

## **MEDS3052C/7052C-001: Informatics for the 21<sup>st</sup> Century Medical Professional (3 credits)**

Room: MSB G005G

### **Course Directors:**

#### **Tiffany Grant, PhD**

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#### **Kristen Burgess, MSLS**

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### **Course Textbook:**

- E. H. Shortliffe and J. J. Cimino, Biomedical Informatics: Computer Applications in Health Care and Biomedicine. 4th Ed., Springer, Oct 2013. ISBN: 978-1447144731
- Links to additional readings will be available on the Reading Syllabus.

### **Course Description:**

This course is designed for upper level undergraduates, graduate students, and aspiring and current medical professionals with an interest in research or informatics. The textbook authors define biomedical informatics as “the scientific field that deals with biomedical information, data, and knowledge--their storage, retrieval, and optimal use for problem solving and decision making. It accordingly touches on all basic and applied fields in biomedical science and is closely tied to modern information technologies, notably in the areas of computing and communication” (p.24). Biomedical informatics broadly encompasses “all areas of application in health, clinical practice, and biomedical research” (p.24).

Using lectures, discussions, hands-on exercises, and presentations from clinicians and researchers at UC, this course provides an orientation to informatics concepts, practices, and tools for the 21st century medical professional. Students will gain an understanding of the relationships between informatics, biomedicine, research, and libraries as well as practical application skills. Assessment for undergraduate students will be based on class attendance and participation, quizzes, final exam, and a research project. Assessment for graduate students will be based on class attendance and participation, quizzes, final exam, a research project, and a research paper.

### **Homework Assignments:**

The majority of homework assignments are readings assignments that you will read and analyze before the next class. All homework assignments should be completed by the start of class on the date listed on

the syllabus.

Other assignments will be completed through Blackboard. Make sure that all written assignments include your full name and date in the upper right hand corner of each sheet. If your paper does not have your name and date it will lose full credit. Some assignments will require you to submit proof of tutorial completion or registration. For these assignments make sure you upload them to Blackboard by the date listed.

**Project:**

Each student will complete a research poster presentation related to an informatics topic provided by the instructors. Course directors must approve student chosen topics. A grading rubric will be provided as well as in-class instruction on poster presentation techniques. Students will present their poster and research to the class at the end of the semester. Graduate students will have an additional research paper.

**Blackboard:**

We will use Blackboard in this class. Blackboard is a web-based course management system with password-protected access at <https://canopy.uc.edu/>. Blackboard will be used to distribute course materials, to communicate and collaborate online, and to post grades. Support for Blackboard is available at [helpdesk@uc.edu](mailto:helpdesk@uc.edu) or 513-556 HELP (4357).

Course announcements will also be delivered via Blackboard and instructors will post announcements about the class, including any changes in the syllabus, to Blackboard.

**Participation:**

The participation grade is based on class attendance. Attendance will be taken at every class. Participation in class discussions and group work as well as Blackboard discussion board participation is included in the participation group.

**Use of Technology During Class:**

This class is held in an electronic classroom. You can use the class laptops or your own personal device. A list of software used during the class will be provided at the beginning of the semester. Feel free to bring your laptop or eReader (iPad, etc.) to class for textbook access.

**Academic Integrity Policy:**

The University of Cincinnati Rules, including the Student Code of Conduct ([http://www.uc.edu/conduct/Code\\_of\\_Conduct.html](http://www.uc.edu/conduct/Code_of_Conduct.html)), and other documented policies of the school, college, and university related to academic integrity will be enforced. Any violation of these regulations, including acts of plagiarism or cheating, will be dealt with on an individual basis according to the severity of the misconduct.

**Special Needs Policy:**

If you have any special need related to your participation in the course, including identified visual impairment, hearing impairment, physical impairment, communication disorder, and/or specific learning disability that may influence your performance in this course, you should meet with the instructors to arrange for reasonable provisions to ensure an equitable opportunity to meet all the requirements of this course. At the discretion of the instructors, some accommodations may require prior approval by Disability Services (<http://www.uc.edu/aess/disability.html>).

**Grading Policy:**

- Participation – 35% (attendance, class participation, discussion board participation, homework)
- Project and Project Presentation – 30%
- Quizzes – 15% (6 quizzes, keep top 5)
- Final exam – 20%

**Grading Scale**

- A+, A, and A 94–100%, 94–100%, 90–93%
- B+, B, B- 86–89%, 83–85%, 80–82%
- C+, C, C- 76–79%, 73–75%, 70–72%
- D+, D, D- 66–69%, 63–65%, 60–62%
- F 0-59%

**Presentation Topics**

**Each student will give a 20 minute poster presentation on one of the following topics:**

- Translational Bioinformatics
- Clinical Informatics
- Clinical Research Informatics
- Nursing Informatics
- Consumer Health Informatics
- Public Health Informatics
- Biomedical Informatics

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**Course Directors:**

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The class has five units: Intro to Informatics; Information Retrieval & Management; Research, Data, & Evaluation; Informatics in Clinical Care; Special Topics in Informatics.

Session	Instruct/ Status	Learning Module	Lecture	Learning Outcomes
1 8/22	T.Grant & K.Burgess  Confirmed	Intro to Informatics	Course Guidelines and Introduction to Informatics	<ul style="list-style-type: none"> <li>• Outline what will be accomplished in this course</li> <li>• Understand Blackboard website organization, course expectations, and grading policy</li> <li>• Understand how to download course textbooks</li> <li>• Develop a definition for biomedical informatics</li> </ul>

2 8/24	K.Burgess confirmed	Intro to Informatics	Information Retrieval and Digital Libraries	<ul style="list-style-type: none"> <li>• Understand essential terminology and concepts of libraries, information retrieval, and biomedical informatics (controlled vocabularies, indexing, etc.)</li> <li>• Understand different types of literature</li> <li>• Develop basic search strategy</li> </ul>
3 8/29	K.Burgess confirmed	Information Retrieval & Management	Databases and Terminology: PubMed, MyNCBI, MeSH	<ul style="list-style-type: none"> <li>• <i>Develop basic search strategy</i></li> <li>• Define Boolean Operators</li> <li>• Develop skills searching PubMed</li> <li>• Compose a search query using keywords and MeSH</li> </ul>
4 8/31	K.Burgess confirmed	Information Retrieval & Management	Databases and Terminology: Scopus, Web of Knowledge, TRIP, Cochrane	<ul style="list-style-type: none"> <li>• Select appropriate biomedical research databases and resources</li> <li>• Explain to use one database versus another database</li> </ul>
5 9/5	E.Kean Confirmed	Information Retrieval & Management	Tools for Collaboration & Citation Management Applications	<ul style="list-style-type: none"> <li>• Use bibliographic management software including RefWorks, EndNote, and Mendeley</li> </ul>
6 9/7	K.Burgess	Information Retrieval & Management	Digital Literacy & Social Media	<ul style="list-style-type: none"> <li>• Define Health 2.0 (patients control over health)</li> <li>• Define Digital Literacy (aware what on internet stays on internet)</li> <li>• Understand use of social media in healthcare</li> </ul>
7 9/12	T.Grant Confirmed	Information Retrieval & Management	NCBI Tools: Overview of GQuery	<ul style="list-style-type: none"> <li>• Develop a basic understanding of NCBI bioinformatics and genomics tools and databases (NCBI homepage, GQuery, PubMed Central, Bookshelf)</li> </ul>
8 9/14	T.Grant Confirmed	Information Retrieval & Management	Bioinformatics Resources (Ensembl, Cytoscape)	<ul style="list-style-type: none"> <li>• Learn to navigate bioinformatics tools to discover information about genes, proteins, biological pathways, and phenotypes associated with disease.</li> </ul>
9 9/19	T.Grant Confirmed	Information Retrieval & Management	Bedside to Bench with NCBI	<ul style="list-style-type: none"> <li>• Learn how to use various NCBI databases to perform research about a medical genetic condition. Learn which NCBI databases can be used at various stages of disease from diagnoses to etiology of disease.</li> </ul>
10 9/21	E.Starback Confirmed	Informatics in Clinical Care	Evidence Based Clinical Practice	<ul style="list-style-type: none"> <li>• Identify and explain the concept, issues, and process of evidence-based clinical practice</li> <li>• Understand how to create a clinical question using PICO and how it can inform search strategy</li> <li>• Use the evidence pyramid to recognize appropriate library resources and understand how medical literature is organized</li> </ul>
11 9/26	P.Hagedorn Confirmed	Informatics in Clinical Care	Evaluating Clinical Research	<ul style="list-style-type: none"> <li>• Describe the importance of research evaluation</li> <li>• Evaluate clinical research with critical appraisal tools</li> </ul>
12 9/28	T.Grant & K. Burgess	Research, Data, & Evaluation	Research and Publication Lifecycle & Open Access: From grants to publishing	<ul style="list-style-type: none"> <li>• Discuss an overview of the research process</li> <li>• Use ClinicalTrials.gov to search for clinical trials</li> <li>• Discuss an overview of the publication process</li> <li>• Describe the NIH Public Access Policy, where to publish and why, Open Access, and author rights</li> </ul>

13 10/3	J. Lee  Confirmed	Research, Data, & Evaluation	NLP, the Semantic Web, and Medicine	<ul style="list-style-type: none"> <li>• Understand what different insights can be extracted from unstructured qualitative data (text, image, sound, video) versus structured quantitative data.</li> <li>• Describe how machine learning algorithms can parse large unstructured medical and scientific datasets. How can we confer structure to a chaotic unstructured dataset?</li> <li>• Discuss how the results of natural language processing algorithms can be visualized in a human interpretable way for a range of audiences.</li> </ul>
14 10/5	J. Lee  Confirmed	Research, Data, & Evaluation	NLP, the Semantic Web, and Medicine	<ul style="list-style-type: none"> <li>• Hands-on work with NVivo, Tableau, topic modeling, and vector space modeling.</li> <li>• Discuss strengths and weaknesses of each analytical technique.</li> </ul>
15 10/10	Fall Reading Day			<ul style="list-style-type: none"> <li>•</li> </ul>
16 10/12	E.Starback  Confirmed	N/A	Poster Class	<ul style="list-style-type: none"> <li>• Create a generic research poster using Microsoft PowerPoint</li> <li>• Understand how to illustrate a structured abstract</li> <li>• Demonstrate knowledge of components of a good poster presentation</li> </ul>
17 10/17	T.Grant K.Burgess  Confirmed	N/A	Hands on Lab Day	<ul style="list-style-type: none"> <li>• Prepare final poster presentation</li> </ul>
18  10/19	T. Baldwin	Research, Data, & Evaluation	Intro to Data Visualization	<ul style="list-style-type: none"> <li>• Learn what visualization may work best for a particular comparison</li> <li>• Describe issues relating to the use of color in data visualizations</li> <li>• Know how to assess and improve the visual storytelling of a visualization</li> <li>• Understand what is an infographic and how it can help with visual storytelling</li> </ul>

19 10/24	B.McMillan Confirmed	Research, Data, & Evaluation	Data Visualization	<ul style="list-style-type: none"> <li>• Identify best practices for data visualization</li> <li>• Select the most appropriate tools for a data visualization need</li> <li>• Create an informative graphic that is appropriate for the type of data and the information needs of the audience</li> </ul> <p>Recommended supplemental reading:  <a href="http://uclid.uc.edu/record=b6104389~S39">http://uclid.uc.edu/record=b6104389~S39</a></p>
20 10/26	T. Grant Confirmed	Research, Data, & Evaluation	Research Data Analysis Tools (DAVID, Geo, cBioPortal)	<ul style="list-style-type: none"> <li>• Develop a basic understanding of performing data analysis on large scale bioinformatics studies</li> </ul>
21 10/31	A. Koshoffer Confirmed	Research, Data, & Evaluation	GIS	<ul style="list-style-type: none"> <li>• Define what a GIS is</li> <li>• Examine the components of a GIS project</li> <li>• Explain why GIS is a powerful analysis tool in interpreting Healthcare Data</li> </ul>
22 11/2	T.Grant A.Koshoffer Confirmed	Research, Data, & Evaluation	Data Management 101	<ul style="list-style-type: none"> <li>• Identify data management best practices</li> <li>• Construct a brief data management plan</li> </ul>
23 11/7	C. Baker Confirmed	Informatics in Clinical Care	Clinical Data Management	<ul style="list-style-type: none"> <li>• Be able to describe Clinical Data Management and its importance in the field of clinical research.</li> <li>• Be able to outline key elements of Clinical Data Management.</li> <li>• Be able to understand the HIPAA Privacy Rule and learn to safeguard clinical research data.</li> </ul>
24 11/9	B. Harnett Confirmed	Informatics in Clinical Care	Introduction to Medical Informatics	<ul style="list-style-type: none"> <li>• Understand the principles of combining information sciences, data, and the healthcare domain</li> <li>• Understand the technical challenges and opportunities using informatics practices</li> <li>• Identify examples of applications of informatics tools for healthcare delivery and research</li> </ul>

25 11/14	A. Spooner Confirmed	Informatics in Clinical Care	Electronic Health Records	<ul style="list-style-type: none"> <li>Describe the current adoption rate of electronic health record systems among US physicians (Reading: <a href="https://dashboard.healthit.gov/index.php">https://dashboard.healthit.gov/index.php</a>)</li> <li>Explain how rules for billing drive the EHR experience for physicians (Reading: <a href="https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/Downloads/eval-mgmt-serv-guide-ICN006764.pdf">https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/Downloads/eval-mgmt-serv-guide-ICN006764.pdf</a>)</li> <li>Outline the basic structure of the Meaningful Use program of the US HITECH Act (Reading: <a href="http://www.nejm.org/doi/full/10.1056/NEJMp1006114">http://www.nejm.org/doi/full/10.1056/NEJMp1006114</a>)</li> </ul>
26 11/16	K. Burgess Confirmed	Special Topics in Informatics	Standard Terminologies in Biomedical Informatics	<ul style="list-style-type: none"> <li>Discuss a selection of currently available standard terminologies (ICD-9-CM, ICD- 10-CM, NDCs, RxNorm, LOINC, Nursing Terminologies, SNOMED CT, MeSH, UMLS)</li> <li>Explain why standards are important in biomedical informatics</li> </ul>
27 11/21	V. Wangia-Anderson Confirmed	Special Topics in Informatics	Data preparation, analysis and visualization with Python.	<ul style="list-style-type: none"> <li>Describe Python modules relevant to machine learning</li> <li>Program with Python to identify data characteristics and prepare data for analysis</li> <li>Program with Python to visualize select data</li> <li>Gain hands-on experience with select Python modules relevant to data mining and machine learning</li> </ul>
28 11/23	Thanksgiving Holiday			<ul style="list-style-type: none"> <li></li> </ul>
29 11/28	K.Burgess	Research, Data, & Evaluation	Research Metrics and Identifiers	<ul style="list-style-type: none"> <li>Use traditional metrics for a journal, author, and paper</li> <li>Discuss and demonstrate Altmetrics</li> <li>Discuss the pros and cons of both types of metrics</li> </ul>
30 11/30	T.Grant K.Burgess Confirmed	NA	Class Presentations	<ul style="list-style-type: none"> <li>20 minutes each</li> </ul>

31 12/5	T.Grant K.Burgess  Confirmed	NA	Class Presentations	<ul style="list-style-type: none"> <li>• 20 minutes each</li> </ul>
32 12/7	T.Grant K.Burgess  Confirmed		Exam Review	
33 12/12	Confirmed		Exam Week	