



Resources for Field – Organizations, Information, Education

What is Biomedical and Health Informatics? - <http://informatics.health/>
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Resources for field

- Organizations
- Information
- Education

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Professional organizations



- AMIA (formerly American Medical Informatics Association)
 - <https://www.amia.org/>
- Mission
 - AMIA advances the informatics professions relating to health and disease. To this end it advances the use of health information and communications technology in clinical care and clinical research, personal health management, public health/population, and translational science with the ultimate objective of improving health.

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Other professional organizations

- Healthcare Information and Management Systems Society (HIMSS) – <https://www.himss.org/>
- American Health Information Management Association (AHIMA) – <http://www.ahima.org/>
- Association of Medical Directors of Information Systems (AMDIS) – <https://amdis.org/>
- Alliance for Nursing Informatics (ANI) – <https://www.allianceni.org/>
- Public Health Informatics Institute (PHII) – <https://phii.org/>
- International Society for Computational Biology (ISCB) – <http://www.iscb.org/>
- Society for Imaging Informatics in Medicine (SIIM) – <https://siim.org/>
- Association for Computing Machinery (ACM) – <https://www.acm.org/>
- Medical Library Association (MLA) – <https://www.mlanet.org/>

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Medical and nursing specialty societies (non-exhaustive)

- American Medical Association (AMA) – <https://www.ama-assn.org/>
- American Nurses Association (ANA) – <https://www.nursingworld.org/>
- Association of American Medical Colleges (AAMC) – <https://www.aamc.org/>
- American College of Physicians (ACP) – <https://www.acponline.org/>
- American Academy of Family Physicians (AAFP) – <https://www.aafp.org/>

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Where does one find more information? Textbooks

- Hersh W, Ed. (2022). *Health Informatics: Practical Guide, 8th Edition*. Lulu.com
 - <http://www.informaticsbook.info/>
- Shortliffe, EH et al., Eds. (2021). *Biomedical Informatics: Computer Applications in Health Care and Biomedicine, 5th Edition*. Springer
- Finnell JT and Dixon BE, Eds. (2022). *Clinical Informatics Study Guide – Text and Review, 2nd Edition*. Springer

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Some other general textbooks

- Rivas, H., Wac, K. (Eds.), 2018. *Digital Health*, Health Informatics. Springer
- Syed-Abdul, S., Zhu, X., Fernandez-Luque, L. (Eds.), 2020. *Digital Health: Mobile and Wearable Devices for Participatory Health Applications*, Elsevier.
- Johnson, K.B., 2021. *I'm A Biomedical Informatics Expert Now!* Ws Education
- Berner, E.S. (Ed.), 2020. *Informatics Education in Healthcare: Lessons Learned*, 2nd ed, Health Informatics. Springer
- Davis, N.A., 2019. *Foundations of Health Information Management - E-Book*, 5th edition. Elsevier
- Kiel, J.M., Kim, G.R., Ball, M.J. (Eds.), 2022. *Healthcare Information Management Systems: Cases, Strategies, and Solutions*, 5th ed. Springer
- Butler-Henderson, K., Day, K., Gray, K. (Eds.), 2022. *The Health Information Workforce: Current and Future Developments*, 1st ed. Springer
- Meehan, R., Sharp, J., 2023. *Making a Difference*. Productivity Press

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More information (cont.), Journals

- Journals of AMIA
 - JAMIA – <https://academic.oup.com/jamia>
 - JAMIA Open – <https://academic.oup.com/jamiaopen>
- Methods of Information in Medicine (MIM)
- International Journal of Medical Informatics (IJMI)
- Journal of Medical Internet Research (JMIR)
 - JMIR Medical Informatics
- Journal of Biomedical Informatics (JBI)
- Applied Clinical Informatics (ACI)
 - ACI Open
- BMJ Health & Care Informatics
- Bioinformatics
- Journal of Digital Imaging (JDI)
- Biomed Central (BMC, <https://www.biomedcentral.com/>)
 - BMC Medical Informatics and Decision Making
 - BMC Bioinformatics

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More information (cont.), Meetings

- AMIA meetings
 - Annual Symposium
 - Informatics Summit
 - Clinical Informatics Conference
- Medinfo (biennial)
- Other clinical informatics meetings
 - HIMSS, national meeting and local chapters
 - AMDIS Physician-Computer Connection
- Bioinformatics meetings
 - Pacific Symposium on Biocomputing (PSB)
 - International Society for Computational Biology (ISCB)

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More information (cont.), Web sites

- US government
 - HHS ONC – <https://www.healthit.gov/>
 - Health IT Playbook – <https://www.healthit.gov/playbook/>
 - ONC HIT curriculum – <https://www.healthit.gov/topic/health-it-resources/health-it-curriculum-resources-educators>
 - AHRQ Digital Healthcare Research – <https://digital.ahrq.gov/>
 - US Health Information Knowledgebase – <https://ushik.ahrq.gov/mdr/portals>
- Other
 - HealthIT Answers – <https://www.healthitanswers.net/>
 - Clinfowiki – <http://clinfowiki.org>

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More information (cont.), email lists, blogs, and podcasts

- Email lists
 - HISTalk – <https://histalk2.com/>
 - HIT Strategist
 - From organizations such as AMIA, HIMSS, AMDIS, etc.
- Blogs
 - Geek Doctor (John Halamka, MD) – <https://geekdoctor.blogspot.com/>
 - Healthcare Standards (Keith Boone) – <https://motorcycleguy.blogspot.com/>
 - Health IT Buzz (ONC) – <https://www.healthit.gov/buzz-blog>
 - Informatics Professor (Hersh) – <https://informaticsprofessor.blogspot.com/>
- Podcasts
 - AMIA – <https://www.amia.org/amia-podcasts>
 - Women in AMIA
 - AMIA Clinical Informatics Fellows (ACIF) Go-Live
 - Kevin Johnson, Informatics in the Round, <https://kevinbjohnsonmd.podbean.com/>
 - Jason Moore, Biomedical Informatics Roundtable, <http://bmipodcast.org/>
 - Dirk Stanley, CMIO Podcast

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More information (cont.), acronyms

- Always asked, so here is a list
 - Health IT Answers – <https://www.healthitanswers.net/health-it-key-acronyms/>
 - Shortliffe glossary, which includes acronyms (2014) – <http://people.dbmi.columbia.edu/shortliffe/docs/Glossary%20-%204th%20ed.pdf>
 - Wikipedia – https://en.wikipedia.org/wiki/List_of_abbreviations_used_in_health_informatics
 - AHIMA – <https://library.ahima.org/doc?oid=107443#.YZ05sC-B2M4>

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More information: US government reports and plans

- *ONC Federal Health IT Strategic Plan 2020-2025*
 - <https://www.healthit.gov/topic/2020-2025-federal-health-it-strategic-plan>
 - Reducing burden of use of EHRs (2020)
 - Health IT priorities for research (2020)
- *National Library of Medicine Strategic Plan 2017-2027*
 - https://www.nlm.nih.gov/pubs/plan/lrp17/NLM_StrategicReport2017_2027.html

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ONC Strategic Plan (2020)



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NLM Strategic Plan (2017)

GOAL 1

Accelerate discovery and advance health through data-driven research

- 1.1 Connect the resources of a digital research enterprise
- 1.2 Advance research and development in biomedical informatics and data science
- 1.3 Foster open science policies and practices
- 1.4 Create a sustainable institutional, physical, and computational infrastructure

GOAL 2

Reach more people in more ways through enhanced dissemination and engagement

- 2.1 Know NLM users and engage with persistence
- 2.2 Foster distinctiveness of NLM as a reliable, trustworthy source of health information and biomedical data
- 2.3 Support research in biomedical and health information access methods and information dissemination strategies
- 2.4 Enhance information delivery

GOAL 3

Build a workforce for data-driven research and health

- 3.1 Expand and enhance research training for biomedical informatics and data science
- 3.2 Assure data science and open science proficiency
- 3.3 Increase workforce diversity
- 3.4 Engage the next generation and promote data literacy

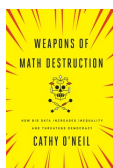
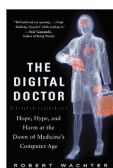
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Sampling from the popular press



- Topol, E., 2012. *The Creative Destruction of Medicine: How the Digital Revolution Will Create Better Health Care*. Basic Books.
- Topol, E., 2015. *The Patient Will See You Now: The Future of Medicine is in Your Hands*. Basic Books.
- Yom-Tov, E., 2016. *Crowdsourced Health: How What You Do on the Internet Will Improve Medicine*, Illustrated edition. MIT Press.
- Mukherjee, S., 2016. *The Gene: An Intimate History*. Scribner.
- O'Neil, C., 2016. *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy*. Crown.
- Patashnik, E.M., Gerber, A.S., Dowling, C.M., 2017. *Unhealthy Politics: The Battle over Evidence-Based Medicine*. Princeton University Press.
- Rosenthal, E., 2017. *An American Sickness: How Healthcare Became Big Business and How You Can Take It Back*. Penguin Press.
- Steele, G., Feinberg, D., 2017. *ProvenCare: How to Deliver Value-Based Healthcare the Geisinger Way*. McGraw-Hill Education.
- Wachter, R., 2017. *The Digital Doctor: Hope, Hype, and Harm at the Dawn of Medicine's Computer Age*. McGraw-Hill Education.
- Shapiro, N., Loberg, K., 2018. *Hype: A Doctor's Guide to Medical Myths, Exaggerated Claims, and Bad Advice - How to Tell What's Real and What's Not*. St. Martin's Press.
- Zuboff, S., 2019. *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power*. PublicAffairs.
- Miller, P., 2019. *Lethal Injection*. Koehler Books.

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Sampling from the popular press (cont).

- Mitchell, M., 2019. *Artificial Intelligence: A Guide for Thinking Humans*, Illustrated edition. Farrar, Straus and Giroux.
- Topol, E., 2019. *Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again*, Illustrated Edition. Basic Books.
- Marcus, G., Davis, E., 2019. *Rebooting AI: Building Artificial Intelligence We Can Trust*, Illustrated edition. Pantheon.
- Robertson, S., 2020. *B C, Before Computers: On Information Technology from Writing to the Age of Digital Data*. Open Book Publishers.
- Johnson, K.B., 2021. *I'm A Biomedical Informatics Expert Now!* Ws Education.
- Graham, S.S., 2022. *The Doctor and the Algorithm: Promise, Peril, and the Future of Health AI*. Oxford University Press.
- Shneiderman, B., 2022. *Human-Centered AI*. OUP Oxford.
- Lycette, J.L., 2023. *The Algorithm Will See You Now*. Black Rose Writing.

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Education and training in informatics

- Inter-disciplinary field
 - Many programs with diverse curricula
 - Programs come in many flavors: clinical, biomedical, health, bio-, nursing, etc.
- Education historically focused on academics but expanded to meet needs and opportunities for practitioners and users
 - Large growth in applied master's degree programs – about 75-80 in US (Cox, 2021)
- Major funder of programs is NLM, which funds programs to train future researchers at doctoral (PhD) and postdoctoral levels at 16 universities
 - Also funding from other sources, including institutions funding clinical informatics subspecialty fellowships
- After general overview, description of OHSU program given as an example
 - Consult programs' Web sites for details

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Academic programs

- List of US informatics programs on AMIA Web site
 - <https://amia.org/careers-certifications/informatics-academic-programs>
- NLM-funded programs (Greenes, 2022)
 - <https://www.nlm.nih.gov/ep/GrantTrainInstitute.html>

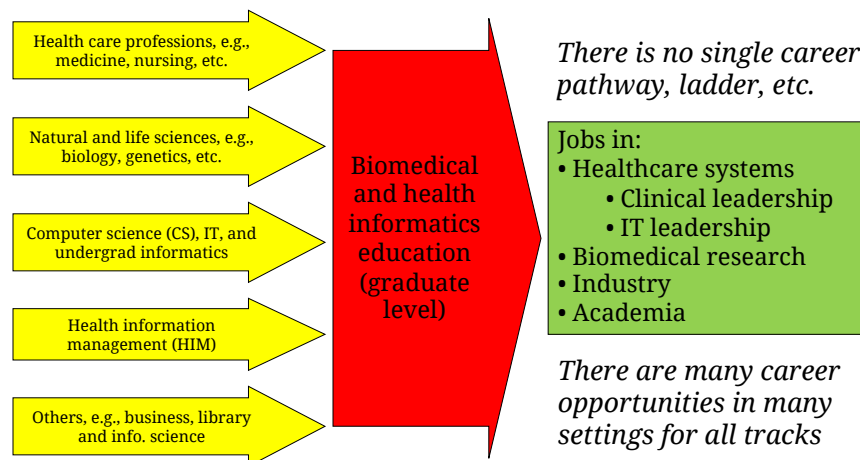
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Career pathways have diverse inputs and outputs (Hersh, 2009)



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Cardinal rule (formula) of informatics education

$$\begin{array}{c} \text{What you do} \\ \text{when you} \\ \text{get out} \end{array} = f \left(\begin{array}{c} \text{What you did} \\ \text{before you} \\ \text{started} \\ + \\ \text{What you} \\ \text{learned in the} \\ \text{program} \end{array} \right)$$

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Key attributes of OHSU informatics educational program

- Building-block structure
 - Work done at one level can be carried forward to next, i.e.,
10x10 → Graduate Certificate → MS (thesis or non-thesis)
→ PhD
- Majors
 - Health & Clinical Informatics (HCIN) – original program; focused on health and healthcare areas
 - Bioinformatics & Computational Biomedicine (BCB) – initial focus on genomics but has expanded to biomedicine

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OHSU biomedical informatics core curriculum domains

High-Level Competency	Domain Names for Health & Clinical Informatics (HCIN)	Domain Names for Bioinformatics & Computational Medicine (BCB)
Apply core concepts of using data, information, and knowledge to advance health and biomedicine	Health & Clinical Informatics	Bioinformatics & Computational Biomedicine
Apply knowledge of appropriate area(s) of health and biomedicine to informatics practice and research	Health Care	Biomedical Science
Apply computing skills to biomedical informatics	Computer Science	Computer Science
Apply quantitative methods to biomedical informatics	Evaluative Sciences	Biostatistics
Apply people and organizational knowledge to informatics	Organizational Behavior and Management	N/A
Apply advanced scholarship to biomedical and health informatics	Thesis/Capstone/Dissertation Requirements	Thesis/Capstone/Dissertation Requirements

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Application of curriculum to specific programs

- 10x10 program is version of introductory course in clinical informatics track
- Graduate Certificate program focuses mainly on first two domains of HCIN major
 - Biomedical informatics
 - Organizational and management sciences
- Master of Science adds other domains plus either
 - Thesis
 - Capstone or Internship – Non-thesis (formerly MBI)
- PhD program adds specialized research training, cognate area of interest, doctoral seminar, and dissertation

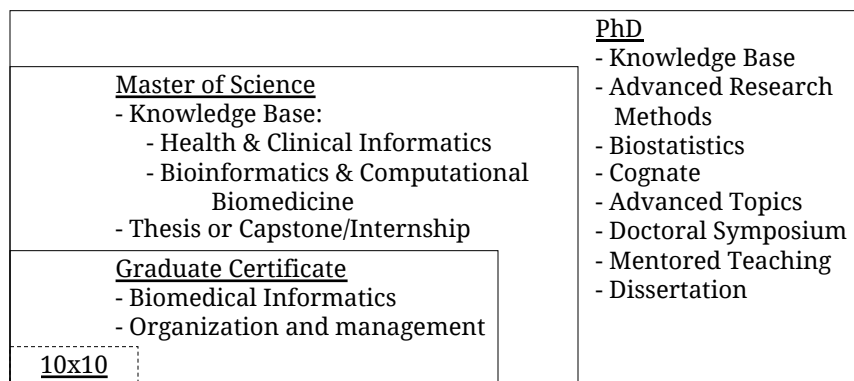
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Another view of “building block” approach



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

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Overview of programs available

Degree/Certificate Track	PhD	MS Thesis	MS Non-Thesis	Graduate Certificate
Health & Clinical Informatics (HCIN)	On-campus	On-campus	On-campus On-line	On-campus On-line
Bioinformatics & Computational Biomedicine (BCB)	On-campus	On-campus	On-campus	N/A

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OHSU informatics – by the numbers



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

Degree	Total	BCB	HCIN
GC	496	0	496
MS	431	74	357
PhD	38	15	23
Total	965	89	876



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How have OHSU students and graduates done?

- A quarter-century of experience...
- General observation: What people do when they graduate is partially dependent on what they did when they entered, e.g.,
 - Physicians, nurses, public health, etc. draw on their clinical/professional background
 - Information technology professionals draw on their unique background and experience
- Graduates have obtained jobs in a variety of settings, e.g., clinical, academic, and industry
- Some have obtained jobs before finishing the program



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Conclusions

- These are exciting times for biomedical and health informatics, with many opportunities in a wide variety of settings
- Attention must also be paid to the professional practice and education of informaticians
- But the main focus of the field must be how to optimally use information and technology properly to advance human health

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