Inventing the Future

The answer to our healthcare problems is not just money. The solution lies in innovation.

The wheel of innovation is spinning faster and faster. We've all heard of gene chip technology, new imaging machines, sophisticated self-diagnostics, tissue engineering, communication technologies and so much more. We see this in diagnostics, imaging, assistive devices and medical equipment. In this issue of *Healthcare Quarterly*, we offer you a sneak preview of some of the technologies that may have a tremendous influence in the near future.

Upcoming issues will look at technology uptake, investment in innovation and knowledge transfer.

Medical Imaging

Pill Camera – A flushable camera, about the size of a large vitamin pill, allows a close-up view of the small intestine. It takes colour pictures at a rate of about two per second. The battery-powered camera transmits digital images to a receiver belt the patient wears all day. By late afternoon, the patient returns to the hospital to give back the belt and have the images, all 50,000 or more of them, uploaded into the computer. And yes, patients don't need to worry about returning the camera.

http://www.newsobserver.com/print/wednesday/connect/story/1517564p687460c.html

Diagnostic

ORTHO ProVue – ORTHO ProVue, developed by Ortho-Clinical Diagnostics, a Johnson & Johnson company, is the first fully automated gel testing system in North America. The instrument automatically monitors quality control, reagent expiration and gel card integrity, and can reduce transcription errors with its bidirectional interface capabilities.
http://www.jnj.com

SonoSite Portable Ultrasound – SonoSite's 3 – pound *iLook,* approved by the FDA in June, is the world's first portable ultrasound. The key: SonoSite reduced twenty circuitboards to one. The $12,000 device makes looking inside the body almost as easy for doctors as checking your heartbeat.
http://www.sonosite.com

Illustrations by Eric Hart

NEEMO 7: Finding Terrestrial Solutions Underwater

A team of NASA astronauts is heading underwater to test the capabilities of remote surgical technologies developed in Hamilton.

Dr. Mehran Anvari, director of McMaster's Centre for Minimal Access Surgery (CMAS), will guide NEEMO 7 – a mission that will focus on the demonstration and evaluation of innovative remote surgical technologies and techniques during a 10-day underwater mission taking place this October.

The astronauts, with Canadian Dave Williams as mission commander, will descend into the tropical waters off Key Largo, FL, to study how to surgically treat astronauts in space. This, in turn, could help patients living in remote regions without quick access to surgeons or hospitals.

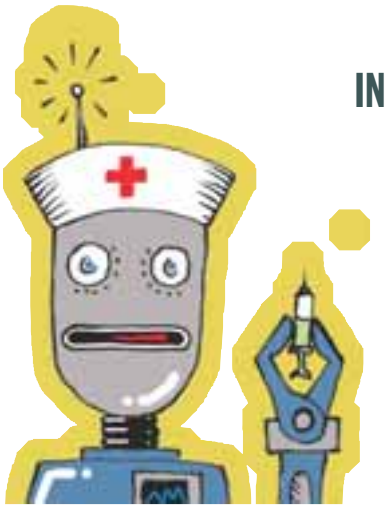
There have been six NEEMO (NASA Extreme Environment Mission Operations) missions to date. NEEMO 7 is a joint project involving McMaster's Centre for Minimal Access Surgery located at St. Joseph's Healthcare Hamilton, the Canadian Space Agency, the U.S. National Oceanic and Atmospheric Administration and the National Aeronautics and Space Administration (NASA).

The main purpose of the October mission is to assess telerobotic surgery and tele-mentoring, with a surgeon at the Hamilton base guiding the doctor doing surgery in the underwater station. The operations will be performed on a mock patient.

Each crew member aboard *Aquarius* will take part in a number of operations, including repairing deep cuts to nerves and arteries, kidney stone removals and procedures on draining an abscess.

Assistive Devices

Penelope – Robotic Scrub Nurse – In the OR, the scrub nurse is responsible for dispensing surgical instruments kept on a tray called the Mayo stand. Robotic Surgical Tech Inc., a Columbia University spinoff enterprise, has developed Penelope™, the robotic scrub nurse, with speech recognition, machine vision and robotic arm path planning and targeting. It receives support from the U.S. Army Telemedicine and Advanced Technology Research Command (TATRC). http://www.roboticsurgicaltech.com



Bionic Leg – Victhom, a Québec-based company, has created the perfect leg, almost. The Bionic Leg is the first to allow amputees to sit and stand up, to navigate stairs naturally, to walk on slopes without having to compensate with the rest of their body. It also reduces metabolic energy expenditure and contains sensors connected to the amputee's body, a motor and a computer. http://www.victhom.com

Medical Devices

Ozone Sterilizer – Québec-based, TSO3 has perfected a sterilization process using ozone as a sterilizing agent. Their first product is the 125L Ozone Sterilizer. The 125L – named after its 125 litre/4.3 cubic foot capacity – was designed to sterilize the new generation of surgical and diagnostic instruments made of non-heat-resistant materials such as polymers and plastics. It received its FDA approval in September 2003 and will be introduced to the North American market late 2004. http://www.tso3.com

Lifecor Wearable Defib – Since its FDA approval in January, the Lifecor LifeVest – the world's first wearable defibrillator - has saved four lives. Designed for patients at high risk for cardiac arrest, the vest detects abnormal heart rhythms by sensing electrical activity on the chest surface. It weighs 3 pounds, but a 1.7-pound version, awaiting approval, is expected soon. http://www.lifecor.com

In the surgical simulations involving telementoring, Anvari will use two-way telecommunication links to guide an untrained surgeon in *Aquarius*. Another simulation involves telerobotics and virtual-reality technology, where Anvari will perform operations on a mock patient inside *Aquarius.*

Aquarius is an underwater habitat located 19 metres below the surface of the sea, 5.6 km off Key Largo in the Florida Keys National Marine Sanctuary. Owned by the U.S. National Oceanic and Atmospheric Administration, Aquarius is about 14 by 4 metres, with 11 cubic metres of living and laboratory space.

Some of the new surgical techniques, including robotic surgery and robotic tele-surgery, have been developed at Hamilton's McMaster University.

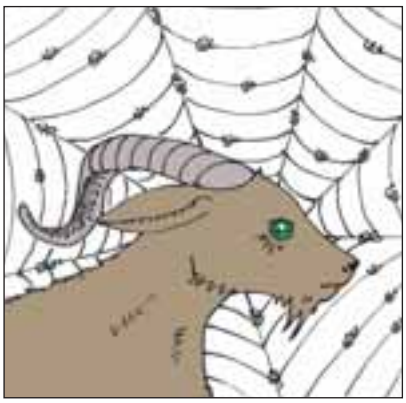
Surgery Online

Bell Canada is helping to make NEEMO 7 a success. It is the first to enable telerobotics over a surgical-grade network in Canada. Bell Canada has formed a strategic partnership with CSTAR (Canadian Surgical Technologies & Advanced Robotics) for developing and testing minimally invasive and robotic-assisted surgeries.

Dr. Patrick Luke, Urologist and Transplant Surgeon at London Health Sciences Centre (LHSC), demonstrated telementoring live from the floor of the Ontario Health Conference 2003 session to an operating room at LHSC.

Biomedical

Immerge Knockout Pig – Randall Partner, University of Missouri embryologist, and his team have developed the world's first cloned pigs bred for human spare parts such as livers, kidneys and hearts. The news went public early this year. http://www.popsci.com



Biosteel – Spider Silk – Nexia Biotechnologies has decided to refocus fibre development toward biopolymer sales and specialized nano-scale fibre applications for spider silk. Spinning of BioSteel proteins into nanometre diameter fibres has been achieved and Nexia is now determining the product specifications for medical and microelectronic applications. Nexia's technology platform is transgenics, the introduction of a gene of interest into the genetic makeup of animals to produce a protein. Nexia's proprietary technology involves goats and the production of proteins in the milk of transgenic goats.
http://www.nexiabiotech.com

Worth Mentioning

PIXALERE – Pixalere is an Internet-based, wireless, wound management system that provides faster homecare delivery and better treatment for patients with complex wounds, particularly in remote areas. Capital health is the first region in Alberta to pilot Pixalere. It can securely, and wirelessly, transmit a patient's clinical information and digital photos of the wound to consulting nurses and doctors at their offices. Upon assessing the lesion, a wound ostomy nurse can either recommend treatment directly to the home care nurse or forward the image and information to a specialist physician for further consultation.
http://www.pixalere.com

Toronto Rehab to launch iDAPT

The Toronto Rehabilitation Institute is building one of the world's most advanced research facilities where new therapies and assistive technologies will be developed for people recovering from disabling injury or illness. The $36 million iDAPT project (Intelligent Design for Adaptation, Participation and Technology), with its high tech laboratories and unique testing facilities, will be housed at the hospital's redeveloped University Centre.

Led by Dr. Geoff Fernie, Toronto Rehab's VP of Research, in collaboration with academic centres across Canada, the iDAPT project is the country's single largest rehabilitation research initiative. Funding for the first phase of the project has been provided, in part, by the Canada Foundation for Innovation with matching funds through the Ontario Innovation Trust.

A funding proposal for phase II of the iDAPT project, to build working spaces for up to 200 scientists and additional laboratories, is currently under review.

Rendering #1 – The Challenging Environment Assessment Laboratory (CEAL), part of phase I of the iDAPT project will be built 60 feet below ground at Toronto Rehab's redeveloped University Centre. CEAL will simulate diverse environmental situations such as winter conditions, unstable walking terrains, and a variety of other challenging environments and conditions enabling scientists to develop new and practical solutions to the real life obstacles people with disabilities encounter.

Rendering #2 – The Home Environment Laboratory (foreground) and the Institutional Environment Laboratory (far corner) are part of phase II of the iDAPT project and will be located on the top floor of Toronto Rehab's new patient care tower. Research here will focus on the development of artificial intelligence and smart home technologies designed to help people with disabilities to live as independently as possible and to improve their quality of life.

Rendering #3 – The Innovations Gallery and Participant Recruitment Centre, another facility stemming from phase II of the project, will be located on the hospital's second floor. Prototypes and products developed by iDAPT's team of scientists, engineers and industrial designers will be showcased here. Information about research projects will also be available, and research study recruitment will take place.