

XXV.

Center for Information Technology

INTRODUCTION

The Center for Information Technology's (CIT's) mission is to support the research and management programs of the National Institutes of Health (NIH) by providing, coordinating, and managing information technology and by advancing computational science. As part of its mission, CIT performs the following functions:

- provides collaborative support to NIH researchers;
- provides efficient, cost-effective information systems and networking services;
- provides state-of-the-art scientific and administrative computing facilities;
- identifies new computing technologies with innovative application to biomedical research;
- creates, purchases, and distributes software applications;
- provides NIH staff with computing information, expertise, and training; and
- serves as a data center to the U.S. Department of Health and Human Services and other Federal agencies.

HIGHLIGHTS OF RECENT SCIENTIFIC ADVANCES RESULTING FROM INTERNATIONAL ACTIVITIES

In fiscal year 1999 (FY 99), CIT scientists and engineers collaborated extensively with scientists from Australia, Canada, China, France, India, Israel, Japan, Jordan, New Zealand, Northern Ireland, Republic of Ireland, Russia, Spain, and Switzerland. In addition, visitors from many Asian, European, and Middle Eastern countries interacted with CIT staff.

CIT has assumed a major role in assisting the National Cancer Institute (NCI) in bringing the latest advances for the diagnosis and treatment of cancer to both Ireland and Jordan through its TELESYNERGY Medical Consultation WorkStation initiative. This multimodality medical teleconferencing environment is unique because of its ability to

provide a synchronized, image-oriented environment to many participants at geographically distant sites.

Hospitals in Belfast, Northern Ireland; Dublin, Republic of Ireland; and Amman, Jordan, are slated to have TELESYNERGY systems installed during FY 00. NCI physicians and the participating hospitals' staff members will be able to participate in clinic rounds, examine patients directly, review radiologic and ultrasound data, and examine microscopic samples obtained through biopsy.

It is expected that research protocols and educational programs will benefit from this high-performance, bidirectional, image-oriented communication technology.

SUMMARY OF INTERNATIONAL PROGRAMS AND ACTIVITIES Country-to-Country Activities and Bilateral Agreements

In December 1998, the Head of the Bioinformatics Unit at the Weizmann Institute of Science, Rehovot, Israel, visited CIT's Computational Bioscience and Engineering Laboratory (CBEL). This Laboratory's Bioinformatics and Molecular Analysis Section hosts a mirror of the Gene Cards database, developed at the Weizmann Institute of Science.

In May 1999, representatives of a special Panel for the Science Council of Japan toured several prominent U.S. Government agencies, including the NIH; the National Coordination Office for Computing, Information, and Communications; and the U.S. Department of Energy. Six members of the special panel visited CIT's Division of Computational Biology (DCB), to exchange views on information technology and computational science programs at the NIH and in Japan.

Two CIT staff members hosted the meeting and gave an overview of DCB and a demonstration of a software for three-dimensional (3-D) medical visualization; the software was provided by the Image Pro-

cessing Research Section, CBEL. They also gave a demonstration of the TELESYNERGY Medical Consultation WorkStation, developed by the Image Management and Communication Section, CBEL.

Two other CIT staff members accompanied NCI staff on a site visit to the Al-Amal Cancer Center, Amman, Jordan, in early September 1999. This facility was reviewed in response to a request from Queen Noor, through the Jordanian government, to send an NIH senior staff member to the Al-Amal Cancer Center to provide leadership through a multiyear appointment. Telemedicine in general, and more specifically the TELESYNERGY system, is an important component of the proposed collaboration between NCI and the Al-Amal Cancer Center.

A CIT staff member initiated contact with Jordan Telecom, and plans were developed for a dial-up ISDN telephone connection between the Al-Amal Cancer Center and the NIH. The installation of a TELESYNERGY system at the cancer center could be accomplished within 1 year, which is the time necessary for final administrative negotiations, staff relocation, budget approvals, and equipment purchase and installation.

CIT is assisting NCI in its international battle against cancer. NCI has entered into a 5-year agreement with the governments of Northern Ireland and the Republic of Ireland to combine their energies in the fight against cancer. To inaugurate this joint effort, an NCI-All Ireland Cancer Conference was held in Belfast, Northern Ireland, on October 3-6, 1999.

The TELESYNERGY system was transported to the conference site for a live demonstration of the power of this medical teleconferencing environment. Through the generous cooperation of British Telecom, a dial-up ISDN telephone circuit was made available to provide real-time connectivity to the asynchronous transfer mode network on the NIH campus, via a specialized gate-

way developed for the TELESYNERGY environment.

The Memorandum of Understanding signed between the three participating countries directly specifies the use of "advanced telecommunications" to facilitate the joint cancer clinical trials initiative. Due to the success of the TELESYNERGY system demonstration, the medical teams in both Belfast and Dublin intend that this system will be the telemedicine cornerstone of the NCI-Ireland Cancer Consortium. TELESYNERGY systems are planned for installation in both Belfast and Dublin before the summer of 2000.

International Meetings

CIT participated in the following international meetings in FY 99:

- Supercomputing '98: High Performance Computing and Communications Conference, in Orlando, Florida, in November 1998;

- 3rd Annual Conference on Anatomic Pathology Informatics, Imaging, and the Internet, in Pittsburgh, Pennsylvania, in November 1998;

- 2nd Conference on Computational Genomics, in Reston, Virginia, in November 1998;

- 1999 Society of Photo Optical Instrumentation Engineers Medical Imaging Conference, in San Diego, California, in February 1999;

- Meeting on Diffusion Assisted Reactions, at the Weizmann Institute of Science, in Rehovot, Israel, in March 1999;

- International Parallel Processing Symposium and Symposium on Parallel and Distributed Processing, in San Juan, Puerto Rico, in April 1999;

- Gordon Research Conference on 3-D Electron Microscopy, in Henniker, New Hampshire, in June 1999;

- 4th International Engelhardt Conference on Molecular Biology, in Moscow, Russia, in July 1999; and

- Nature Genetics Microarray Meeting, in Scottsdale, Arizona, in September 1999.

Intramural Programs and Activities

Visiting Scientists and Visiting Associates from Australia, Canada, China, France, India, Israel, Japan, New Zealand, Russia, Spain, and Switzerland worked with CIT investigators on various collaborative research projects.

A DCB staff member lectured to faculty and students of the Department of Physics, Bar-Ilan University, Ramat Gan, Israel, on Single-Molecule Spectroscopy.

In a DCB study to obtain data about the activity of superhelical or solenoid structures, the research centered on classification of these structures and characterization of the general features of solenoid structures. The results will be described in a review, which will be written jointly with a Visiting Professor from Australia.

A Visiting Scientist from Canada collaborated on exploring the structure of helical filaments of the HIV-1 Rev protein filaments; a Visiting Fellow from Japan worked with DCB to study the three-dimensional structure of bacteriophage T4; and a Visiting Scientist from New Zealand collaborated on methods for improving resolution of three-dimensional reconstruction from cryoelectron micrographs.

A number of DCB joint studies focus on determination of macromolecular structure, by using images from electron microscopy. Of particular interest are the structure of selected viruses (herpes simplex virus, poliovirus, bacteriophage T4, and human immunodeficiency virus type 1 [HIV-1] Rev protein), bacterial components, and other macromolecular structures. A Visiting Sci-

entist from China collaborated on all of these projects.

DCB worked with a Visiting Professor from the Department of Physics, Bar-Ilan University, Ramat Gan, Israel, on estimating the width of the upper layer of a two-layer medium, by using continuous-wave optical experiments. DCB also cooperated with a Visiting Professor from Spain in studies on two topics in the theory of single-molecule spectroscopy.

A DCB staff member performed amino acid sequence analysis of signal peptides and the region adjacent to them, to understand the mechanism of protein translocation across the cytoplasmic membrane. The findings established that the net charge of the first 18 residues of the mature sequence is essential for protein translocation of gram-negative bacteria. A Visiting Professor from Russia collaborated on a report of the work, which has been submitted for publication.

A peptide containing several identical heptad repeats has been designed to test understanding of alpha helical, coiled-coil pentamerization. The experiment shows that the peptide spontaneously forms long alpha helical fibrils with a diameter of about 3 nm at slightly acid pH and spherical aggregates at neutral pH. The x-ray analysis of the fibrils suggests a five-stranded, coiled-coil rope with adjacent alpha helices, staggered along the fibril axis. The report is in preparation as a collaboration with a Visiting Professor from Switzerland.

A French Guest Researcher worked with the Mathematical and Statistical Computing Laboratory. A Visiting Fellow from India cooperated with the Laboratory on a project entitled Statistical and Computational Methods for Molecular Biology and Biomedicine. A Visiting Fellow from Spain collaborated on a project entitled Studies in Applied Mathematics and Statistics.