



1997

# Medical Informatics



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## Outlines

MONDAY

TUESDAY

WEDNESDAY

THURSDAY

FRIDAY

SATURDAY

← Day 1 - Monday, June 2, 1997

← Session 1: 8:30 - 10:00 AM



*HPCC, NII, current issues in medical informatics*

### Faculty

Donald A.B. Lindberg, M.D.

### Educational Objectives

This lecture will summarize the federal interagency High Performance Computing and Communications program accomplishments in non-medical and health related aspects and will enumerate some past, current, and future research funding sources.

At the completion of the session, participants will:

1. Understand the "interagency model" and the government-industry-university approach to the HPCC work.
2. Understand the initial opportunities in biomedical applications of the NII.
3. Have a beginning set of funding contacts.

### Session Outline

1. High Performance Computing and Communications federal program
  - Background and Legislation
  - Objectives and Organization
  - Phase 1
  - Accomplishments - Grand Challenges
  - Progress on Grand Challenge Problems
  - Phase 2
    - National Information Infrastructure
    - National Challenge Applications
      - Non-medical
      - Medical
2. NLM Role in the NII
  - Intramural Research
  - UMLS

- Visible Human
  - Extramural Research
  - NII medical testbed
  - Telemedicine
  - Computer-based patient record
3. Public Policy Issues
- Medical Data Privacy
  - National Security
  - Intellectual Property Rights
  - Traditional Copyright Demands
  - Today's Revolution in Electronic Publishing
4. Federal Research Funding Sources for Medical Informatics
- NLM Programs
  - Other HHS Programs
  - Other federal agency support



← Session 2: 10:30 - 12:00 N

*Principles of Database design*

## Faculty

Daniel R. Masys, M.D.

## Educational Objectives

This lecture and lab session will introduce basic principles of organization of data in computerized systems. At the completion of the session, participants will:

1. Understand the historical evolution of computerized data handling methods
2. Know the relative strengths and weaknesses of hierarchical, relational, information network, and object-oriented database systems
3. Understand the process of development of a set-theory-based relational data model, including entity-relationship definitions, principles of fully normalized relational models, state transitions and data flow diagrams.
4. Understand the design principles involved in the transformation of a flat file record structure to a normalized relational structure (lab exercise).

## Session Outline

1. Database definitions and paradigms
  - What is a Database?
  - Historical Evolution of data management techniques
  - General benefits of Database Management Systems (DBMSs)
  - DBMS types
  - Heirarchical
  - Information Network (linked lists and pointers)
  - Relational
  - Object-oriented
2. Principles of Relational database design

- Representation of real world objects and their attributes
  - Relationships between objects
  - Table notation formalisms
  - Relationships: one-to-one, one-to-many, many-to-many
3. System design and building methods
    - Entity-relationship diagrams
    - State Transition Models
    - Data Flow Diagram
  4. Transforming flat files to tables
  5. A sample problem in database design



← Session 3: 1:30 - 3:00 PM

*The Internet Yesterday & Today*

## Faculty

Richard P.C. Rodgers, M.D.

## Educational Objectives

This lecture and lab session will review the historical evolution and technical underpinnings of the Internet, with special emphasis on the World Wide Web and related developments. At the completion of the session, participants should:

1. Understand the nature and organization of the Internet, how it came into existence, and how it is currently evolving.
2. Understand the important role of open standards in the evolution of the Internet, and how these differ from proprietary standards.
3. Understand basic aspects of the major applications of the Internet, including electronic mail, file transfer, remote login, Usenet news, teleconferencing, and data retrieval.
4. Understand the historical evolution, current capabilities, current technological evolution, and social issues surrounding the currently most important Internet application, World Wide Web. The structure of a Web document will be reviewed, though the creation of actual WWW documents by the students will be left for the evening lab session.

## Session Outline

- What is the Internet?
  - The Nature of the Internet
  - The Composition of the Internet
  - Associated Organizational Structures
  - The Physical Structure of the Internet
- Historical Evolution of the Internet
- Related Government Initiatives (HPCC & NII)
- Technical Underpinnings: Protocols & Open Standards
- Communications Issues
- Getting the User Connected
- Putting the Internet to Work
  - Electronic Mail

- File Transfer
- Remote Computer Access
- Usenet News
- Communications & Teleconferencing
- Data Retrieval: *Grateful Med*, gopher, WAIS, World Wide Web



← Session 4: 3:30 - 5:00 PM

## *Unified Medical Language System & Internet Grateful Med*

### Faculty

Lawrence C. Kingsland, Ph.D.

### Educational Objectives

This lecture and lab session will introduce the National Library of Medicine's Unified Medical Language System (UMLS) and a major new application which uses it: Internet Grateful Med. At the completion of the session, participants will:

1. Understand the problem addressed by the Unified Medical Language System initiative
2. Know the major components of the Unified Medical Language System
3. Have been exposed to the breadth of content of the UMLS Metathesaurus
4. Receive an introduction to and concentrated lab time with NLM's new Internet Grateful Med program, using the UMLS Metathesaurus and other resources to provide assisted searching in MEDLINE and other NLM databases

### Session Outline

1. Problem addressed by the Unified Medical Language System
2. Multiplicity of vocabularies, classifications, naming systems
3. Major components of the Unified Medical Language System
  - Metathesaurus
  - Semantic Network
  - Information Sources Map
  - Lexicon, Lexical Tools
4. Breadth of the Unified Medical Language System Metathesaurus
5. UMLS Knowledge Source Server
6. Internet Grateful Med
  - The problem addressed by Internet Grateful Med
  - The NLM Access Model
  - Assisted searching with an intelligent gateway system
  - Active use of the UMLS Metathesaurus
  - Search formulation; retrieval
  - Search refinement
  - Guided lab time (tutorial)
  - Independent lab time; tutors on hand





## Session 4: 3:30 - 5:00 PM

### *Principles of Web Page Design*

#### **Faculty**

David Remsen, MBL staff

#### **Educational Objectives**

This session will introduce the concepts of descriptive and procedural markup using the Web-based HyperText Markup Language as the example. At the completion of this session participants will:

- I. Know how to create, edit, and verify their own HTML markup
- II. Be introduced to the core HTML tag syntax
- III. Be introduced to more advanced HTML elements including:
  - i. The TABLE family of tags
  - ii. The BODY family of tags

← ↑ Day 2 - Tuesday, June 3, 1997  
←



## Session 1: 8:30 - 10:00 AM

### *Molecular biology information resources*

#### **Session 1: 8:30 - 10:00 AM**

*Molecular biology information resources*

#### **Faculty**

David Landsman, Ph.D.

#### **Educational Objectives**

In this lecture and the accompanying lab session, Dr. Landsman will discuss methods developed at the National Center for Biotechnology Information, to extract information about chromosomes, genomes, molecular sequences and structures, and the associated information in the biomedical research literature. Students will get hands on experience of these tools.

#### **Session Outline**

1. Molecular biology data objects
  - Building blocks
  - Sequences
  - Folding

2. Databases of molecular objects
  - GenBank and its international collaborators
  - Molecular Modelling Database (MMDB) and Protein Data Base (PDB)
  - The Genomes Division of GenBank
3. Extracting data from these databases
  - Entrez
  - Network Entrez



## Session 2: 10:30 - 12:00 N

### *Encryption and Public Policy Issues*

#### **Faculty**

Donald A.B. Lindberg, M.D.

#### **Educational Objectives**

This lecture and discussion will present the theoretical and practical bases for recommendations concerning medical data privacy, data encryption technology, and some of the national security considerations.

At the completion of the session, participants will:

1. Know the issues facing the US regarding copyright and database protection world-wide
2. Know if they support or do not support federal privacy legislation, and its features
3. Understand the basis for current data encryption methods.
4. Will have tested at least two Security Token Authentication devices.
5. Know if they prefer to operate Challenge Response or Time Synchronous security devices.

#### **Session Outline**

1. Intellectual Property Rights
    - WIPO Treaty proposals
    - Pub Med Plans
  2. Encryption
    - Basic concepts
    - DES
    - Public-Private Key
    - Implementation and Devices
- a) Data Encryption Technology
- Private Key Encryption
    - Digital Encryption Standard
    - Kerberos
  - Public-Private Key Encryption
- b) System Considerations

- Length of Cipher Keys
- Security
- Token Authentication

### c) Devices

- Challenge - Response
- Time Synchronous

## 3. Medical Data Privacy

- Requirements
- Legislation
  - Overview
  - Status of Federal Privacy Legislation
  - Contentious Issues
- Initial Practical Experience with Medical Data Privacy Assurance



## Session 3: 1:30 - 3:00 PM

### *The Internet Tomorrow: Emerging Technologies*

### Faculty

Richard P.C. Rodgers, M.D.

### Educational Objectives

This lecture and lab session will discuss and demonstrate newer and more experimental applications for the Internet, including multicasting and teleconferencing, and various World Wide Web-related developments such as Virtual Reality Modeling Language (VRML) and downloadable software (Java, tcl/tk, and Python). Demonstrations will comprise live and taped material, including applications related to the NLM's Visible Human Project. At the completion of the session, participants should:

1. Understand current developments in advanced Internet applications, and how they might come to be applied within biology and medicine.
2. Understand the distinctions between unicasting and multicasting, the difference between UDP and TCP transmission protocols, and the major compression techniques and protocols as applied to teleconferencing over the Internet.
3. Understand the capabilities and limitations of VRML.
4. Understand the technical issues involved in downloadable software modules, and the comparative strengths and weaknesses of the various languages that have been proposed to support this capability.

### Session Outline

- Multicasting and the MBONE

- Virtual Reality Modeling Language (VRML)
- Downloadable applications ("applets") for the World Wide Web
  - Java
  - tcl/tk
  - Python
- Issues in the Evolution of the World Wide Web
  - Security & Privacy
  - Tools for Commerce
  - Control of Access (PICS)
  - Open vs. Proprietary vs. "De Facto" Standards



### Session 3: 3:30 - 5:00 PM

#### *Putting Databases on the Web*

#### **Faculty**

David Remsen

#### **Educational Objectives:**

This course will introduce the participants to the means to make flat and relational data files available on the web. By the end of the session participants will:

1. Be introduced to the HTML FORMS syntax
2. Understand the mechanisms by which HTML FORM information can be used to communicate with a database on a remote system. Participants will be able to interact with some "live" database models on the web.
3. Be introduced to ODBC and SQL concepts and their use in web-based data serving.
4. Recieve and overview of some commercial database servers and their strengths and weaknesses.



### Evening Session

#### *SGML: An introduction*

#### **Faculty**

David Remsen

#### **Educational Objectives -**

This short course will introduce participants to the Standard Generalized Markup Language and why it is being looked to as a possible means to create standard models for information storage and structuring. The objectives of this course will be to:

1. Provide an overview of SGML syntax



2. Introduce the concept of document-oriented information storage
3. Understand the concept of a Document Type Definition and how it is written
4. Understand how a DTD is used to validate a document instance.
5. Give participants an understanding of how a DTD can be applied to existing data structures

← ↑ Day 3 - Wednesday, June 4, 1997



## Sessions 1-4

### *Health Services Research*

#### **Faculty**

Jim Grigsby, Ph.D.

#### **Educational Objectives**

The lectures and lab sessions will introduce participants to the basic principles of health services research. At the completion of the session, participants will:

1. Have an understanding of the scope of health services research
2. Have a sense of the importance of health services research in the establishment of policy.
3. Understand the basic approaches to health services research design
4. Gain an appreciation for the use of risk-adjustment in analysis of health outcomes.

#### **Session Outline**

##### **Session 1: 8:30 - 10:00 AM**

###### *Introduction to Health Services Research*

- The scope of health services research
- Policy implications
- Funding for health services research
- Research questions and relationship to clinical research
- Design: experiments and quasi-experiments

##### **Session 2: 10:30 - 12:00 N**

###### *Data and data collection*

- Indicators and outcomes
- Data and instruments
- Prospective data collection
- Retrospective data collections: chart review and claims history
- Minimizing burden for data collectors and respondents

### **Session 3: 1:30 - 3:00 PM**

#### *Design Lab*

- Analysis of a research question
- Study design
- Specification of endpoints, covariates, and independent variables
- Sources of data

### **Session 4: 3:30 - 5:00 PM**

#### *Data Analysis Lab*

- Working with a database
- Evaluating outcomes
- Risk adjustment and its effect on outcomes
- Selection of risk factors for analysis



### **Evening Personal Skills Workstop, Thursday June 5, 1997**

*SGML*

← ↑ Day 4- Thursday, June 5, 1997 and Day 5 - Friday, June 6, 1997



### **Sessions 1-4: 8:30 AM - 5:00 PM**

*Clinical Information Systems*

This series of lectures and lab sessions will cover the design principles of large-scale clinical information systems that meet the needs of academic medical centers.

#### **Faculty**

Paul Clayton, Ph.D. George Hripcsak, M.D. Stephen B. Johnson, Ph.D.

#### **Educational Objectives**

At the completion of the session, participants will:

1. Understand the success factors in building and managing large-scale information systems in an academic medical center.
2. Know the design principles of clinical information systems, and understand the function of each component: patient database, controlled vocabulary, event monitor, and user interfaces.
3. Understand the cost/benefit issues involving health care information systems, in particular, the role of automated care plans and practice guidelines.

## Session Outline

1. ← IAIMS (Integrated Academic Information Management System)
  - IAIMS goals
  - Success factors
  - Institutional Commitment
  - Leadership
  - Network
  - People
  - Architecture
  - Applications
  - Demonstration
2.
  - ← Clinical information system architecture
    - Architectural issues
    - Scale: from desktop to nation
    - Heterogeneity: network, applications, users
    - Centralization: quality control vs. flexibility
    - Case study: large-scale, heterogeneous, system with centralized control
3. Data interchange standards
  - Goals
  - Seven layer ISO model
  - Medical standards organizations
  - Health Level Seven (HL7)
  - Limitations
4. ← Medical databases and vocabularies
  - What is special about medical data?
  - Large number of entities
  - Complex naming
  - Degrees of granularity
  - Temporal nature
  - Perspectives for classification
  - Nesting of modifiers
  - Medical databases
  - Content: medical events
  - Views: patient care, research, department
  - Design issues: performance, availability, extensibility, ease of access
  - Clinical vocabularies
  - Goals: coding, translation, decision support
  - Methods
  - Maintenance issues
  - Established vocabularies
5. ← Clinical data acquisition and review
  - Types of clinical applications
  - Types of clinical users and working styles
  - Data acquisition
    - Input modalities (text, voice, pen, touch)
    - Design principles
  - Data review



- Display modalities (graphics, text, sound, video)
  - Design principles
6. ← Decision analysis
- Purpose
  - Judgment under uncertainty
  - Bayesian approach
  - Decision trees
  - Assessing probabilities and utilities
  - Sensitivity analysis
7. ← Decision-support systems
- Goals
  - Approaches to decision support
  - Types of decision-support systems
  - Knowledge representation and sharing
  - Architecture of an event monitor
  - Care plans and practice guidelines
8. ← Costs and benefits
- Costs of building systems
  - Conclusions drawn from usage
  - The role of information systems



## Evening Personal Skills Workstop, Thursday June 5, 1997

*Embedded Applets and web scripting Technologies/Web-based multimedia*

### Faculty

Adrian Smith, MBL staff

### Educational Objectives

← ↑ Day 6 - Saturday, June 7, 1996

**Session 1-3: 8:30 - 3:00 P**



← *Telemedicine: Present Status, Future Applications*

### Faculty

Jay H. Sanders, M.D.

### Educational Objectives

At the completion of this session, the participants will:

1. Have a clear understanding of the technological capabilities of a telemedicine system.
2. Be able to recognize the quality/cost/access implications of a telemedicine health care delivery system.

system.

3. Be aware of the potential implementation barriers in developing a telemedicine infrastructure.

## Session Outline

1. Status of Existing Telemedicine Initiatives
  - Technological Functionalities
  - Specific Health Care Environment Needs and Applications
2. Barriers to the Diffusion of Telemedicine
  - Legal/Regulatory
  - Economic
  - Human Factors
  - Technological
3. The Next Generation
  - The Electronic Housecall
  - Dynamic Data Banks
  - Computer Interfaces
  - Inter-Health-Net



## Session 4: 3:30 - 5:00 PM

← *Designing a Medical Informatics Curriculum*

## Faculty

## Educational Objectives

At the completion of this session, participants should have an understanding of issues attendant to the development and implementation of a medical informatics curriculum at the fellows' home institutions.

## Session Outline

This session will be an interactive discussion among faculty and fellows. It will review the topics covered at the MBL course and promote discussion regarding future changes.

## 5:00 PM

Course Wrap-Up and Farewell

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