Overview of Health Informatics

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A Few Words About Me...

2003 **Doctor of Medicine (1st-Class Honors)** Ramathibodi

2009 **M.S. (Health Informatics)** University of Minnesota

2011 **Ph.D. (Health Informatics)** University of Minnesota

Currently

- Deputy Dean for Operations
- Lecturer, Section for Clinical Epidemiology & Biostatistics

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Session Outline

- Overview of Health Informatics
  - This presentation
- Overview of Health IT
  - Next presentation

What Is “Informatics”

- French: **informatique** = the science and technology of information processing using computers (Greenes & Shortliffe, 1990)
- “[T]he discipline focused on the acquisition, storage, and use of information in a specific setting or domain” (Hersh, 2009)
- “[T]he science of information” (Bernstam et al, 2010)

Medical Informatics

- "Ancient" term
- Being retired
- Future use discouraged by experts
- Only retained in titles of professional organizations

Why did we retain the term?

The most prominent profession in medical field are doctors, nurses, and other allied health workers. These professions are vital in medical informatics since they are referred to as the medical practitioners. By the term "medical", technically, they are directly related to these medical practitioners. Since these professions are crucial and key player in the field, they decided to retain the term "Medical Informatics"

Main Problems

- Medical = Doctor? (e.g. not nursing?)
- **Medical** informatics vs. **Clinical** informatics

Clinical science - related to clinical settings. But medical also relates to clinical informatics. Basically, the medical informatics is the broader meaning, while the clinical informatics tend to relate to a specific setting.

Health informatics is preferred by Ajarn. Also, the professor works in the field of Health Informatics.

Better Terms

Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

- Biomedical informatics — Includes neurology, physiology, etc. This is the bigger term.
- Health informatics — preferable — The health informatics is related to the medicine.
- Biomedical and Health informatics — politically correct but too long

A Few Subtleties

Health informatics DOES NOT NECESSARILY include bioinformatics

- **Health** informatics suggests the goal is "health"
- **Health** informatics vs **Public health** informatics
- **Health** informatics includes **Bio**informatics?
- No clear winner between

Health informatics is broader than the biomedical informatics. The Biomedical Informatics is the subset of the Health Informatics.

Biomedical and Health Informatics

Biomedical informatics vs. **Health** informatics

Bioinformatics: uses biology, subset of biomedical informatics, which uses computers

But What Is M/B/H Informatics Anyway?

- Medical computing/computers in medicine?
- '[R]eferring to biomedical informatics as "**computers in medicine**" is like defining cardiology as "**stethoscopes in medicine**".'

  (Bernstam et al, 2010) a tool used to study the heart -- reducing the term as a tool??
- "[T]he field concerned with the cognitive, information processing, and communication tasks of medical practice, education, and research, including the information science and technology to support these tasks"

  (Greenes & Shortliffe, 1990)

More Definitions of M/B/H Informatics

- "[T]he field that is concerned with the optimal use of **information**, **often** aided by the use of **technology**, to improve individual health, health care, public health, and biomedical research" (Hersh, 2009)
- "[T]he application of the science of **information** as **data plus meaning** to problems of biomedical interest" (Bernstam et al, 2010)

data (information) + health ---- biomedical and health informatics

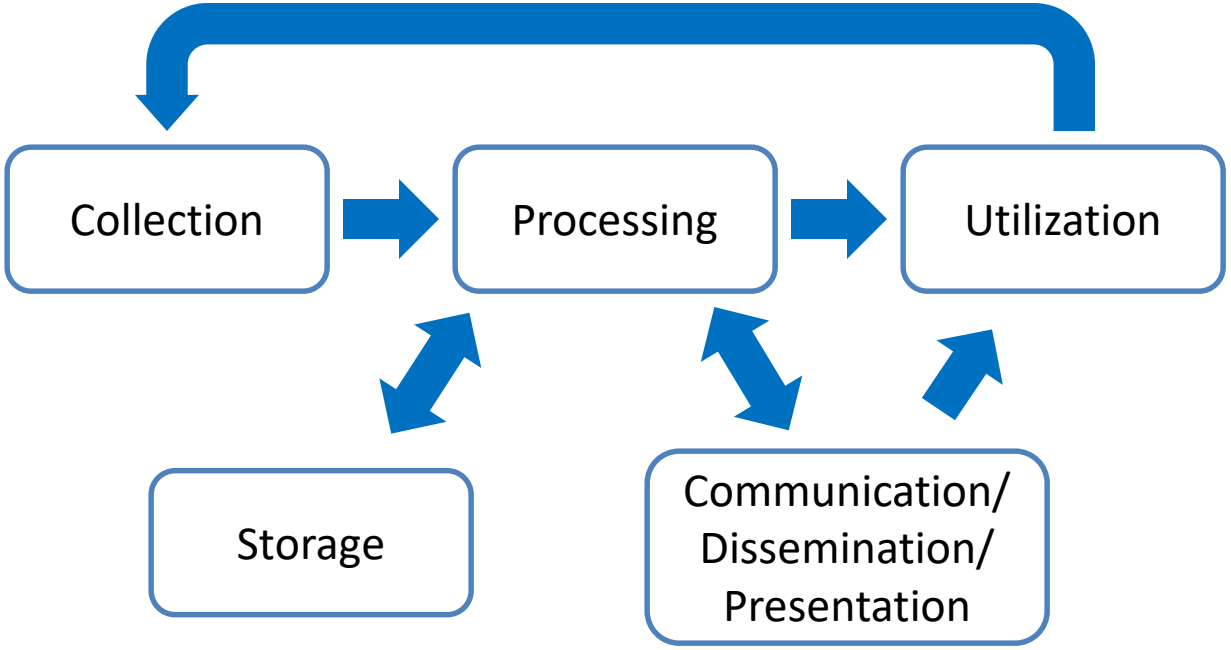
In many cases, we use information technology, and the field of work focuses on heathcare, epidemiology, and individual health.

Summary About M/B/H Informatics

Informatician = informaticist, informatician is preferable

- Focuses more on information, not technology
- Task-oriented view: Focus on exploiting the information and data by utilizing and processing the knowledge through technology (i.e., storage, math tools)

Technology = application of scientific knowledge to the practical aims of the human life

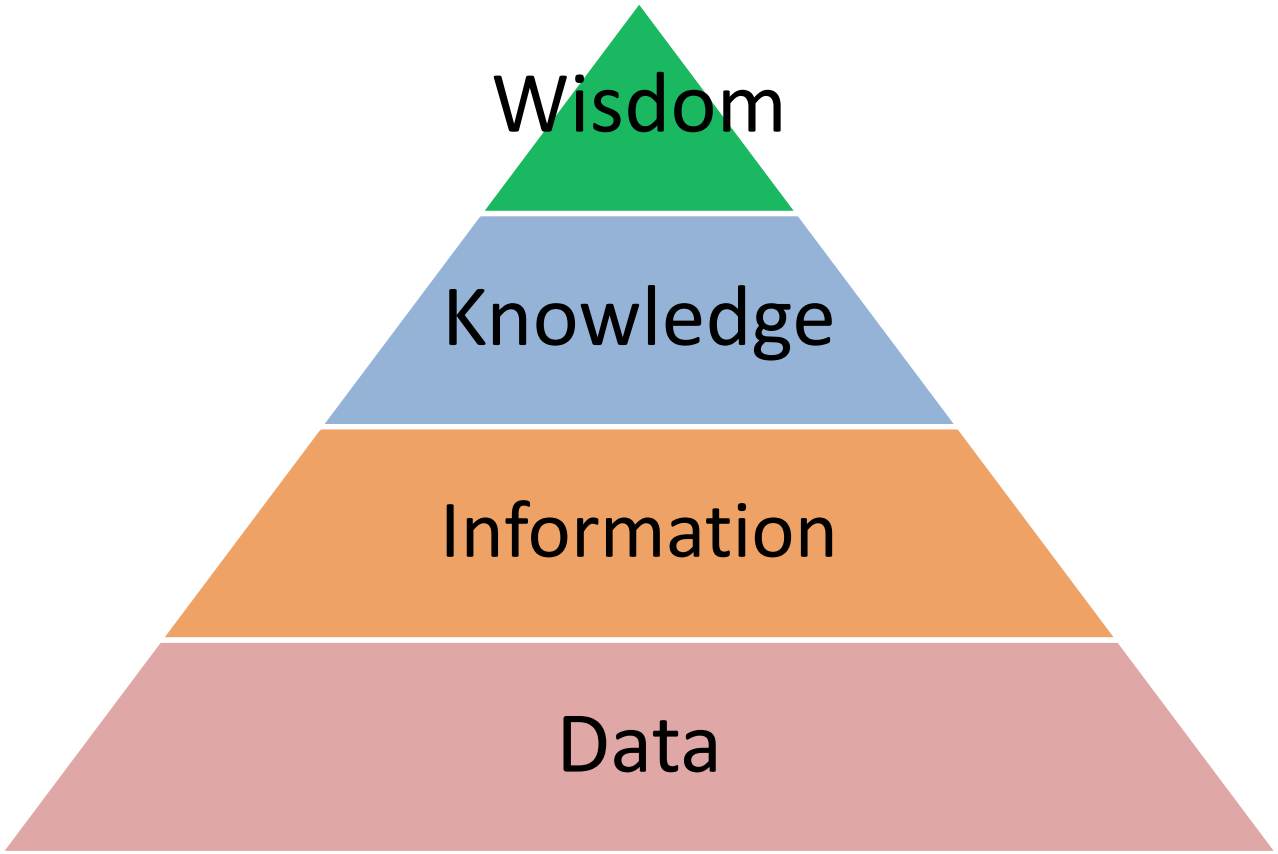


Summary About M/B/H Informatics

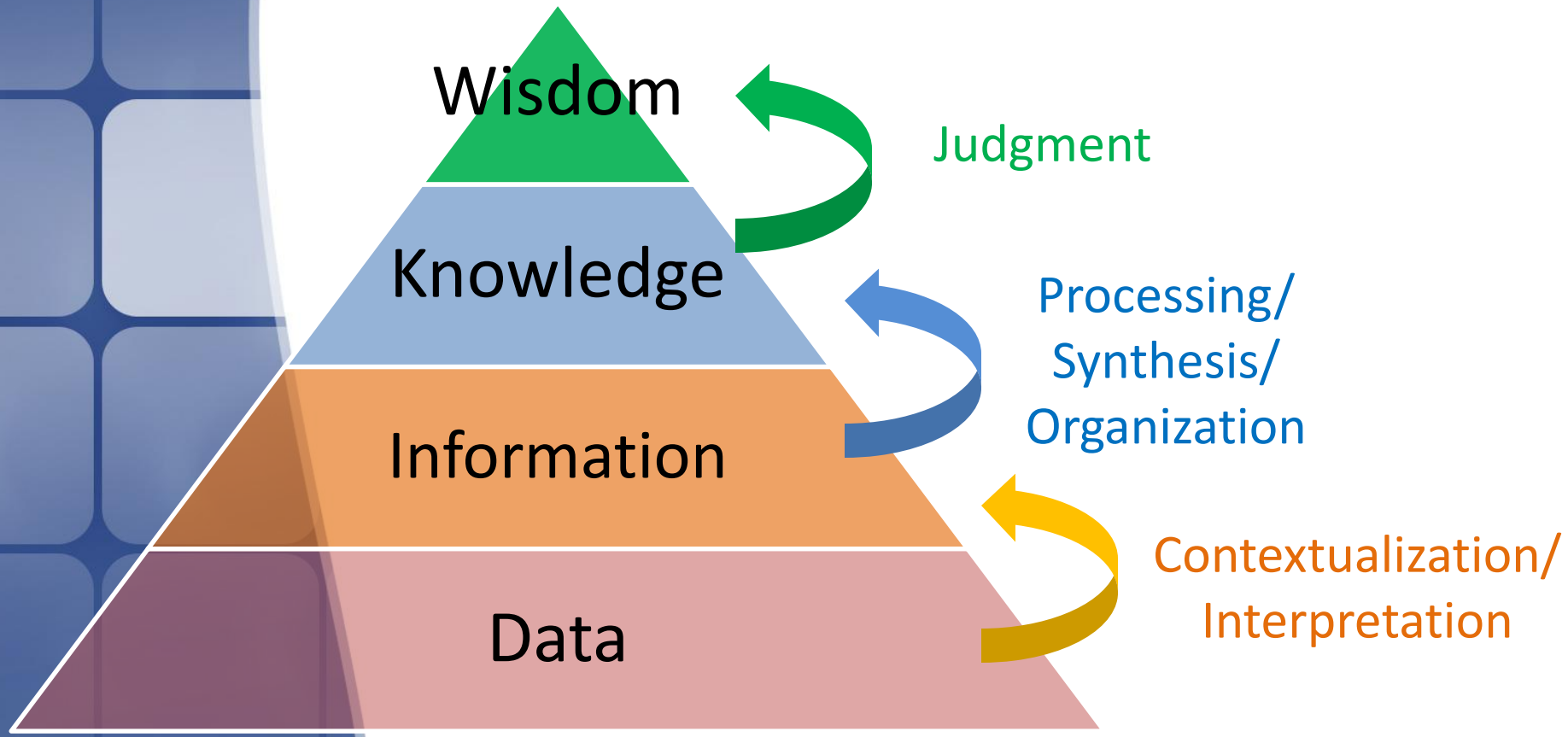
- Areas under the domain of M/B/H informatics
  - Health service delivery (health care)
    - Medical, dental, nursing, pharmacy, etc.
    - IT management in health care organizations
  - Public health
    - Policy & administration, epidemiology, environmental health, health services research, etc.
  - Individual patient/consumer's health
  - Education of health professionals
  - Biomedical research (clinical trials, public health research, research in biomedical sciences)

So....What Is Information?

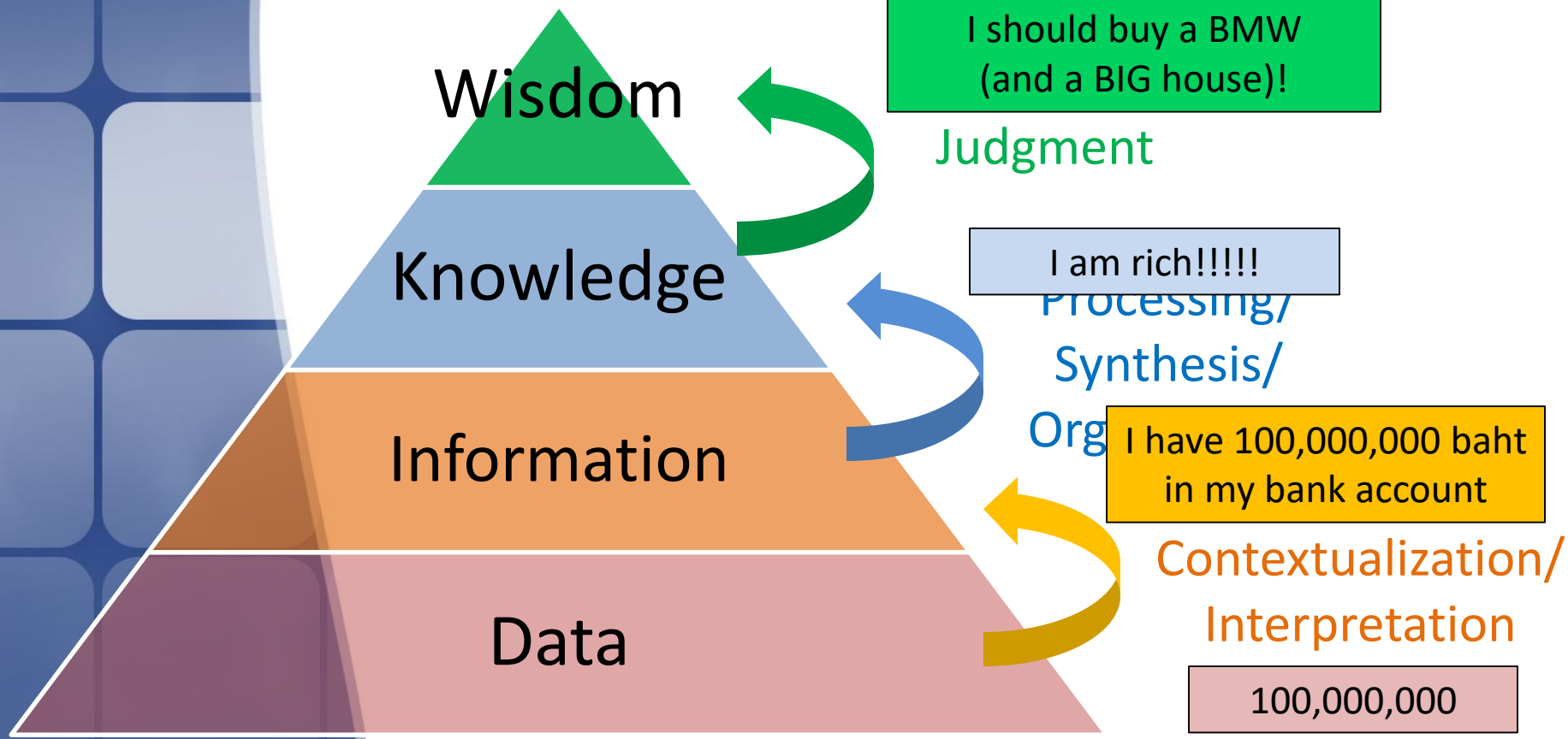
Data-Information-Knowledge-Wisdom (DIKW) Pyramid



Data-Information-Knowledge-Wisdom



Example


Wisdom
Knowledge
Information
Data
I should buy a BMW
(and a BIG house)!
Judgment
I am rich!!!!!
Processing/
Synthesis/
Org
I have 100,000,000 baht
in my bank account
Contextualization/
Interpretation
100,000,000

Class Exercise #1

From the following problems, identify/exemplify data, information, knowledge, and wisdom

Class Exercise #1: Problem A

- Patient A has a blood pressure reading of 170/100 mmHg

Class Exercise #1: Problem B

- Patient B is allergic to penicillin. He was recently prescribed amoxicillin for his sore throat.

Class Exercise #1: Problem C

- Patient C's plain film X-ray is as shown:

Class Exercise #1: Problem A

- Patient A has a blood pressure reading of 170/100 mmHg

Class Exercise #1: Problem A

- Patient A has a blood pressure reading of 170/100 mmHg
- **Data:** 170/100
- **Information:** BP of Patient A = 170/100 mmHg
- **Knowledge:** Patient A has high blood pressure
- **Wisdom:**
  - Patient A needs to be investigated for cause of HT
  - Patient A needs to be treated with anti-hypertensives
  - Patient A needs to be referred to a cardiologist

Class Exercise #1: Problem B

- Patient B is allergic to penicillin. He was recently prescribed amoxicillin for his sore throat.

Class Exercise #1: Problem B

- Patient B is allergic to penicillin. He was recently prescribed amoxicillin for his sore throat.
- **Data:** Penicillin, amoxicillin, sore throat
- **Information:**
  - Patient B has penicillin allergy
  - Patient B was prescribed amoxicillin for his sore throat
- **Knowledge:**
  - Patient B may have allergic reaction to his prescription
- **Wisdom:**
  - Patient B should not take amoxicillin!!!

Class Exercise #1: Problem C

- Patient C's plain film X-ray is as shown:

Class Exercise #1: Problem C

- Patient C's plain film X-ray
- **Data:**

- **Information:**
  - Patient C's plain film X-ray is as seen in the image
  - There is a break in the continuity of the periosteum of Patient C's left radius and ulna
- **Knowledge:**
  - Patient C has fractures of left radius and ulna
- **Wisdom:**
  - Patient C's fractures need to be properly treated

Image Source: http://en.wikipedia.org/wiki/Bone_fracture

Back to Earlier Definitions of Informatics

M/B/H Informatics is…

- "[T]he field that is concerned with the optimal use of **information**, **often** aided by the use of **technology**, to improve individual health, health care, public health, and biomedical research" (Hersh, 2009)
- "[T]he application of the science of **information** as **data plus meaning** to problems of biomedical interest" (Bernstam et al, 2010)

Informatics focuses on "I", not "T"

What is "Biomedical Informatics"?

Reproduced/Adapted from American Medical Informatics Association (http://www.amia.org/about-amia/science-informatics)

Biomedical Informatics

Biomedical informatics (BMI) is the interdisciplinary field that studies and pursues the effective uses of biomedical data, information, and knowledge for scientific inquiry, problem solving, and decision making, motivated by efforts to improve human health.

Reproduced/Adapted from American Medical Informatics Association (http://www.amia.org/about-amia/science-informatics)

Biomedical Informatics: Corollaries to the Definition

1. BMI develops, studies and applies theories, methods and processes for the generation, storage, retrieval, use, and sharing of biomedical data, information, and knowledge.
2. BMI builds on computing, communication and information sciences and technologies and their application in biomedicine.

Reproduced/Adapted from American Medical Informatics Association (http://www.amia.org/about-amia/science-informatics)

Biomedical Informatics: Corollaries to the Definition

3. BMI investigates and supports reasoning, modeling, simulation, experimentation and translation across the spectrum from molecules to populations, dealing with a variety of biological systems, bridging basic and clinical research and practice, and the healthcare enterprise.

4. BMI, recognizing that people are the ultimate users of biomedical information, draws upon the social and behavioral sciences to inform the design and evaluation of technical solutions and the evolution of complex economic, ethical, social, educational, and organizational systems.

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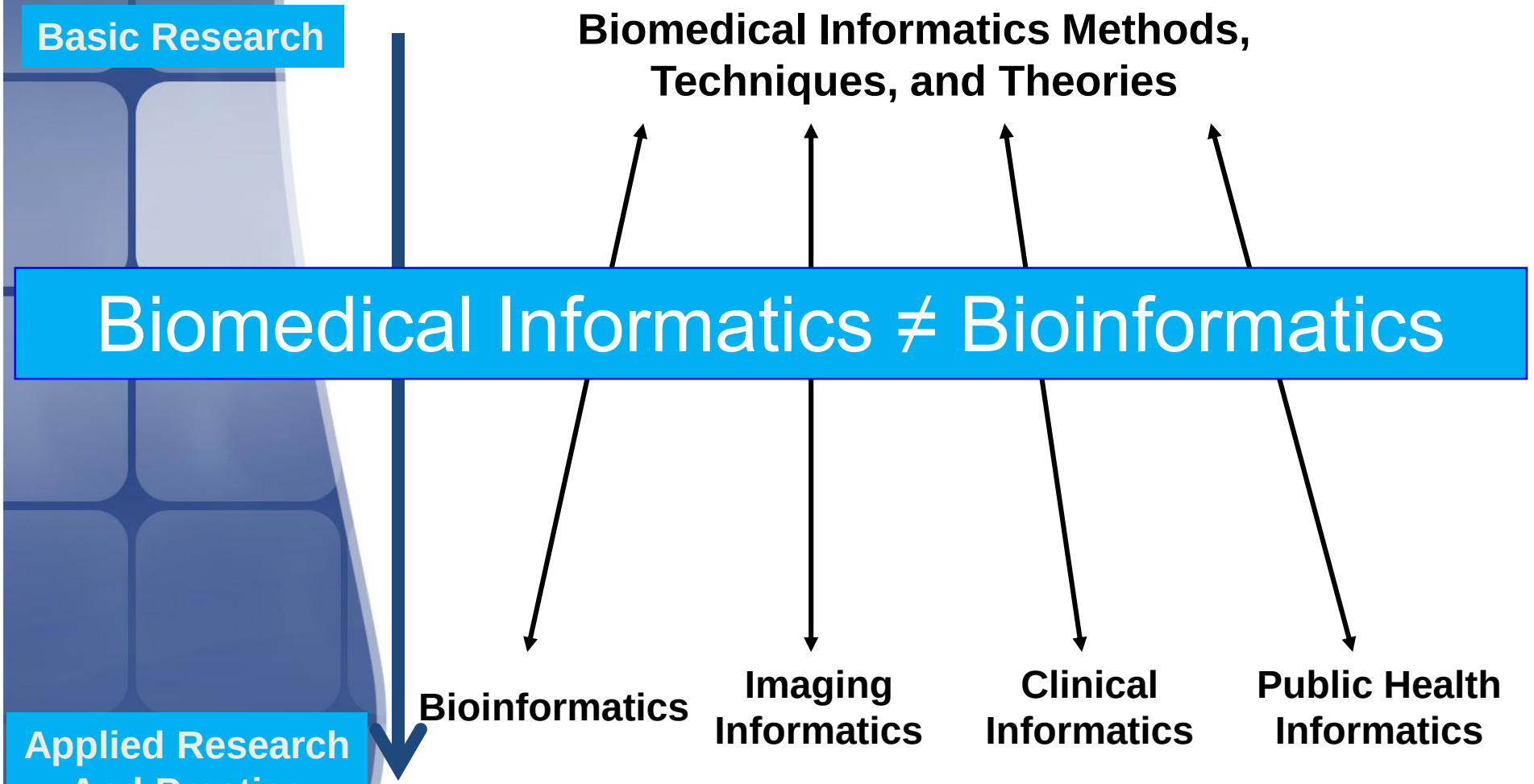
Biomedical Informatics in Perspective



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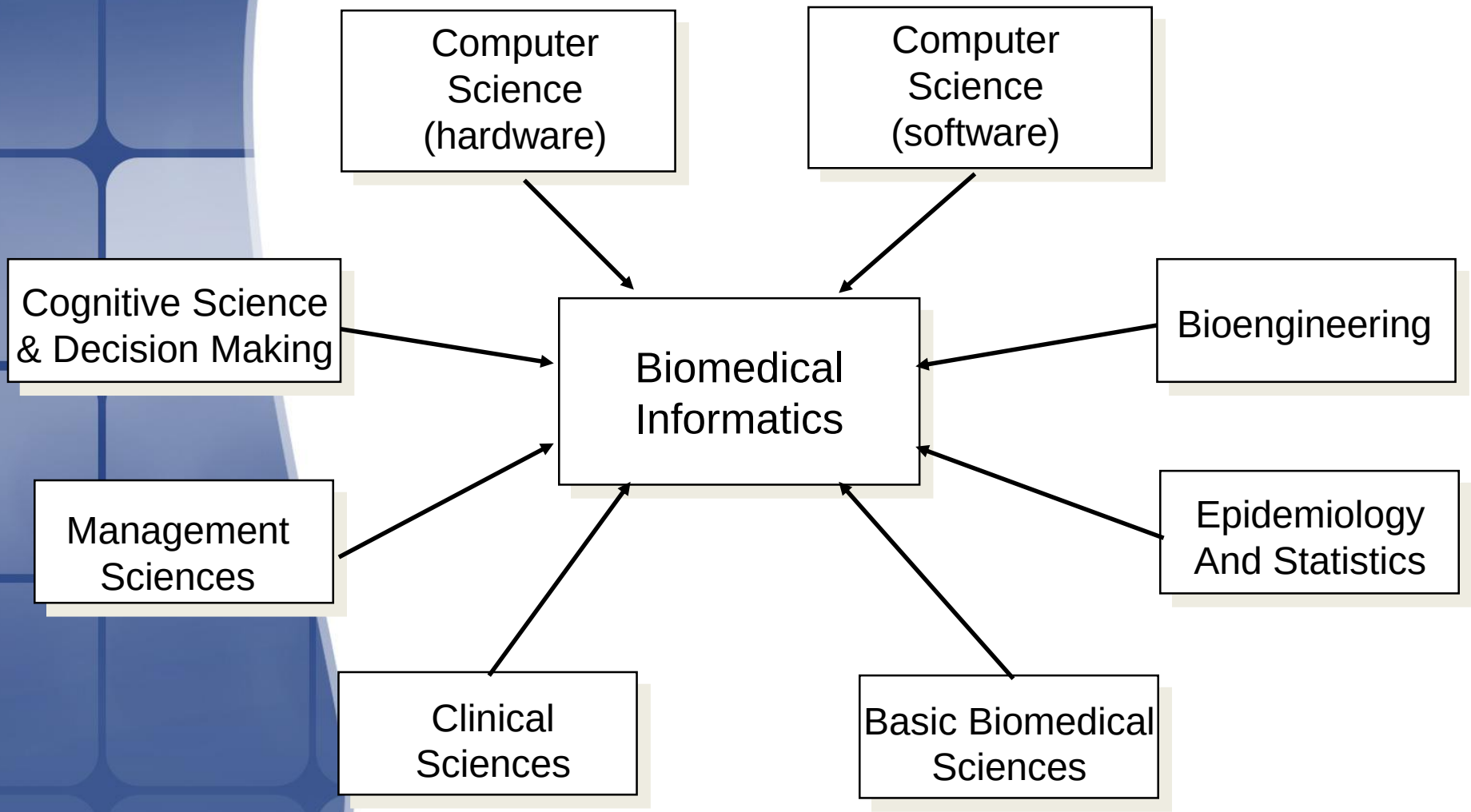
Interdisciplinary Nature of Biomedical Informatics



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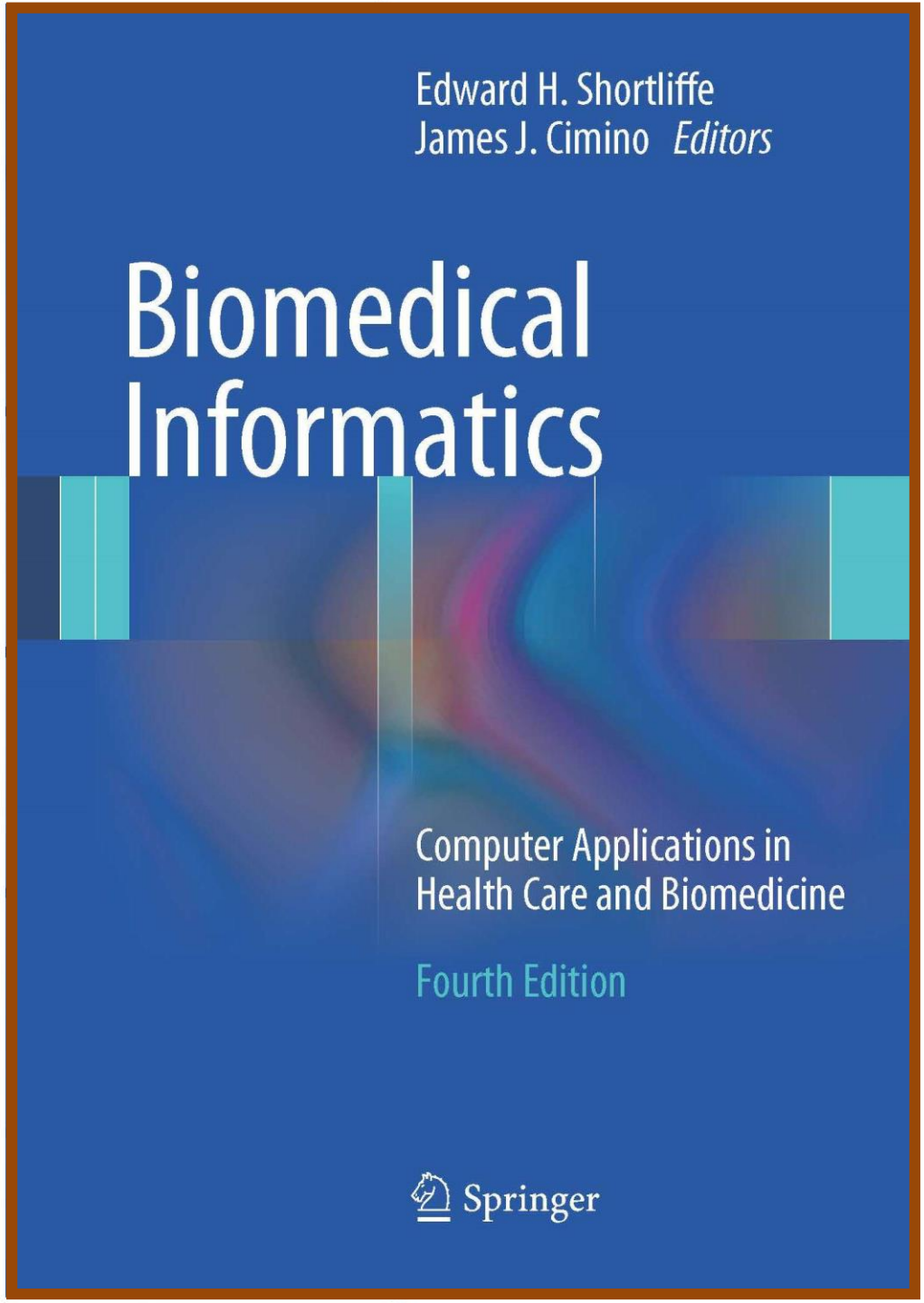

Biomedical Informatics Textbook

(4th edition)

Springer Verlag - 2013

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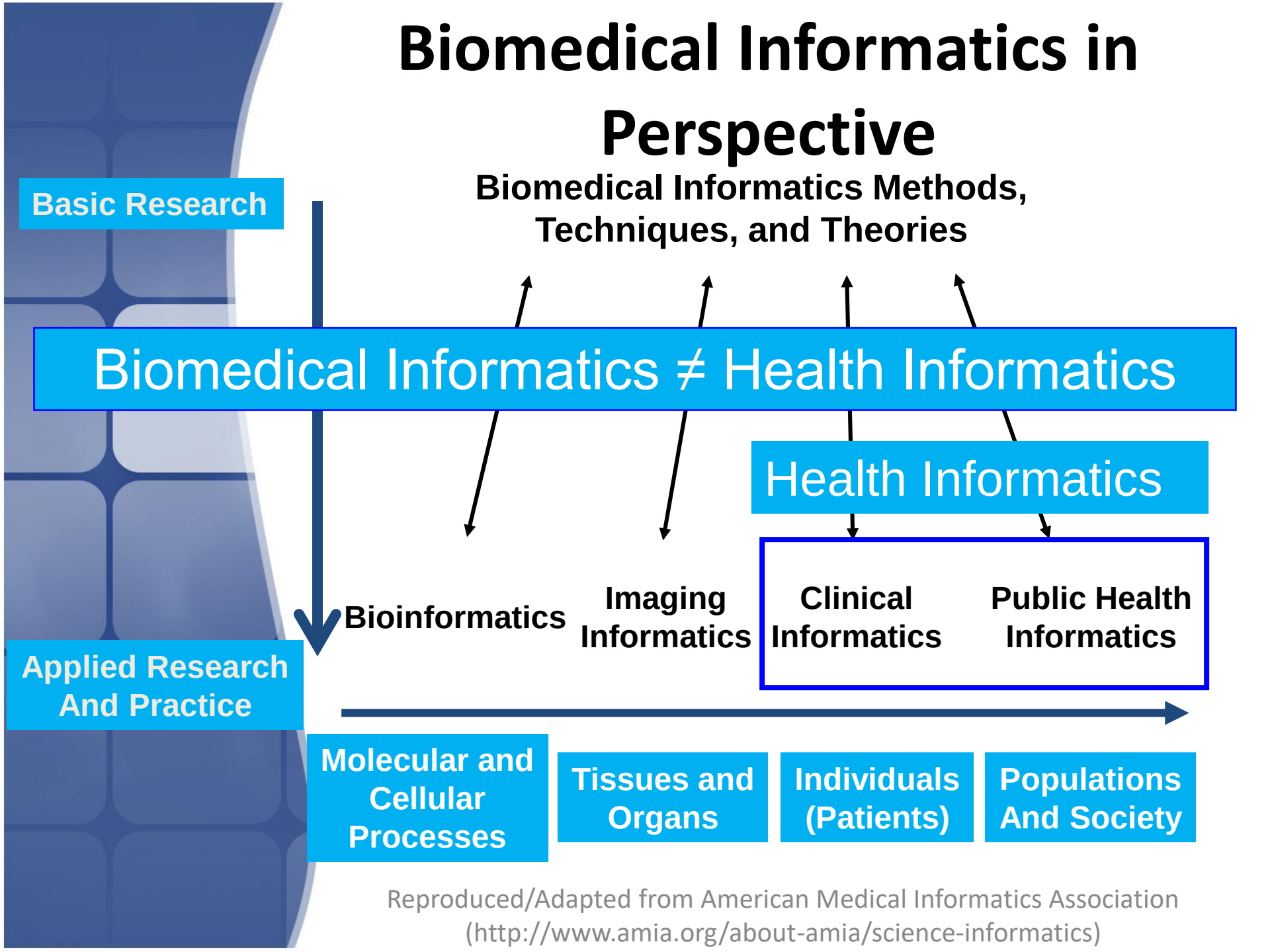

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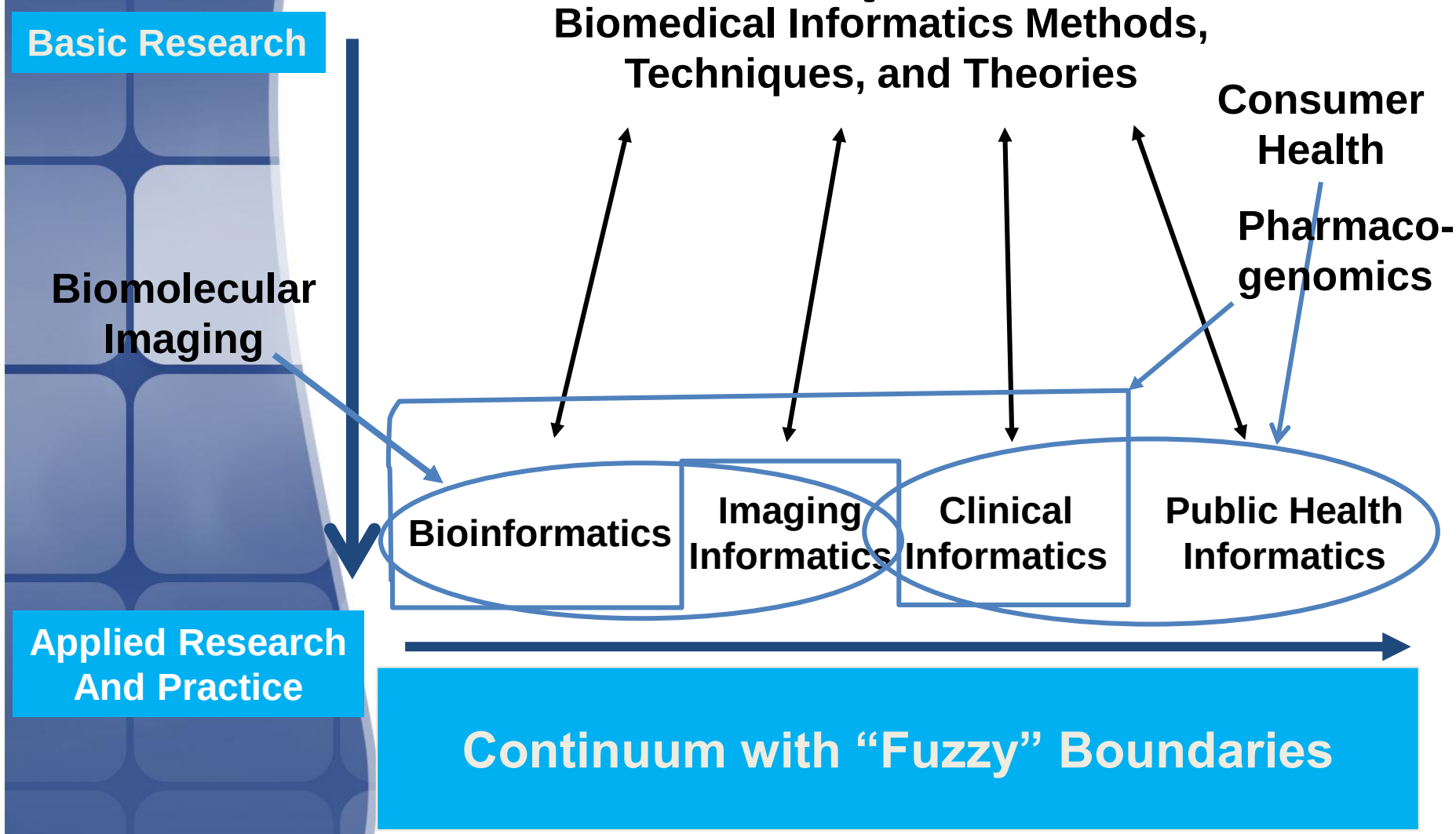

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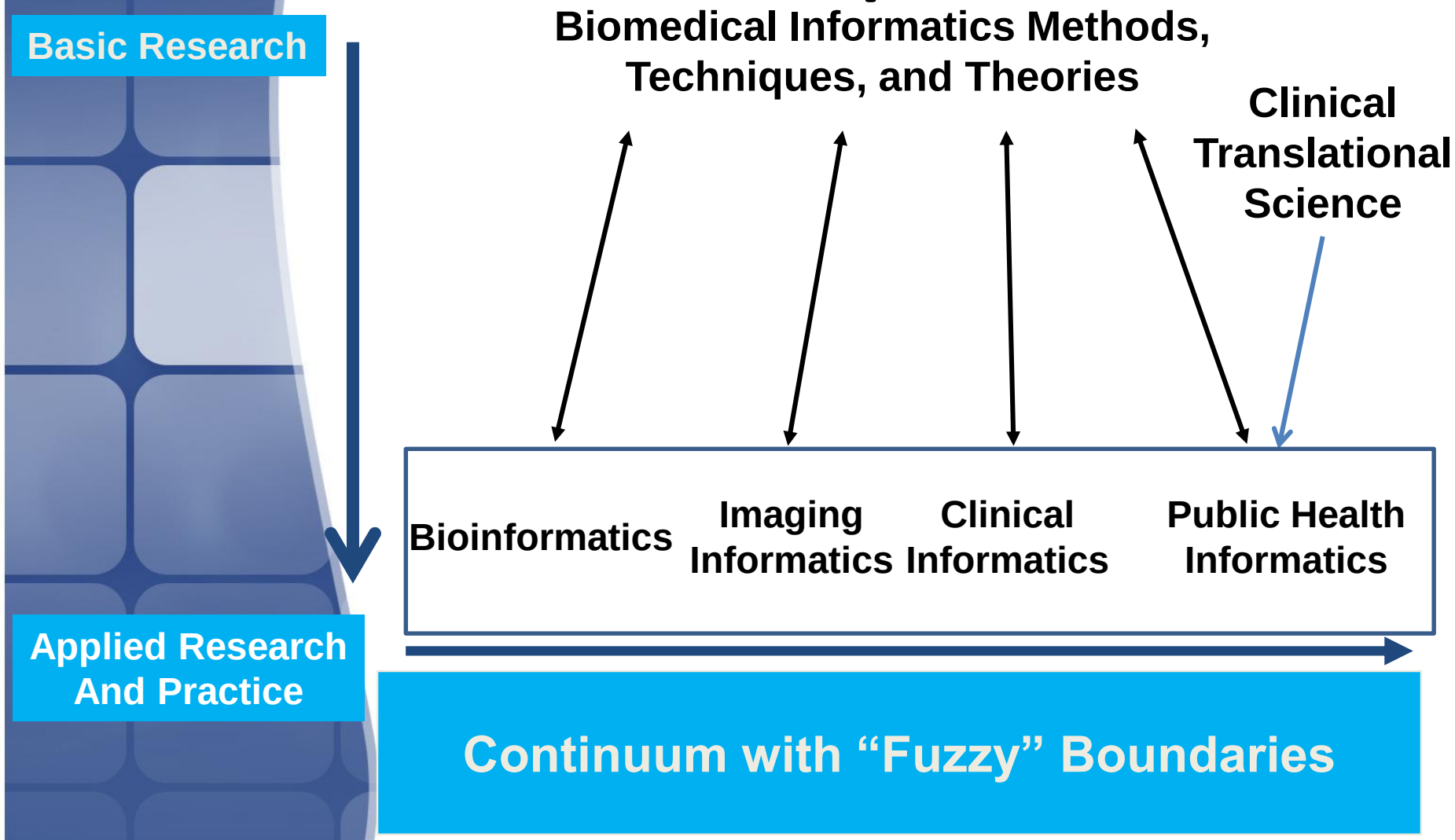

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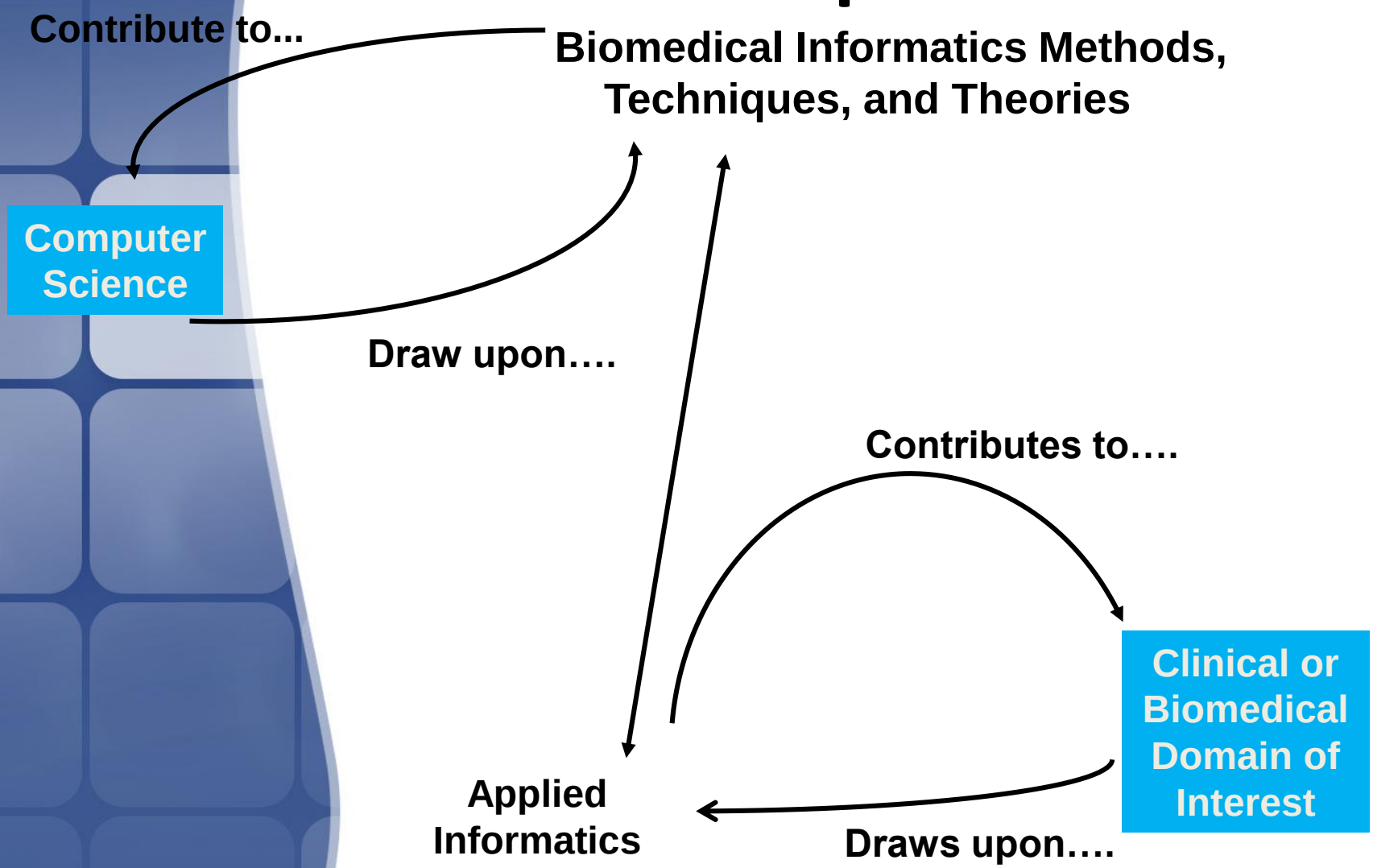

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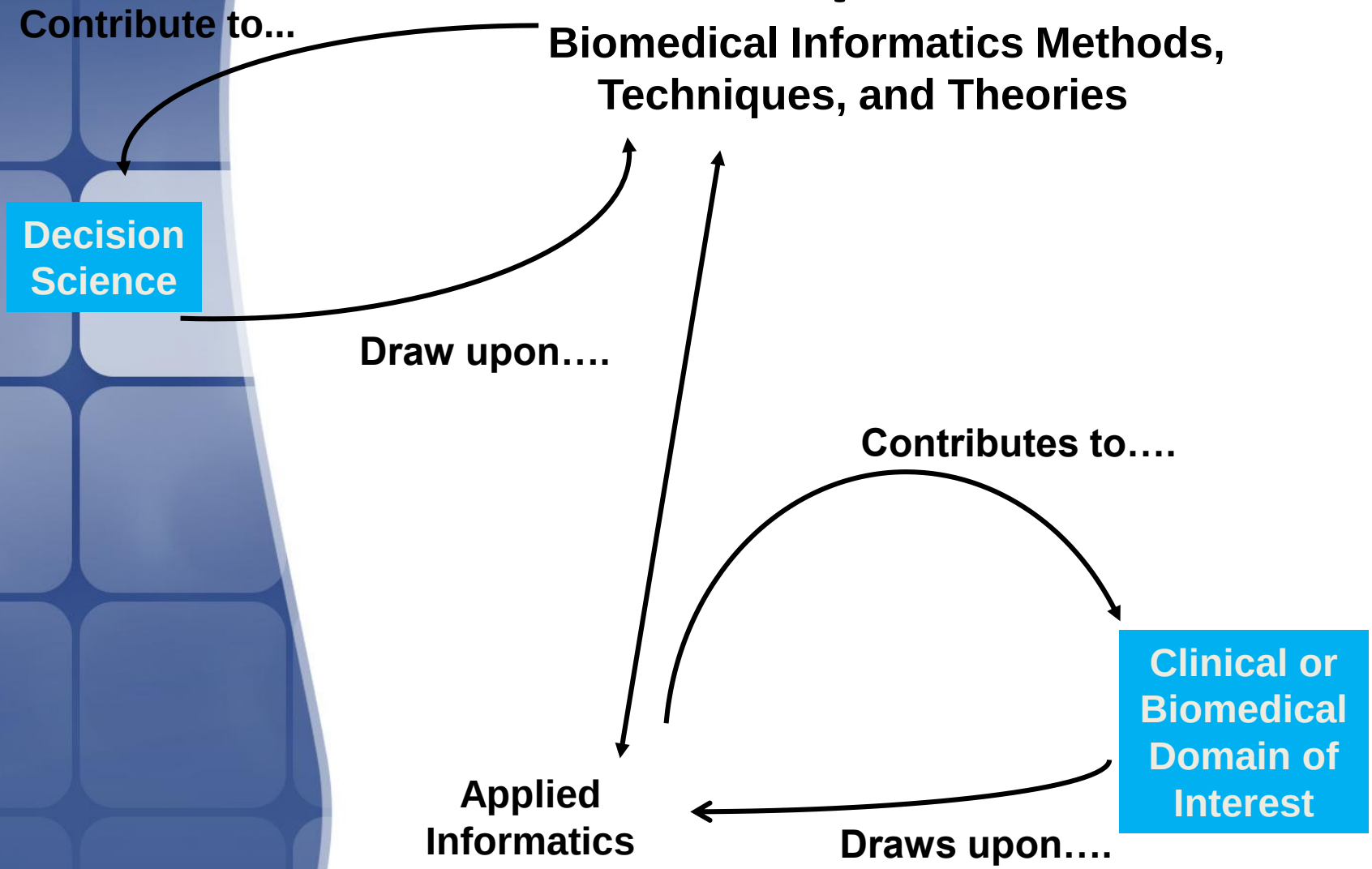

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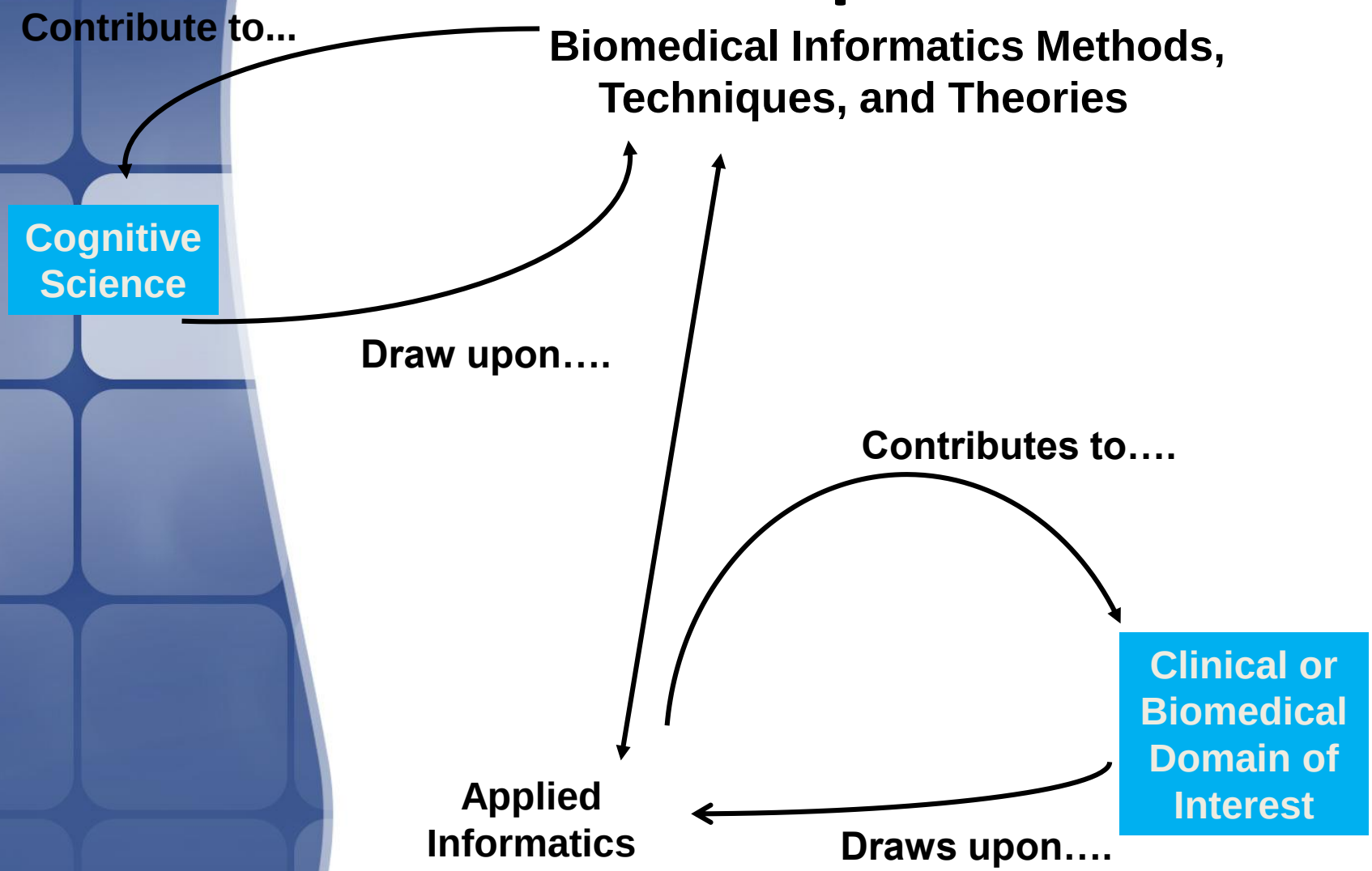

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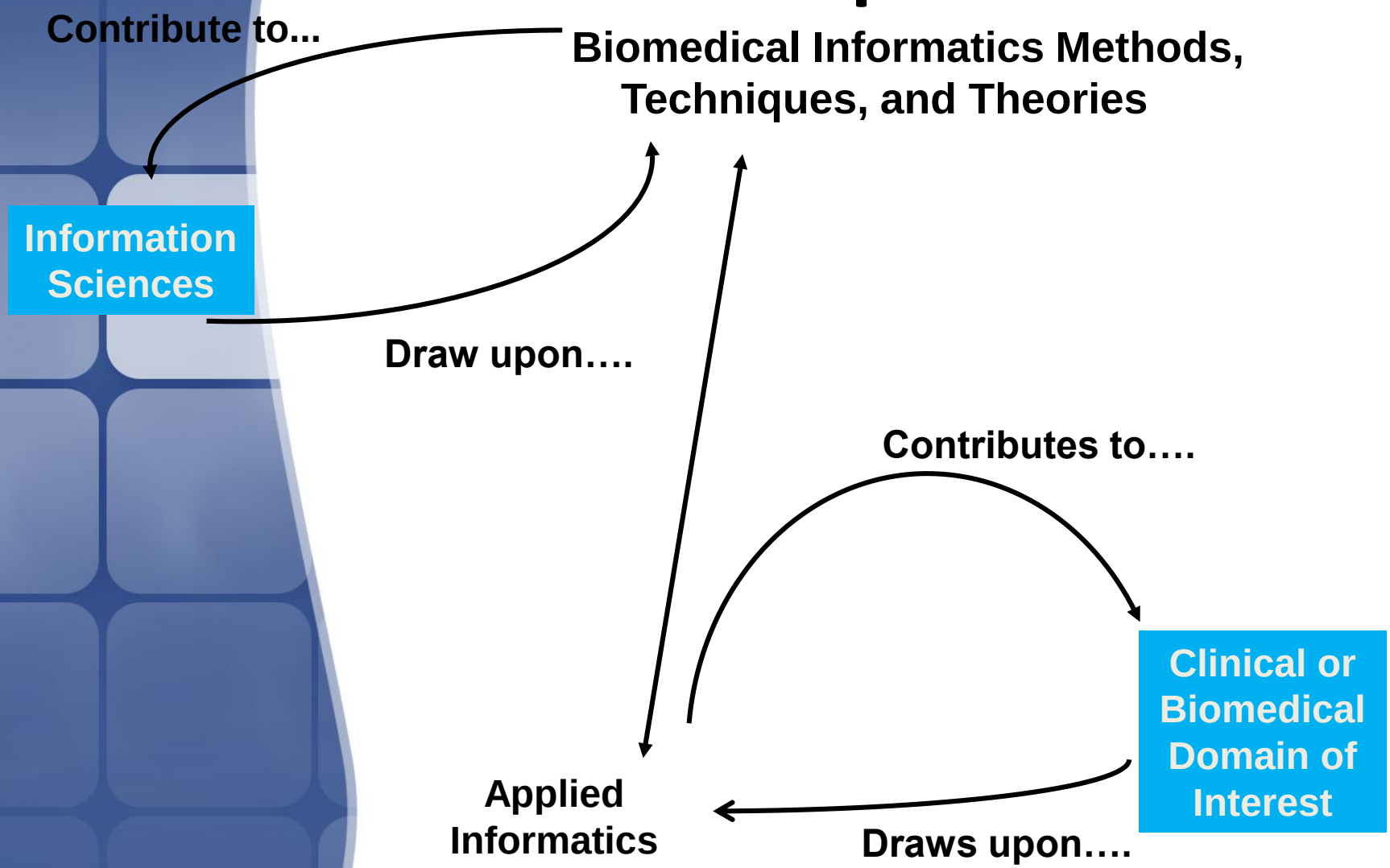

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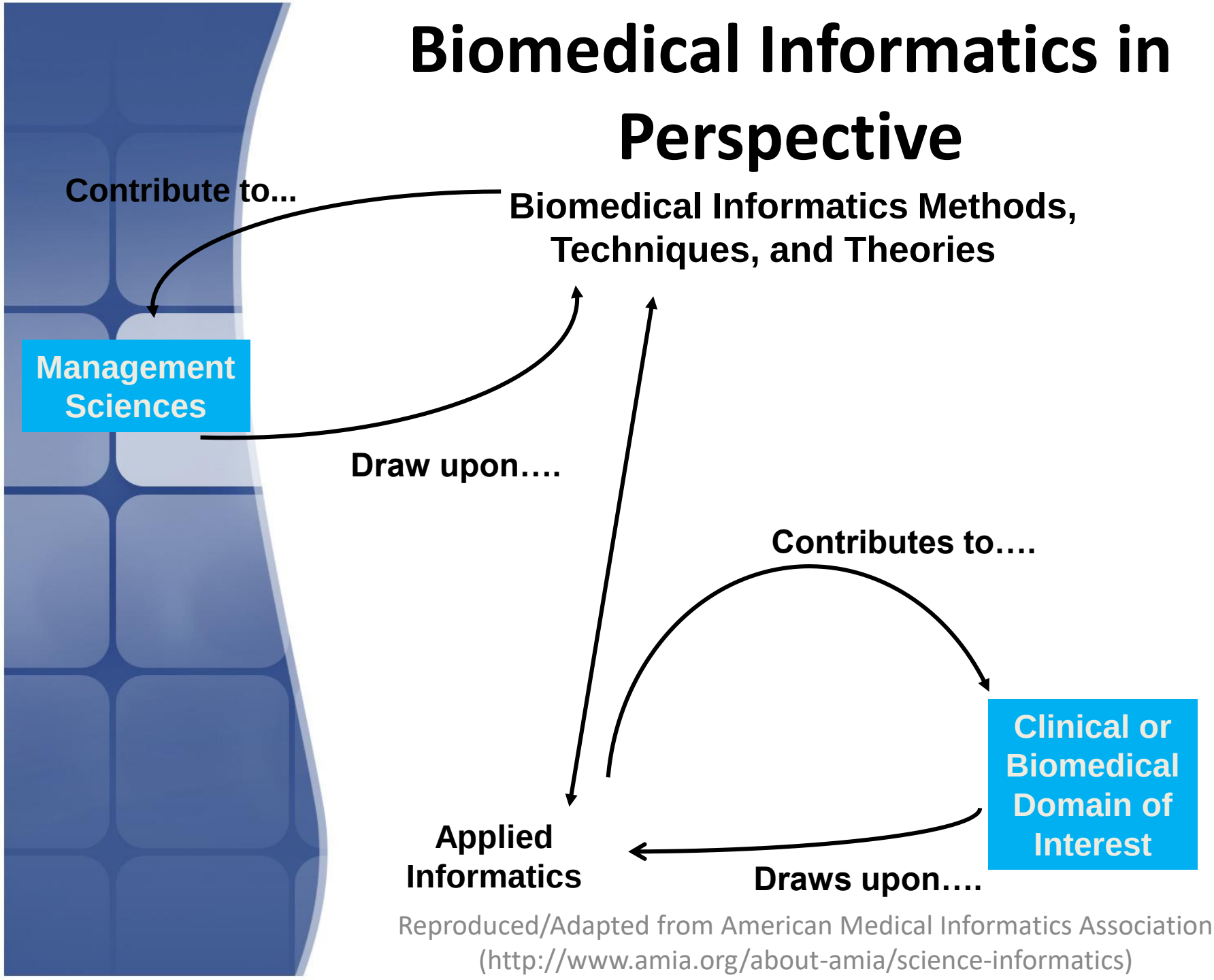

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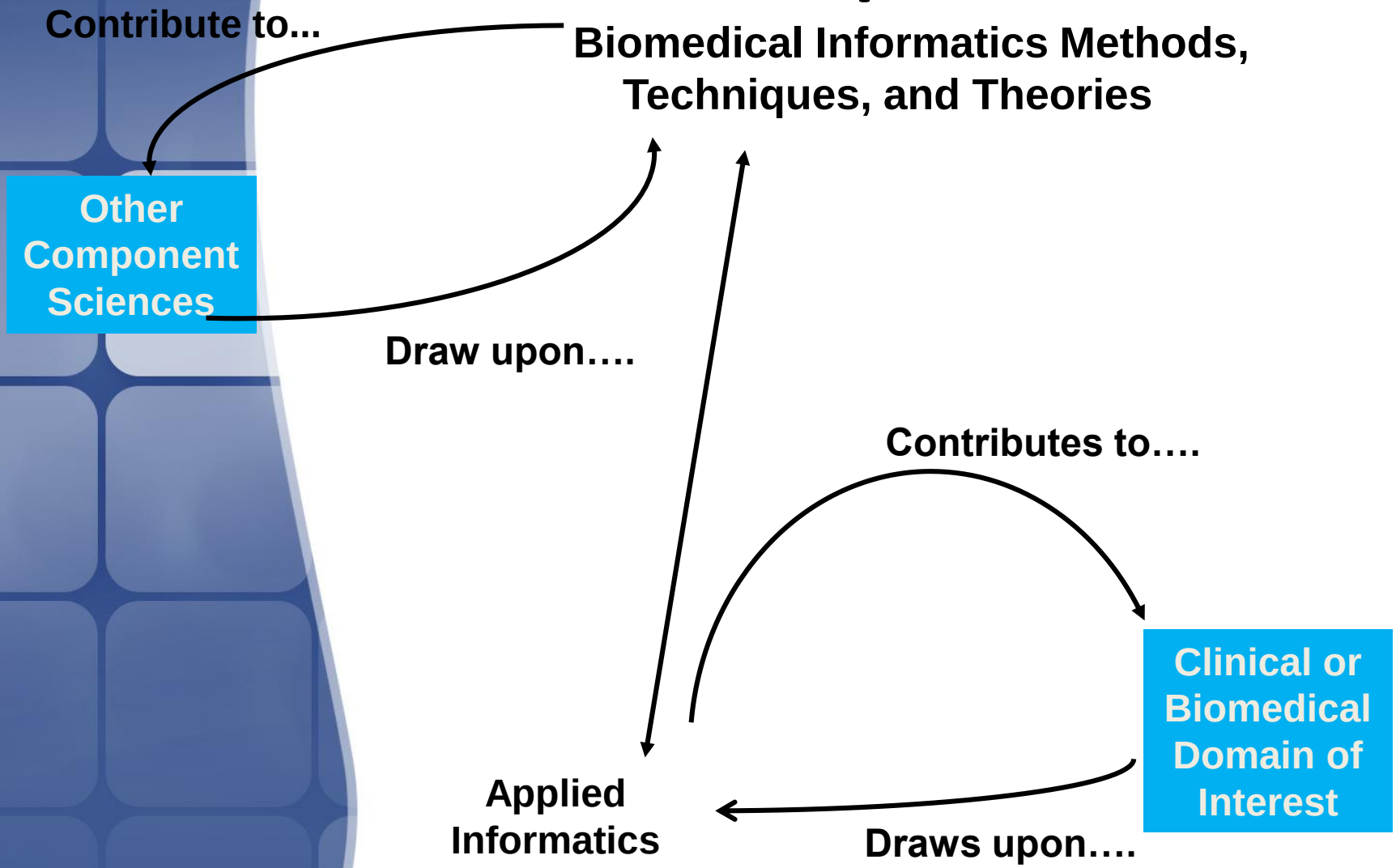

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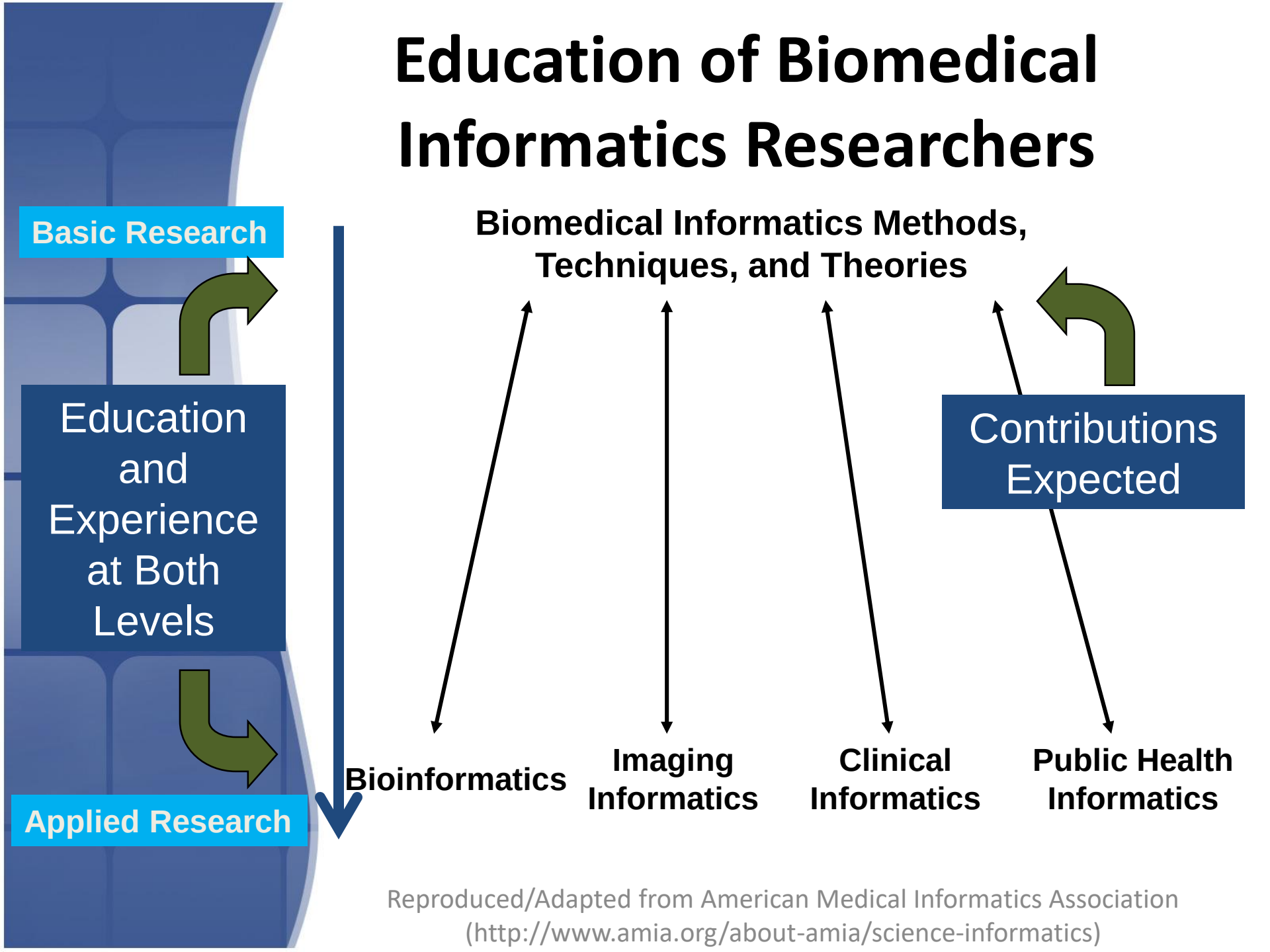
Education of Biomedical Informatics Researchers



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An Envisioned Cycle That Ties Patient Care with Knowledge Creation and Dissemination

Providers Caring for Patients

Electronic Health Records

Biomedical and Clinical Research

Regional and National Public Health and Disease Registries

Standards for Prevention and Treatment

Creation of Protocols, Guidelines, and Educational Materials

Information, Decision-Support, and Order-Entry Systems

A "Learning Healthcare System"

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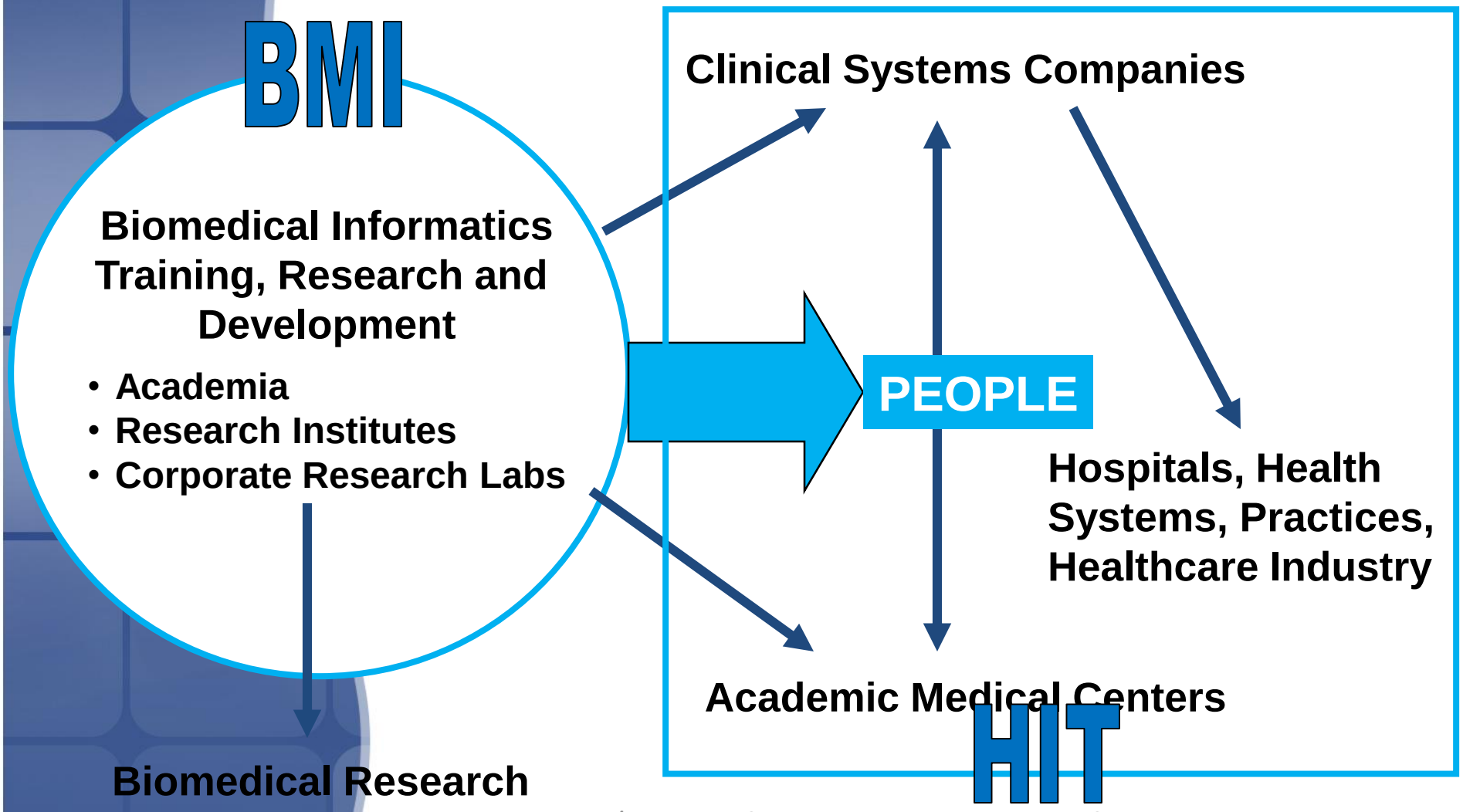
BMI and HIT



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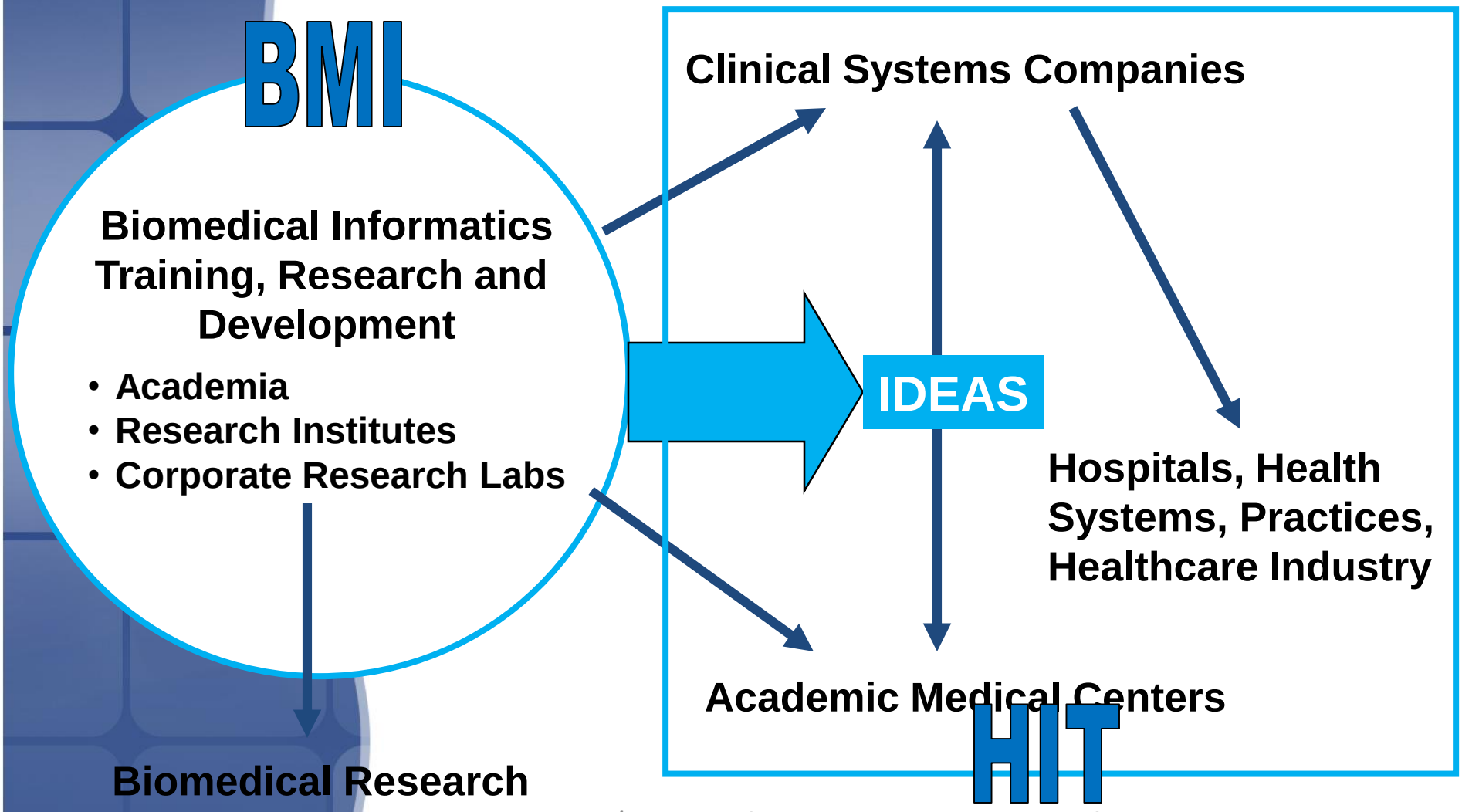

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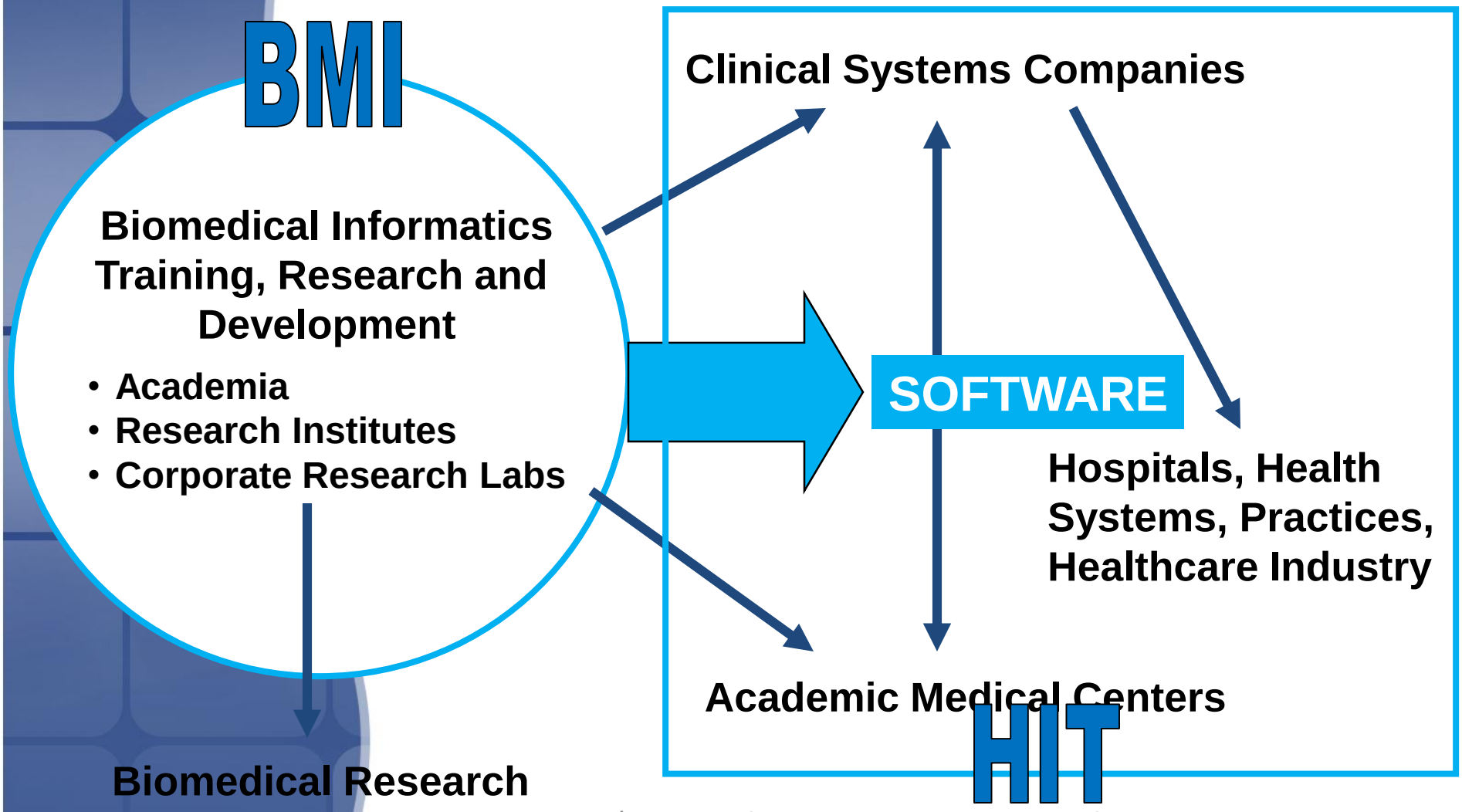

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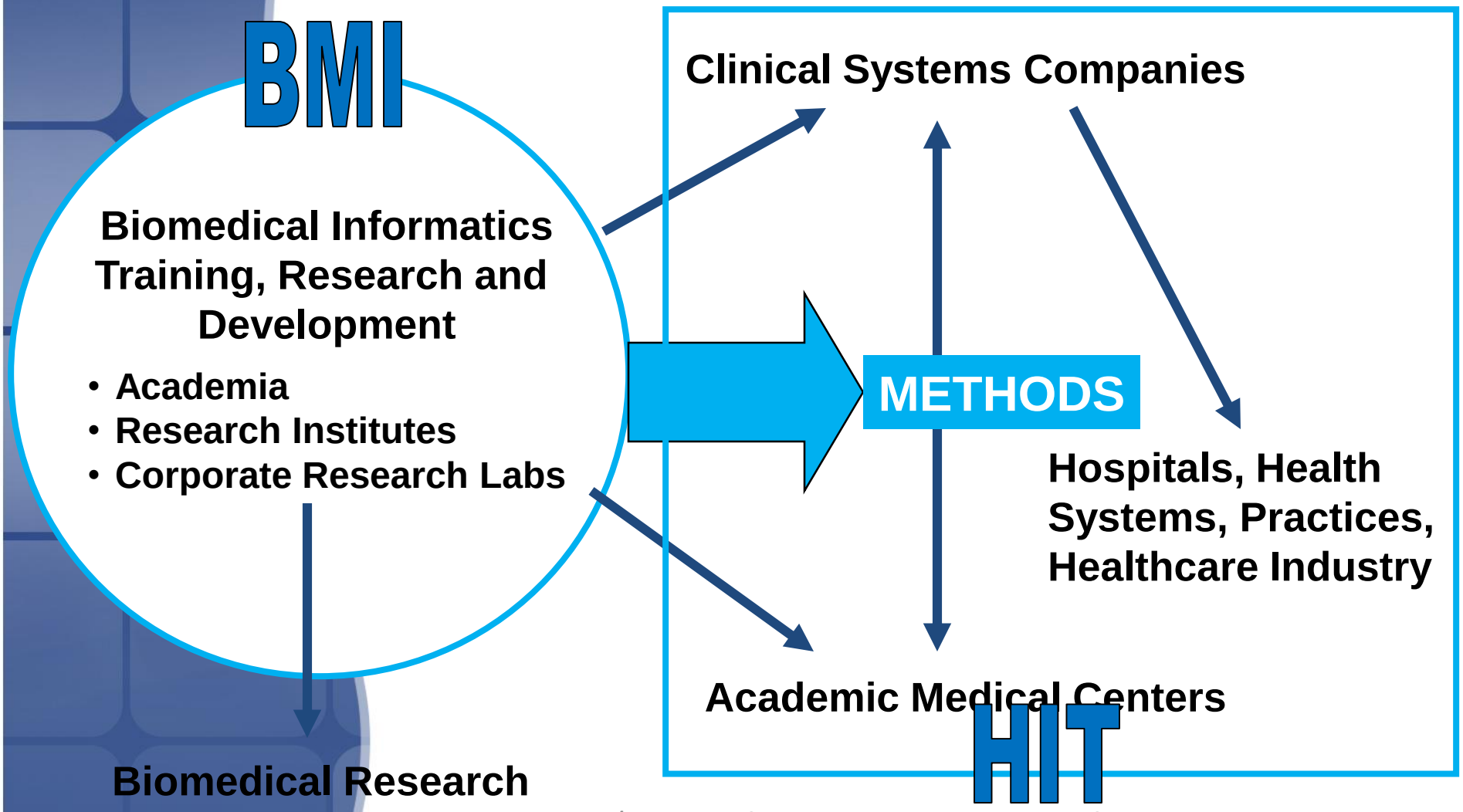

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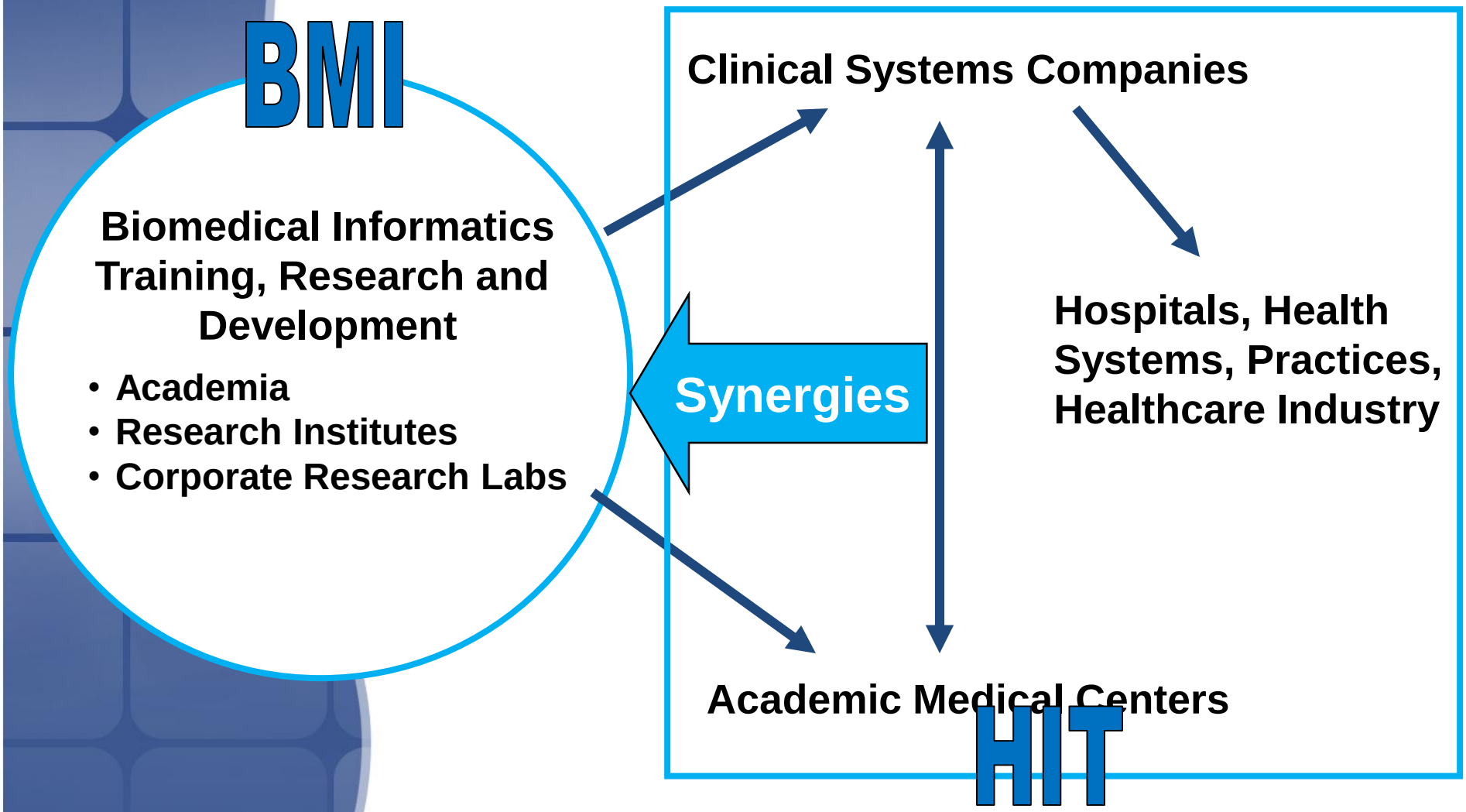

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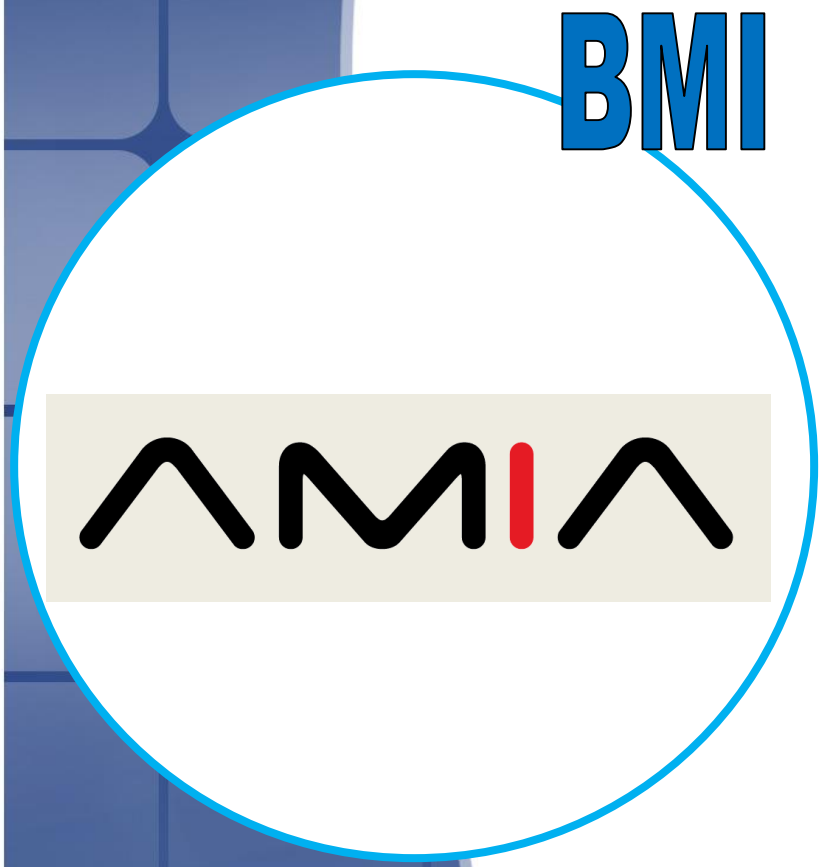

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AMIA: The Professional Home for Biomedical and Health Informatics

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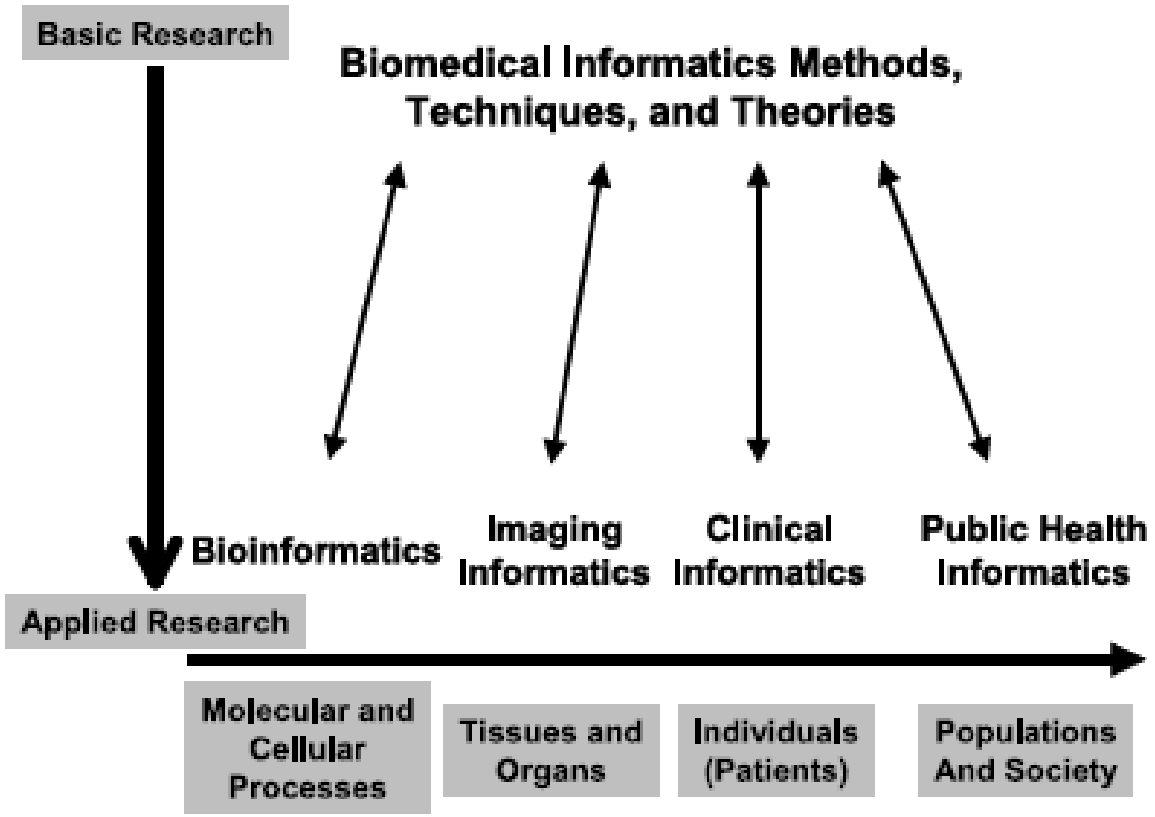
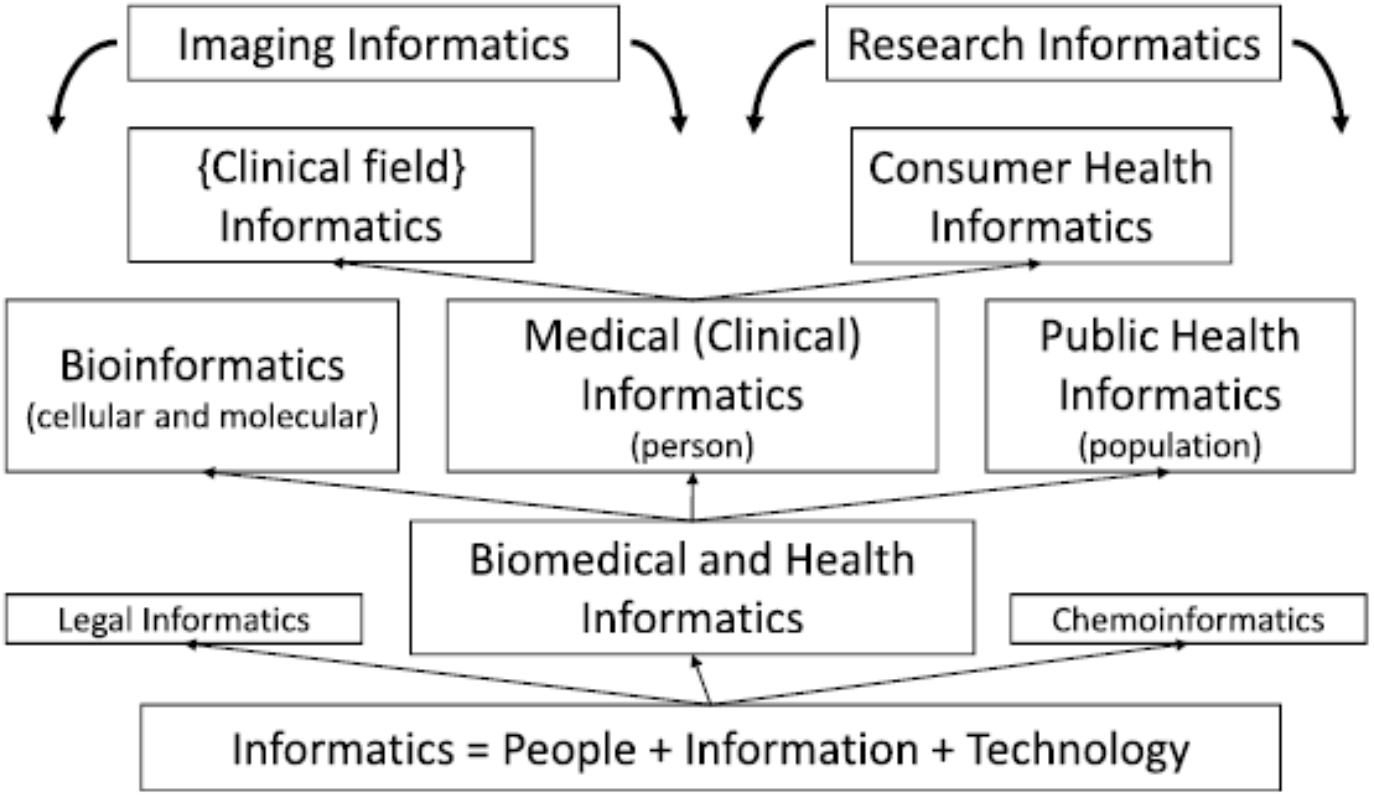
M/B/H Informatics As A Field



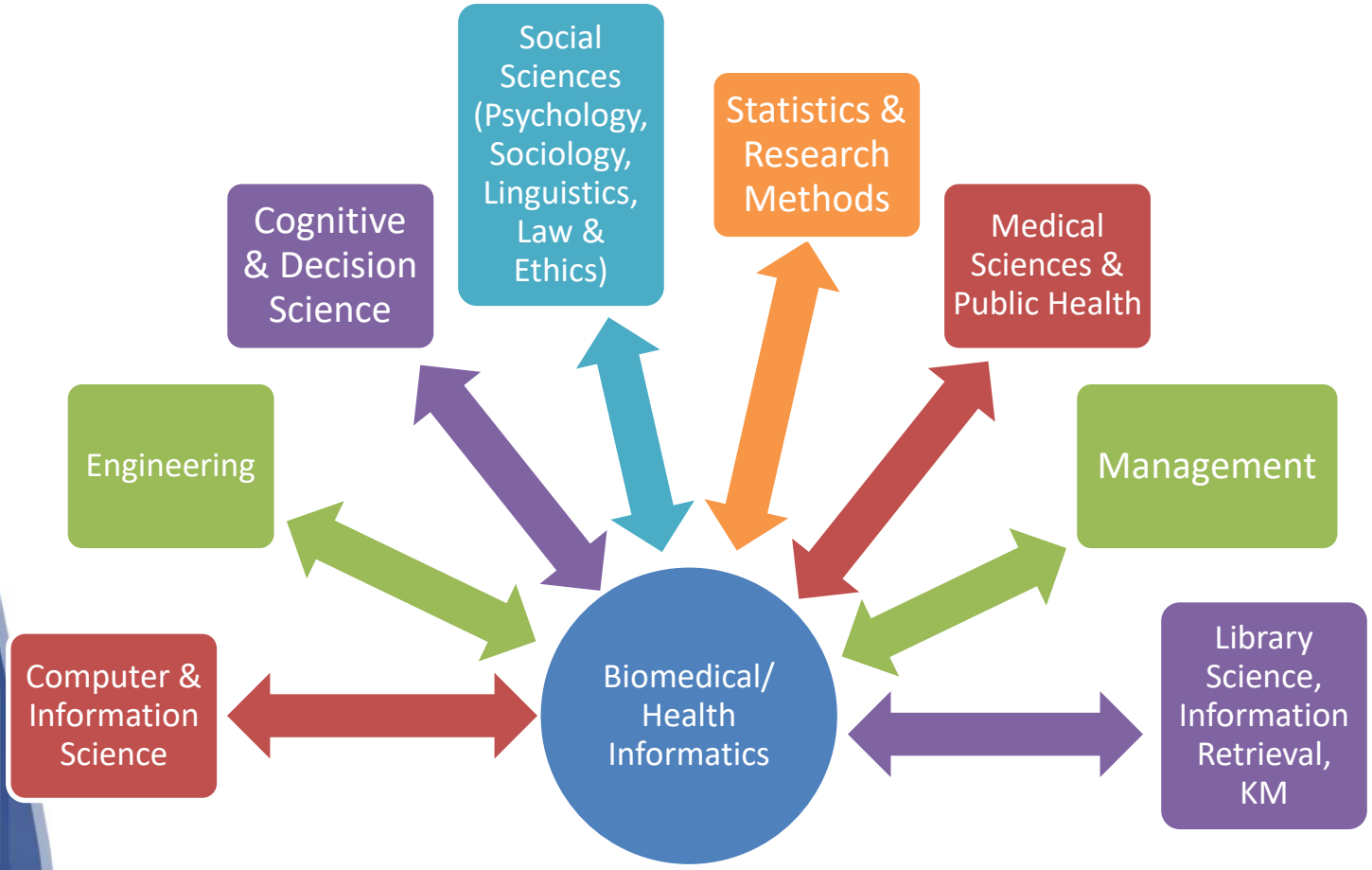
(Shortliffe, 2002)

M/B/H Informatics As A Field



(Hersh, 2009)

M/B/H Informatics and Other Fields



And More!

Areas of Popular Interests (Selected)

- Health IT applications & implementation
  - Electronic Health Records (EHRs)
  - Computerized Physician Order Entry (CPOE)
  - Clinical Decision Support Systems (CDSSs)
  - Picture Archiving and Communication Systems (PACS)
  - Other hospital IT (nursing, pharmacy, lab, etc.)
  - Personal Health Records (PHRs)
  - Telemedicine & Telehealth
- eHealth, mHealth, Health Information Exchange (HIE)
- Health IT adoption and use, public policy
- People & organizational (POI), ethical-legal-social (ELSI)
- Consumer health
- Knowledge representation & discovery, NLP
- Standards & Interoperability
- Workforce building & education

Roles of People in M/B/H Informatics

- IT Executives
  - Chief Information Officer (CIO)
  - Chief Medical Information Officer (CMIO)
  - Chief Nursing Information Officer (CNIO)
  - Chief Technology Officer (CTO)
- System analysts, designers, developers, implementers, engineers, project managers, trainers
- Clinicians with informatics background (super-users, change agents, business analysts)
- Specialists in specific areas
  - HIE specialists, security & privacy specialists
  - Health information management specialists, medical records personnel
- Policy makers & policy analysts
- Academicians (educators, researchers, innovators)

Levels of M/B/H Informatics Training

- Informatics contents in professional education
  - Initial training (core/electives)
  - Residency & fellowship training
  - Continuing education
- Certificate programs/Short courses
- Bachelor's degree in informatics or related fields
  - Degree in M/B/H informatics: usually in Europe
  - Degree in computer science/ICT with M/B/H informatics focus
- Master's and doctoral degrees in informatics
  - U.S., Europe, Australia, New Zealand
  - Thailand (Master's)
    - Ramkhamhaeng University
    - Faculty of Public Health, Mahidol University
    - (Future) Ramathibodi-Tropical Medicine, Mahidol University
- Clinical informatics fellowships (U.S.)
- Postdoctoral fellowships (e.g. NLM)

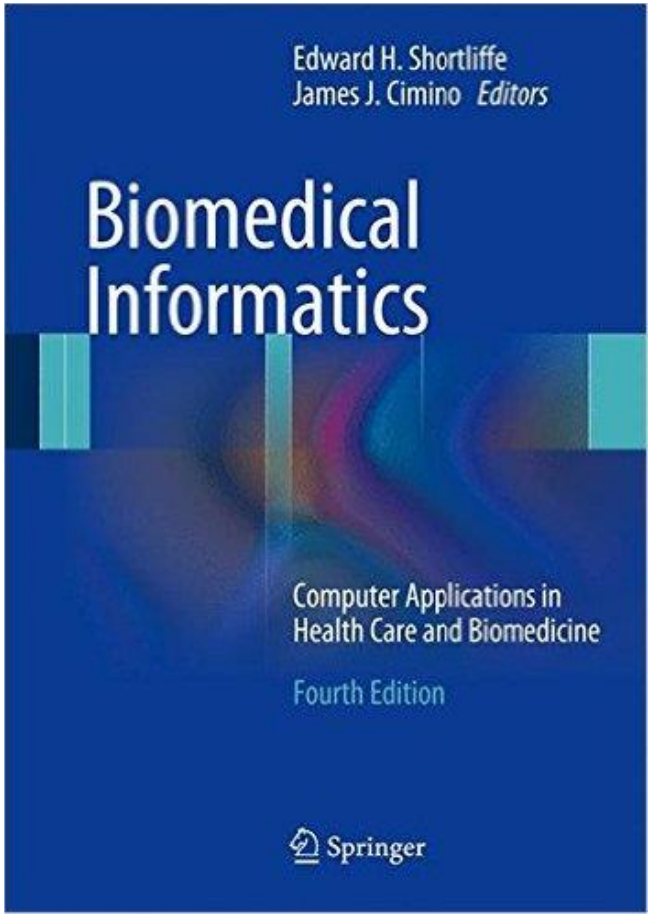
Informatics Workforce in Thailand

- In other countries, 1 IT staff is employed per about 50-70 non-IT staffs (Hersh, 2008)
- No available data about Thailand but…
  - Only a handful of “informaticians” available (both formally trained and otherwise)
  - Many clinicians (and executives) who got interested in IT (but many focus on the “technology” not “information” and so would usually jump up and down on the new technologies but would not be a good IT manager or executive)
  - Most computer science/ICT graduates lack exposure to or understanding about healthcare

Professional Societies in M/B/H Informatics

- International Medical Informatics Association (IMIA)
  - MEDINFO
- American Medical Informatics Association (AMIA)
  - AMIA Annual Symposium
- Healthcare Information and Management Systems Society (HIMSS)
  - HIMSS Annual Conference & Exhibition
  - HIMSS Asia Pac
- American Health Information Management Association (AHIMA)
- Thai Medical Informatics Association (TMI)
  - TMI Annual Conference

“Bible” of Biomedical/Health Informatics



Shortliffe EH, Cimino JJ, editors. Biomedical Informatics: Computer Applications in Health Care and Biomedicine. 4rd ed. New York: Springer; 2014. 965 p. https://www.amazon.com/Biomedical-Informatics-Computer-Applications-Biomedicine/dp/1447144732

Useful Online Resources

- Societies amia.org imia.org himss.org tmi.or.th
- U.S. Office of the National Coordinator for Health IT (ONC) www.hhs.gov/healthit
- Handbook of Biomedical Informatics en.wikipedia.org/wiki/Book:Handbook_of_Biomedical_Informatics
- Blogs
  - Life as a healthcare CIO geekdoctor.blogspot.com
  - Informatics Professor informaticsprofessor.blogspot.com
  - TMI www.tmi.or.th/index.php?Itemid=46
  - Thai Informatician gotoknow.org/blog/thethaiinformatician
- Twitter: twitter.com/nawanan/health-informatics

Journals in the Field (Selected)

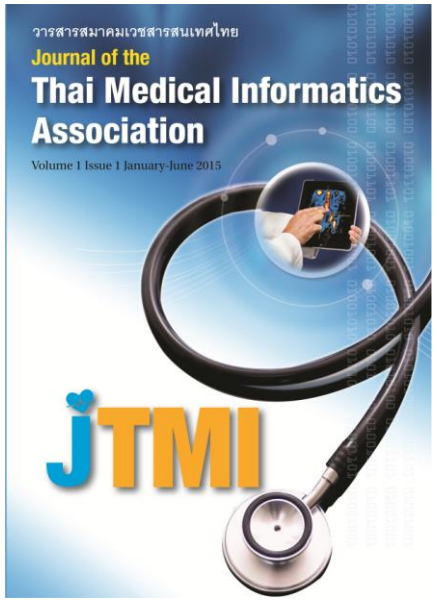
- Healthcare Informatics www.healthcare-informatics.com
- **Journal of the American Medical Informatics Association (JAMIA)** www.jamia.org
- **International Journal of Medical Informatics (IJMI)**
- Journal of Biomedical Informatics (JBI)
- Methods of Information in Medicine
- BMC Medical Informatics and Decision Making
- Journal of Medical Internet Research (JMIR)
- Yearbook of Medical Informatics
- **Journal of the Thai Medical Informatics Association (JTMI)**
- Occasionally, Health Affairs, New Engl J Med, & JAMA

JTMI Articles Introducing the Field

สู่สุขภาวะด้วยสารสนเทศ: บทความทบทวนสาขาวิชา Biomedical and Health Informatics, ตอนที่ 1—กำเนิดของ Informatics และชื่อสาขาอันหลากหลาย

สู่สุขภาวะด้วยสารสนเทศ: บทความทบทวนสาขาวิชา Biomedical and Health Informatics, ตอนที่ 2—แขนงวิชาของ Informatics และความสัมพันธ์กับสาขาวิชาอื่นๆ

นวนรรน ธีระอัมพรพันธุ์
ภาควิชาเวชศาสตร์ชุมชน คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล



http://www.jtmi-journal.com/index.php/jtmi/article/view/19/1

http://www.jtmi-journal.com/index.php/jtmi/article/view/20/2

Next

Overview of Health IT

References

- Bernstam EV, Smith JW, Johnson TR. What is biomedical informatics? J Biomed Inform. 2010 Feb;43(1):104-10.
- Greenes RA, Shortliffe EH. Medical informatics. An emerging academic discipline and institutional priority. JAMA. 1990 Feb 23;263(8):1114-1120.
- Hersh W. A stimulus to define informatics and health information technology. BMC Med Inform Decis Mak. 2009;9:24.
- Hersh W. Health and biomedical informatics: opportunities and challenges for a twenty-first century profession and its education. Yearb Med Inform. 2008:157-164.