Boston University Metropolitan College

Biomedical Sciences and Health IT

CS570 A1/E1, Spring 2020
Course Format (On Campus/Blended)
School of Theology (STH) Rm B02B, 745 Commonwealth Avenue

Course description

This course is designed for IT professionals, and those training to be IT professionals, who are preparing for careers in healthcare-related IT (Health Informatics). This course provides a high-level introduction into basic concepts and terminologies of biomedicine and provide insights into the structure and organization of the American healthcare system and how it is intertwined with IT. The course introduces means to measure the "normal" human state, disease processes, diagnostic modalities, and treatments used to manage some common diseases together with the elements of medical terminology and human anatomy and physiology necessary to understand these processes.

In each session the students will first be introduced to biological function, pathology, laboratory medicine, diagnostic imaging and therapeutic interventions covering specific medical specialties. On this basis the students will gain an understanding as to the types of information being gathered and what is important to the clinical professionals. The second part of each module will consist of a case study examining how IT tools and resources help medical professionals integrate multiple sources of information to make diagnostic and therapeutic decisions. In particular, we will be examining how Artificial Intelligence (AI) approaches are impacting diagnosis and even influencing medical decision-making. Throughout the modules, the students will also be introduced to various aspects of American healthcare system and healthcare IT.

To reinforce the lecture and case study material, two guest lecturers will share their first-hand experience with students. For Spring 2020, the lecturers will be Prof. Joel Weissman, a specialist in Healthcare reform at Brigham & Women's Hospital and Harvard Medical School, and Dr. Jonathan Schoenfeld, a Radiation Oncologist at the Dana-Farber Cancer Institute and Associate Professor at Harvard Medical School, who is an expert in radiotherapy and diagnostic imaging. Student activities include participation in class lectures, assignments and discussions. Due to the nature of the material, student questions and participation are actively encouraged. Particular areas of interest may lead to student design of their own final exam report (see below).

This course has been designed in accordance with Master's Degree curriculum requirements within the Accreditation Standards for Health Informatics and Health Information Management educational programs.

All course material will be posted on the Spring 2020 CS570 Blackboard web site.

Boston University Metropolitan College

Course Director

Dr. Jonathan S. Duke-Cohan
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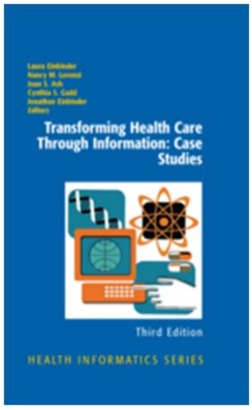
Office hours: by appointment

Required textbook



Einbinder L., Lorenzi N.M., Ash J, Gadd C.S., Einbinder J. (2010). Transforming Health Care Through Information: Case Studies. 3rd edition, Springer. (There is no need to buy this book – it is available electronically through BU library and relevant chapters will be posted to the Blackboard site as appropriate).

Course learning objectives

- Identify the medical parameters important contributing to the pathophysiology of human body systems
- Recognize common diagnostic methods, treatments, and medical procedures
- Understand medical decision making in the diagnosis and treatment of human organ system disease
- Predict the IT needs of healthcare providers as they diagnose and treat common diseases
- Describe IT systems needed to support modern diagnostic imaging and be introduced to the growing role of Artificial Intelligence
- Understand the transfer of information from various sources to the centralized electronic health record
- Learn the basic delivery, financial and legal aspects of the American healthcare system

Learning outcomes

By successfully completing this course you will:

- Develop familiarity with biomedical terminology
- Become familiar with the overall structure of American Health Care System
- Understand the roles and business of Health Informatics
- Know how to search for, identify, and download biomedical on-line material

Be able to advance your knowledge of Health Informatics by taking additional courses or through self-study.

Prerequisites

None

Class policies

1) **Attendance & Absences** – Full attendance and participation is expected. If there is a reason to miss a session, advanced notice through email should be sent to the lecturer.
2) **Assignment Completion & Late Work** – All assignments should be submitted on time. If there is a delay, the student must be in touch with the instructor. Late submissions without reasons will result in grade deduction.
3) **Academic Conduct Code** –Cheating and plagiarism will not be tolerated in any Metropolitan College course. They will result in no credit for the assignment or examination and may lead to disciplinary actions. Please take the time to review the Student Academic Conduct Code: http://www.bu.edu/met/metropolitan_college_people/student/resources/conduct/code

NOTE: [This should not be understood as a discouragement for discussing the material or your particular approach to a problem with other students in the class. On the contrary – you should share your thoughts, questions and solutions. Naturally, if you choose to work in a group, you will be expected to come up with more than one and highly original solutions rather than the same mistakes.]

Grading Criteria

- Assignments - This course will have 5 graded assignments.
- Final Examination – The final exam will be a research report based on a selection of Health Informatics topics from which the student may choose one or, in instances of special interest, be of the student's own design. The Course director will supply some initial references for each topic and the students will have time to read those references, gather other information and prepare a skeleton draft indicating the headings for sections and

the general direction of the report. The Course Director will then meet with each student individually to ensure a smooth path to the final report that will consist of 5-10 double-spaced pages with illustrations or tables as appropriate together with a source bibliography listing (1800-3600 words excluding bibliography).

The final grade for this course will be based on the following:

Deliverable	**Weight**
Assignments	45%
Participation	15%
Final Exam	40%

Study guide

Module 1 - Introduction to Biomedicine and the U.S. Healthcare System

- Lecture One: Introduction to Biomedical Science
- Lecture Two: Introduction to Laboratory Medicine

Learning Objectives:

- The human body is made of systems and systems are made of organs that are interdependent. This interdependency is very finely balanced and requires constant data sampling of its environment and numerous feedback mechanisms.
- How things go wrong— genotype and phenotype polymorphism, stem cells and differentiation, developmental problems, the effects of aging, infectious disease, and cancer.
- The basis of measuring what is wrong when things go wrong—laboratory medicine, data generation and imaging enabling arrival at a diagnosis.
- The basics of health informatics
- The basics of healthcare system and the structure of the U.S. healthcare system
- The problems of and future challenges to the U.S. healthcare system

Module 2 - How we are structured: the Muscular, Skeletal, Skin, and Digestive Systems

- Lecture Three: Muscular, Skeletal, and Integumentary Systems
- Lecture Four: The Digestive System

Learning Objectives:

- General understanding of the structural organization of the human body and the functionality of the digestive system.
- Exploration of diagnostic methods and imaging procedures to identify disorders.
- The role of IT in data and image analysis, transfer and presentation.
- The Health Insurance Portability and Accountability Act of 1996 (HIPAA)

Module 3 - Energy, Energy Distribution and Product Disposal: the Cardiovascular and Respiratory Systems

- Lecture Five: The Cardiovascular System
- Lecture Six: The Pulmonary System

Learning Objectives:

- Basic understanding of the structure, function and interdependency of the heart and the lung functions.
- Basic comprehension of the multiple cardiovascular and respiratory regulatory checkpoints and how aberrations in a single functionality can cascade to generate a complex pathology.
- Appreciation of imaging techniques and therapeutic options available for diagnosing and treatment of cardiovascular and respiratory problems.
- The role and limitation of paper records
- Some considerations when implementing an IT system to replace paper forms
- Basics of Health Information Systems

Module 4 - The Nervous System and Immunity

- Lecture Seven: The Nervous System
- Lecture Eight: The Immune System

Learning Objectives:

- Recognition and understanding of the basic structure and functionality of the nervous system.
- An understanding of the pathophysiology of the nervous system together with common diagnostic methods and treatments
- An understanding of the development of the various cells of the blood, their relation to immunity, and to the established lymphoid structures including the lymphatics, lymph nodes, spleen, tonsils and thymus. The integration of the immune system with the barriers to the outside world: the skin, gut and respiratory epithelial lining.
- An understanding of the immune response to infection
- An understanding of the pathophysiology of the immune system together with common diagnostic methods and treatments
- Basic understanding of patient-facing software applications, such as personal health record

Module 5 - Renal, Urinary and Reproductive Systems, and Cancer

- Lecture Nine: The Renal, Urinary, and Reproductive Systems
- Lecture Ten: Cancer

Learning Objectives:

- The structure, function and basic physiology of the renal, urinary, and reproductive systems
- The means to measure and image function in these systems
- Therapies available and possible medical interventions
- How tumors arise: disposition and multi-step insults to the cell
- Common diagnostic methods, treatments, and procedures associated with these disorders
- Imaging techniques to aid differentiation of normal tissue from neoplastic tissue
- Adverse drug reactions and adverse drug events

Module 6 - The Endocrine System

- Lecture Eleven: The Endocrine System in control of reproduction and development
- Lecture Twelve: The Endocrine System in control of normal physiology

Learning Objectives:

- Recognition of the fundamental importance of endocrine messaging to every stage of human development, subsequent homeostasis and reproduction.
- An appreciation of cascading errors of varying severity depending upon the level at which an endocrine pathway is disturbed.
- Diagnostic assays to assess endocrine malfunctions; integration of physical changes and biochemical parameters to conclude a differential diagnosis
- Therapeutic options and measures of success

Textbook Reading (Alcamo and Krumhardt, 2010)

- Chapter 7: The Endocrine System;
- Chapter 11: The Reproductive Organs;
- Chapter 12: Reproduction, Development and Birth

Recommended Reading:

- Chapter 9 A selective history of EHR technology (Trotter and Uhlman, 2011)

Course Timetable Summary

a. **The course will consist of 14 lectures, 12 Health Informatics/AI case studies integrated with 5 assignments and one HI-related Research Report in lieu of a final exam.**

b. Note that for the days with tinted background below, students registered for the blended format are expected to be present on campus.

Date	Lecture	Case Study/Assignments/Activities
January 21 2020	01. Introduction to Biomedical Science	HI Case Study 1; *Assignment 1; Assignment 2*
January 28 2020	02. Introduction to Laboratory Medicine	HI Case Study 2; *Assignment 1 due*
February 4 2020	03. Muscular, Skeletal, and Integumentary Systems	HI Case Study 3; *Assignment 2 due*
February 11 2020	04. The Digestive System	HI Case Study 4; *Assignment 3*
February 25 2020	Guest Lecture A	Lecture 05. The Cardiovascular System
March 3 2020	06. The Respiratory System	HI Case Study 5; *Assignment 3 due; Assignment 4*
March 17 2020	07. The Nervous System	HI Case study 6; **Topic selection for final exam**
March 24 2020	Guest Lecture B	HI Case study 7; *Assignment 4 due*; *Assignment 5*
March 31 2020	08. The Immune System	HI Case study 8; *Assignment 5* due
April 7 2020	09. The Renal, Urinary, and Reproductive Systems	HI Case study 9; **Skeleton report due**;
April 14 2020	10. Cancer	HI Case study 10; *Final exam consultation*
April 21 2020	11. The Endocrine System in control of reproduction and development	HI Case study 11; *Final exam consultation*
April 28 2020	12. The Endocrine System in control of normal physiology	HI Case study 12/Course Discussion; **Final Exam Report due by May 2 2020**

Instructor biography

Dr. Jonathan Duke-Cohan is a Principal Research Scientist at the Dana-Farber Cancer Institute and Principal Associate in Medicine at Harvard Medical School, a permanent Visiting Professor at the 1st Faculty of Medicine of the Charles University in Prague, Czech Republic and long-term Visiting Faculty in the Department of Pharmaceutical Sciences at the University of Antwerp, Belgium. After receiving his B.Sc. from the University of London, UK, and his Ph.D. from the Institute of Cancer Research of the University of London, he spent a brief period at the Ontario Cancer Institute in Toronto, following which he became junior faculty in the Department of Immunology of the

Hebrew University-Hadassah Hospital in Jerusalem, Israel. At the Dana-Farber/Harvard for more than 30 years, his research focuses upon the molecular interactions that control development and function of the human immune system. For several years, he undertook teaching of physiology and molecular/cell biology to the 1st year students at Harvard Medical School. In addition, he holds a postgraduate qualification in Software Engineering (with a focus on logic, cryptology and algorithmic analysis) from Harvard University.

Instructor Web pages:
https://www.bu.edu/csmet/profile/jonathan-s-duke-cohan/
https://www.dana-farber.org/find-a-doctor/jonathan-duke-cohan/
https://www.dfhcc.harvard.edu/insider/member-detail/member/jonathan-s-duke-cohan-phd/

Boston University Library guide

As Boston University students you have full access to the BU Library—even if you do not live in Boston. From any computer, you can gain access to anything at the library that is electronically formatted. To connect to the library use the link http://www.bu.edu/library. You may use the library's content whether you are connected through your online course or not, by confirming your status as a BU community member using your Kerberos password.

Once in the library system, you can use the links under “Resources” and “Collections” to find databases, eJournals, and eBooks, as well as search the library by subject. Go to http://www.bu.edu/library/research/collections to access eBooks and eJournals directly. If you have questions about library resources, go to http://www.bu.edu/library/help/ask-a-librarian to email the library or use the live chat feature.

To locate course eReserves, go to http://www.bu.edu/library/services/reserves.

Please note that you are not to post attachments of the required or other readings in the water cooler or other areas of the course, as it is an infringement on copyright laws and department policy. All students have access to the library system and will need to develop research skills that include how to find articles through library systems and databases.