

Biomedical and Health Informatics: Careers and Opportunities at the Intersection of Computer Science and Biomedicine

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Biomedical and Health Informatics

Careers and Opportunities at the Intersection of Computer Science
and Biomedicine

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Outline

- Definitions
- Applications and challenges
- Careers and opportunities

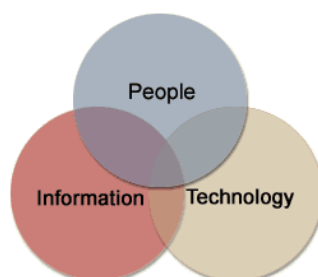
What is biomedical and health informatics (Hersh, 2009)?

- I get asked this so often that I keep a Web site
 - <http://www.billhersh.info/whatis/>
- And a blog
 - <http://informaticsprofessor.blogspot.com>
- Biomedical and health informatics (BMHI) is the field concerned with the optimal use of information, often aided by technology, to improve individual health, healthcare, public health, and biomedical research

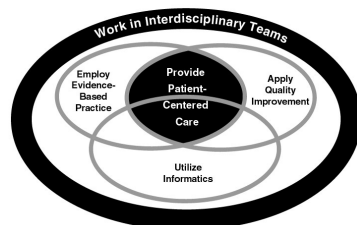
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Other views of informatics



Overlap of Core Competencies for Health Professionals



Fundamental Theorem
(Friedman, 2009)

Goal of informatics is:

$$\left(\text{brain icon} + \text{computer icon} \right) > \text{brain icon}$$

Goal is not:

$$\text{computer icon} > \text{brain icon}$$

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A bright picture for biomedical informatics in the 21st century

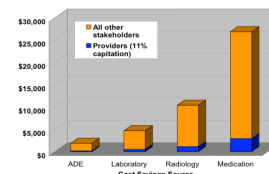
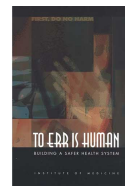
- Recognition of the value of health information technology, including the electronic health record (EHR), for improving the quality and safety of healthcare
- Data analytics of EHR and other data for increasing quality and efficiency of healthcare
- Use of personal health record (PHR), wearables, and other personal information for engaging people in their health and healthcare
- Coming role of genomics and precision medicine, based in part on bioinformatics and computational biology, will revolutionize diagnosis and treatment of disease

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Problems in healthcare motivating informatics

- Safety – IOM “errors report” documented 48-96K deaths per year due to medical errors (Kohn, 2000)
- Quality – patients receive appropriate care only 55% of time (McGlynn, 2003)
- Cost
 - Electronic health records (EHRs) cost-effective overall, but benefits do not accrue to those making the investment (Johnston, 2003)
 - Widespread interoperable EHRs could save \$77B per year (Hillestad, 2005)
- Access to information – physicians unable to access known information about patients in 44% of ambulatory visits (Smith, 2005)
- Access to data for “re-use” difficult (Safran, 2007)



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Has led to substantial federal investment in health IT



"To improve the quality of our health care while lowering its cost, we will make the immediate investments necessary to ensure that within five years, all of America's medical records are computerized ... It just won't save billions of dollars and thousands of jobs – it will save lives by reducing the deadly but preventable medical errors that pervade our health care system."
January 5, 2009

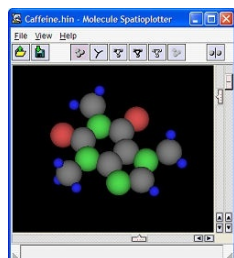
American Recovery and Reinvestment Act (ARRA) allocated \$30 billion in incentives for adoption of EHRs – www.healthit.gov

Has led to substantial adoption of EHRs in almost US hospitals and 80% of physician offices – but plenty of work still needed to optimize and derive the value



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Investment also being made in biomedical research



"Modern biomedical scientists use computers and robots to separate molecules in solution, read genetic information, reveal the three-dimensional shapes of natural molecules like proteins, and take pictures of the brain in action. All of these techniques generate large amounts of data, and biology is changing fast into a science of information management. There is no way to manage these data by hand. What researchers need are computer programs and other tools to evaluate, combine, and visualize these data."
<https://commonfund.nih.gov/bioinformatics/>

Many NIH initiatives recognize key role for informatics

- Clinical & Translational Research Award (CTSA)
- Big Data to Knowledge (BD2K)
- Precision Medicine Initiative
- 21st Century Cures Act



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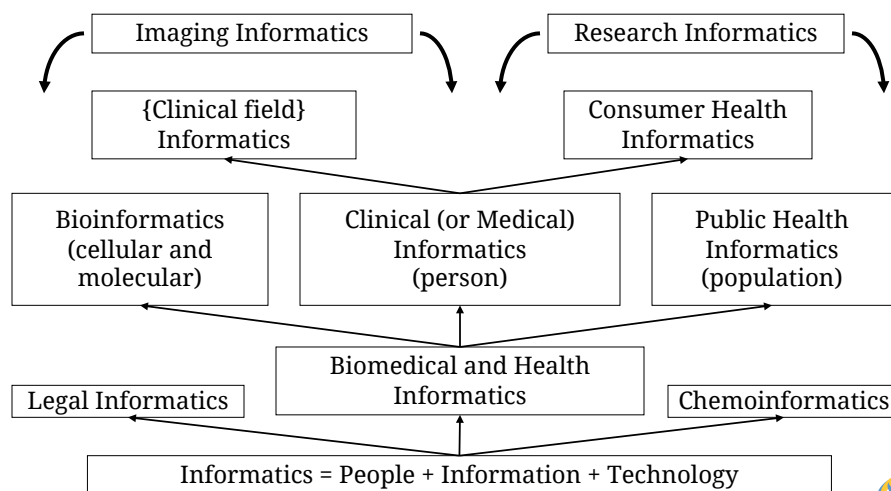
Other areas of opportunity in informatics

- Bioinformatics – harnessing the human genome for improving health
 - Personalized medicine tailored to the individual
- Public health – protecting the public and promoting health
 - One important area is disease surveillance, e.g., tracking H1N1, bioterrorist threats, etc.
- Consumer health – enabling better management of health
 - Personal health records for Internet-savvy baby boomers
- Imaging – use of images and their analysis for biomedical research and clinical care

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Many subareas of informatics



(Hersh, 2009; adapted from Shortliffe, 2006)



Programming an EHR is simple, right?

Vista CPRS in use by: DoctorOne (BROKERSERVER)

SEVEN, INPATIENT 3E S 3E-100-4 Primary Care Team Unassigned
 666-00-0807 Mar 09, 1945 (65) Provider: DOCTOR.ONE Attending: Doctor.Two Flag VistaWeb Postings
 Remote Data A

Active Problems	Allergies / Adverse Reactions	Postings
Depression *Tachycardia Hypertrophy (BENIGN) OF PROSTATE WITHOUT URINARY OBSTRUCTION *Phlebitis And Thrombophlebitis Of Femoral Vein (DEEP) Graves' Disease	Pet Hair Keflex	Allergies

Active Medications	Clinical Reminders	Due Date
No Active Medications Found	Depression Screening PC Nutritional Screening Influenza Vaccine Pneumococcal Vaccine (Pneumovax)	Dec 07 08 DUE NOW DUE NOW DUE NOW

Recent Lab Results	Vitals	Appointments/Visits/Admissions
No Orders Found	T 98.6 F Aug 20, 2010 11:30 (37.0 C) P 68 Aug 20, 2010 11:30 R 24 Aug 20, 2010 11:30 BP 194/88 Aug 20, 2010 11:30 HT 70 in Aug 20, 2010 11:30 (177.8 cm) WT 199 lb Aug 20, 2010 11:30 (90.3 kg) PN 0 Aug 20, 2010 11:30 POX 98 Aug 20, 2010 11:30 BMI 28.61 Aug 20, 2010 11:30	Aug 03, 10 09:00 Endocrine Inpatient Appointment Jul 23, 10 08:00 Inpatient Stay 3e North Jul 15, 10 13:00 General Medicine Action Required Jul 01, 10 14:00 General Medicine Action Required Jun 20, 10 13:00 General Medicine Action Required Jun 10, 10 10:00 General Medicine Action Required May 24, 10 13:00 Inpatient Stay 3e North May 20, 10 08:00 General Medicine Action Required May 18, 10 08:00 General Medicine Action Required May 10, 10 15:00 General Medicine Action Required

Cover Sheet | Problems | Meds | Orders | Notes | Consults | Surgery | DIC Summ | Labs | Reports

But programming the EHR is actually the easy part

- Mixing IT with clinical workflow has been difficult
- Some health IT has had safety issues
- Many issues with privacy and security, which go beyond healthcare
- Larger problems in healthcare organization and financing make change difficult

OHSU to pioneer digital health innovation for the benefit of patients nationwide

October 03, 2017 Portland, Oregon



OHSU has been awarded two grants totaling \$62 million from the National Center for Advancing Translational Sciences, part of the National Institutes of Health, to support the use of health data, algorithms and information systems to bridge basic science and clinical research.

The newly awarded grant provides OHSU with \$25 million over five years to establish and lead the new National Center for Data to Health, or CD2H, which aims to foster collaboration across more than 50 premier medical research institutions within the prestigious Clinical and Translational Science Awards, or CTSA, network.

Downloads



[Melissa Haendel, Ph.D.](#)

Melissa Haendel, Ph.D., co-director of the NCATS-funded Biomedical Data Translator. (OHSU)



Related



[Translational research institute at OHSU receives \\$37 million](#)



Informatics is increasingly becoming a “data science”

- EHR (and probably all informatics) work changing from “implementation” to “analytics” (Hersh, 2012)
- Data science is the “sexiest job of the 21st century?” (Davenport, 2012)
- Growing importance of role for analytics in healthcare (Adams, 2011; O’Reilly, 2012; Hersh, 2014)
 - But we must use caution to make sure that clinical data is complete, correct, and otherwise sound (the role of informatics?) (Hersh, 2013)



INFORMATICS PROFESSOR

THIS BLOG MAINTAINS THE THOUGHTS ON VARIOUS TOPICS RELATED TO BIOMEDICAL AND HEALTH INFORMATICS BY DR. WILLIAM HERSH, PROFESSOR AND CHAIR, DEPARTMENT OF MEDICAL INFORMATICS & CLINICAL EPIDEMIOLOGY, OREGON HEALTH & SCIENCE UNIVERSITY.

FRIDAY, NOVEMBER 3, 2017

WILLIAM HERSH

Why Pursue a Career in Biomedical and Health Informatics?

There are an ever-growing number of career opportunities for those who enjoy working with data, information, and knowledge to improve the health of individuals and the population in the field of *biomedical and health informatics*. This field develops solutions to improve the health of individuals, the delivery of healthcare, and advancing of research in health-related areas. Jobs in informatics are highly diverse, running the spectrum of the highly technical to those that are very interpersonal. All are driven, however, by the goal of using data, information, and knowledge to improve all aspects of human health [1, 2].



<http://www.billhersh.info/>



<https://informaticsprofessor.blogspot.com/>

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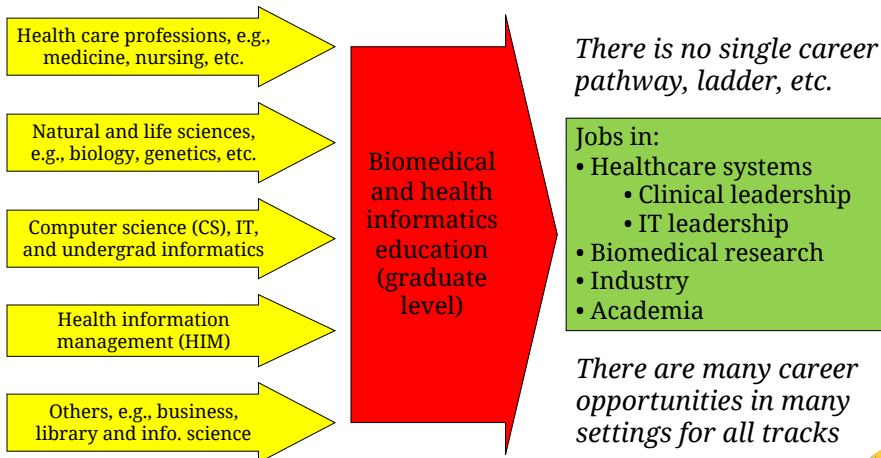
Many opportunities for informatics careers

- Most prevalent in clinical informatics (in healthcare settings), but plenty of other opportunity in other areas of informatics
 - Bioinformatics – leading and assisting computational analysis of genomics and related technologies
 - Clinical and translational research – using informatics to aid biomedical research
 - Public health – using information to protect the public and promote health
 - Consumer health – helping the general population maintain and improve health
 - Imaging informatics – using images for biomedical research, clinical care, etc.



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Career pathways have diverse inputs and outputs (Hersh, 2009)

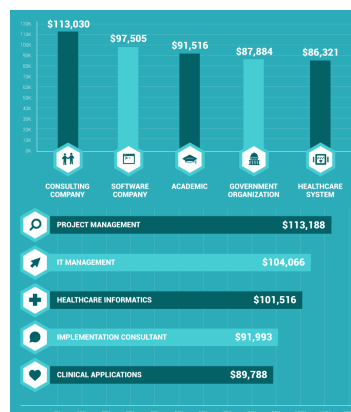
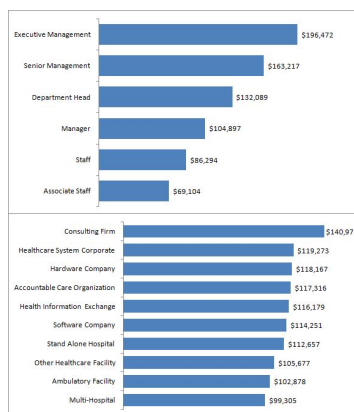


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Show me the money: how much do informatics professionals make?

- HIMSS compensation survey (2015, 2018) and HealthITJobs.com (2016) for health IT
- Salaries vary by level, region, experience, organizational size and type
- Even higher for some: physicians, academics, and advanced data science/analytics



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Graduate study at OHSU

<http://www.ohsu.edu/informatics>



Degrees/Certificates Awarded 1998-2017 (666 people)

Degree/Certificate	Total	BCB	CI
Doctor of Philosophy	24	6	18
Master of Biomedical Informatics	206	14	192
Master of Science	88	17	71
Certificate Program	420	0	420
Total	738	37	701

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

Track Degree/Certificate	PhD	MS	MBI	Grad Cert
Clinical Informatics	On-campus	On-campus	On-campus	On-campus
		On-line	On-line	On-line
Bioinformatics and Computational Biology	On-campus	On-campus		



Dept. of Medical Informatics & Clinical Epi (DMICE) faculty

- Care coordination and value-based care – David Dorr
- Machine learning – Aaron Cohen
- Information retrieval (search) – Bill Hersh
- Data quality – Nicole Weiskopf
- Simulation and safe use of EHR – Jeff Gold, Vishnu Mohan
- Patient decision aids – Karen Eden
- Imaging and telemedicine – Michael Chiang
- Drug repurposing – Shannon McWeeney
- Microbiome – Lisa Karstens
- Ontologies – Melissa Haendel



DMICE is a national leader in informatics

- No official rankings, but OHSU informatics program is
 - 1 of 16 programs to have a National Library of Medicine NIH Training Grant for PhD and postdoctoral students
 - 1 of 7 programs funded under the Office of the National Coordinator Health IT Workforce Development Program
 - Consistent recipient of research funding, appointment to national leadership positions, publication in high-profile journals, etc.
 - Highly accomplished alumni employed in many different settings

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Other relevant DMICE happenings

- Many research opportunities
 - DMICE receives about \$10 million in grant funding per year
 - Grants funded through NIH, AHRQ, ONC, NSF, others
- Epic-OHSU partnership
 - First-of-kind partnership for Epic
 - Have stood up research and educational instances of Epic
 - Allow research in usability, clinical decision support, simulation, etc.
- Revision of curriculum to enhance data science/analytics
 - Curriculum funding projects from NIH and ONC

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DMICE online

- DMICE seminars
 - YouTube:
<https://www.youtube.com/channel/UCCekPERb6i3xXEDQxwlCeIA>
- Web and blog
 - Web: <http://www.ohsu.edu/informatics>
 - Blog: <https://blogs.ohsu.edu/health-data/>
- Social media
 - Facebook:
<https://www.facebook.com/ohsu.informatics>
 - Twitter: [@OHSUInformatics](https://twitter.com/OHSUInformatics)

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Questions?

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