*Sponsored by the National Library of Medicine and the Marine Biological Laboratory, Woods Hole Massachusetts*

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# Back Session Education Objectives and Outlines

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*Note: course content and scheduling still undergoing refinement; this version current as of April 10, 1996.*

## Top Day 1 - Thursday, May 30, 1996

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

*HPCC, NII, current issues in medical informatics*

**Faculty**

Top 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**

Top 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**

Top 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 SystemInternet Grateful Med*

**Faculty**

Top 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

**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

**Evening Personal Skills Workstop, Thursday May 30, 1996**

*Literature Searching*

**Faculty**

Top Judy Ashmore, MBL staff

**Educational Objectives**

This workshop will enable participants to identify and retrieve information through the National Library of Medicine family of databases including the newly available Internet Grateful Med (IGM) .

At the completion of the session participants will be able to formulate basic search strategies and retrieve references from the medical literature using Grateful Med with special emphasis on the health services research literature.

**Session Outline**

- Overview of NLM 's User-Friendly Software
- Internet Grateful Med
- Grateful Med for Windows
- Grateful Med for MAC

- Grateful Med for PC
- Basics of Grateful Med Searching
- Features and Databases
- MESH Basics and Concepts
- Subject, Author and Title Searching
- Loansome Doc
- Other NLM sponsored databases:
    - Internet access to the National Information Center on Health Services Research and Health Care Technology (NICHSR) databases
- Hands on practice searching
- Wrap up/Recap/Evaluation

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## Day 2 - Friday, May 31, 1996

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

*Molecular biology information resources*

**Faculty**

Top 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**

Top 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 if they support or do not support federal privacy legislation, and its features.
2. Understand the basis for current data encryption methods.
3. Will have tested at least two Security Token Authentication devices.
4. Know if they prefer to operate Challenge Response or Time Synchronous security devices.

**Session Outline**

1. Public Policy Issues
2. Encryption
    - Basic concepts
    - DES
    - Public-Private Key
    - Implementation and Devices
3. Medical Data Privacy
    - Requirements
    - Legislation
        - Overview
        - Status of Bennett Bill
        - Contentious Issues
    - Initial Practical Experience with Medical Data Privacy Assurance
4. Data Encryption Technology
    - Private Key Encryption
        - Digital Encryption Standard
        - Kerberos
    - Public-Private Key Encryption
5. System considerations
    - Length of Cipher Keys
    - Security
    - Token Authentication
6. Devices
    - Challenge - Response
    - Time Synchronous

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

*The Internet Tomorrow: Emerging Technologies*

**Faculty**

Top 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 4: 3:30 - 5:00 PM**

*Principles of Web Page Design*

**Faculty**

Top David Remsen, MBL staff

**Educational Objectives**

At the completion of this session, participants will have an understanding of Hypertext Markup Language (HTML) and its application in the creation of World Wide Web pages.

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## Day 3 - Saturday, June 1, 1996

**Sessions 1-4**

Mathematical Modeling: principles and practice

**Faculty**

Top Carol M. Newton, M.D., Ph.D.

**Educational Objectives/Session Outline**

This lecture and lab session will introduce some basic principles of biomedical modeling and its uses, and skills for originating and studying one's own models.

At the completion of the session, participants will have:

Seen examples of some biomedical models and what can be learned from studying them;Learned how to move from a statement of assumptions about a biological system to writing down a set of differential equations to study it;Developed and studied a model of their own;Studied several biomedical models (e.g., predator-prey, epidemic spread, pharmacokinetics, enzyme system, a library staffing model)If time permits, nonlinear regression software for fitting diferential equation models directly to data will be demonstrated.

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## Day 5 - Monday, June 3, 1996 and Day 6 - Tuesday, June 4, 1996

**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**

Top 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
    - Baysian 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, Monday June 3, 1996**

*PowerPoint*

**Faculty**

Top Adrian Smith, MBL staff

**Educational Objectives**

This lecture will enable the participants to make full use of Microsoft PowerPoint, a microcomputer-based presentation generation package.

At the completion of the session, participants will:

1. Understand the document model used by PowerPoint.
2. Be comfortable building presentations using PowerPoint's built-in "Wizards".
3. Have a better understanding of the processes involved in creating a multimedia presentation.

**Session Outline**

1. Why use computer-generated presentations?
2. What is PowerPoint?
3. - Concepts
4. Wizards
5. - Presentation Wizard
6. - Auto-Content Wizard
7. - Help Wizard
8. Creating a Presentation
9. - Choosing a Wizard
10. - Adding Information
11. - Previewing the Presentation
12. Views
13. - Slide View
14. - Slide Sorter View
15. - Outline View
16. - Notes
17. Design Considerations
18. - Color
19. - Layout
20. - Effects
21. Multimedia elements
22. - Graphics
23. - Video
24. - Audio

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## Day 7 - Wednesday, June 5, 1996

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

*The Informatics of Managed Care*

**Faculty**

Top Daniel R. Masys, M.D.

**Educational Objectives**

This session will review the economic changes shaping medical care and their implications for the design of information systems.

**Session Outline**

1. Trends in "Healthcare Reform"
2. Correlating Costs and Outcomes with clinical events
3. Reference data sets: AHCPR CONQUEST
4. Networks of Computers for Networks of Providers
5. Dealing with Complexity: Managed Care coverage rules

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

*Telemedicine: Present Status, Future Applications*

**Faculty**

Top 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.
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 3. Evaluation Results
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 3: 1:30 - 2:30 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.

**Session 4: 2:30 - 3:00 PM**

Course Wrap-Up and Farewell

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