Internet2 Health Sciences

Internet2 health sciences applications are enabling students, faculty, researchers, and clinicians to collaborate and interactively access information and resources. In addition, these applications are helping disseminate knowledge to assist students in learning, viewing, and analyzing information. Current health sciences applications include areas such as medical education, virtual reality, and telepathology, all of which have high-performance needs requiring advanced networking services.

www.internet2.edu

Virtual Reality

Virtual Pelvic Floor
University of Illinois at Chicago

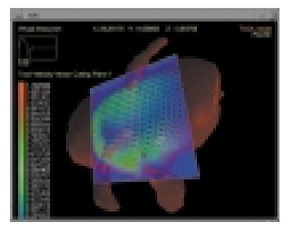
http://www.sbhis.uic.edu/vrml/Research/PelvicFloor/PelvicFloor.htm

Successful surgical intervention depends on the surgeon's ability to conceptually visualize complex anatomical structures (such as the pelvic floor) three-dimensionally. Tele-immersive applications, combining teleconferencing, telepresence, and virtual reality, and the advanced network capabilities of Internet2 networks, allow both teacher and students to enjoy improved visualization of 3-D structures.

Tele-immersion participants interact using two or more networked ImmersaDesk™ systems and using special eyeglasses with sensors that track each viewer's movements and cause the system to automatically orient the model in relation to the viewer. The teacher and students—even in geographically remote locations—are able to share and interact with a 3-D anatomical model, converse, see each other, and point in three dimensions using an electronic wand.
ImmersaDesk is a trademark of The University of Illinois, Board of Trustees

Virtual Aneurysm
University of California at Los Angeles

http://www.cs.ucla.edu/~dalee/radsci/



The Virtual Aneurysm is a simulation and virtual reality visualization of brain blood flow. Using a software system that will be able to accurately model an aneurysm imaged using x-ray computed tomographic angiography (CTA), a doctor can visualize the aneurysm in a virtual reality environment, predict its future behavior, and gain insight into the diagnosis and treatment. Cutting planes and stream lines tools can be used to examine the pressure, fluid velocity, and shear forces of the aneurysm. Researchers are working to improve the accuracy of blood flow simulations, and on the development of intelligent tools to enable doctors to more easily visualize critical flow patterns and to evaluate simulated surgical interventions. Internet2 high-performance networking provides the advanced capabilities (high-bandwidth and low delay) necessary to enable the remote visualization and navigation of multi-terabyte virtual aneurysm simulations stored on a high-performance server at UCLA.

Medical Informatics

Distributed Medical Informatics Education
Oregon Health Sciences University and the University of Pittsburgh

http://www.ohsu.edu/bicc-informatics/
http://www.upmc.edu/sti/medinformatics/

Medical informatics is a broad field spanning electronic medical records, telemedicine, information retrieval, image processing and analysis, bioinformatics, and evaluation methodologies. Using Internet2 high-speed networking and distance learning modalities, students in the informatics programs within Oregon Health Sciences University and the University of Pittsburgh have access to a broader range of faculty, areas of subject expertise, and other students with whom to collaborate.

Visualization/Collaboration

Human Embryo Development
George Mason University, Oregon Health Sciences University, National Library of Medicine

http://www.nac.gmu.edu/visembryo.htm
http://www.ohsu.edu/chrc/

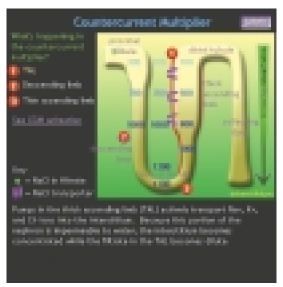
This large, NLM-funded project focuses on providing a way for medical professionals to communicate detailed information about human embryo development in a visual form. This project comprises a network of medical collaboration workstations, using high-performance, off-the-shelf networked computer systems combined with advanced software for collaboration, and medical visualization. The workstations are installed at eight project locations and interconnected over high-performance networks operating at data rates over 100 megabits per second nationwide. As a result, doctors will be able to visualize and manipulate high-resolution image data collaboratively for diagnoses, clinical case management, and medical education.

George Mason University is providing overall responsibility for the project as well as collaboration technology. Oregon Health Sciences University (OHSU) has a leading role in the Annotation and Modeling application and is responsible for aspects of embryology dealing with the heart and lungs. For example, using image sets from the Visible Embryo Project to create 3-D computer models, the OHSU Heart Research Center is helping to improve understanding of the complex processes of normal and abnormal heart development. Their Embryology Education Application makes visualization tools available for medical student use and creates animations of embryo organ system development. Internet2 networks allow sharing of the images in real-time with researchers in California and Washington, D.C.

Interactive and Simulation-Based Learning Environments

Renal Physiology Modules
Stanford University, Virtual Labs Project

http://summit.stanford.edu/hhmi



Current one-dimensional mediums limit students' ability to "see into" the dynamic systems of the body. To overcome these limitations, the Stanford University's Medical Media and Information Technologies (SUMMIT) Project is developing interactive and simulation-based learning environments in physiology for undergraduates at Stanford; Internet2 advanced networking will enable future collaboration in curricula among member universities. The first module in renal physiology contains a knowledge base in kidney structure, function, and difficult renal concepts addressed in the traditional course material. Topics include auto regulation, urinalysis, and countercurrent (cc) multiplier. The module contains a laboratory and quiz section that allows students to integrate and apply their knowledge to real-life problems. Finally, a resource section contains a glossary, previous lecture material, and a link to an online office hours chat room. Future modules will include such topics as neuro, cardiovascular, respiratory, and gastrointestinal physiology.

Anatomy and Surgery Workbench and Local NGI Testbed Network
Stanford University, School of Medicine

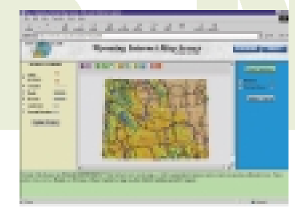
http://haiti.stanford.edu/~ngi/final/

SUMMIT's Next Generation Internet (NGI) testbed network within the Stanford School of Medicine evaluates the effectiveness of the Anatomy and Surgery Workbench applications. The testbed network links selected classrooms, labs, clinical departments, and the medical library using a high-speed gigabit Ethernet backbone. The new 3-D Learning Space and connected classrooms allow students to learn anatomy and basic surgical skills through the use of 3-D workstations, haptic (touch sensitive) devices, stereoscopic displays, distributed rich media databases, and application program servers. Both applications support synchronous collaboration through a shared virtual workspace and will use haptic feedback to augment the visual sense. This technology permits the definition of new curricular elements including the repeated dissection of anatomical structures, visual segmentation of raw data sets, creation of 3-D organ models, and the practice of fundamental surgical maneuvers. The capabilities of Internet2 high-performance networks and use of a distributed client-server system allow teachers and users to share online, image-rich data, and professional experiences.

Telemedicine

Surveyor
University of Wyoming and the Wyoming Department of Health

http://www.wims.uwyo.edu

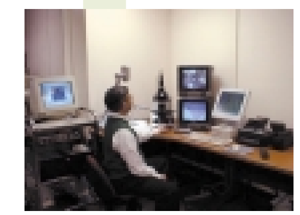


This project provides a centralized Internet-accessible source of information and tools for health science research and education to enable practitioners, administrators, educators, researchers, and students to improve the quality of health care services in rural and underserved areas. Through a "one-stop" searchable Internet portal, both novices and experts are able to quickly locate reliable sources of information on health and health-care issues. Their web-based research environment integrates rural health data with geographic information systems (GIS) technology to support studies of rural health and rural health care. Internet2 high-performance networks make it possible to quickly transmit large volumes of data for rapid display. In addition, the project supports continuing education for rural health care practitioners and in-residence opportunities for health science students through Internet resources and telecommunication.

Medical Consultation and Distance Learning

NLM Testbed for Collaborative Videoconferencing
National Library of Medicine

http://tlc.nlm.nih.gov/distancelearningandcollaboration.html



The National Library of Medicine provides a testbed environment demonstrating the use of MPEG-2 videoconferencing and NTSC quality video over Internet2 networks and the Next Generation Internet (NGI) for use in telemedicine/consultation and distance learning programs. Quality of service requirements for healthcare applications on high-performance networks are being researched to ensure the integrity of the information being transmitted and the value added by real-time interaction. The testbed environment allows point to point and multi-point videoconferencing (via multicast) between collaborating sites, and also allows transmission of a range of medical content from varied sources, including presentation stands, videomicroscopes, videotape, digital stethoscopes, and otoscopes. Demonstrations of the technology are ongoing and configuration of the testbed continues to evolve.