

Biomedical Sciences and Health IT

CS570D1/EL

Course Format (On Campus/Blended)

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 medical terminology, human anatomy and physiology, disease processes, diagnostic modalities, and treatments used to manage some common diseases. IT case studies demonstrate the key roles of health informatics and how IT tools and resources help medical professionals integrate multiple sources of information to make diagnostic and therapeutic decisions.

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 demonstrating the overlap of biology, medicine, and health informatics. 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, we anticipate inviting two guest lecturers to share their first-hand experience with students. For Spring 2016, we anticipate the lecturers to be Prof. Joel Weissman, a specialist in Healthcare reform at Brigham & Women's Hospital, and Dr. Jonathan Schoenfeld, a Radiation Oncologist at the Dana-Farber Cancer Institute and expert in diagnostic imaging. Student activities include participation in class lectures, assignments, discussions, graded quizzes, and exercises (self-assessment, not graded).

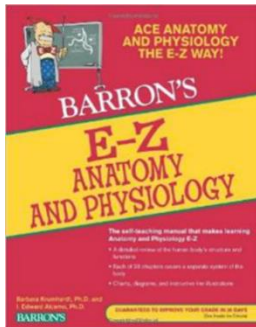
This course has been designed in accordance with Master's Degree curriculum requirements within the Accreditation Standards for Health Informatics and Health Information Management educational programs.

Teaching Team

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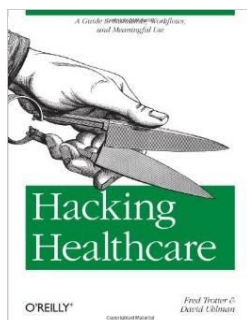
Required textbook



Edward Alcamo, Barbara Krumhardt. (2010) E-Z Anatomy and Physiology (Barron's E-Z Series). Barron's Educational Series; 3rd edition. ISBN-13: 978-0764144684. This textbook can be purchased from [Barnes & Noble at Boston University](#).

This book can also be downloaded from Amazon as a Kindle e-book. This e-book is recommended only if you have the Amazon Kindle Fire, the iPad running the Kindle App, or notebook PC or Mac running the Kindle application. Due to the color illustrations, this download is not recommended for monochrome tablets/e-readers. **Note that E-books are not allowed in the final exam, only paper books and lecture notes are permitted.**

Recommended textbooks



Trotter, F. and Uhlman, D. (2011). Hacking healthcare: A guide to standards, workflows, and meaningful use. O'Reilly Media. ISBN 9781449305024. This textbook can be purchased from Barnes & Noble at Boston University.



Jane Rice. (2014) Medical Terminology for Health Care Professionals. 8th Edition. Prentice Hall. ISBN 978-0133429541. This textbook can be purchased from Barnes & Noble at Boston University.



Einbinder L, Lorenzi NM, Ash J, Gadd CS, Einbinder J. (2010). Transforming Health Care Through Information: Case Studies. 3rd edition, Springer. (Available electronically through BU library).

Course learning objectives

- Identify the anatomy, physiology as related to 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
- 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.html.

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

- Quizzes - This course will have 4 to 5 graded quizzes.
- Assignments - This course will have 4 to 5 graded assignments.
- Discussions – There are 5 graded discussion forums that involve posting and reviewing the answers to the discussion topics.
- Class Project – The class project will test students' overall understanding and grasp of the course content.
- Final Examination – The final exam will be comprehensive and will cover material from the entire course. It will be an open-book proctored exam consisting of questions similar to the ones in the assignments and the class project. In the open-book final exam, only paper books and lecture notes are allowed. *E-books are not allowed in the final exam.*

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

Deliverable Weight

Quizzes 25%

Assignments 30%

Participation 10%

Final Exam 35%

Study guide

(Note that there may be slight modifications to the dates below dependent upon the schedule for the guest lectures).

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

Recommended Reading:

- Chapter 2 An anatomy of medical practice (Trotter and Uhlman, 2011)

Activities:

- Discussion 1 postings end Thursday February 4th at 6:00 PM
- Assignment 1 due Thursday February 4th at 6:00 PM
- Graded Quiz 1 due Thursday February 4th at 6:00 PM

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)

Textbook Reading (Alcamo and Krumhardt, 2010)

- Chapter 5: The Integumentary System
- Chapter 6: Bones and Joints
- Chapter 7: The Skeletal System
- Chapter 8: Muscle Tissues
- Chapter 9: The Muscles
- Chapter 18: The Digestive System
- Chapter 19: Metabolism and Nutrition

Recommended Reading:

- Chapter 1 Introduction (Trotter and Uhlman, 2011)
- Chapter 12 HIPAA: the far-reaching healthcare regulation (Trotter and Uhlman, 2011)

Activities:

- Discussion 2 postings end Thursday February 18th at 6:00 PM
- Assignment 2 due Thursday February 18th at 6:00 PM
- Graded Quiz 2 due Thursday February 18th at 6:00 PM

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

Textbook Reading (Alcamo and Krumhardt, 2010)

- Chapter 15: The Cardiovascular System
- Chapter 17: The Respiratory System

Recommended Reading:

- Chapter 4: The bandwidth of paper (Trotter and Uhlman, 2011)

Activities:

- Discussion 3 postings end Thursday March 3rd at 6:00 PM
- Assignment 3 due Thursday March 3rd at 6:00 PM
- Graded Quiz 3 due Thursday March 3rd at 6:00 PM

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

Textbook Reading (Alcamo and Krumhardt, 2010)

- Chapter 10: Nervous Tissue
- Chapter 11: Nervous system Organization
- Chapter 12: The Special Senses

- Chapter 14: The Blood
- Chapter 16: The Lymphatic and Immune Systems

Recommended Reading:

- Chapter 6 Patient-facing software (Trotter and Uhlman, 2011)

Activities:

- Discussion 4 postings end Thursday March 24th at 6:00 PM
- Assignment 4 due Thursday March 24th at 6:00 PM
- Graded Quiz 4 due Thursday March 24th at 6:00 PM

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

Textbook Reading (Alcamo and Krumhardt, 2010)

- Chapter 20: The Urinary System
- Chapter 21: Fluid, Electrolyte, and Acid/Base Balance

Recommended Reading:

- Chapter 7 Human Errors (Trotter and Uhlman, 2011)

Activities:

- Discussion 5 postings end Thursday April 7th at 6:00 PM
- Assignment 5 due Thursday April 7th at 6:00 PM
- Graded Quiz 5 due Thursday April 7th at 6:00 PM

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)

Instructor biographies

Dr. Jonathan Duke-Cohan is a Principal Associate in Medicine at Harvard Medical School and the Dana-Farber Cancer Institute and is a Visiting Professor at the 1st Faculty of Medicine of the Charles University in Prague, Czech Republic. 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 25 years, his research focuses upon the molecular interactions that control development and function of the human immune system. For several years, he also 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 cryptology, logic and algorithmic analysis) from Harvard University.



Prof. Guanglan Zhang holds Masters degrees in Biomedical Engineering (M.Eng., Nanyang Technological University, Singapore) and Automatic Control Theory and Application (M.Eng., Northwestern Polytechnic University, China). She received a Ph.D. (Nanyang Technological University, Singapore) for doctoral work in bioinformatics. She is an Assistant Professor in Computer Science at Boston University Metropolitan College, where she teaches Health Informatics subjects and is a member of the Health Informatics

Laboratory.

Dr. Zhang has worked in the biomedical informatics field since 1998. The most important aspects of her work include development and implementation of biomedical databases, computational simulations of laboratory experiments, development of diagnostic methods for tissue typing, and computational support for vaccine development. Computational tools that she developed are used in the study of immunology, vaccinology, infectious disease, and cancer. She has authored more than 40 peer-reviewed scientific journal publications and developed dozens of biomedical specialist databases and computational systems.

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.