

# FOUNDATIONS OF BIOMEDICAL INFORMATICS

GMS6850

3 CREDIT HOURS

FALL 2015

*The notion that information is enough, that more and more information is enough, that you don't have to think, you just have to get more information - gets very dangerous.*

- Edward de Bono

LOCATION: HPNP

MEETING TIMES: M/W 3:30-5:00 PM

**INSTRUCTOR:** *William Hogan, MD, MS*

*Office:* 3241 Clinical and Translational Research Building

*Email:* hoganwr@ufl.edu

*Phone:* 294-4197

**OFFICE HOURS:** *By appointment*

**COURSE COMMUNICATIONS:** Students may email the instructor with questions, but are encouraged to consider whether their questions are of general interest to the entire class. Dedicated class time will be devoted to discussing and answering general questions about either course content or course mechanics that are relevant to all students.

**REQUIRED TEXTS:**

1. Shortliffe EH, Cimino JJ, eds. Biomedical Informatics – Computer Applications in Health Care and Biomedicine. 4<sup>th</sup> ed. Springer. ISBN 978-1-4471-4474-8.
2. Smith B, Vizenor L, Ceusters W. Human action in the healthcare domain: A critical analysis of HL7's Reference Information Model. In Svennerlind C, Almäng J, Ingthorsson R, eds. Johanssonian Investigations. Essays in Honour of Ingvar Johansson on His Seventieth Birthday, Frankfurt: Ontos Verlag. 2013, 554-573. Available at: <http://ontology.buffalo.edu/12/HL7-and-BFO.pdf> (although this link still works for me, too <http://ontology.buffalo.edu/HL7/RIM-2013.pdf>)
3. Articles to be made available through Ares/e-reserve:

- a. Goodman K, Berner ES, Dente MA, et al. Challenges in ethics, safety, best practices, and oversight regarding HIT vendors, their customers, and patients: A report of an AMIA special task force. *Journal of the American Medical Informatics Association*, 2011;18:77-81. Available at: <http://jamia.bmj.com/content/18/1/77.full>
- b. Kulikowski CA, Shortliffe EH, Currie LM, et al. AMIA Board white paper: definition of biomedical informatics and specification of core competencies for graduate education in the discipline. *Journal of the American Medical Informatics Association*, 2012;19:931-938. Available at: <http://jamia.bmj.com/content/19/6/931.full>
- c. Bloomrosen M, Starren J, Lorenzi NM, et al. Anticipating and addressing the unintended consequences of health IT and policy: A report from the AMIA 2009 Health Policy Meeting. *Journal of the American Medical Informatics Association*, 2011;18:82-90. Available at: <http://jamia.bmj.com/content/18/1/82.full>
- d. Karsh B, Weinger MB, Abbot PA, Wears RL. Health information technology: Fallacies and sober realities. *Journal of the American Medical Informatics Association*, 2010;17:617-623. Available at: <http://jamia.bmj.com/content/17/6/617.full>
- e. Smith SW, Koppel R. Healthcare information technology's relativity problems: a typology of how patients' physical reality, clinicians' mental models, and healthcare information technology differ. *Journal of the American Medical Informatics Association*, 2014;21:117-131. Available at: <http://jamia.bmj.com/content/21/1/117.full>
- f. Ross Koppel, Christoph U Lehmann. Implications of an emerging EHR monoculture for hospitals and healthcare systems. *Journal of the American Medical Informatics Association*, 2015;22:465-471. Available at: <http://jamia.oxfordjournals.org/content/22/2/465.abstract?etoc>

#### **ADDITIONAL RESOURCES:**

For more on ontology:

1. The "Bat Video", an introduction on how to develop ontologies, available at: <http://stream.buffalo.edu/shared/research/phismith/Stanford10-25-06/Tutorial.WMV>

2. Smith B. From concepts to clinical reality: An essay on the benchmarking of biomedical terminologies. *Journal of Biomedical Informatics*, 2006;39:288-298. Available at: <http://www.sciencedirect.com/science/article/pii/S1532046405001036>
3. Smith B. Ontology. In Floridi L, ed. *Blackwell Guide to the Philosophy of Computing and Information*, Oxford: Blackwell, 2003, 155–166. Available at: [http://ontology.buffalo.edu/smith/articles/ontology\\_pic.pdf](http://ontology.buffalo.edu/smith/articles/ontology_pic.pdf)

Others:

1. Komaroff AL. The variability and inaccuracy of medical data. *Proceedings of the IEEE*, 1979;67(9):1196-1207. *Despite its age, it nevertheless presents issues with biomedical data that are pervasive still today.*
2. Harrison MI, Koppel R, and Bar-Lev S. Unintended Consequences of Information Technologies in Health Care—An Interactive Sociotechnical Analysis. *Journal of the American Medical Informatics Association*, 2007;14:542-549.
3. McDonald CJ. Protocol-based computer reminders, the quality of care, and the non-perfectability of man. *New England Journal of Medicine*, 1976;295(24):1351-1355.

**COURSE DESCRIPTION:** *Biomedical informatics is the science of information as studied in or applied to biomedicine.* Its scope therefore is information in patient care, public health, biomedical research, and health sciences education. This course will cover foundational issues such as the nature of information, how biomedical information is unique, the purposes for which biomedical information is created and used, the methods of analysis and inference on biomedical information, and the ethical and privacy issues involved. A survey of various kinds of information systems and software in biomedicine and issues in their implementation and use will follow, including but not limited to electronic health records, software for analysis of genomic/genetic data, and public health surveillance systems.

**PURPOSE OF COURSE:** The purpose of this course is to introduce students to the field of biomedical informatics and give them sufficient knowledge and skills in the discipline to (1) improve how they approach issues of information capture, management, and use in their careers, (2) understand and assess the biomedical informatics literature, (3) critically evaluate the reasonableness of proposed information system projects, and (4) pursue an academic degree in biomedical informatics if so desired.

**COURSE GOALS AND/OR OBJECTIVES:** By the end of this course, students will be able to:

1. Explain the fundamental nature of information and the implications for information capture and processing

2. Understand the unique issues that pertain to biomedical information vs. other types of information in health care, research, and education
3. Distinguish between ontology vs. epistemology, and data vs. what data are about
4. Read the biomedical informatics literature and understand key terms, descriptions, methods, results, and their implications
5. Engage organizational leadership, information technology professionals, subject matter experts, and other key stakeholders in decision making around and implementation of information systems in their future careers
6. Describe current trends and problems in the field of biomedical informatics
7. Articulate the human, organizational, social, and societal impacts of information and information systems and their significance

**TEACHING PHILOSOPHY:** I am the facilitator of a learning process where we all have things to teach and learn. Hopefully, you will learn a great quantity more than I do, but I will be disappointed if I do not learn at all and you do not teach at all. Therefore, questions, discussions, interactions, challenges, investigation, examination, and so on are the order of the day, and take precedence over didactics.

## COURSE POLICIES:

**ATTENDANCE POLICY:** Class attendance is mandatory. Excused absences follow the criteria of the UF Graduate Catalogue (e.g., illness, serious family emergency, military obligations, religious holidays), and should be communicated to the instructor prior to the missed class day when possible. UF rules require attendance during the first two course sessions. Missing more than three scheduled sessions will result in a failure. Regardless of attendance, students are responsible for all material presented in class and meeting the scheduled due dates for class assignments. Finally, students should read the assigned readings prior to the class meetings, and be prepared to discuss the material for each session.

**QUIZ/EXAM POLICY:** The midterm exam is a take-home exam. Students are forbidden to collaborate or consult with one another on this exam. Students must of course follow the University Policy on Academic Misconduct, which includes but is not limited to prohibition of plagiarism. Exams are due by the beginning of the scheduled class period listed in the course schedule below.

**MAKE-UP POLICY:** Students are allowed to make up work only as the result of illness or other unanticipated circumstances. In the event of such emergency, documentation will be required

in conformance with University policy. Work missed for any other reason will earn a grade of zero.

**TERM PAPER POLICY:** The final project for this course is a term paper. It is due by the end of the last class period during exam week. As with the midterm exam, students are forbidden to collaborate or consult with one another on this paper. I will use a plagiarism checker approved by the University to help determine that the work is your own.

Note: Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found in the online catalog at: <http://gradcatalog.ufl.edu/content.php?catoid=5&navoid=1054>.

## UF POLICIES:

**UNIVERSITY POLICY ON ACCOMMODATING STUDENTS WITH DISABILITIES:** Students requesting accommodation for disabilities must first register with the Dean of Students Office (<http://www.dso.ufl.edu/drc/>). The Dean of Students Office will provide documentation to the student who must then provide this documentation to the instructor when requesting accommodation. You must submit this documentation prior to submitting assignments or taking the quizzes or exams. Accommodations are not retroactive, therefore, students should contact the office as soon as possible in the term for which they are seeking accommodations.

**UNIVERSITY POLICY ON ACADEMIC MISCONDUCT:** Academic honesty and integrity are fundamental values of the University community. Students should be sure that they understand the UF Student Honor Code at <http://www.dso.ufl.edu/students.php>. You are expected and required to comply with the University's academic honesty policy (University of Florida Rules 6C1-4.017 Student Affairs: Academic Honesty Guidelines, available at <http://regulations.ufl.edu/chapter4/4017.pdf>). Cheating, plagiarism, and other forms of academic dishonesty will not be tolerated. Note that misrepresentation of the truth for academic gain (e.g., misrepresenting your personal circumstances to get special consideration) constitutes cheating under the University of Florida Academic Honesty Guidelines.

**NETIQUETTE: COMMUNICATION COURTESY:** All members of the class are expected to follow rules of common courtesy in all email messages, threaded discussions, and chats. The first instance of clearly rude and/or inappropriate behavior will result in a warning. The second instance will result in a deduction of five percentage points (20 points) from your overall grade. The third instance will result in a drop of a letter grade (A to B, A- to B-, and so on).

## GETTING HELP:

For issues with technical difficulties for E-learning in Sakai, please contact the UF Help Desk at:

- [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu)
- (352) 392-HELP - select option 2
- <https://lss.at.ufl.edu/help.shtml>

Any requests for make-ups due to technical issues MUST be accompanied by the ticket number received from LSS when the problem was reported to them. The ticket number will document the time and date of the problem. You MUST e-mail your instructor within 24 hours of the technical difficulty if you wish to request a make-up.

Other resources are available at <http://www.distance.ufl.edu/getting-help> for:

- Counseling and Wellness resources
- Disability resources
- Resources for handling student concerns and complaints
- Library Help Desk support

Should you have any complaints with your experience in this course please visit <http://www.distance.ufl.edu/student-complaints> to submit a complaint.

## GRADING POLICIES:

Note: I will follow all UF policies for assigning grade points as required in the UF Graduate Catalog at <http://gradcatalog.ufl.edu/content.php?catoid=5&navoid=1054#grades>.

I will base the student's grade on attendance/participation, a mid-term exam, and a term paper as follows:

Assignment	Points (percentage)
Class attendance and participation	120 points (30%)
Midterm exam	120 points (30%)
Term paper	160 points (40%)

## CLASS ATTENDANCE AND PARTICIPATION

The attendance policy is described above. In addition to reading the assigned material prior to class and being merely present for class, I also expect you to participate. I do not expect everyone to ask questions or make comments at every session, but I do expect that over the course of the semester, you are engaged with the material to the point where you are regularly bringing your questions, insights, experiences, etc. to class and sharing them with the group.

### **MIDTERM EXAM**

As described above, the midterm exam is a take-home exam and collaboration, consultation, etc. with other students and persons outside the classroom (including via email, listservs, Twitter, FaceBook, other online or social media, etc.) is forbidden. You are of course encouraged to consult and search for written, *existing* sources of information online. The goal of the midterm is to see if you are grasping enough of the core principles, knowledge, etc. of biomedical informatics to begin to apply them to particular scenarios.

Specifics for the midterm:

- The midterm exam will be distributed and discussed during class exactly one week prior to its due date.
- You must write your answers in a single document using an open-source word processor, MS Word, or Pages (or something else by permission).
- You must email me your completed exam as an attachment. Please use the following filename format: lastname\_2015\_spring\_midterm.doc.
- You may email me questions about the exam, which I will answer within 24 hours. I will send your question(s) and my response(s) to the entire class, so that everyone has the same information about my expectations.
- I will check for plagiarism. Please be sure you know how to quote and cite your sources, if any.

### **TERM PAPER INSTRUCTIONS:\***

The goal of the term paper is to increase your knowledge of a topic beyond what we cover in class. Pick a topic that you find interesting, research it in reputable sources, and write it up

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\* Note: I adapted these guidelines from a colleague at Oregon Health Sciences University, Dr. Bill Hersh.

clearly, coherently, and logically. You must include substantial (>75%) information that we did not cover in class. If you are writing about a topic that we are covering late in the semester, consult with me about what I will/will not be covering in class on the topic.

A key challenge with this assignment is choosing a topic that you can treat adequately, but not in excruciating detail, in 10-15 pages. Thus, “electronic health records” is too broad, and a research question that has been addressed by only one paper in the literature is too narrow.

To help you with the selection of your topic, you must submit a one page “topic description, rationale, and anticipated key points” assignment to be turned in 1-2 weeks after the break (see course schedule). For this assignment, list your topic, describe it in one paragraph with key points, and give me your rationale for choosing this topic (that is, what is it about this topic that interests you?). This assignment is not graded separately from the term paper itself, but I will deduct 15 points from the term paper grade if it is not turned in on time (or at all). I will give each student feedback within 2 weeks of receiving this assignment, leaving a minimum of 4 additional weeks to write the paper and turn it in before the deadline (but you may certainly start writing at any time and adjust it later based on my feedback).

You will need to spend a significant amount of time (approx. 5-10 hours expected) researching various topics of interest and exploring their scope. One possibility is to scan the table of contents of recent issues of the Journal of the American Medical Association, the Journal of Biomedical Informatics, BMC Medical Informatics and Decision Making, the Journal of Biomedical Semantics, etc.

Do not hesitate to email me with questions. We can also discuss the term paper at office hours.

Logistics of the term paper:

- 10-15 pages double-spaced, including tables, figures, and references, with one-inch margins all around. Maximum body text font size is 12 point. Do not use excessive whitespace between headings, headings and text, etc.
- Readable narrative, and not a series of lists or bulleted items.
- In your own words and not copied and pasted from other writings. (I will use a plagiarism-checking tool).
- Use any open-source word processor, Microsoft Word, or Pages. Other word processors may be used with my permission.



- Email the final version to me, with the document attached. The filename should begin with your last name, and include the year and semester of the course (e.g., cleese\_2015\_spring\_paper.doc).
- You may format the references according to the style of your choice (e.g., APA, Vancouver), so long as you are consistent and include enough information for me to locate them.

#### GRADING SCALE:

letter grade	grade points	grade percentage
A	4.0	95-100
A-	3.67	90-94
B+	3.33	87-89
B	3.0	83-86
B-	2.67	80-82
C+	2.33	77-79
C	2.0	73-76
C-	1.67	70-72
D+	1.33	67-69
D	1.0	63-66
D-	0.67	60-62
E	0	<60

#### COURSE SCHEDULE:

Day	Date	Topic	Reading	Notes
1	8/24	Introductions, course mechanics/overview, and definition of biomedical informatics		
2	8/26	Overview of biomedical informatics	Shortliffe, Ch. 1	

			Kulikowski paper	
3	8/31	What is information		
4	9/2	How is biomedical information unique	Shortliffe, Ch. 2	
5	9/7	LABOR DAY HOLIDAY – NO CLASS		
7	9/9	Overview of clinical information systems	Shortliffe, Ch. 14	
6	9/14	Natural language processing and understanding	Shortliffe, Ch. 8	<b>Dr. Daisy Wang</b>
8	9/16	The electronic health record 1	Shortliffe, Ch. 12	
9	9/21	The electronic health record 2	Koppel paper	
10	9/23	Consumer informatics / The personal health record	Shortliffe, Ch. 17	<b>Dr. François Modave</b>
11	9/28	Clinical decision support	Shortliffe, Ch. 22	
12	9/30	Ethics and legal issues of biomedical informatics, including privacy and security of information	Shortliffe, Ch. 10 Goodman paper	
13	10/5	Information and the US Healthcare System		
14	10/7	Overview of administrative healthcare information and information systems		<b>Deepa Ranka</b>
15	10/12	Public health informatics and information systems	Shortliffe, Ch. 16	Take home exam distributed by email before

				class and discussed during class
16	10/14	Information systems in action 1: governance, analysis, requirements, use cases, selection	Shortliffe, Ch. 6	
17	10/19	Information systems in action 2: implementation, change/upgrades, replacement	Karsh paper	Take home exam due via Canvas by 10/20 12:00a EDT
18	10/21	Human cognition and information systems	Shortliffe, Ch. 4	
19	10/26	Unintended consequences of information systems, adverse events, patient safety	Bloomrosen paper	
20	10/28	Interoperability and standards 1	SW Smith paper	Proposed term paper topic assignment due via Canvas by 10/29 12:00 EDT
21	11/2	Interoperability and standards 2	B Smith paper	
22	11/4	Evaluation in biomedical informatics	Shortliffe, Ch. 11	
23	11/9	Overview of bioinformatics	Shortliffe, Ch. 24	<b>Dr. François Modave</b>

24	11/11	VETERANS DAY HOLIDAY – NO CLASS		
25	11/16	Clinical research informatics	Shortliffe, Ch. 26	<b>Gigi Lipori</b>
26	11/18	Information processing 1: query, retrieval, reports		
27	11/23	Information processing 2: analytics, business intelligence, and visualization		<b>Dr. Jiang Bian</b>
28	11/25	THANKSGIVING HOLIDAY – NO CLASS		
29	11/30	Overview of imaging informatics	Shortliffe, Ch. 9	<b>Dr. Lin Yang</b>
30	12/2	Emerging themes in biomedical informatics: precision genomic/molecular medicine		<b>Dr. Mattia Prosperi</b>
31	12/7	Human computer interaction and usability		
32	12/9	Emerging themes in biomedical informatics: Big Data, mobile health, translational bioinformatics		Last day of class. Submit term paper to Canvas by 12/11 5:00p EST.

## COURSE/INSTRUCTOR EVALUATION BY THE STUDENT

Students are expected to provide feedback on the quality of instruction in this course based on 10 criteria. These evaluations are conducted online at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will receive specific times when they are open. Summary results of evaluations are available to students at <https://evaluations.ufl.edu>.

## DISCLAIMER

This syllabus represents my current plans and objectives. As we go through the semester, those plans may need to change to enhance the class learning opportunity. Such changes, communicated clearly, are not unusual and should be expected.