Coalition of
Academic
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Centers

Alabama Supercomputing Authority
Huntsville, Alabama

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Tempe, Arizona

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Caltech
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Center for Computational Sciences
Lexington, Kentucky

Center for Computational Sciences
Oak Ridge, Tennessee

Center for Innovative Computer
Applications at Indiana University
Bloomington, Indiana

Center for Research on
Parallel Computation
Houston, Texas

Cornell Theory Center
Ithaca, New York

National Center for
Atmospheric Research
Boulder, Colorado

National Center for Supercomputing
Applications at UIUC
Champaign, Illinois

National Energy Research
Supercomputer Center
Livermore, California

National Supercomputer Center
for Energy and Environment
Las Vegas, Nevada

North Carolina Supercomputing
Center at MCNC
Research Triangle Park, North Carolina

Ohio Supercomputer Center
Columbus, Ohio

Pittsburgh Supercomputing Center
Pittsburgh, Pennsylvania

Purdue University
West Lafayette, Indiana

San Diego Supercomputer Center
San Diego, California

Supercomputer Computations
Research Institute
Tallahassee, Florida

System Network Computer Center
at Louisiana State University
Baton Rouge, Louisiana

Texas A & M University
Supercomputer Center
College Station, Texas

The Pennsylvania State University
University Park, Pennsylvania

University of Florida
Gainesville, Florida

University of Georgia
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University of Texas at Austin
Computation Center
Austin, Texas

University of Utah
Salt Lake City, Utah

University of Wisconsin
Madison, Wisconsin

C A S C

IMPROVING HEALTH CARE DELIVERY THROUGH HIGH PERFORMANCE COMPUTING

America faces the dual challenge of reducing national health care costs while providing affordable, quality services for all its citizens. High performance computing is an increasingly important tool in achieving both these goals.

Federal support for research that applies advanced computer technology to health care delivery is proving a sound investment. Research to improve treatment planning, enhance medical training and bring services to remote geographic areas already is resulting in improved quality of care and significant cost savings.

The Ohio Supercomputer Center (OSC) is one example of the key role of advanced computing centers in the high tech health care arena. Some examples of their success include:

IMPROVING THE EPIDURAL -- The epidural is a common anesthetic for childbirth, back and hip surgeries. But in inexperienced hands it poses serious risks. Residents traditionally learn the delicate procedure on live patients. Time-consuming and costly, multiple human trials, always in the presence of a supervising doctor are required.

Residents at the Ohio University College of Medicine and three other university medical centers soon will be learning to administer epidural blocks through virtual simulation techniques developed at the OSC -- honing their skill on supercomputers before attempting to work on patients.

Three-dimensional volume graphics and a force-reflecting "Cyberglove," which realistically simulate appropriate patient anatomy and provide instant feedback of errors, have been tested and approved for this purpose by anesthesiology experts. This research is funded by the U.S. Air Force.

REMOTE MEDICAL TRIAGE -- Being able to provide sophisticated medical services to remote geographic areas is an unanticipated benefit of high speed computer networking. University-based supercomputer centers, credited with developing networking technology, are now pioneers in applying it to health care.

The Remote Medical Triage project is one example. The University of Hawaii, OSC and the Georgetown University Medical Center in Washington, D.C., are testing the feasibility of long distance radiation treatment planning. Patient data, such as an MRI, is sent by satellite from a medical site in Hawaii to Ohio for 3-D imaging, then to Washington for expert consultation and back to Hawaii for treatment. Each transmission takes only a few seconds. The speed of NASA's COMSAT and funds from the Advanced Research Projects Agency make this project possible.

WHEELCHAIR DESIGN -- Under a grant from the U.S. Department of Education, OSC researchers are using virtual reality to test the efficiency of various wheelchair designs and to streamline architectural elements required for compliance with the Americans With Disabilities Act. This research tracks power wheelchair users as they navigate through simulated architectural environments. The technique also enables disabled individuals to gain the dexterity needed to operate power chairs, and allows health care providers to fine-tune wheelchair operations on the basis of high accuracy assessment of user proficiency.

Other supercomputing centers are also making strides in applying high performance computing to health care delivery. Among them:

THE VISIBLE HUMAN PROJECT -- Researchers at the University of Colorado School of Medicine, have been working with the National Center for Atmospheric Research (NCAR), to create the radiologic and photographic definition of a human male cadaver in three-dimensions, with details as small as one millimeter resolved clearly.

Funded by the National Library of Medicine, the project provides the most comprehensive computer image database of human anatomy ever available for teaching and research. It consists of 1,878 full-color CT scans that define the entire human body at every location in space. But the work is far from done. Funding is being sought to finish segmenting and classifying this volume data into anatomical objects and to explore the potential for biomedical research that will open up once this is complete.

KINESIOLOGY -- Researchers with the University of Texas at Austin Biomechanics Laboratory are using high performance computing to create full dynamic simulations of muscle interactions and multi-joint coordination of the human skeleton in action. These simulations, involving complex mathematical models of muscle-joint dynamics and the forces induced by such everyday tasks as jumping, running, walking and rising from a chair, are leading to improved diagnosis and treatment of bone and joint disease. The project is funded by NASA's Office of Space Science Applications.

BONE TRANSPLANT BIOENGINEERING -- Researchers with the Department of Mechanical and Aerospace Engineering at Cornell University are using advanced computers at the Cornell Theory Center to study the efficacy of various bone-implant systems, with emphasis on the hip. The models they produce of the stresses placed on normal bones and on the artificial components of hip joints, are leading to customized prostheses and reducing the need for prosthesis replacement surgery.