Washington University in St. Louis
SCHOOL OF MEDICINE

Clinical Research Training Center

Syllabus: Course M17 CLNV 530 01, Fall 2018
Introduction to Biomedical Informatics: Foundations
Mondays 4 – 7 pm

Course Masters

Preferred method of contact: email
Office Hours: By appointment

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Guest Lecturers:

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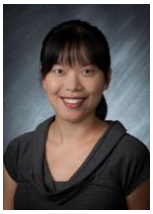
Po-Yin Yen, RN, PhD	yenp@wustl.edu	

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Philip R.O. Payne, PhD, FACMI
Director, Institute for Informatics
Robert J. Terry Professor
Professor of Computer Science and Engineering

Dr. Payne is an internationally recognized leader in the field of clinical research informatics (CRI) and translational bioinformatics (TBI) and is the founding director of the Institute for Informatics (I^2) at Washington University in St. Louis, where he also serves as the Robert J. Terry Professor and Professor of Computer Science and Engineering. Previously, Dr. Payne was Professor and Chair of the Department of Biomedical Informatics at The Ohio State University.

Dr. Payne's leadership in the clinical research informatics community has been recognized through his appointment to numerous national steering, scientific, editorial and advisory committees, including efforts associated with the American Medical Informatics Association (AMIA), AcademyHealth, the Association for Computing Machinery (ACM), the National Cancer Institute (NCI), the National Library of Medicine (NLM) and the CTSA consortium, as well as his engagement as a consultant to academic health centers throughout the United States and the Institute of Medicine. Dr. Payne's research Interests include:

- Knowledge-based approaches to the discovery and analysis of bio-molecular and clinical phenotypes and the ensuing identification of precision diagnostic and therapeutic strategies in cancer
- Interventional approaches to the use of electronic health records in order to address modifiable risk factors for disease and enable patient-centered decision making
- The study of human factors and workflow issues surrounding the optimal use of healthcare information technology

Albert M. Lai, PhD
Deputy Directory, Institute for Informatics
Chief Research Information Officer
Associate Professor, Department of Medicine, Division of General Medical Sciences

Background:
Albert M. Lai, PhD, is the Deputy Director for the Institute for Informatics and an Associate Professor of General Medical Sciences. Dr. Lai also serves as the inaugural Chief Research Information Officer at Washington University School of Medicine in St. Louis. Dr. Lai specializes in the development of research informatics infrastructure and is well recognized in the fields of clinical research informatics and consumer health informatics. His recent research has focused on the application of natural language processing, temporal reasoning and information fusion to generate a longitudinal computable phenotype to support clinical trial prescreening. His research portfolio has been supported by a combination of NCATS, NLM, NCI, AHRQ and PCORI grants and contracts. Previously, Dr. Lai served as the Associate Chief Research Information Officer at The Ohio State University Wexner Medical Center.

Dr. Lai is focused on applying computer science and informatics techniques to solve problems in the clinical domain and his research Interests include:

- Clinical research informatics
- Clinical informatics
- Consumer health informatics
- Telemedicine
- Usability
- Natural language processing
- Mobile health

About This Course

Required Texts:
The following text will have required reading: *Principles of Biomedical Informatics, 2nd addition, Ira j. Kalet.*

Additional Journal publications and/or equivalent readings may also be assigned and will be posted in Canvas at least 1-week prior to the lectures for which they are relevant.

Course Description: This survey course provides an overview of the theories and methods that comprise the field of biomedical informatics. Topics to be covered include:

- The nature of biomedical data
- The symbolic and computational representation of data, information, and knowledge
- The use of data science methods to interpret and understand various data types
- Cognitive and decision science
- The design and use of information technology solutions targeting the biological, clinical, and population health domains
- Current trends in biomedical computing and healthcare information technology

The course will consist of both didactic lectures as well as experiential learning opportunities including "hands on" laboratory sessions and/or journal club style discussion. The course will culminate with a project in the form of a written grant proposal requiring the in-depth examination, critique and presentation of a topic related to one of three topics in biomedical informatics (see details below).

Biomedical Informatics I is designed primarily for individuals with a background in the health and/or life sciences and who have completed a course in introductory statistics (e.g., MATH 1011). No assumptions are made about computer science or clinical background; however, some experience with computers and a high-level familiarity with the health and life sciences will be useful. This course does not require any programming knowledge, and it will not teach students how to program.

Goals of the Course: The goal of this course is to introduce trainees to the basic definitions, theories, and methods that serve as the foundations for the scientific field of Biomedical Informatics.

Upon completion of this course, students will be familiar with core concepts relevant to the major sub-domains of Biomedical Informatics (Bioinformatics, Translational Bioinformatics, Imaging Informatics, Clinical Informatics, Clinical Research Informatics, and Public or Population Health Informatics). Additionally, students will have:

- An appreciation for different scales of biological, clinical, and population-level data, in particular their origin, derivation and utility;
- An understanding of the contributing theoretical frameworks that underlie modern approaches to the analysis and understanding of such data types; and
- Critical evaluation skills that allow for the evaluation of informatics interventions informed by items (1) & (2) and intended to address real-world clinical problems.

Daily Work/Homework:
Each week's class will have a lab with a take home component. Students will be expected to complete the lab exercise and submit results to Canvas by the following Monday.

Major Assignment Descriptions:
The course will culminate with a project in the form of written R-21 scale grant proposal (https://grants.nih.gov/grants/guide/pa-files/PA-16-161.html) and a 15 minute in-person presentation of the proposal to the class. There will also be a final, written, take-home exam. The project will involve the identification of three specific aims as they relate to a driving problem and the subsequent exploration of both the significance of the problem and an approach to addressing said aims. The driving problem selected for the project should align with one of the following three topic areas:

1. Methods for translating biological discoveries into first-in-human clinical trials
2. Approaches to the instrumentation of Electronic Health Record systems for the purposes of phenotyping patients
3. Techniques for integrating diverse data types in order to analyze trends in healthcare delivery and utilization at a population-level.

Technology Requirements:
All the class materials, as well as the assignments and communications will be done through Canvas found at: *(link not available until August, 2018)*

Students will be expected to bring a laptop to class for the experiential learning components of the course. Problems with your computer or other technology issues are not an excuse for delays in meeting expectations and missed deadlines for the course. If you have a problem, get help in solving it immediately. At a minimum, you will need the following software/hardware to participate in this course:

1. A laptop computer with a current operating system (e.g. Windows, Mac OS, Linux)
   a. *You will need appropriate privileges on this computer to be able to install additional, open-source software packages as assigned by the instructors throughout the class*
2. An up-to-date internet browser (preferably Google's Chrome or Apple's Safari)

3. An active WUSTL key (such that you can log-into the wireless network and/or other university computing resources)
4. The ability to access and use the Canvas Learning Management System
5. Access to a high-speed internet connection

In addition, all students will be expected to obtain a username and password for the National Library of Medicine's (NLM) terminology services. This requires the completion of an account request and user license at the following web-site: https://uts.nlm.nih.gov/home.html

Time Requirements

For face-to-face courses in the CRTC program, it is expected that you will be in class 1 hour per week for each credit of the course a week plus travel time (i.e. this is a 3-credit course so that is 3 hours a week). In addition, it is assumed you will be doing homework and reading assignments that take at least double that time. You should anticipate your time commitment for this course to be at least 9 hours a week.

Course Schedule (subject to modification)

Dates	Topic	Instructor(s) & Chapter
	Module One: Biomedical Data	**Chapter 1**
8/27	Introduction to biomedical informatics as a scientific discipline/ nature of biomedical Data	Philip Payne
9-3	**LABOR DAY – NO CLASS**	
9-10	Objects and Meta data	Albert Lai
9-17	Databases, Quality, Data & Knowledge	Tara Payne
	Module Two: Symbolic Biomedical Knowledge	**Chapter 2**
9-24	Symbolic Knowledge - Logic	Tara Payne/Philip Payne
10-1	Knowledge Collections	Tara Payne/Philip Payne
10-8	Logic and Inference	Philip Payne
	Module Three: Probabilistic Biomedical Knowledge	**Chapter 3**
10-15	Probabilistic knowledge - Probability	Randi Foraker
10-22	Bayes'	Randi Foraker
10-29	Decision Making & Information Theory	Thomas Kannampallil/Joanna Abraham
11-5	**AMIA – NO CLASS**	
	Module Four: Biomedical Information Access	**Chapter 4**
11-12	Information Retrieval	Po-Yin Yen
11-19	Clinical Systems	Philip Payne
11-26	Networks and Data Exchange	Albert Lai
	Course Wrap up	
12-3	Course Review & Journal club	Philip Payne
12-10	Final Projects Due and In-Person Presentations	Philip Payne/Albert Lai
12-17	Final Take Home Exam Due	

Assessment/Grading

Grade Composition:

Summary of Course Assignment Point Values:

Weekly Lab write-ups (grades as Pass/Fail))	15%
Final Project (25% paper/15% presentation)	40%
Final Exam	30%
Attendance, Participation, and Professionalism	15%
	100

Grading Scale:

Grades/sub-grades	Course Points	4-point scale
A+ (98% to 100%)	98-100	4.00
A (93% to 97%)	93-97	4.00
A- (90% to 92%)	90-92	3.7
B+ (88% to 89%)	87-89	3.3
B (83% to 87%) – minimum for Core courses	**83-86**	**3.00**
B- (80% to 82%)	80-82	2.7
C+ (77% to 79%)	77-79	2.3
C (73% to 77%) – minimum for Electives	**73-76**	**2.00**
C- (70% to 72%)	70-72	1.7

Penalties for Late Work:

Late work will not be accepted, unless in the event of unforeseen circumstances. If these situations arise, students must receive written approval from the coursemaster. If you must miss a class, please email a copy of the weekly assignment to Andrea Krussel prior to the start of the class when it is due.

Attendance Requirement:

In-class participation is an important part of the coursework taken as part of the BMI, MSCI or AHBR programs and the clinical research training programs within the CRTC. Students are expected to **physically attend at least 75% of class sessions** for each course they take. Watching the videotaped class presentations, if available, is helpful to keep up with missed sessions, but is not a substitute for class attendance. Students whose professional duties or personal circumstances prevent them from meeting this program attendance requirement must receive prior written approval of the coursemaster, and agree on an alternate plan to achieve course objectives and earn academic credit.

Canvas Support

If you have any technical problems accessing Canvas, please e-mail krussela@wustl.edu . Note, this mailbox is not monitored in the evening or on weekends. If you need immediate help after hours please put a service request into https://wusm.service-now.com.

Course Policies

Participation:

- It is vitally important that our classroom environment promote the respectful exchange of ideas. This entails being sensitive to the views and beliefs expressed during discussions whether in class or online.
- Your success in this course will heavily depend on your ability to communicate, engage and participate in all course activities. Successful completion of this course requires that a student keep up with all assignments and prep work for the lab components.

If you are unable to participate in the scheduled class activity or discussions you must notify the coursemaster within the week of that class module or discussion. **An unexcused failure to engage or participate with the class will be counted as an absence; unexcused absences may result in failure.** The coursemaster reserves the right to make judgment to accept and/or make–up assignments missed because of failed participation in the course activities.

Drop Dates:

If the occasion should arise that you want or need to drop this class, please see me first. You can drop for any reason during the course of the semester, however you my only receive a partial or no tuition reimbursement depending upon how far into the semester you drop the course. See the Academic Calendar for your program for specific dates and reimbursement policies. Note, late withdrawals will also appear on your transcript as a withdrawal.

CRTC Academic Policy Guidelines:

Guidelines regarding CRTC course registration and enrollment, grades, tuition obligation, and academic leave are consolidated in the CRTC Academic Policy Guidelines. Please take a moment to review this document.

CRTC Guidelines for Academic and Non-Academic Transgressions:

By registering for this course, you have agreed to the terms of the CRTC Guidelines for Academic and Non-Academic Transgressions. If you have not already reviewed this policy, please be sure to before beginning any CRTC related coursework.

Academic Integrity/Plagiarism:

- Academic dishonesty is a serious offense that may lead to probation, suspension, or dismissal from the University. One form of academic dishonesty is plagiarism – the use of an author's ideas, statements, or approaches without crediting the source. Academic dishonesty also includes such acts as cheating by copying information from another student. **Plagiarism and cheating are not acceptable.**
- Academic dishonesty will be reported to the Office of the Registrar for possible action. The coursemaster will make an academic judgment about the student's grade on that work and in that course. The CRTC process regarding academic dishonesty is described in the CRTC Guidelines for Academic and Non-Academic Transgressions

Writing Assistance:

For additional help on your writing, consult the expert staff of The Writing Center in Olin Library (first floor). It can be enormously helpful to ask someone outside a course to read your essays and to provide feedback on strength of argument, clarity, organization, etc.

Mental Health Resources:
Mental Health Services' professional staff members work with students to resolve personal and interpersonal difficulties, many of which can affect the academic experience. These include conflicts with or worry about friends or family, concerns about eating or drinking patterns, and feelings of anxiety and depression. See: http://shs.wustl.edu/MentalHealth.

Reporting Policies:
Please also review the CRTC website for policies regarding sexual assault reporting and reporting concerns about bias, prejudice or discrimination.