



NITRD Programs Related to Health Care and Biomedical Research

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Director

National Coordination Office for
Information Technology Research and Development

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President's Information Technology Advisory Committee



Networking and Information Technology Research and Development

- Networking and Information Technology R&D Program (NITRD) helps focus interagency IT R&D:
 - Identify common research needs
 - Plan multi-agency research programs
 - Coordinate and collaborate on research announcements and funding
 - Review research results and adjust accordingly
- Includes R&D programs of twelve participating agencies
- Helps to build the technology base on which the information technology industry has grown
- Evolved from the Federal High Performance Computing and Communications Initiative (HPCC), Computing Information and Communications Program (CIC), and Next Generation Internet Program (NGI)
- Assessed by the President's Information Technology Advisory Committee



Participating Agencies and Departments

- Department of Defense
 - Defense Advanced Research Projects Agency (DARPA)
 - National Security Agency (NSA)
 - Office of the Director of Defense Research and Engineering (ODDR&E)
 - Defense Information Systems Agency (DISA)
- Department of Energy
 - Office of Science (DOE/SC)
 - National Nuclear Security Administration (DOE/NNSA)
- Department of Health and Human Services
 - National Institutes of Health (NIH)
 - Agency for Health Research and Quality (AHRQ)
- Department of Commerce
 - National Institute of Standards and Technology (NIST)
 - National Oceanic and Atmospheric Administration (NOAA)
- National Science Foundation (NSF)
- National Aeronautics and Space Administration (NASA)
- Environmental Protection Agency (EPA)
- Observer: Federal Aviation Administration (FAA)



President's Information Technology Advisory Committee (PITAC)

- **PITAC authorized in the High-Performance Computing Act of 1991 (P.L. 102-194)**
 - The Advisory Committee shall provide the Director [of OSTP] with an independent assessment of:
 - Progress made in implementing the Program
 - The need to revise the Program
 - The balance between the components of the Program
 - Whether the research and development undertaken pursuant to the Program is helping to maintain United States leadership in computing technology
 - Other issues identified by the Director
- **PITAC recommendations have helped guide the NITRD program and its predecessors. Examples include:**
 - *Information Technology Research: Investing in Our Future*, February 1999
 - *Next Generation Internet Review*, April 1999, April 2000
 - *Transforming Health Care Through Information Technology*, February 2001

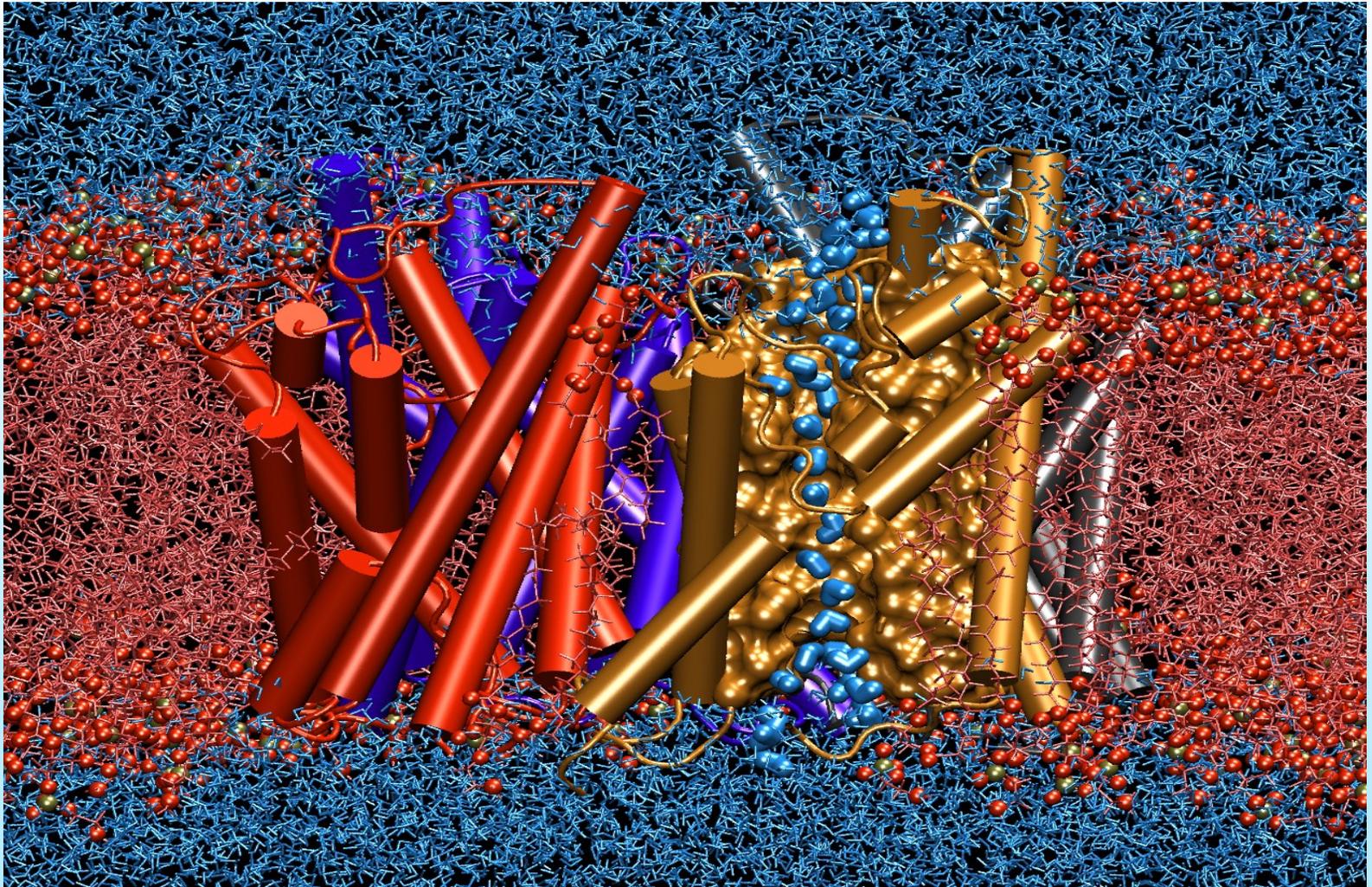


NITRD Research Applicable to Medicine: High-End Computing

- **Computing architecture and technology**
- **Algorithms and tools**
- **Applications**
- **Computing resources**

Simulation of Aquaporin Protein Inside a Cell (NSF & NIH)

Visualization shows transport of water molecules into cell.



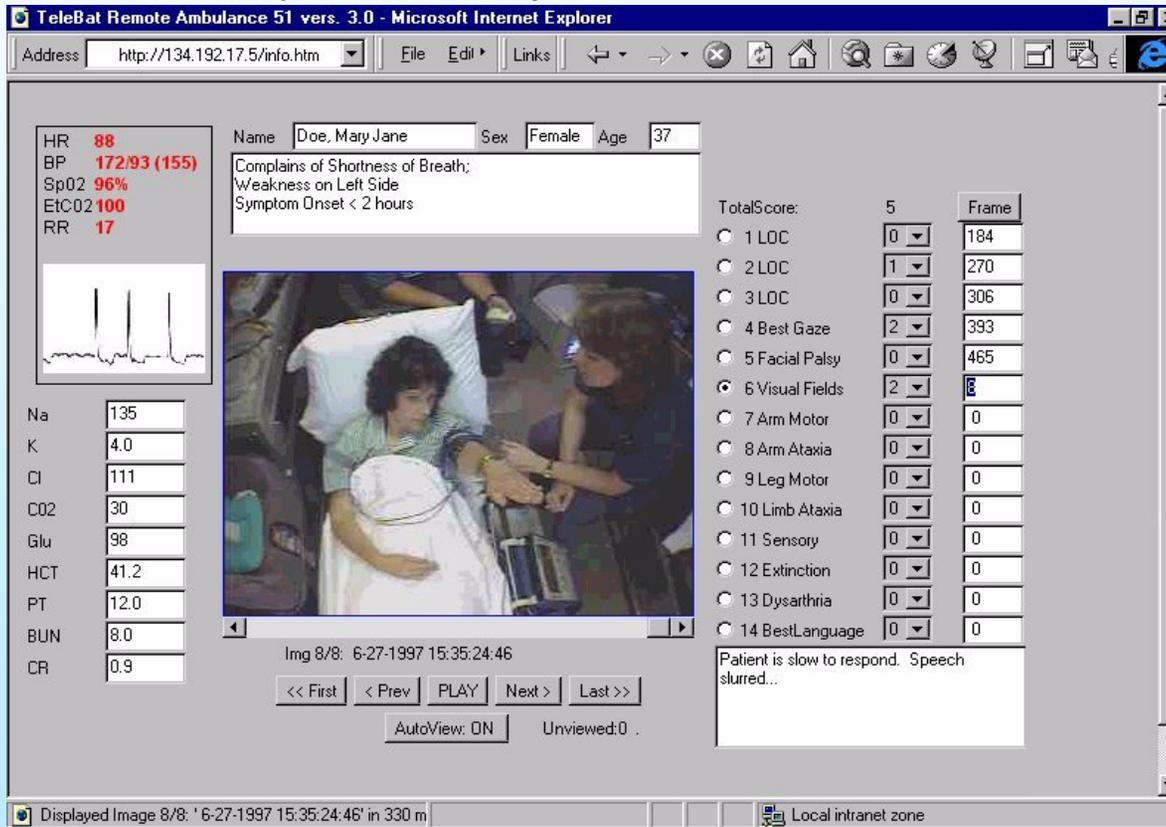


NITRD Research Applicable to Medicine: Large Scale Networking

- **Network technology, scaling, reliability, security**
- **Wireless, ad hoc, and sensor network capabilities**
- **Network measurements and management**
- **Future Internet architecture to overcome current limitations, e.g., real-time applications**
- **Middleware to enable network-aware applications**
- **Collaboration technologies**
- **Network resources**

- Optimizes treatment options in the “Golden Hour”
- Initiates the patient record in the ambulance
- Enhances the efficiency of the ER
- Improves patient outcomes

Intuitive Physician’s Interface



TeleBat Remote Ambulance 51 vers. 3.0 - Microsoft Internet Explorer

Address: http://134.192.17.5/info.htm

Name: Doe, Mary Jane Sex: Female Age: 37

Complains of Shortness of Breath;
Weakness on Left Side
Symptom Onset < 2 hours

HR: 88
BP: 172/93 (155)
SpO2: 96%
ETCO2: 100
RR: 17

TotalScore: 5

	Frame
<input type="radio"/> 1 LOC	0
<input type="radio"/> 2 LOC	1
<input type="radio"/> 3 LOC	0
<input type="radio"/> 4 Best Gaze	2
<input type="radio"/> 5 Facial Palsy	0
<input checked="" type="radio"/> 6 Visual Fields	2
<input type="radio"/> 7 Arm Motor	0
<input type="radio"/> 8 Arm Ataxia	0
<input type="radio"/> 9 Leg Motor	0
<input type="radio"/> 10 Limb Ataxia	0
<input type="radio"/> 11 Sensory	0
<input type="radio"/> 12 Extinction	0
<input type="radio"/> 13 Dysarthria	0
<input type="radio"/> 14 BestLanguage	0

Na: 135
K: 4.0
Cl: 111
CO2: 30
Glu: 98
HCT: 41.2
PT: 12.0
BUN: 8.0
CR: 0.9

Img 8/8: 6-27-1997 15:35:24:46

Patient is slow to respond. Speech slurred...

Displayed Image 8/8: '6-27-1997 15:35:24:46' in 330 m

- Adjustable image compression quality (medium JPEG compression)

- Adjustable image size (320x240 24-bit images)

- About 5 kbps per phone line (4 phone lines)

- Resulting in diagnostic quality slowscan video images at about 2.5 seconds per image



NITRD Research Applicable to Medicine: Trust, Privacy & Security

- **Model for who trusts whom to do what is critical for defining security and privacy infrastructure.**
- **Two easy models:**
 - Everyone trusts everyone else to see everything
 - Rigid hierarchy and compartments
- **Medical care has very complex trust model where people trust others for limited periods of time for limited purposes.**
 - HIPAA raises the stakes
- **Achieving adequate security and privacy will be challenging.**



NITRD Research Applicable to Medicine: Software Design and Productivity

- **Develop methods and tools for software requirements, specification, design, and implementation that will produce software on time, within cost, that meets functional requirements**
- **Recent problems with control software for military F/A-22 aircraft highlights importance of software design and productivity**
- **Medical software must be reliable**



NITRD Research Applicable to Medicine: Human-Computer Interaction and Information Management

- **Research topics include:**

- How humans use data and information to control systems
- Synergy between humans and computers in performing scientific exploration, model building and use, data mining, decision making

- **Medical information poses particular problems:**

- Over 800 million doctor visits in U.S. per year
- Data comes in large “chunks” like CAT scans and small chunks like web pages and doctors notes.
- Human interface to enter and retrieve data must be intuitive, easy, and fast.
- Tools are needed to determine relations among data elements.
- Data must include quality metrics.
- Finding where data is located is a significant challenge.
- Information (both good and bad) propagates very rapidly.



NITRD Research Applicable to Medicine: High Confidence Software and Systems

- **Research into software theories and methods to support software design and implementation “guaranteed” to meet specified design properties**
 - Reliability, security, safety, usability, confidentiality
- **Specifying such properties and verifying their attainment is currently ill-defined and difficult.**
- **Examples of applications:**
 - Certification of software for infusion pumps used in hospitals to deliver IV medications
 - Certification of security of software in Common Criteria Program
- **Funded National Academy of Sciences certification study**



Examples of Specific Federal Health-Related Research Projects

- **Patient monitoring and management**
 - Video and sensor analysis for geriatric care
 - Decision aids for acute care nursing
 - “Just-in-time” medical information
 - Distributed patient care digital library
 - Wearable navigation devices
- **Information management and analysis**
 - Analysis of genomic and structural biological data
 - Pairwise comparisons of DNA sequences
 - Understanding images of cellular and sub-cellular processes
 - Understanding function of proteins
 - Simulating cellular processes including effects of pathogens
 - Early detection of disease outbreaks
 - Secure distribution of medical information



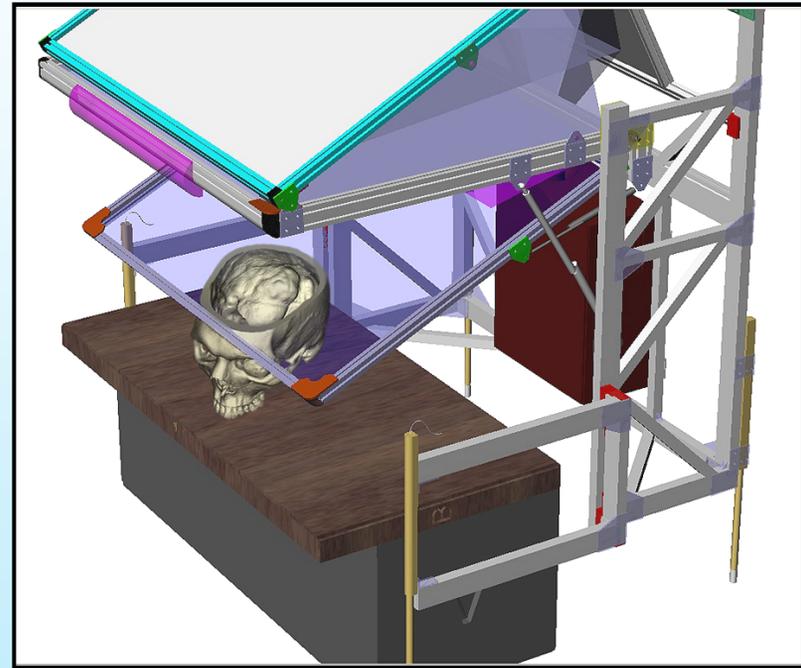
Examples of Specific Federal Health-Related Research Projects

- **Modeling and simulation**
 - Human knee modeling for surgical planning
 - Soft tissue modeling for surgery
 - Electronic books for teaching surgical procedures
 - Modeling of sub-cellular processes
 - Identification of binding sites in DNA
- **Medical technology**
 - Safety of medical IT systems
 - Robotic surgery
 - Telemedicine
 - Medical collaboratories
 - Health and disaster aid network
- **Standards Development**
 - “Health Level 7” messaging standard
 - Security standards

Networked Collaborative Surgical System (NIH/NLM)



Networked tele-immersive system
for surgical consultations



Virtual sculpting of implants



Possible Areas for PITAC Recommendations to Information Technology Research Community

- **Research priorities for nearer-term research**
- **Research areas with high potential economic or social payoff**
- **Partnering opportunities to adapt existing information technologies to medical needs**
- **Opportunities for information technology research community to assist in standards development and prototyping**



For Further Information

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Or visit us on the Web:

www.nitrd.gov