Overview of Health Informatics

ITI

BMI-Dept


Fellowship
Week
1
Overview of Health Informatics
ITI, BMI-Dept
Day 2

Agenda

- For whom is the course?
- How Healthcare can be improved?
- What is informatics?
- Data, information, knowledge and wisdom
- Health informatics
- Health informatics domains
- Health informatics stakeholders
- Who is the health informatician?
- Health infromatician, carrier profiles

For whom is this course?!

This course is dedicated for Healthcare stakeholders, who choose to know more about BMHI, on order to improve healthcare services provided and enrich their knowledge.

Course Outline

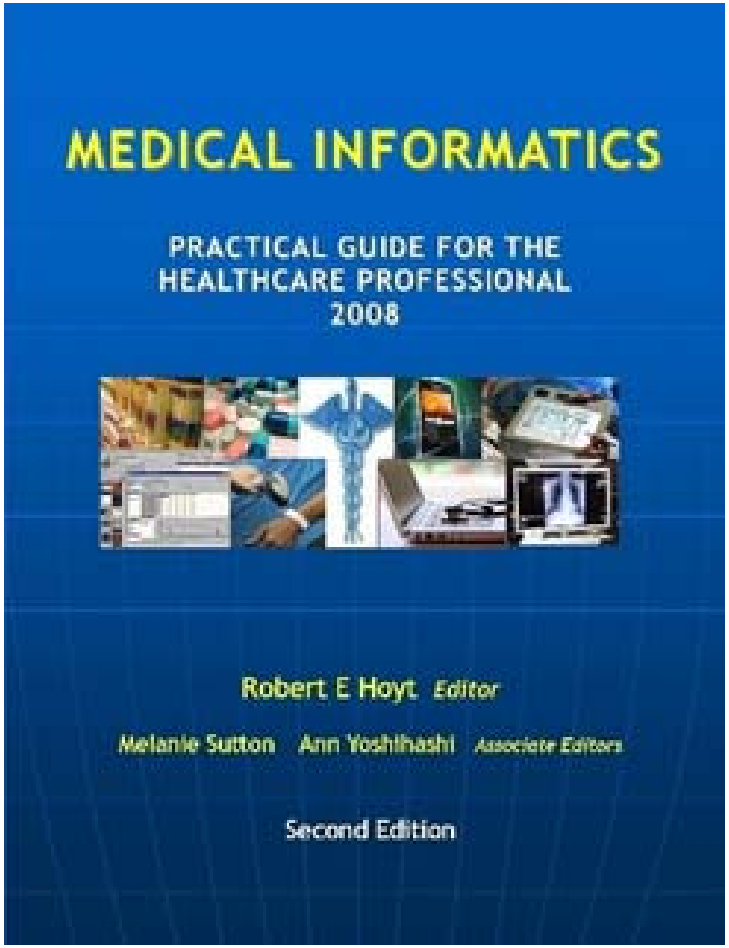
1. BMHI (Definition, hierarchy, importance of the field, challenges)
2. National and international Organizations concerned with BMHI
3. BMHI System Components
4. HIS (subsystems, applications)
5. Consumer Health Informatics
6. HIPAA regulations; security, safety, confidentiality and ethics related to BHMI fields
7. Structure and Imagining Informatics

Course Outline, cont.

8. BMHI Standards
9. Disease Management and Disease Registries
10. Telemedicine
11. Information Retrieval and Online Medical Resources
12. Secondary use of clinical data; Bio-surveillance and Clinical trials
13. Computational Biology and Bioinformatics
14. Managerial sciences and BMHI (OB, PM)

Required Book

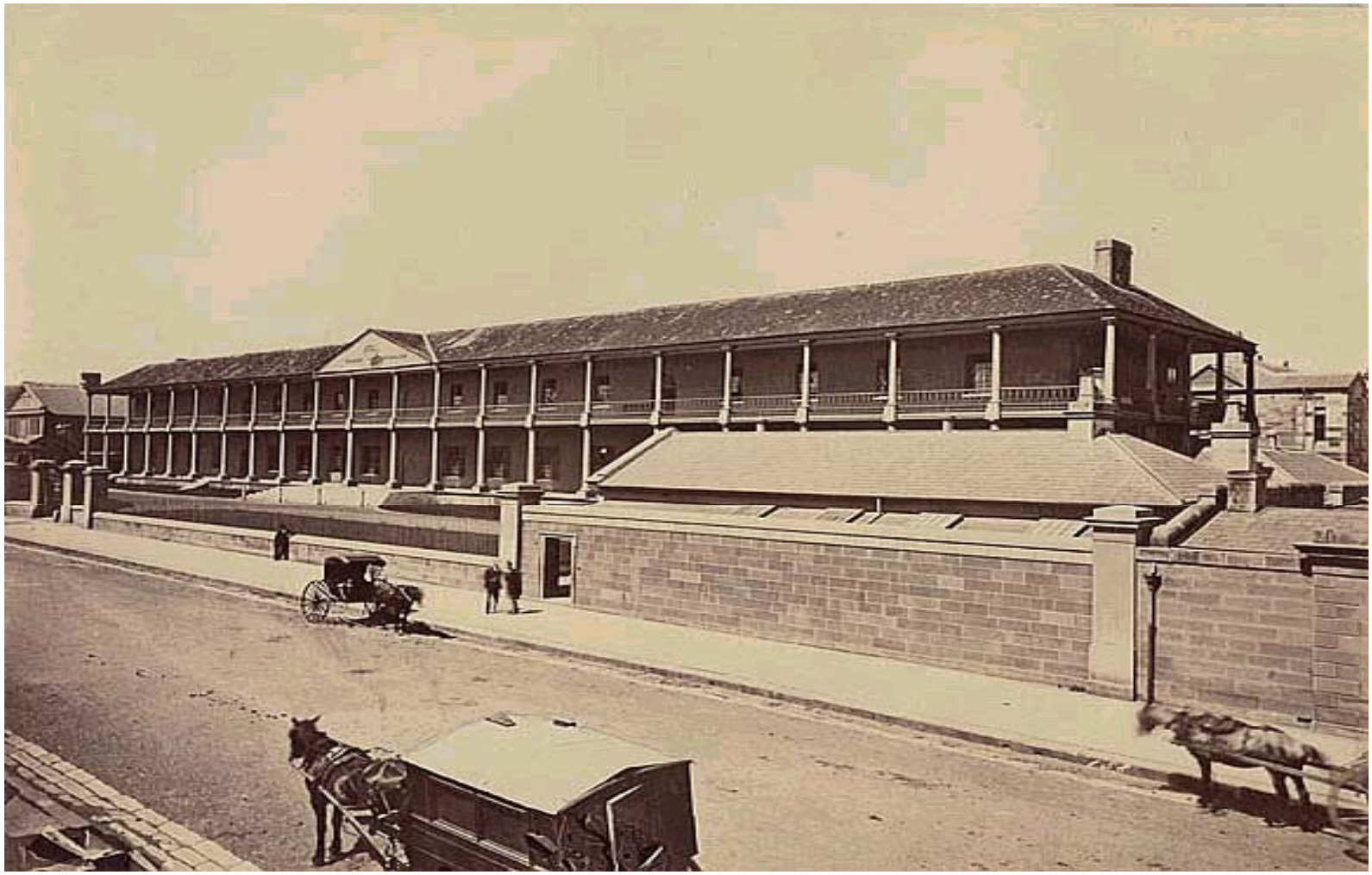
Medical Informatics
Practical Guide for The
Healthcare Professional



How Healthcare can be improved?

- Adopting powerful strategies
- Building new hospitals
- Scientific discoveries
- Awareness
- More Healthcare professionals
- ….etc.

Health Informatics, a need to change



Old Hospitals

Health Informatics, a need to change

Modern Hospitals

Health Informatics, a need to change

Old Hospital Beds

Health Informatics, a need to change

Modern Hospital beds

Health Informatics, a need to change

Old Operating Theater

Health Informatics, a need to change

Modern Operating Theater

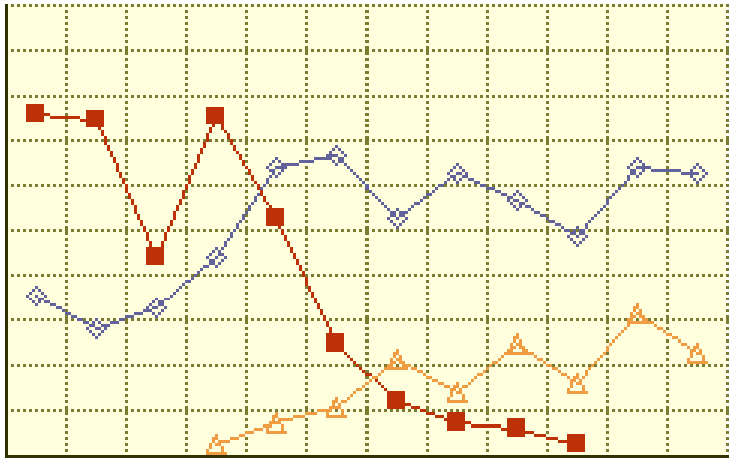
Health Informatics, a need to change

Old Medical Record, it there!!

Health Informatics, a need to change

Today's Medical Record, it there!!

We Believe!!



Better Information

Better Healthcare

What Is Informatics?!

- Oxford Pocket Dictionary: the science of processing data for storage and retrieval; information science
- Merriam Webster: the collection, classification, storage, retrieval, and dissemination of recorded knowledge
- More simply:

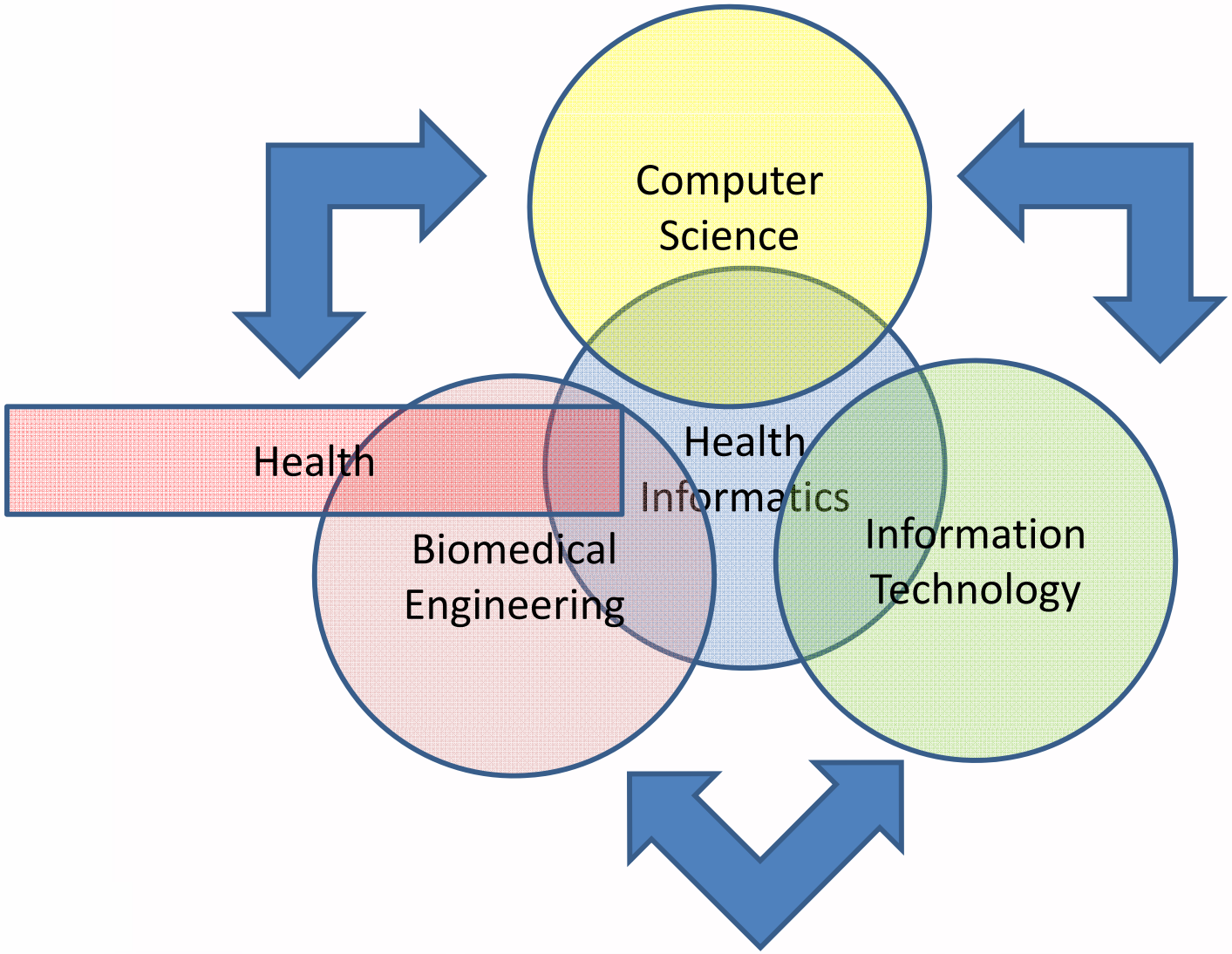
Informatics = people + Information + technology

Informatics, Logistics (Haux, 2004)

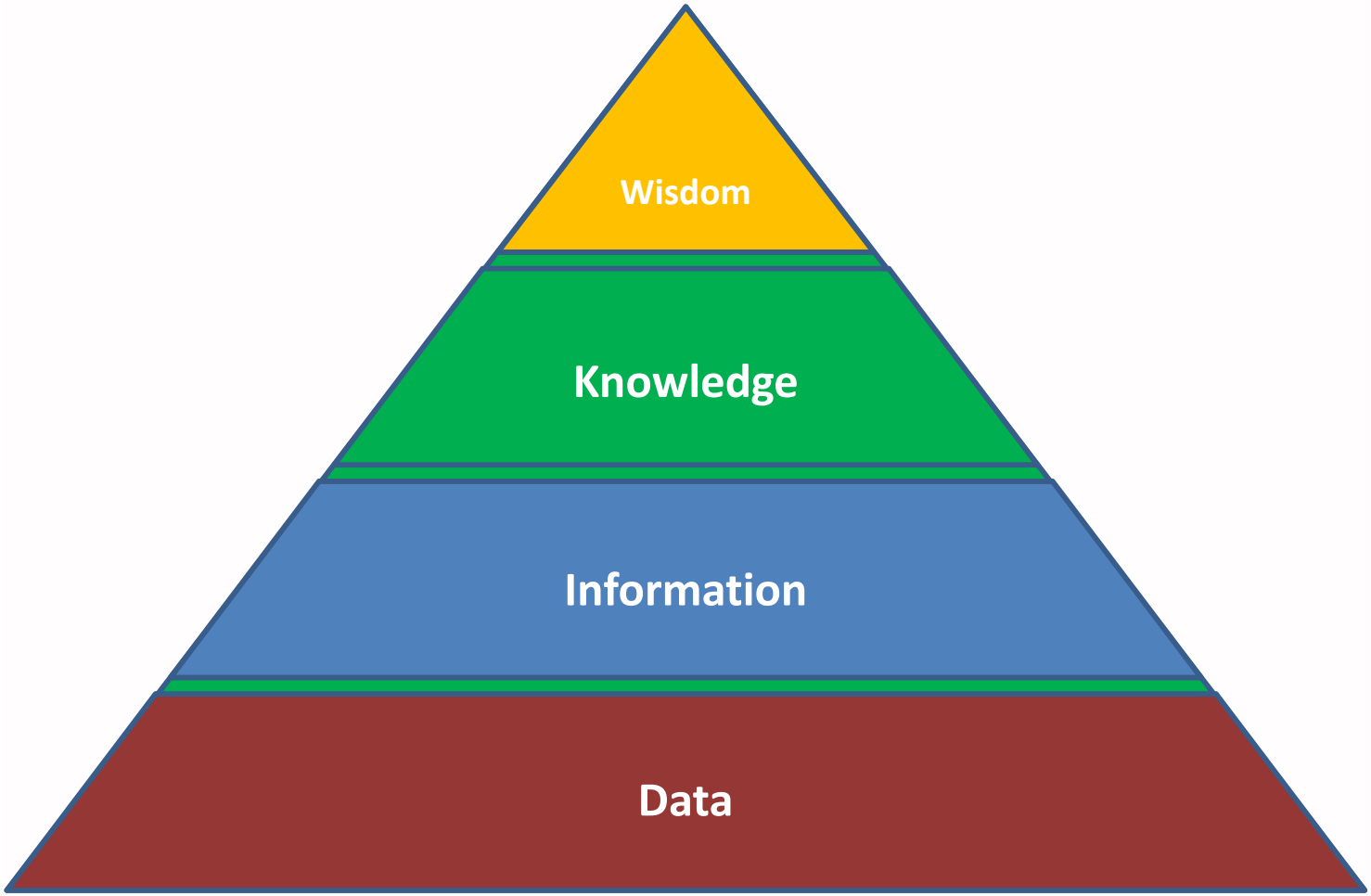
Information and knowledge logistics work through providing:

- the right information and knowledge
- at the right time
- at the right place
- to the right people
- in the right form
- In order to make the right decision

Informatics Vs…



DIKW Hierarchy



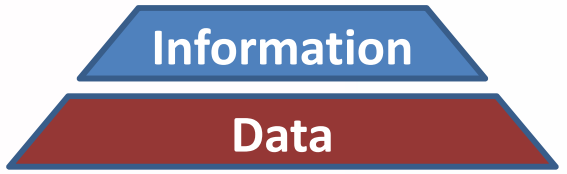
Data

(Bellinger, 2004)

Data

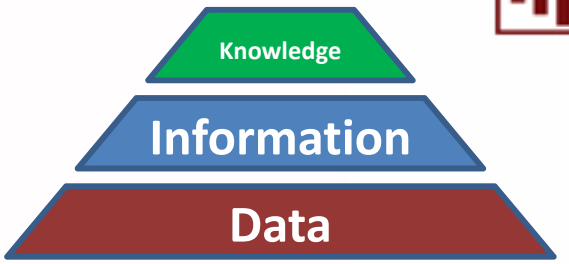
- Raw
- Just symbols
- No significance beyond itself
- Could be in any form

Information
(Bellinger, 2004)



- Is data + their meanings
- Could be Significant
- Focus in data and relation between them

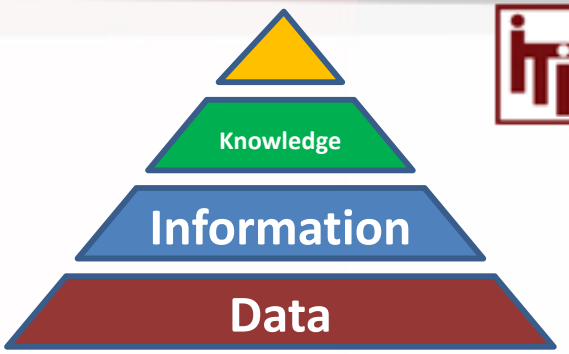
Knowledge
(Bellinger, 2004)



- Appropriate connection of information
- Deterministic process

- Significant and useful by itself

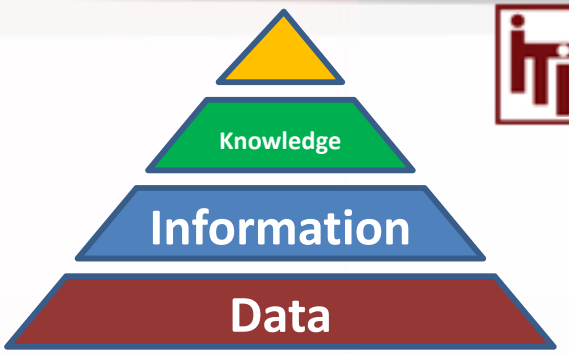
Wisdom
(Bellinger, 2004)

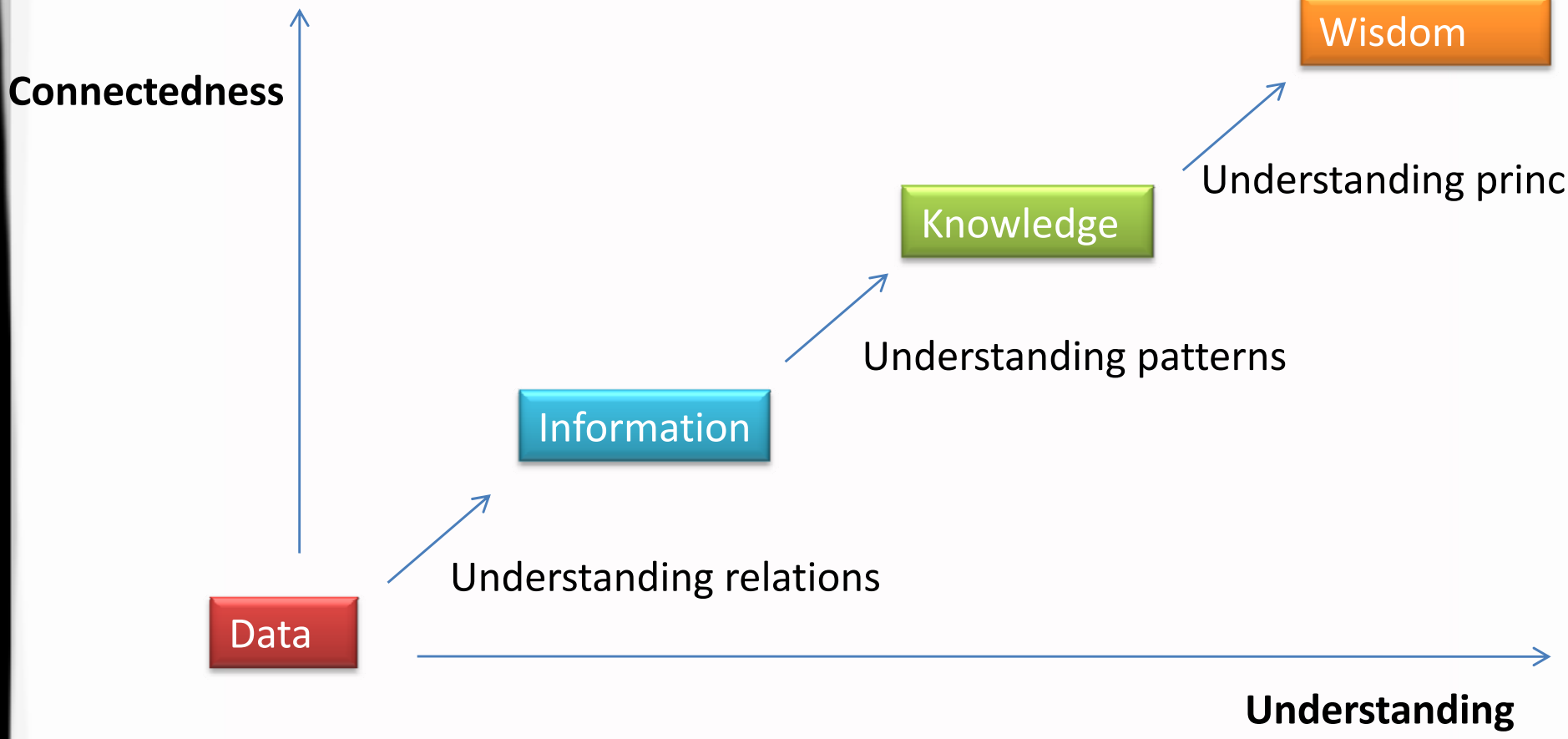


- "the process by which we also discern, or judge, between right and wrong, good and bad"
- Extrapolative
- Non-deterministic
- Non-probabilistic

"Wisdom is not a product of schooling but of the lifelong attempt to acquire it" (Albert Einstein)

DIKW cont. (Bellinger, 2004)





Health Informatics

- Health informatics, Medical Informatics, Clinical Informatics and Biomedical Informatics are very related, without sharp differences.
- The field is “Relatively Young”
- The terms are new, and continuously developing
- Midway between Health (medicine) and technologies
- Many!!

Health Informatics, Definitions

HI Discipline is highly interdisciplinary

- “an evolving scientific discipline that deals with the collection, storage, retrieval, communication and optimal use of health related data, information and knowledge. The discipline utilizes the methods and technologies of the information sciences for the purposes of problem solving, decision making and assuring highest quality health care in all basic and applied areas of the biomedical sciences” (Graham, 1994)

Health Informatics, Definitions cont.

- “application of computers, communications and information technology and systems to all fields of medicine - medical care, medical education and medical research” (Collen, 1980)
- “scientific field that deals with resources, devices and formalized methods for optimizing the storage, retrieval and management of biomedical information for problem solving and decision making” (Shortliffe, 1995)
- “the scientific field that deals with biomedical information, data, and knowledge—their storage, retrieval, and optimal use for problem solving and decision making” (Shortliffe, 2006)

Health Informatics, Definitions cont.

- "understanding, skills and tools that enable the sharing and use of information to deliver healthcare and promote health" (BMIS, 2005)

Try to define it by yourself!!

Health Informatics, History

- The HI discipline has been founded in order to fulfill the need for incorporating new ICTs within healthcare.
- 1949, Germany, first professional organization for informatics “Deutsche Gesellschaft fur Medizinische Dokumentation, Informatik und Statistik”, link. (VUMC-DBMI)
- 1950’s, Ledley and Lusted realized that computers could be useful in diagnosis and treatment due to their archiving and processing power. (Hersh, 1992)
- 1960’s, in France, the first though about the term Medical Informatics as “Informatique Medicale”. (VUMC-DBMI)

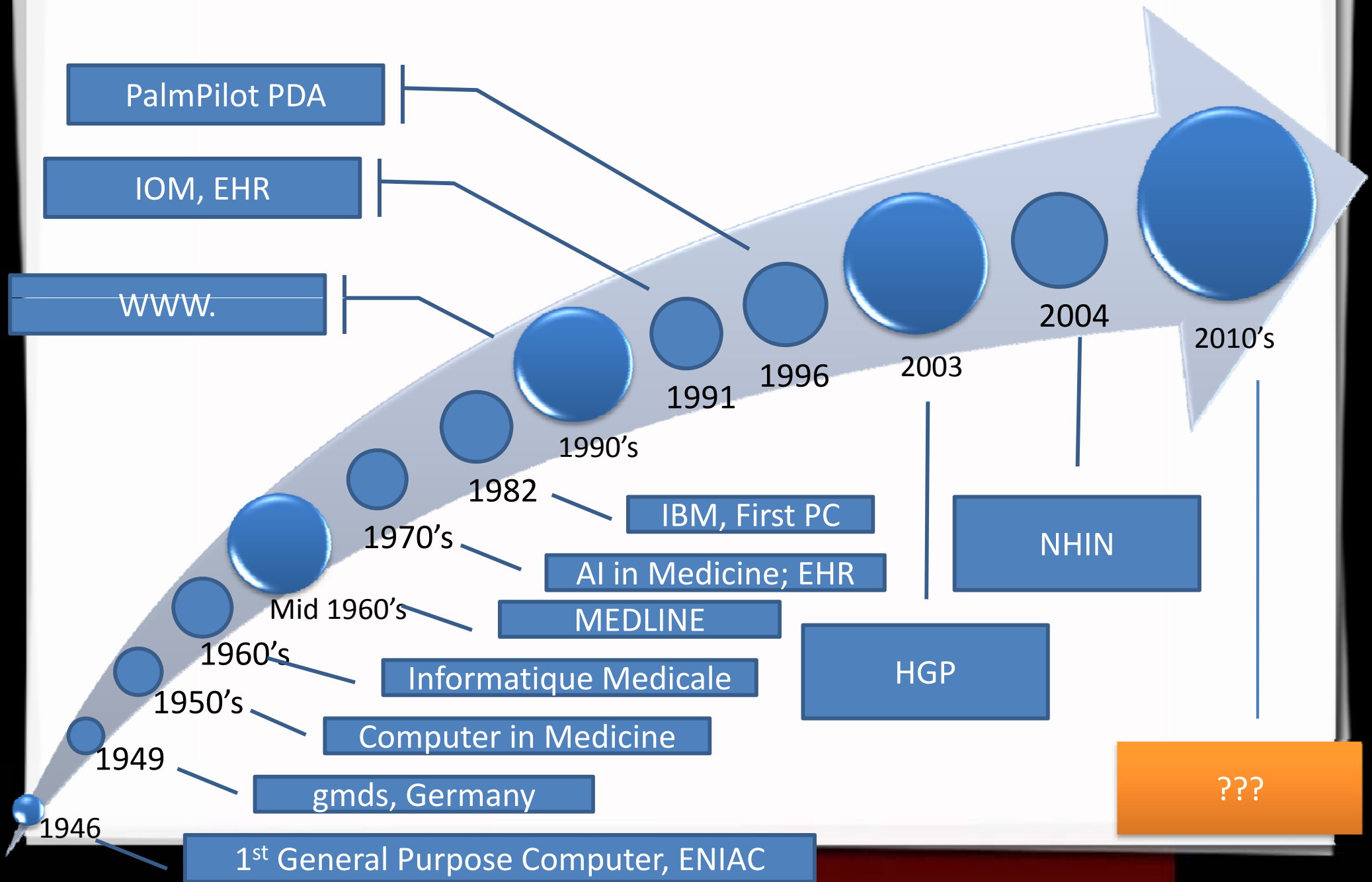
Health Informatics, History cont.

- Mid 1960's, origin of MEDLINE and MEDLARS
- 1970's, Artificial Intelligence (AI) projects concerned with medicine, such as MYCIN (Pittsburg Univ.) and INTERNIST-1 (Stanford Univ.).
- 1970's, Electronic Health Record notion appeared. (Hoyet, 2008)
- 1990's, WWW, by Tim Berners Lee, "Backbone" for medical digital libraries, health information exchange and web-based medical applications.
  - It's a revolution!

Health Informatics, History cont.

- 1991, Institute of Medicine (IOM) recommend applying EHR. (Hoyet, 2008)
- 1996, origin of PalmPilot PDA, “first truly popular handheld computing device”, extensively used in medical field. (Koblentz, 2005)
- 2003, Human Genome Project completion, starting the next step of data analysis. (HGP, 2010)
- 2004, Nationwide Health Information Network (NHIN) notion appeared, connecting all Health Informatics application i.e Interoperability. (HHS, 2010)

Time Chart


PalmPilot PDA
IOM, EHR
WWW.
1946
1949
1950's
1960's
Mid 1960's
1970's
1982
1990's
1991
1996
2003
2004
2010's
1st General Purpose Computer, ENIAC
gmds, Germany
Computer in Medicine
Informatique Medicale
MEDLINE
AI in Medicine; EHR
IBM, First PC
HGP
NHIN
???

Sciences participating in Health Informatics!!

- Computer science
- Information sciences
- Legalizations
- Economics
- Managerial sciences
- Math/Statistics
- Medical sciences
- Communication sciences
- Social sciences
- And More are yet to come…

Health Informatics is not purely technical nor purely social.

It's Socio-technical

Health Informatics, Domains (Bernstam-UT)

Bioinformatics

1. Biological structure informatics
2. Computational biology
3. Expression profiling and microarrays
4. Genomic ontologies
5. Genomics
6. Linking the genotype and phenotype
7. Neuroinformatics
8. Pharmacogenomics
9. Proteomics

Clinical Informatics

10. Barriers to clinical system implementation
11. Clinical systems in ambulatory care
12. Clinical systems in high intensity care
13. Careflow and process improvement systems
14. Disease management
15. E-health and clinical communication
16. Evaluation of health information systems
17. Health data warehousing
18. Health information systems
19. Integrated health and financial systems

Education and Training

20. Computer-assisted medical education
21. Consumer health information
22. E-learning or distance learning
23. Education and training
24. Library information systems
25. Medical informatics teaching
26. Patient education and self-care
27. Professional education

Human Information Processing and Organizational Behavior

28. Cognitive models and problem solving
29. Data visualization
30. Natural language understanding and text generation
31. Human factors and usability
32. Human factors and user interfaces
33. Human-computer interaction
34. Models of social and organizational behavior
35. Natural language processing

Imaging and Signal Analysis

36. Image processing and transmission
37. Image recognition, registration, and segmentation methods
38. Imaging and signal standards
39. Knowledge representation and ontologies for imaging
40. Model-based imaging
41. Signal processing and transmission
42. Virtual reality and active vision methods and applications

Innovative Technologies in Health Care

43. Computer-communication infrastructures
44. Internet applications
45. Mobile computing and communication
46. Portable patient records
47. Security and data protection
48. Software agents and distributed systems
49. Telemedicine
50. Virtual reality
51. Wireless applications and handheld devices

Knowledge Management

52. Automated learning and discovery
53. Clinical guidelines and protocols
54. Controlled terminology, vocabularies, and ontologies
55. Intelligent data analysis and data mining
56. Decision support systems
57. Knowledge management
58. Knowledge representation
59. Neural network techniques
60. Pattern recognition/classification

Nursing Informatics

61. Nursing informatics
62. Nursing care systems
63. Nursing vocabulary and terminology
64. Nursing education/Curriculum in nursing informatics
65. Nursing documentation

Organizational Issues

66. Careflow management systems
67. Care delivery systems
68. Cooperative design and development
69. Economics of care
70. Ethical and legal issues
71. Health services evaluation: performance and quality
72. Organizational impact of information systems
73. Quality assessment and improvement
74. System implementation and management issues
75. Technology assessment

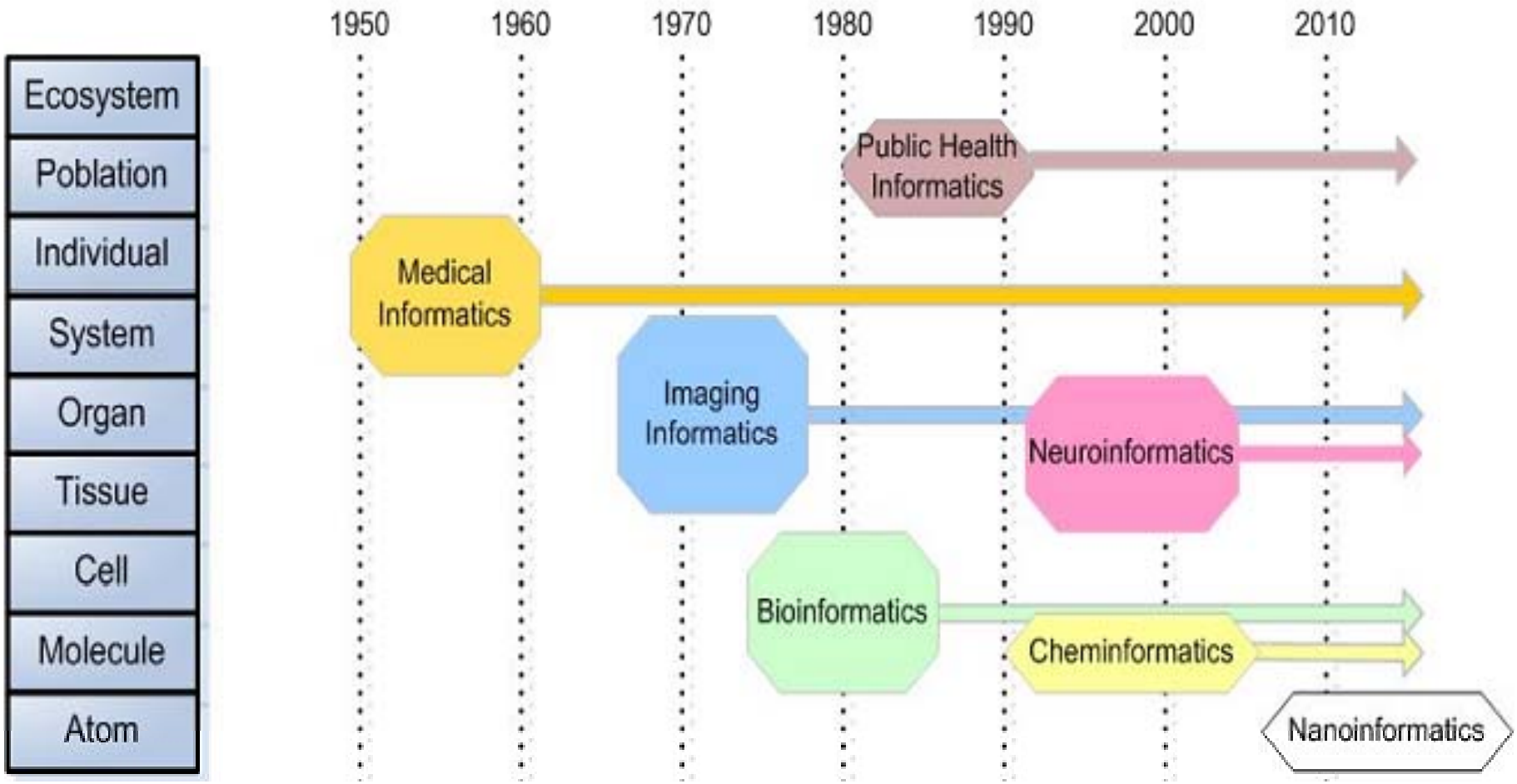
Patient Record

76. Cryptography, database security, and anonymization
77. Database access and delivery
78. Database design and construction
79. Data standards and enterprise data sharing
80. Patient record management
81. Privacy, confidentiality, and information protection
82. Standard medical vocabularies
83. Standards for coding
84. Standards for data transfer

Public Health Informatics

85. Administrative/financial systems
86. Biosurveillance
87. Consumer health informatics
88. Emergency and disaster response
89. Genetic epidemiology
90. Health intervention systems
91. Health promotion systems
92. Health outcomes assessment
93. Patient self-care and patient-provider interaction

Health Informatics, Fields (Martín-Sanchez, 2008)



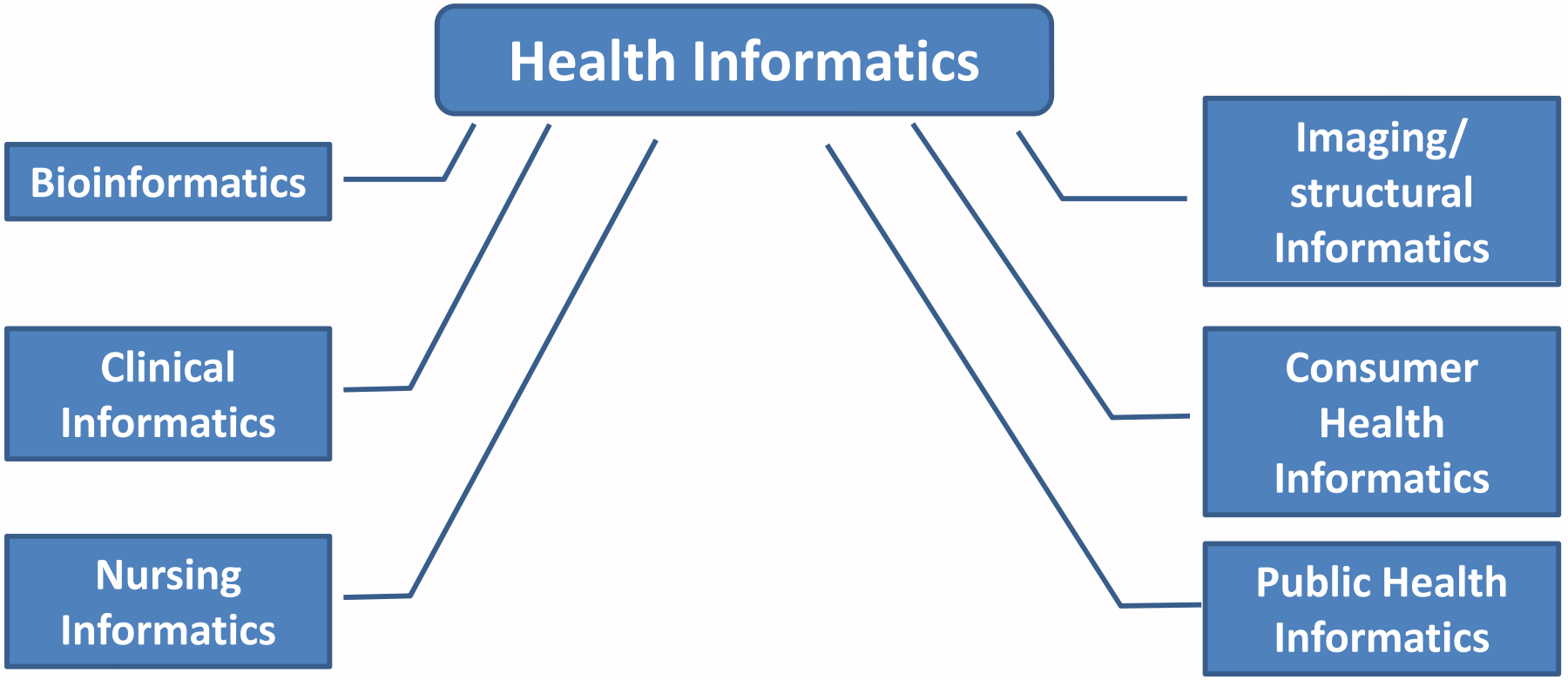
Spectrum of the informatics disciplines across time (as one moves from left to right) and over different levels of bio-complexity from atom to ecosystem (bottom-up) domains

It’s not only technology!

“technology is not the destination, it is the transportation” (Safron-AMIA)

In field of BMHI, Technology is a hulk and needs to be guided, who can?!

Health Informatics, Fields (Shortliffe, 2006)



Health Informatics, Fields

Bioinformatics

- "…the computational branch of molecular biology."(Claverie, 2005)
- "the study of how information is represented and analyzed in biological systems, starting at the molecular level" (Shortliffe, 2006)
- "field of science in which biology, computer science and information technology merge to form a single discipline" (NCBI,2010)

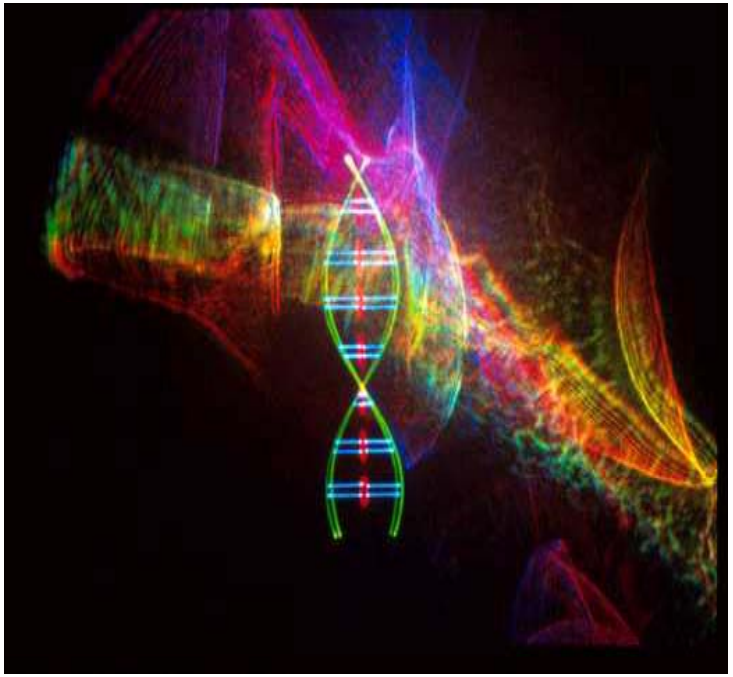
Health Informatics, Fields

Bioinformatics

1- In Vivo

2- In Vitro

3- In Silico (Bioinformatics)



Health Informatics, Fields (Shortliffe, 2006)

Clinical Informatics

- Focusing on Clinical care:
  - Medicine
  - Dentistry
  - Veterinary
  - …etc

- Demanding “patient-oriented informatics applications”

Health Informatics, Fields

Nursing Informatics

- “The application of biomedical informatics methods and techniques to problems derived from the field of nursing. Viewed as a subarea of clinical informatics” (Shortliffe, 2006)
- “…integrates nursing science, computer science, and information science to manage and communicate data, information, and knowledge in nursing practice” (Straggers, 2002)

Health Informatics, Fields

Nursing Informatics

- Nurses are strongly involved in both direct and indirect patient care.
- The Nurse is a key player in healthcare
- How health informatics could help?!
- Nursing Informatics status is impressive!

Health Informatics, Fields (Shortliffe, 2006)

Public Health Informatics

- "the systematic application of information and computer science and technology to public health practice, research, and learning" (Yasnoff, 2000)
- Focus on population, rather individuals i.e. Clinical Informatics
- Oriented to prevention than treatment
- Mainly governmental than private sector

Health Informatics, Fields (DHHS, 1994)

Public Health Informatics

Ten essential services of public health:

1. Monitor the health status of individuals in the community to identify community health problems
2. Diagnose and investigate community health problems and community health hazards
3. Inform, educate, and empower the community with respect to health issues
4. Mobilize community partnerships in identifying and solving community health problems
5. Develop policies and plans that support individual and community efforts to improve health

Health Informatics, Fields (DHHS, 1994)

Public Health Informatics

Ten essential services of public health, cont.:

6. Enforce laws and rules that protect the public health and ensure safety in accordance with those laws and rules
7. Link individuals who have a need for community and personal health services to appropriate community and private providers
8. Ensure a competent workforce for the provision of essential public health services
9. Research new insights and innovate solutions to community health problems
10. Evaluate the effectiveness, accessibility, and quality of personal and population-based health services in a community

Health Informatics, Fields

Imaging/ Structural Informatics

- "Subfield of biomedical informatics that has arisen in recognition of the common issues that pertain to all image modalities and applications once the images are converted to digital form" (Kulikowski, 1997)
- "The study of methods for representing, organizing, and managing diverse sources of information about the physical organization of the body and other physical structures, both for its own sake, and as a means for organizing other information" (Brinkley, 1991)

Health Informatics, Fields

Imaging/ Structural Informatics

- Both Imaging and Structural Informatics are overlapping.
- Images in medicine are fundamental.
- Source of images may be:
  - X-Ray
  - Ultrasound
  - NMR/MRI

Health Informatics, Fields

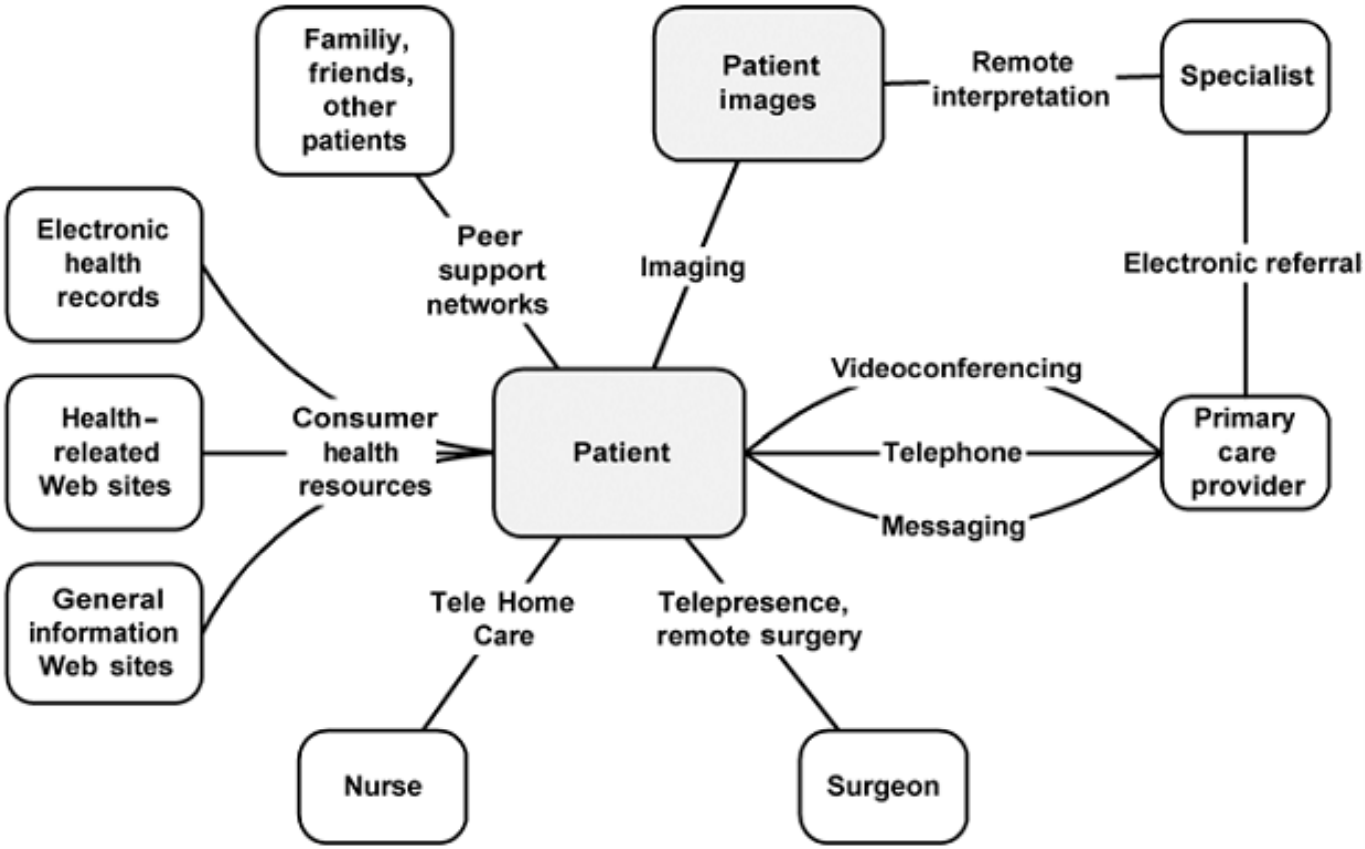
Consumer Health Informatics

- “the branch of medical informatics that analyses consumers’ needs for information; studies and implements methods of making information accessible to consumers; and models and integrates consumers’ preferences into medical information systems” (Eysenbach, 2000)
- “a subspecialty of medical informatics which studies from a patient/consumer perspective the use of electronic information and communication to improve medical outcomes and the health care decision-making process” (AMIA, 2008)

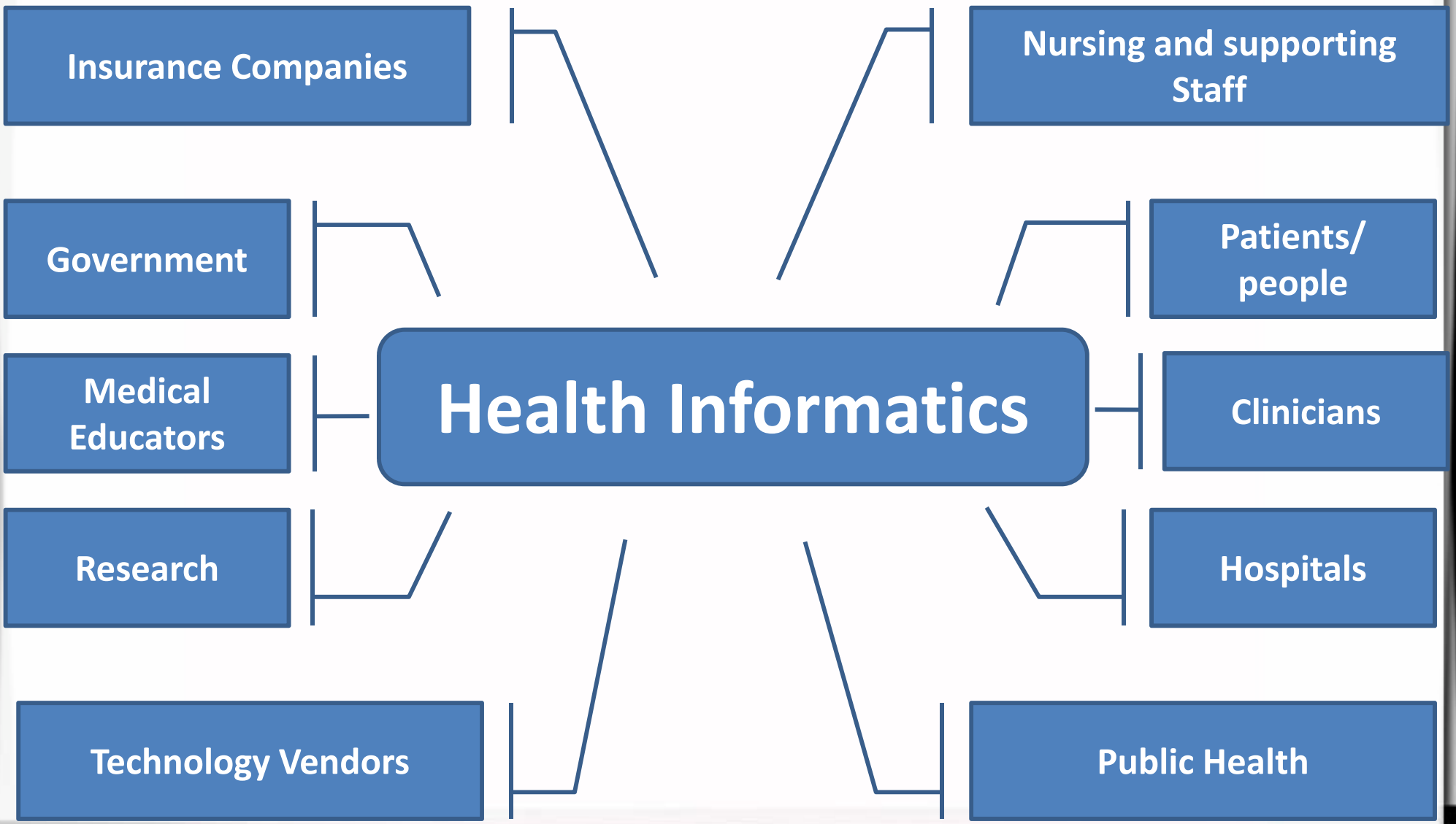
Health Informatics, Fields (Shortliffe, 2006)

Consumer Health Informatics

The figure shows different ways that electronic communications can be used to link patients with various health resources, through home or a well equipped tele-health facility



Health Informatics Stakeholders (Hoyt, 2008)



Health Informatics Stakeholders (Hoyt, 2008)

Common goals:

- Reduce medical errors and resultant litigation
- Provide better return on investment
- Improve communication among the key players
- Improve the quality of care
- Reduce duplication of tests or prescriptions ordered
- Improve patient outcomes, like morbidity and mortality
- Standardize care among clinicians, organizations and regions
- Improve clinician productivity
- Speed up access to care and administrative transactions
- Protect privacy and ensure security

Health Informatics Stakeholders (Hoyt, 2008)

Patients/People

- Online searches for health information
- Web portals for storing personal medical information, making appointments, checking lab results, e-visits, etc
- Research choice of physician, hospital or insurance plan
- Online patient surveys
- Online chat, blogs, podcasts, vodcasts and support groups
- Personal health records
- Telemedicine and home Telemonitoring

Health Informatics Stakeholders (Hoyt, 2008)

Clinicians

- Medline searches
- Online resources and digital libraries
- Patient web portals, secure e-mail and e-visits
- Physician web portals
- Clinical decision support, e.g. reminders and alerts
- Electronic health records (EHRs)
- Personal Digital Assistants (PDAs) with medical software
- Telemedicine and telehomecare
- Online continuing medical education (CME)
- Voice recognition software
- Electronic (e)-prescribing
- Disease management and registries
- Picture archiving and communication systems (PACS)
- Pay for performance
- Health Information Organizations (HIOs)
- E-research

Health Informatics Stakeholders (Hoyt, 2008)

Nursing and supporting Staff

- Patient enrollment
- Electronic appointments
- Electronic billing process
- EHRs
- Web based credentialing
- Telehomecare monitoring
- Practice management software
- Secure patient-office e-mail communication
- Electronic medication administration record
- Online educational resources and CME
- Disease registries

Health Informatics Stakeholders (Hoyt, 2008)

Public Health

- Incident reports
- Syndromic surveillance as part of bio-terrorism program
- Establish link to all public health departments (Public Health Information Network)
- Geographic information systems to link disease outbreaks with geography

Health Informatics Stakeholders (Hoyt, 2008)

Government

- Nationwide Health Information Network
- Information technology pilot projects
  - Disease management
  - Pay for performance
  - Electronic health records and personal health records
  - Electronic prescribing
- “Ethical and Legal issues”

Health Informatics Stakeholders (Hoyt, 2008)

Medical Educators

- Online medical resources for clinicians, patients and staff
- Online CME
- Medline searches
- Video teleconferencing, web conferencing, podcasts, etc

Health Informatics Stakeholders (Hoyt, 2008)

Insurance Companies

- Electronic claims transmission
- Trend analysis
- Physician profiling
- Information systems for “pay for performance”
- Monitor adherence to clinical guidelines
- Monitor adherence to preferred formularies
- Promote claims based personal health records and information exchanges
- Reduce litigation by improved patient safety through fewer medication errors

Health Informatics Stakeholders (Hoyt, 2008)

Hospitals

- Interoperable electronic health records
- Electronic billing
- Information systems to monitor outcomes, length of stay, disease management, etc
- Bar coding and radio frequency identification (RFID) to track patients, medications, assets, etc
- Wireless technology
- e-intensive care units
- Patient and physician portals
- E-prescribing
- Health Information Organizations (HIOs)
- Telemedicine
- Picture archiving and communication systems (PACS)

Health Informatics Stakeholders (Hoyt, 2008)

Research

- Database creation to study populations, genetics and disease states
- Online collaborative web sites e.g. Microsoft SharePoint
- Web services to pull together multiple participants at e.g the National Institute

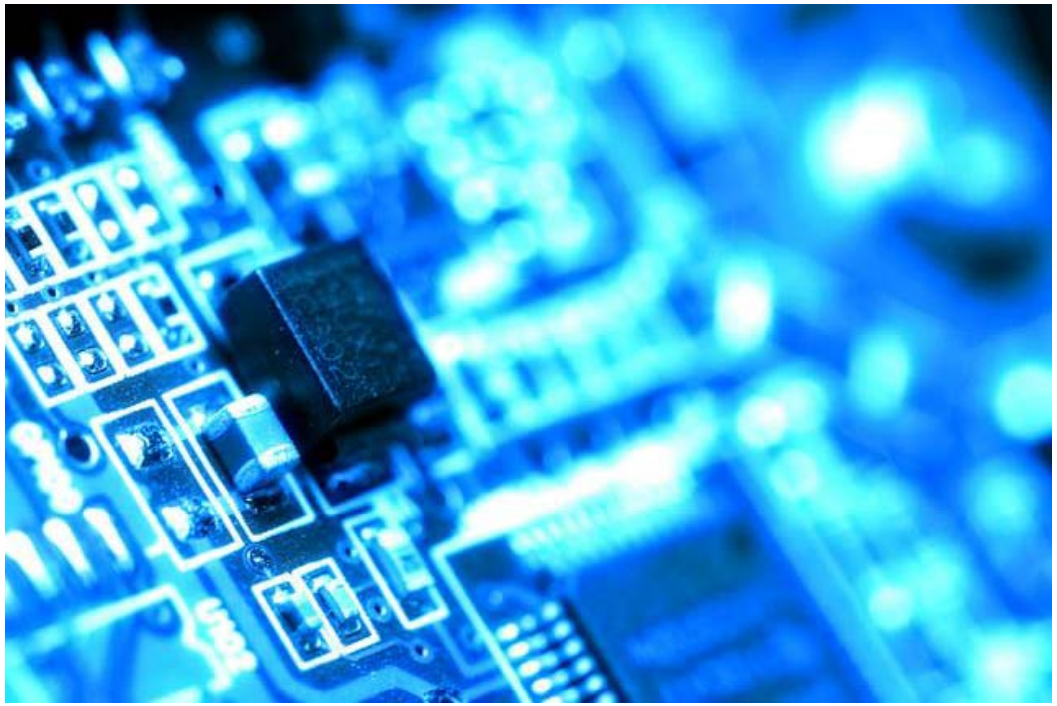
of Health

- Electronic forms e.g. Microsoft InfoPath, IBM Lotus forms
- Software for statistical analysis of data e.g. SPSS
- Literature searches
- Randomization using software programs
- Improved subject recruitment using EHRs and e-mail
- Online submission of grants

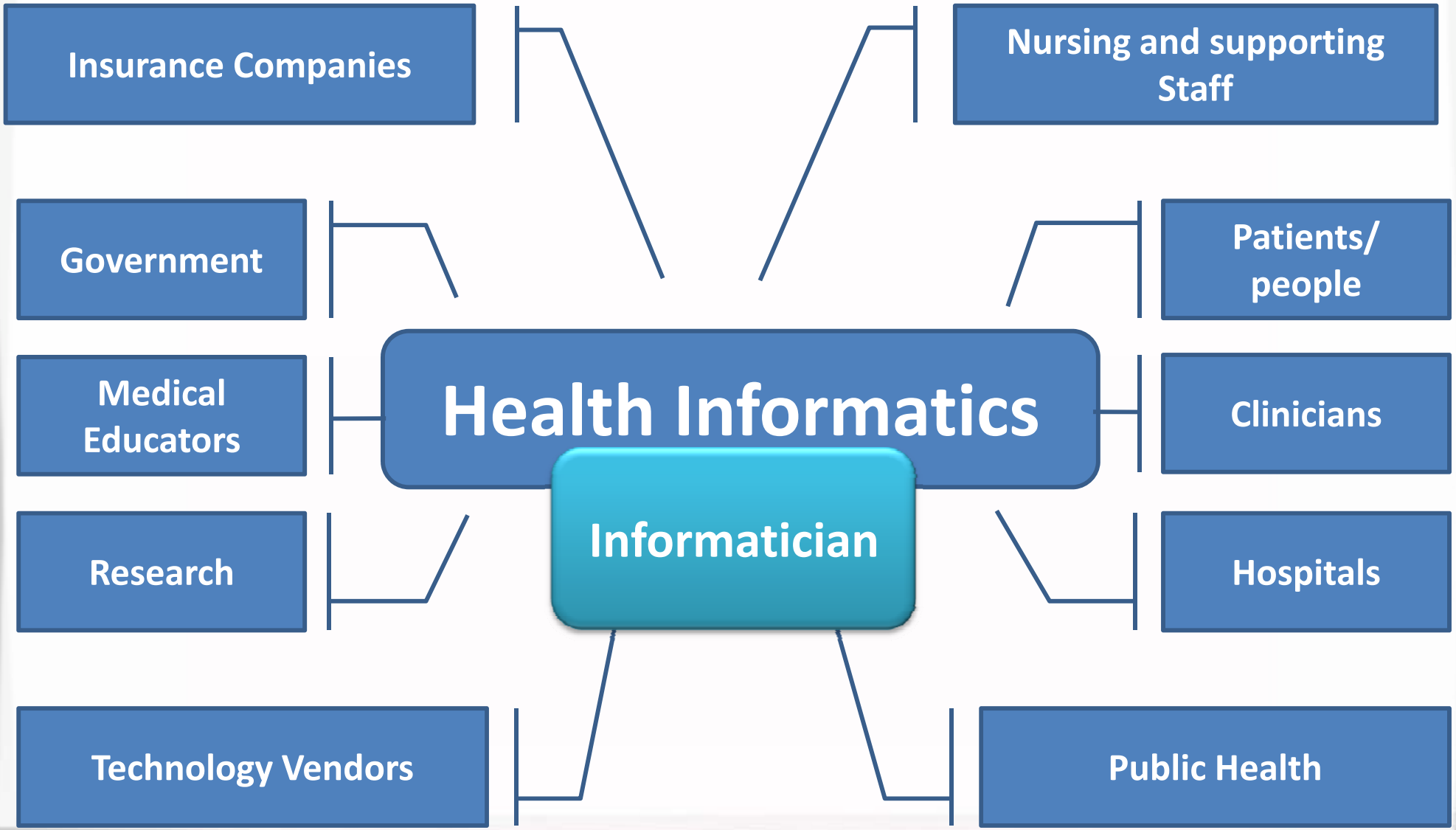
Health Informatics Stakeholders (Hoyt, 2008)

Technology Vendors

- Applying new technology innovations in the field of medicine: hardware, software, genomics, etc
- Data mining
- Interoperability



Health Informatics Stakeholders (Hoyt, 2008)



Who is the Health Informatician?!
Time to ask this question

- Health Informatician or Informatisit is the one coordingating, synchronizing and managing different efforts provided by different health informatics stakeholders.
- In other word “Orchestring”.

Why Health Informatics as a career?!

- There is a huge need
  - Big incidence of preventable medical errors, WHO, 1/10 patients
  - More hospitals go through automation
  - Government needs more control
- It's a new discipline, so need more candidates at:
  - Hospitals
  - MoH
  - Vendors
  - Etc…

  There is a space for many (Physicians, Nurses, Pharmacists, IT-cians, …etc)!
- Many initiatives are arising (Telemedicine, NHIN, EHR, …etc)
- Very interesting, exciting and dynamic!
- Income…!!

Health informatician, Carrier Profiles (BioHealthmatics)

1. Medical Informatics Program Designer
2. Clinical Systems Analyst
3. IT Clinical Process Engineer
4. IS Clinical Project Leader
5. SW Developer
6. IT Training Director
7. Help Desk Assistant
8. …etc.

Health informatician, Carrier Profiles cont. (BioHealthmatics)

1. Medical Informatics Program Designer:

Working among a research team in designing & developing SW programs such as: drug database and database management system to support CDSs, systems to support RHIOs and radiology information systems. These programs gather and process clinical data and finally report the results to the end-user. Medical Informatics Program Designer utilizes his gained knowledge on Information Retrieval, Database Management Systems and support systems in designing the required program specifications.

Health informatician, Carrier Profiles cont. (BioHealthmatics)

2. Clinical Systems Analyst:

- Gathering end user requirements and recommendations on the currently implemented HIS/or planned HIS. Utilizing her/his Medical informatics background in identifying the facing problems and hospital precise requirements to the HIS vendors;
- Developing, implementing and evaluating the HISs used within the healthcare facility;
- Pre and post go-live support to different stakeholders regarding HIS;
- Periodic checking and troubleshooting any problems regarding the HIS, ranging from human-ware and software to physical infrastructure related to the HIS, and
- Making recommendations about the best HIS to be used and the recommended customization including technical and confidentiality/security issues

Health informatician, Carrier Profiles cont. (BioHealthmatics)

3. IT Clinical Process Engineer:

Designing the blueprints for data-flow across the healthcare facility. These blueprints contain the developed/enhanced systems to achieve the optimal/customized information system across the healthcare facility. IT Clinical Process Engineer works on hardware, software and human-ware related to the HIS. IT Clinical Process Engineer participates with IT and Management staff in order to practically implement these blueprints.

Health informatician, Carrier Profiles (BioHealthmatics)

4. IS Clinical Project Leader:

Leading the team to design, develop and evaluate clinical projects. IS Clinical Project leader plan, schedule, direct, monitor, co-coordinate the team's activities in addition to identifying/allocating resources to manage and implement the project. She/he is also responsible to develop milestones necessary for ongoing project evaluation as well as reporting about the project to stakeholders.

Health informatician, Carrier Profiles (BioHealthmatics)

5. SW Developer:

Participating with the clinical-programs developing team members in developing different Software that support clinical processes utilizing her/his Software Engineering and Programming skills.

Health informatician, Carrier Profiles (BioHealthmatics)

6. IT Training Director:

Is responsible for making short and long term training plans, developing, implementing and evaluating these plans. IT Training Director collaborates with the hospital manager and HR staff in order to achieve these goals.

Health informatician, Carrier Profiles (BioHealthmatics)

7. Help Desk Assistant:

- Provides a wide range of IT support to healthcare-facilities stakeholders, ranging from basic computer skills to deep HIS functionalities usage.
- She/he is playing a very important and appreciated role.

Health informatician, Carrier Profiles cont.

What else?!

Plagiarism

- Please visit:

http://wps.prenhall.com/hss_understand_plagiarism_1/

- Then send the result to the supervisor at:

hi.fellowship@gmail.com

Tasks

- Read the required papers
- Investigate more about other carrier profiles
- Prepare a presentation about your working environment, highlighting the new roles according to carrier profiles discussed today

Next Saturday

- Short quiz
- Students' Presentations
- Debates about the papers

Thanks

By: *ITI-BMI Dept.*

hi.fellowship@gmail.com