

Purdue University CHE 59700: Analytical Approach to Healthcare Delivery (Spring 2019)

A. Instructor. William R. Clark, M.D.

B. Course Description. Engineers are integral to medicine in numerous ways and a significant number of engineering graduates enter the healthcare workforce to make important contributions. However, engineers may have limited insights into the dynamics of healthcare delivery, a better understanding of which could enhance further the role that engineers play. This course provides a “real world” overview of healthcare delivery in the United States (US). The topics initially covered include the major medical product segments, regulatory framework, and financial considerations, including costs, health insurance, and reimbursement. Following a focused review of relevant physiology and pathophysiology, a series of critical medical conditions having the highest impact on the US healthcare system are discussed. The final aspect of the course is a team project, in which an engineering solution is proposed to address an unmet clinical need for one of major conditions discussed.

C. Course requirements. The course is open to all students enrolled in the Graduate School. The prerequisite/corequisite is BIOL 23000 (or BCHM 30700) or permission from the instructor.

D. Recommended (NOT REQUIRED) Texts.

1. *Guyton and Hall Textbook of Medical Physiology*, Edited by John E. Hall, Elsevier, 2016, 13th ed, ISBN: 978-1-4557-7005-2
2. *Crowley's An Introduction to Human Disease: Pathology and Pathophysiology Correlations*, Edited by Emily Reisner, Howard Reisner, Jones and Bartlett Learning, 2017, 10th ed, ISBN 978-1284050233
3. *Health Care Delivery in the United States*, Edited by James R. Knickman, Anthony Kovner, Springer, 2015, 11th ed, ISBN: 978-0826125279

E. Course Learning Objectives. The overall objective of this course is to provide students a detailed overview of the US healthcare system, with emphasis on the important role of engineers. The course is structured in three parts:

- **Overview of healthcare industry.** Describe the different environments in which patients receive care (hospital, outpatient, home); understand US health economics by identifying the major cost drivers in the system, including hospital care and physician costs along with drugs and other medical products; develop a basic understanding of the sources of health insurance coverage in the US, including the differences between government-based (Medicare/Medicaid) and commercial payers; characterize the major segments of medical products (pharmaceutical/biotechnology compounds, medical devices/diagnostics, and consumer products) along with the regulatory framework applying to each of these segments (especially in relation to the approval pathways for new products); describe the different approaches used to reimburse medical manufacturers for use of their products; delineate the major components of both pharmaceutical and medical device companies, in particular those functions for which engineers play an important role (research and development, manufacturing, regulatory affairs, sustaining engineering, and intellectual property).
- **Highest-impact clinical conditions.** After a focused physiology/pathophysiology review, understand the impact of the following conditions, not only from a clinical perspective but also a resource utilization (cost) perspective: coronary artery disease, heart failure, diabetes, cancer, obesity, Alzheimer’s disease, chronic kidney disease, stroke, arthritis, sepsis, and acute kidney injury; characterize the clinical characteristics along with the causes, demographics, and current treatment of each of these disorders.
- **Addressing unmet clinical needs.** For one of the above disorders or another disease, develop an understanding of an unmet clinical need and propose an engineering-based solution addressing that need.

F. Instructor’s Commitment. Your instructor will: 1) be courteous, punctual, well-organized, and prepared for lecture and other class activities; 2) answer questions clearly in class or arrange for detailed discussions out of class if in-class answers are not suitably clear; 3) be available during office hours or notify you beforehand if I am unable

to keep them; 4) provide a suitable guest lecturer when I am traveling; and 5) grade uniformly and consistently to the posted guidelines.

- G. Consulting with the Instructor.** I encourage you to discuss academic or personal questions with me during my office hours or via email. These discussions need not be limited to ChE 49700 content.
- H. Academic Dishonesty.** Academic dishonesty *will not be tolerated* in any form in this course. Specifically, Purdue prohibits “dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty.” [Section B-2-a, Code of Student Conduct] Furthermore, the University Senate has stipulated that “the commitment of acts of cheating, lying, and deceit in any of their diverse forms (such as the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest.” [University Senate Document 72-18, December 15, 1972] All incidents of academic dishonesty will be reported to the Dean of Students. **Such incidents include: i) possessing or accessing, in hardcopy or electronic form, the solution manual to the course text, or to the exams, ii) claiming credit for work that is not your own original work, and iii) enabling other students to create work that is not their original work. The punishment for the first offense is a grade of zero for the entire work (exam or homework), and the punishment for a second offense is an F mark for the class.**
- I. Conduct.** University policy states that it is the responsibility of all students to attend all class sessions (http://www.purdue.edu/studentregulations/regulations_procedures/classes.html). Each student is expected to come to class on time and not disrupt the class. Each student is also expected to follow Purdue’s codes of student conduct (http://www.purdue.edu/studentregulations/student_conduct/regulations.html) and behave in a professional manner. The rights of students in violation of the code of conduct are outlined. Each student is expected to exhibit consideration and respect towards the other students, the graders, the teaching assistants (TAs), and the faculty member. Each student is expected to exhibit a positive attitude. Your conduct will be a factor in awarding grades to students between two letter grades. Purdue University’s student conduct policy specifically addresses academic dishonesty.
- J. Violent Behavior Policy.** Purdue University is committed to providing a safe and secure campus environment for members of the University community. Purdue strives to create an educational environment for students and a work environment for employees that promote educational and career goals. Violent behavior impedes such goals. Therefore, violent behavior is prohibited in or on any University Facility or while participating in any University activity.
- K. Nondiscrimination.** Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. Purdue University prohibits discrimination against any member of the University community on the basis of race, religion, color, sex, age, national origin or ancestry, genetic information, marital status, parental status, sexual orientation, gender identity and expression, disability, or status as a veteran. The University will conduct its programs, services and activities consistent with applicable federal, state and local laws, regulations and orders and in conformance with the procedures and limitations as set forth in Executive Memorandum No. D-1, which provides specific contractual rights and remedies. Any student who believes they have been discriminated against may visit www.purdue.edu/report-hate to submit a complaint to the Office of Institutional Equity. Information may be reported anonymously.
- L. Attendance.** University policy states that it is the responsibility of all students to attend all class sessions (http://www.purdue.edu/studentregulations/regulations_procedures/classes.html). You are expected to attend all lectures and recitation periods.
- M. Illness.** If a student becomes sick with flu-like symptoms, he/she should seek prompt medical attention, and then not come back to class until he/she has been symptom-free for more than 24 hours. A note from P.U.S.H., or another

trained medical professional, is required to document illness. Materials will be made available electronically to assist any students who are ill, and reasonable accommodations will be made on an individual basis to ensure that all students have the opportunity to learn. In the event of a severe outbreak of illness at Purdue that mandates class not meet, all attempts will be made to deliver the course online through Blackboard.

N. Bereavement Policy. Purdue recognizes that a time of bereavement is very difficult for a student. The University therefore provides rights to students facing the loss of a family member through the Grief Absence Policy for Students (GAPS): <http://www.purdue.edu/odos/services/griefabsencepolicyforstudents.php>. Students who find themselves in need of assistance in a time of bereavement should contact Professor Clark privately to discuss specific needs.

O. Individual Learning and Testing Needs. Any student who feels he/she may need an accommodation with any aspect of the course based on a personal circumstance should contact Professor Clark privately to discuss his/her specific needs. If you are a student with any form of individual learning needs, please speak with the faculty instructors whether or not you seek an accommodation so that we are aware of your circumstance and can deliver course content in a manner that is most compatible with your situation.

P. Emergency Preparedness. Purdue University is a very safe campus and there is a low probability that a serious incident will occur here at Purdue. However, it is important to emphasize the emergency procedures for evacuation and shelter-in-place incidents. Preparedness will be critical if an unexpected event is to occur. Emergency preparedness is your personal responsibility. Purdue University is actively preparing for natural disasters or human-caused incidents with the ultimate goal of maintaining a safe and secure campus. The following is a review of the emergency procedures at Purdue University.

1. For any emergency call 911.
2. There are nearly 300 Emergency Telephone Systems throughout campus that connect directly to the Purdue Police Department (PUPD). If you feel threatened or need help, push the button and you will be connected to the PUPD.
3. If there is a fire alarm, we will immediately evacuate the building and proceed to in front of the MSEE building. Do not use the elevator.
4. If there is a Shelter-in-Place requirement for a tornado warning, we will shelter in the lowest level of this building away from windows and doors. This location is between FRNY G140 and FRNY B124.
5. If there is a Shelter-in-Place requirement for a hazardous materials release, we will shelter in the classroom shutting any open doors and windows.
6. If there is a Shelter-in-Place requirement for a civil disturbance, we will shelter in a room that is securable preferably without windows. This location is FRNY 2182.

Q. Campus Emergencies. In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructors' control. **Here are ways to get information about changes in this course. You are expected to check your @purdue.edu email address frequently.**

R. Use of Copyrighted Material. Among the materials that may be protected by copyright law are the lectures, notes, and other material presented in class or as part of the course. Always assume the materials presented by an instructor are protected by copyright unless the instructor has stated otherwise. Students enrolled in, and authorized visitors to, Purdue University courses are permitted to take notes, which they may use for individual/group study or for other non-commercial purposes reasonably arising from enrollment in the course or the University generally.

Notes taken in class are, however, generally considered to be "derivative works" of the instructor's presentations and materials, and they are thus subject to the instructor's copyright in such presentations and materials. No individual is permitted to sell or otherwise barter notes, either to other students or to any commercial concern, for a course without the express written permission of the course instructor. To obtain permission to sell or barter notes, the individual wishing to sell or barter the notes must be registered in the course or must be an approved visitor to

the class. Course instructors may choose to grant or not grant such permission at their own discretion and may require a review of the notes prior to their being sold or bartered. If they do grant such permission, they may revoke it at any time, if they so choose.

S. Course Meeting Schedule.

Lectures:	Tuesday and Thursday	Noon – 1:15 PM
Presentation 1:	03/26 (Tuesday)	Noon – 1:15 PM
Presentation 2:	04/23 (Tuesday)	Noon – 1:15 PM
Final Report due:	04/26 (Friday)	5:00p

At the approximate mid-point of the semester, students will assemble into groups of four and choose a high-impact clinical condition to study. Each group will provide two progress updates (Presentations 1 and 2) during the course of the semester in lieu of formal examinations. A complete written summary of each group's assessment (Final Report) will be due at semester's end in lieu of a final examination.

Last Day To Withdraw From a Course With a W or WF Grade: Friday, March 8

No Class:	03/12 (Tuesday)	Spring Break
	03/14 (Thursday)	Spring Break

T. Instructor Contact Information.

Professor William R. Clark – Email: clarkw@purdue.edu, Telephone: (765) 496-8647 (office); (317) 691-1438 (cell)

Office: FRNY 2158

Office Hours: TTh 10:00 – 11:00 AM (or by appointment)

U. Assessment of Course Outcomes. A weighted average grade will be calculated as follows.

Homework assignments (2): 20% of total

Presentations (2): 40% total

Final report: 40% of total

The grading scale will be as follows.

A: 100 – 85% of the weighted points

B: 84.9 – 75% of the weighted points

C: 74.9 – 65% of the weighted points

D: 64.9 – 55% of the weighted points

F: Less than 55% of the weighted points

Note that students with grades within 3 weighted percentage points of either the upper or lower bounds of a grade range listed above will receive a “plus” or “minus” mark, respectively, after his/her score (*e.g.*, scores between 75% and 78% of the total weighted points would earn an B–). Marks of an A– will not be given.

Group projects

Student groups may assess a high-impact clinical condition from the list of those discussed in class or another one (with instructor approval). In either case, each group should plan to meet with Professor Clark before beginning work on the project to set expectations. The assessment will include the clinical characteristics of the disorder along with its causes, demographics, and current treatment – these topics will be presented in Presentation 1. With Professor Clark or another engineering faculty member serving as a mentor, an unmet clinical need for the disorder will be identified along with an engineering-based solution for the problem – these considerations will be the focus of Presentation 2. For a particular disorder, the engineering approach can have a direct clinical effect (*e.g.*, improved medical device treatment) or indirect clinical effect (*e.g.*, novel manufacturing approach for pharmaceuticals).