The Full Spectrum Biomedical and Health Informatics Education at Oregon Health & Science University

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The full spectrum

- Informaticians
  - Academic ⬅➡ Professional
- Informatics domains
  - Bio ⬅➡ Clinical
- Educational experience
  - Primary ⬅➡ Continuing
- Beyond informaticians

Education of informaticians

- OHSU Biomedical Informatics Graduate Program
  - Aims to train future professionals, researchers, and leaders
- Tracks in two domains
  - Clinical Informatics
  - Bioinformatics and Computational Biology

Degree/Certificate Track	PhD	Master of Science	Master of Biomedical Informatics	Graduate Certificate
Clinical Informatics	On-campus	On-campus On-line	On-campus On-line	On-campus On-line
Bioinformatics and Computational Biology	On-campus	On-campus		

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Curriculum building block approach

Masters
- Courses in Domains:
    - Clinical Informatics
    - Bioinformatics & Comp Bio
- Thesis or Capstone/Internship

Graduate Certificate
- Courses in Domains:
    - Clinical Informatics

10x10
- Or Introductory Course (BMI 510)

PhD
- Knowledge Base
- Advanced Research
  Methods
- Biostatistics
- Cognate
- Advanced Topics
- Doctoral Symposium
- Mentored Teaching
- Dissertation
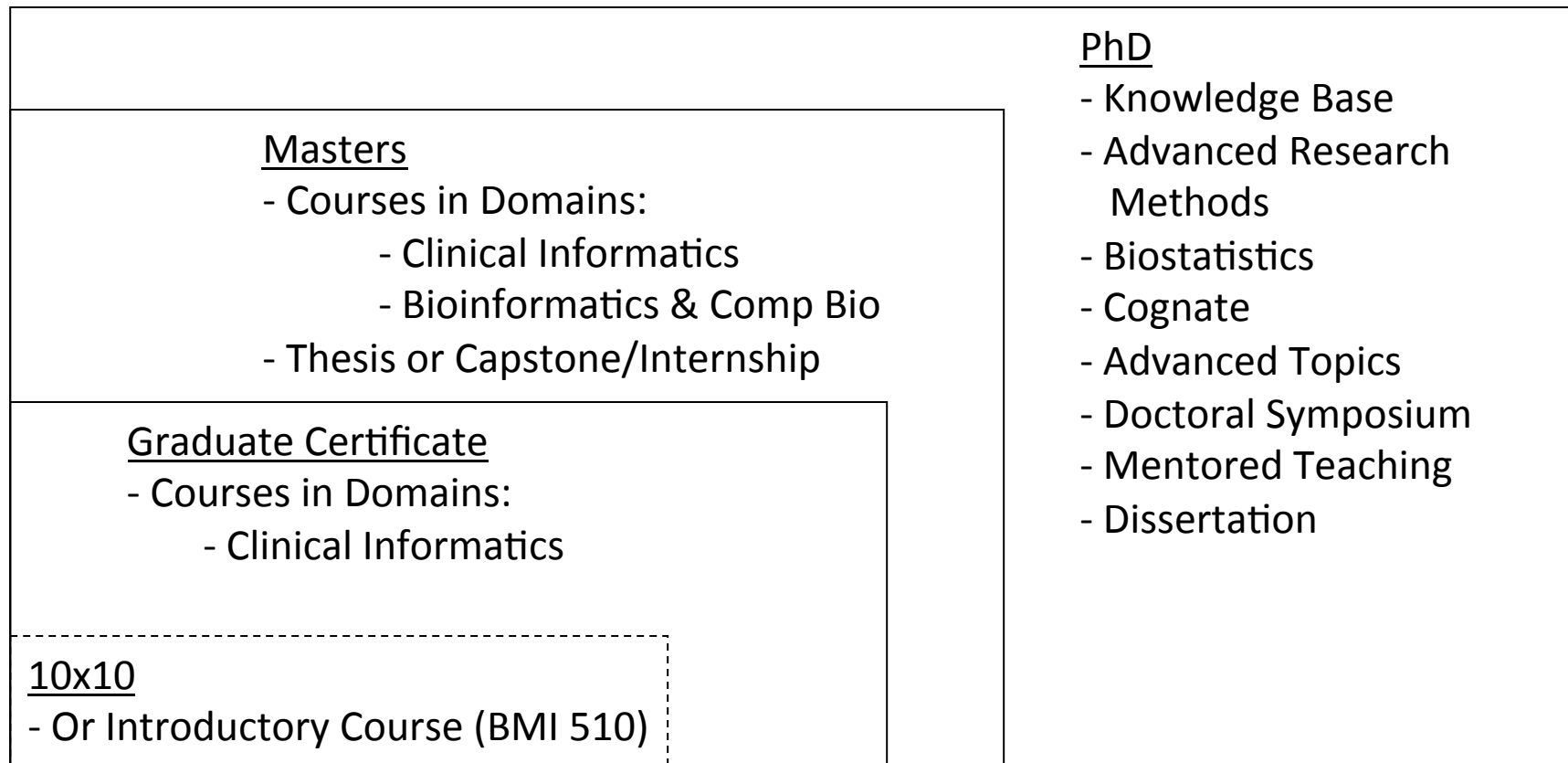
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OHSU Biomedical Informatics Graduate Program

- Accredited by CAHIIM

- Mostly tuition-supported but with two key fellowship programs

  - National Library of Medicine Training Grant – T15 training grant funded by NIH since 1992

  - ACGME-accredited Clinical Informatics Fellowship – funding by OHSU, Portland VA Medical Center, and OCHIN

- http://www.ohsu.edu/informatics-education

Alumni numbers, with some job titles and employers

Track Certificate/Degree	Clinical Informatics*	Bioinformatics & Computational Biology	Total
Graduate Certificate	406	N/A	406
Master of Biomedical Informatics**	190	8	198
Master of Science	72	16	88
PhD	18	6	24
Total	686	30	716
Number of students receiving degrees and certificates: 653			

* includes former Health Information Management Track
** includes former Master of Medical Informatics degree

Employers
- OHSU
- OHSU Knight Cancer Institute
- Providence Health System
- Kaiser-Permanente
- OCHIN
- Impact Advisors
- Accenture
- Philips Healthcare
- Cerner
- Jefferson Health Information Exchange
- National Library of Medicine
- Harvard Medical School
- WebMD
- Institute for Systems Biology

Job Titles
- Clinical informatics analyst
- Informatics researcher
- Computational Biologist
- Consultant
- Data Analyst I, II, III
- Chief medical informatics officer
- Bioinformatician
- Business Intelligence Analyst
- Usability Engineer
- Data manager
- Database administrator/architect
- Faculty

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Clinical Informatics Track

- Focused on informatics applied to health, healthcare, and public health
- Available online at Graduate Certificate and Master's levels
- Physician subspecialty fellowship
  - Master's program accepted for board eligibility – now extended to 2022
  - Six fellowships, including OHSU's, use courses in their programs

International students from: Argentina, Singapore, Thailand, Egypt, Israel, Saudi Arabia, Zimbabwe, China, and other countries

Continuing education

- 10x10 ("ten by ten")
  - In partnership with AMIA, original 10x10 offering
  - Standalone version of introductory course
  - Allows entry into OHSU Graduate Program
  - https://dmice.ohsu.edu/hersh//10x10.html
- Office of the National Coordinator for Health IT (ONC)
  - Grant to update Health IT Curriculum includes continuing education course in Healthcare Data Analytics
  - Offers MOC-II credit for clinical informatics subspecialists
  - https://dmice.ohsu.edu/onc-course/

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What about data science?

- Data analytics course launched three years ago
- Bioinformatics and Computational Biology Track morphing into Bioinformatics and Computational Biomedicine Track
  - Keep quantitative focus, expand beyond genomics data
- Clinical Informatics track adding course in applied data analytics
- NIH funding from Big Data to Knowledge (BD2K) Program allowing development of open educational resources (OERs) and skills courses
  - https://dmice.ohsu.edu/bd2k/

Clinical informatics education for clinicians

Started with medical students (Hersh, 2014), but in reality applicable to all clinical students and professionals

Part of larger health systems science (Skochelak, 2016)

PERSPECTIVES

Beyond information retrieval and electronic health record use: competencies in clinical informatics for medical education

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Abstract: Physicians in the 21st century will increasingly interact in diverse ways with information systems, requiring competence in many aspects of clinical informatics. In recent years, many medical school curricula have added content in information retrieval (search) and basic use of the electronic health record. However, this omits the growing number of other ways that physicians are interacting with information that includes activities such as clinical decision support, quality measurement and improvement, personal health records, telemedicine, and personalized medicine. We describe a process whereby six faculty members representing different perspectives came together to define competencies in clinical informatics for a curriculum transformation process occurring at Oregon Health & Science University. From the broad competencies, we also developed specific learning objectives and milestones, an implementation schedule, and mapping to general competency domains. We present our work to encourage debate and refinement as well as facilitate evaluation in this area.

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Table 1 Competencies in clinical informatics and specific learning objective/milestone within each

Competency	Learning objectives/milestones
Find, search, and apply knowledge-based information to patient care and other clinical tasks	Information retrieval/search: choose correct source for specific task, search using advanced features, apply results
	Evaluate information resources (literature, databases, etc) for their quality, funding sources, biases
	Identify tools to assess patient safety (eg, medication interactions)
	Utilize knowledge-based tools to answer clinical questions at the point of care (eg, textbooks, calculators, etc)
	Formulate an answerable clinical question
	Determine the costs/charges of medications and tests
	Identify deviations from normal (laboratory tests/X-ray/results) and develop a list of causes of the deviation
Effectively read and write from the electronic health record for patient care and other clinical activities	Graph, display, and trend vital signs and laboratory values over time
	Adopt a uniform method of reviewing a patient record
	Create and maintain an accurate problem list
	Recognize medical safety issues related to poor chart maintenance
	Identify a normal range of results for a specific patient
	Access and compare radiographs over time
	Identify inaccuracies in the problem list/history/medication list/allergies
	Create useable notes
	Write orders and prescriptions
	List common errors with data entry (drop down lists, copy and paste, etc)
Use and guide implementation of CDS	Recognize different types of CDS
	Be able to use different types of CDS
	Work with clinical and informatics colleagues to guide CDS use in clinical settings
Provide care using population health management approaches	Utilize patient record (data collection and data entry) to assist with disease management
	Create reports for populations in different health care delivery systems
	Use and apply data in accountable care, care coordination, and the primary care medical home settings
Protect patient privacy and security	Use security features of information systems
	Adhere to HIPAA privacy and security regulation
	Describe and manage ethical issues in privacy and security
Use information technology to improve patient safety	Perform a root-cause analysis to uncover patient safety problems
	Familiarity with safety issues
	Use resources to solve safety issues
Engage in quality measurement selection and improvement	Recognize the types and limitations of different types of quality measures
	Determine the pros and cons of a quality measure, how to measure it, and how to use it to change care
Use HIE to identify and access patient information across clinical settings	Recognize issues of dispersed patient information across clinical locations
	Participate in the use of HIE to improve clinical care
Engage patients to improve their health and care delivery though personal health records and patient portals	Instruct patients in proper use of a personal health record
	Write an e-message to a patient using a patient portal
	Demonstrate appropriate written communication with all members of the health care team
	Integrate technology into patient education (eg, decision making tools, diagrams, patient education)
	Educate patients to discern quality of online medical resources (Web sites, applications, patient support groups, social media, etc)
	Maintain patient engagement while using an electronic health record (eye contact, body language, etc)
Maintain professionalism through use of information technology tools	Describe and manage ethics of media use (cloud storage issues, texting, cell phones, social media professionalism)
Provide clinical care via telemedicine, and refer those for whom it is necessary	Be able to function clinically in telemedicine/telehealth environments
Apply personalized/precision medicine	Recognize growing role of genomics and personalized medicine in care
	Identify resources enabling access to actionable information related to precision medicine
Participate in practice-based clinical and translational research	Use electronic health record alerts and other tools to identify patients and populations for offering clinical trial participation
	Participate in practice-based research to advance medical knowledge

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Informatics education for clinicians and beyond

- OHSU has developed curricula around our competencies (Hersh, 2014)
  - Interactive lectures and series, e.g.,
    - "Information is Different Now That You're a Doctor"
    - "Informatics, EBM, and Critical Thinking"
  - Pearls – weekly 7-10 minute recording on various topics
  - Clinical skills – e.g.,
    - Using EHR – Epic and VistA
    - Applying quality measures
- Next step – undergraduate course in new OHSU-PSU School of Public Health
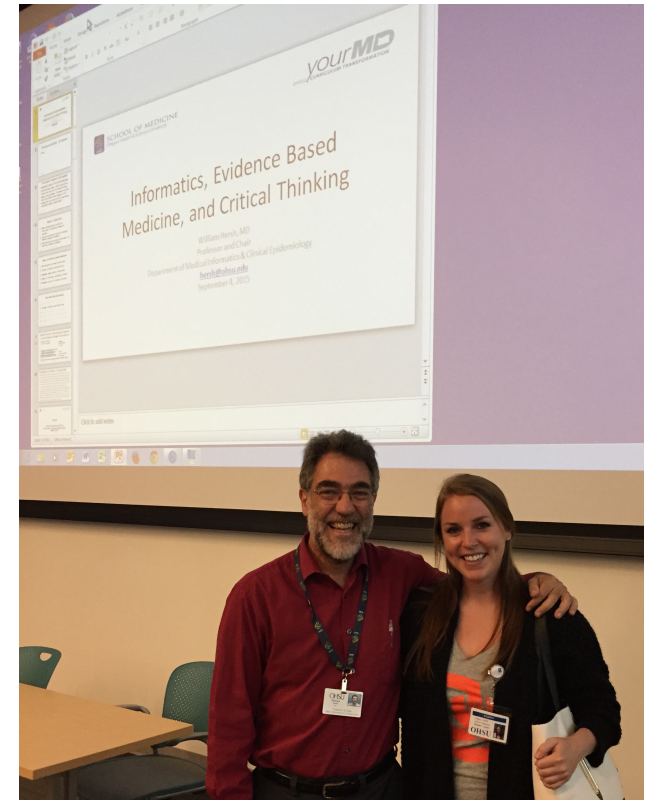
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For more information

- Bill Hersh
  - http://www.billhersh.info
- Informatics Professor blog
  - http://informaticsprofessor.blogspot.com
- OHSU Department of Medical Informatics & Clinical Epidemiology (DMICE)
  - http://www.ohsu.edu/informatics
  - http://www.ohsu.edu/blogs/health-data/
  - http://www.youtube.com/watch?v=T-74duDDvwU
  - http://bit.ly/1KMwaaM

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