the laboratory to specific clinical problems.

TSCI 5074. Data Management, Quality Control And Regulatory Issues. 2 Credit Hours.
This interdisciplinary course is designed to train participants in the necessary data management and quality control procedures required for the conduct of patient-oriented clinical research. It consists of three segments: (1.) introduction to data management principles and standard practices; (2) development of the student's own mentored research; and (3) introduction to bioinformatics.

TSCI 5075. Scientific Communication. 2 Credit Hours.
This interdisciplinary course is designed to train participants to write effectively in all aspects of conducting patient-oriented clinical research. Students will have the opportunity to learn to and, by the end of the course, be required to: (1) recognize and avoid errors in grammar, punctuation, and usage that are common in scientific writing; (2) construct units of writing whose structure, style, and logical continuity allows instant and clear comprehension; (3) construct concise, informative titles; (4) develop clear, comprehensive, abstracts for papers and grant proposals; (5) construct complete, well-rationalized sets of specific aims for grant proposals; and (6) effectively apply the 4-Point Rule (What is the question? How did we approach it? What happened? What does it mean?) to all forms of scientific writing.

TSCI 5076. Applied Healthcare Informatics and Analytics. 2 Credit Hours.
This elective course is designed for students interested in applied healthcare informatics and analytics. This course will focus primarily on practical skills and knowledge for hands-on analytics applied to healthcare settings. Discussions of theory will be more limited and directed to a greater understanding required for practical application of the knowledge. The course will include traditional lectures as well as in-class and assigned database work using Microsoft Access, Excel, and Power BI. The course will include periodic short quizzes as well as a mid-term and final exam. Course participants will plan and evaluate a small healthcare analytics project for use in a healthcare system.

TSCI 5077. Translational Science Training (TST) Practicum. 1-3 Credit Hours.
This elective course provides an opportunity for participation in unique clinical and translational research activities that are highly individualized for each student on the basis of prior experience and research interests.

TSCI 5078. Introduction to Intellectual Property, Technology Transfer and Commercialization. 1 Credit Hour.
This elective course provides an in-depth overview of the essential components encompassed in the protection of intellectual property, patents, licensing, technology transfer, and product commercialization. Content is provided through a series of lectures, assigned readings, literature reviews, class presentations, and discussions with faculty.

TSCI 5079. Practicum in Intellectual Property, Technology Transfer and Commercialization. 0.5-1 Credit Hours.
This elective course provides an opportunity for participation in unique and translational research activities that focus on the processes involved in the protection of intellectual property and the transfer and commercialization of technology. Activities are highly individualized for each student on the basis of prior experience and research interests.

TSCI 5080. Integrating Molecular Biology with Patient-Oriented Clinical Research Practicum. 1 Credit Hour.
This is the required practicum to TSCI 5073. This practicum is designed to provide the opportunity for highly individualized research activities for integrating molecular biology methods into patient-oriented clinical research.

TSCI 5201. Statistical Principles of Machine Learning for Biomedical Data. 3 Credit Hours.
This class offers a hands-on approach to machine learning and data science. The class discusses the application of supervised and unsupervised techniques for machine learning including random forests, support vector machines, boosting, deep learning, K-means clustering and mixture models. The course focuses on real data application with open source implementations in Python and R. Prerequisites: Introductory-level course in probability and statistics; comfort with a programming language (R and/or Python) will be essential for completing the homework assignments; basic linear algebra and calculus are plus.

TSCI 5230. Analytical Programming for Biomedical Data Science. 3 Credit Hours.
This class offers a hands-on approach to data science programming for biomedical research. We will introduce R, Python, SQL, and the software tools that interoperate with them. We will also cover cross-cutting best practices for organizing one's work to facilitate collaboration, reproducibility, and portability. Students who already have data they want to analyze are encouraged to use it in their assignments.

TSCI 6001. Introduction To Translational Science. 1 Credit Hour.
This elective course provides an in-depth overview of the essential components encompassed by translational science. Content is provided through a series of lectures, assigned readings, literature reviews, class presentations, and discussions with faculty.

TSCI 6060. Patient-Oriented Clinical Research Methods-2. 2 Credit Hours.
This interdisciplinary course is the second in a two-semester sequence designed to train participants in the conduct of patient-oriented clinical research. Students will have the opportunity to learn to and, by the end of the course be required to: (1) define criteria for inferring causation from observational studies; (2) design strategies for subject retention in a prospective study; (3) design strategies for monitoring progress in a randomized control trial; (4) delineate strategies for minimizing bias in cohort studies and randomized control trials; (5) compare and contrast the uses, strengths, and weaknesses of different clinical trial designs; (6) read and interpret research reports of cohort studies and randomized control trials; and (7) describe the steps in conducting a meta-analysis. Prerequisites: TSCI 5071.

TSCI 6061. Patient-Oriented Clinical Research Biostatistics-2. 2 Credit Hours.
This interdisciplinary course is the second in a two-semester sequence designed to train participants in the biostatistical analysis and patient-oriented clinical research. Students will have the opportunity to learn to and, by the end of the course, be required to: (1) perform a two-way analysis of variance and explain the results; (2) perform survival analysis; (3) compare and contrast the purpose and characteristics of different forms of interventional trials; and (4) plan the sample size, analysis, and stopping rules of a randomized clinical trial. Prerequisites: TSCI 5072.

TSCI 6064. Grantsmanship and Peer Review. 1 Credit Hour.
The purpose of this elective course is to provide an overview of the peer review process for research proposals as well as the essential components of grant management. Lecture and assignment topics will include: (1) funding agencies, missions, deadlines, and instruction; (2) Institutional Grantsmanship Issues; (3) National Institutes of Health (NIH) Organization (Institutes, Councils, Centers, and Budgets); (4) NIH Awards and Study Sections; (5) process and communications with the NIH; (6) interpreting and responding to written critiques; (7) mock study section meeting; and (8) grantsmanship after funding.

TSCI 6065. Health Services Research. 2 Credit Hours.
This course focuses on concepts and methods used in research focusing on health care quality, utilization, access, and safety. The seminar will utilize skills-based learning, small group activities, and outside assignments. By the end of the course, candidates will be required to: (1) Articulate underlying core concepts; (2) Describe basic methods used in health services research; (3) Identify relevant databases and data sources for health services research; (4) Critically appraise and interpret published reports of health services research; (5) Discuss current issues in HSR; (6) Understand how to incorporate health services concepts, methods, or tools into current research. Prerequisites: TSCI 5071 and TSCI 6060.

TSCI 6066. Instrument Development And Validation. 1 Credit Hour.
This elective course introduces methods to develop and evaluate self-report measures. The seminar is built on classical test theory with a focus on the practice of creative surveys. Participants should be able to (1) estimate various forms of reliability; (2) demonstrate various forms of validity evidence; and (3) explain how statistical analyses may be used to inform the validation process.

TSCI 6067. Genomic Healthcare. 1 Credit Hour.
This course prepares students to integrate genomic and other omics technology into patient care and clinical research. It begins with an introduction to genomics and overview of omics technologies. Students will explore the different resources of genomic information and have opportunities to apply these resources to keep abreast of current knowledge in their health topic of interest including the ethical individual and societal challenges ahead. Genomics in cancers is an active area in personalized medicine, and this topic will be discussed by a local cancer genomics expert. The course will also provide an introduction and overview of current applications of gene therapeutics to a variety of disorders. By the end of the course, students will have a working knowledge of the human genome and the tools for integrating this information into clinical research as well as conveying it to patients.

TSCI 6068. Cross-Cultural Adaptation Of Research Instruments. 1 Credit Hour.
This elective course introduces students to the concept of cross-cultural equivalence of research instruments - a prerequisite for making valid comparisons across two or more ethnic groups - and the process of cross-cultural adaptation used to achieve this equivalence. Students will have the opportunity to learn the multiple steps necessary to successfully cross-culturally adapt research instruments and how to assure content, semantic, technical, conceptual, and criterion equivalence of individual items and scales. A number of instruments used in cross-cultural research will be reviewed and critiqued with regard to their cross-cultural equivalence.

TSCI 6069. Statistical Issues, Planning, And Analysis Of Contemporary Clinical Trials. 2 Credit Hours.
This elective course will serve as an in-depth survey of the various clinical trial designs, analysis, and regulatory issues. Students will learn to apply statistical principles in designing clinical trials to minimize risk to patients while maximizing generalizable discovery. Specific topics include Phase I-V studies, adaptive designs, longitudinal and survival studies. Students will learn to specify the primary outcome and to estimate the required sample size for common trial designs. Clinical trial design and analysis is often complicated by idiosyncrasies such as missing data, and the methodology for handling these will be covered. Prerequisites: TSCI 5072 and TSCI 6061.

TSCI 6070. Biostatistics Methods For Longitudinal Studies. 2 Credit Hours.
This elective course will discuss a broad range of statistical techniques for deriving statistical inference from longitudinal studies. Main topics include design of longitudinal studies (power analyses and sample size estimation), analyses of repeated measured outcomes (continuous and discrete), analyses of time to event outcomes, techniques to address challenges associated with missing data and confounding, and rigorous casual modeling approaches. Students will learn to identify feasible and efficient statistical design of longitudinal; studies and to conduct rigorous and robust statistical methods to analyze data arising from longitudinal studies. The goal is to develop students' biostatistical competencies in conducting high-quality longitudinal studies in medical research. Prerequisites: TSCI 5072 and TSCI 6061.

TSCI 6097. Research. 1-12 Credit Hours.
The Research Course is set up for the student to conduct their Mentored Research Project with their supervising professor. This time is to be spent directly working on the project and includes, but is not limited to, writing consent forms, collecting data, analyzing data, and preparing a manuscript. After MSCI-TS COGS approval of the research project, students take three semester credit hours of research during each semester of the Master of Science in Clinical Investigation and Translational Science Degree Program.

TSCI 6098. Thesis. 1-12 Credit Hours.
An MSCI-TS Program Program student is required to enroll in Thesis the semester they submit their manuscript for approval by the MSCI-TS COGS. The 1.0 semester credit hour is required to graduate from the MSCI-TS Program.

TSCI 6100. Practicum In IACUC Procedures. 1 Credit Hour.
This elective course presents an in-depth introduction to the institutional program that provides oversight and regular review of projects that involve the care and use of animals. This includes consideration of the operational procedures of the Institutional Animal Care and Use Committee (IACUC) of the UT Health Science Center at San Antonio. Course objectives are achieved through a combination of readings, monthly attendance at selected IACUC meetings, and discussions with faculty.

TSCI 6101. Topics In Translational Science. 1 Credit Hour.
This research seminar course is designed to introduce graduate students to the field of Translational Science and to members of academic, business, health, and scientific communities who are actively engaged in Translational Science. This course will also provide a forum for students to discuss their own Translational Science research.

TSCI 6102. Practicum In IRB Procedures. 1 Credit Hour.
This elective course presents an in-depth introduction to the institutional program that provides oversight and regular review of research projects that involve human subjects. This includes consideration of the operational procedures of the multiple Institution Review Boards (IRB) of the UT Health Science Center at San Antonio. Course objectives are achieved through a combination of readings, monthly attendance at selected IRB meetings, and discussions with faculty.

TSCI 6103. Selected Topics In Advanced Research Ethics. 1-3 Credit Hours.
This elective course provides an in-depth understanding of a selected topic in research ethics. Students work independently to develop a detailed literature review specific to an area of research and are required to prepare a manuscript describing the results. Regular meetings with the Course Director will review progress towards course goals.

TSCI 6104. Practicum in Health Equity. 1 Credit Hour.
This course provides an opportunity for participation in unique health equity activities that are highly individualized for each student based on prior experiences and research interests. Prerequisites: approval of Planned Activities Form. Open for Cross Enrollment on Space Available Basis.

TSCI 6105. Topics in Cancer Prevention. 1 Credit Hour.
This course address current topics in cancer prevention science through a series of didactic lectures and discussions with cancer prevention faculty. Topics span the continuum of cancer prevention from basic cancer epidemiology and carcinogenesis, to cancers of special relevance in South Texas and interventions. An exposure to prevention clinical trials and disparity research will also be presented. Consent of instructor is required for registration.

TSCI 6106. Practicum in Cancer Prevention Science. 0.5-1 Credit Hours.
This elective course provides an opportunity for participation in unique clinical and laboratory cancer prevention research activities that are highly individualized for each student on the basis of prior experience and research interests. Consent of the instructor is needed for registration.

TSCI 6201. Data Science Leadership in Healthcare. 1 Credit Hour.
This class offers a hands-on approach to data science operations in biomedical science. The class discusses the management of data science teams, collaboration within healthcare organizations, and the social and ethical responsibility of data scientists. The course focuses on real world applications.

TSCI 6202. Data Visualization and Building Applications. 2 Credit Hours.
This class offers a hands-on approach to data visualization for biomedical data science. The class uses R, Python and Javascript and the software tools that interoperate with them. Some cross-cutting best practices. The course focuses on real world applications. Prerequisites: Introductory-level courses in probability and statistics; comfort with a programming language will be helpful to completing the homework assignments.

TSCI 6203. Practicum in Biomedical Data Science. 1 Credit Hour.
This elective course provides an opportunity for participation in unique biomedical data science and translational research activities that are highly individualized for each student on the basis of prior experience and research interests.

TSCI 7099. Dissertation. 1-12 Credit Hours.
Preparation and writing of the Doctoral dissertation. Registration for at least two terms is required of Ph.D. candidates.