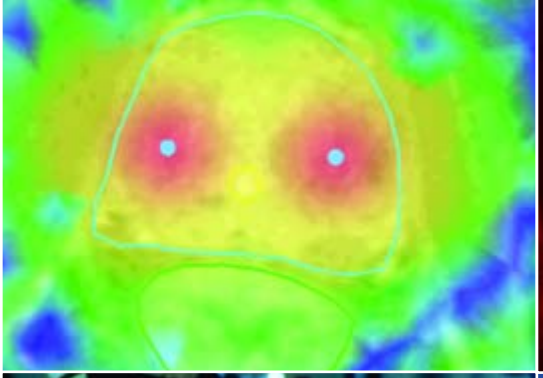
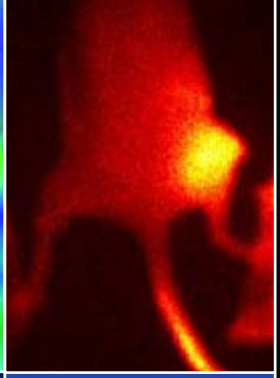
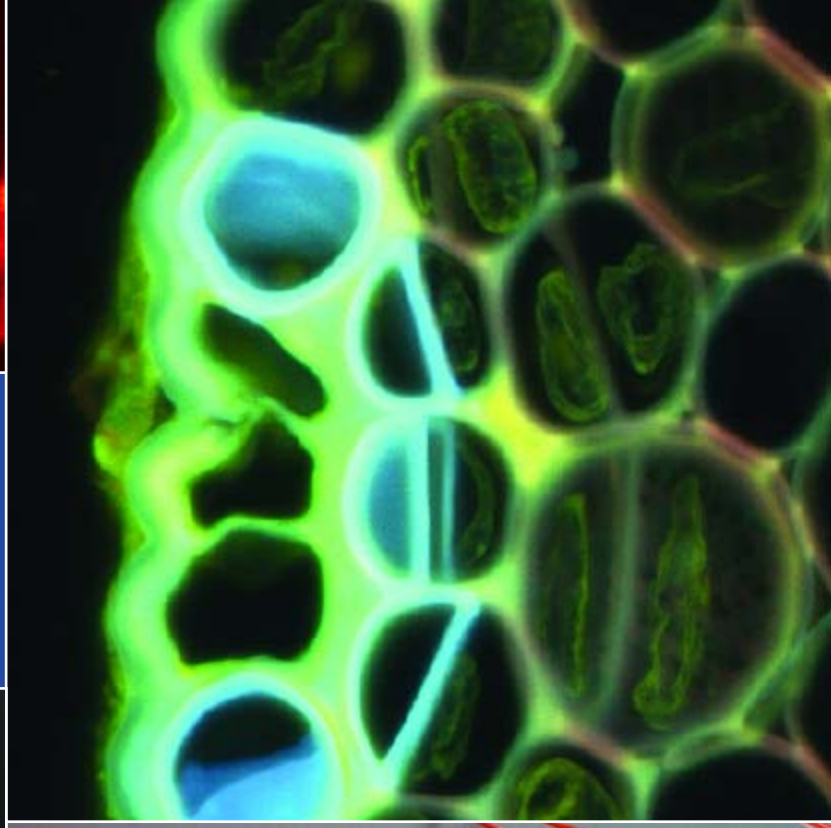
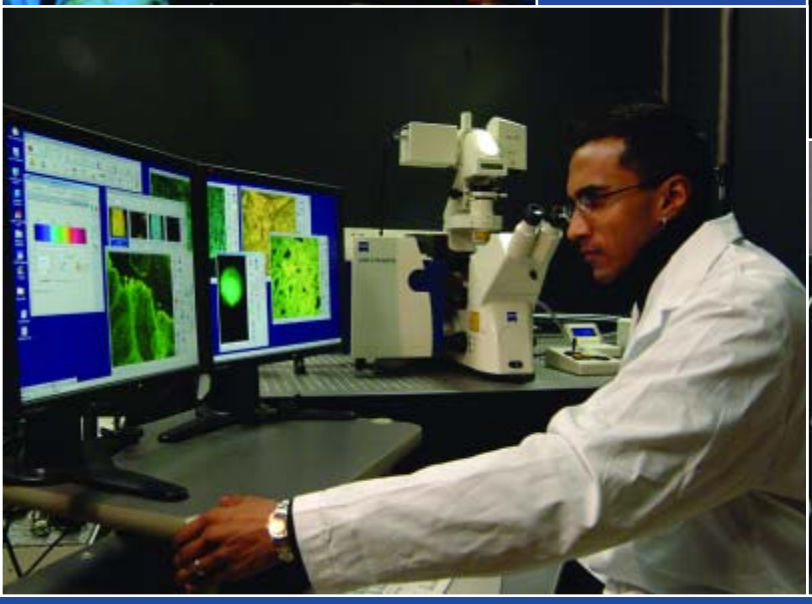








The Laboratory for Applied Biophotonics

Report for Period 2004-2006

This is the first biennial report to the Ontario Centres of Excellence Inc. on the operation of the Laboratory for Applied Biophotonics (LAB) at the Ontario Cancer Institute/University Health Network, Toronto. LAB is a partnership between Photonics Research Ontario/OCE Inc. and UHN. The report outlines the structure and operation of LAB, presents performance measures for the first 18-month operating period, and gives details of the commercialization work in which LAB personnel have led and/or contributed in industry-directed projects, in technology and partnership brokering and in investigator-directed projects. Finally, the collaborative involvement of LAB personnel in the training of high-quality personnel is highlighted. These two activities -commercialization and HQP training- are the major impact factors in the OCE mandate, so that LAB is proud to have made significant contributions in these areas.

LAB's vision is to build on this strength by expanding to encompass other emerging and converging technologies that will become major economic drivers for Ontario in the next decade. This will also enable it to support the work of other OCE Centres as it has done to date for Photonics Research Ontario.

Performance Summary

Number of Revenue Generating Projects	13
Revenue to Lab	$570,000
Leveraging or In-kind	~$1,500,000
Number of Academic Collaborations	8
Training of HQP	> 200

LAB Resources, Services & Capabilities

UHN's BIOPHOTONICS PROGRAM has incomparable resources within Canada for developing biophotonics technologies. It comprises 2,500 sq. ft, with more than $3M of equipment, and is located in Canada's largest teaching hospital, providing industry with direct access to medical support and the country's top clinicians. It's physical resources include

Equipment

- Laser and optical instrumentation labs, with high powered lasers, including cw, nanosecond and femtosecond lasers
- A dedicated full-service advanced optical microscopy facility
- High powered lasers, including cw, nanosecond and femtosecond lasers
- Spectroscopy: UV-VIS absorption, fluorescence, Raman,
- State of the art imaging equipment, including hyperspectral, bioluminescence, fluorescence cameras
- Prototyping and device assembly facility
- An in vivo pre-clinical evaluation and operating suite
- Tissue handling and analysis lab

Optical Imaging

- Advanced optical microscopy, including confocal, 2-photon epifluorescence, and MACROscopy
- Small animal imaging, including molecular imaging of fluorescence-tagged mono/poly-clonal antibodies targeted
- Novel clinical imaging for diagnostics and surgical guidance, such as laser induced fluorescence endoscopy, optical coherence tomography

Optical Diagnostics and Monitoring

- Surgical guidance and disease detection using fluorescence imaging
- Near-IR and Raman spectroscopy for early cancer/ disease detection and in vivo monitoring of analytes
- Trans-illumination spectroscopy for disease risk assessment
- Non-invasive monitoring of drug pharmacokinetics in vivo by diffuse reflectance and fluorescence spectroscopy

Optical Therapies

- Expertise in photodynamic therapy, laser thermal coagulation, pulsed laser and low-level laser therapies
- Clinical studies and partnerships with clinicians at Canada's largest cancer hospital
- Pre-clinical and cell culture studies on drug efficacy, uptake and tolerance
- Development of new therapeutic techniques and modalities

Device Development

- Facilities and expertise from proof-of-concept studies to assembly of machine-ready medical grade prototypes
- Optical, electronics and industrial/mechanical design
- Testing at in vitro, pre-clinical and clinical stages

Clinical Translation

- Clinical studies and partnerships with clinicians at several hospitals in Toronto
- Device development and testing for clinical settings
- Translation of both Diagnostic and Therapeutic applications
- Experience with clinical trials in endoscopy, neurology, urology and surgical applications

An Introduction to the Laboratory for Applied Biophotonics

The Laboratory for Applied Biophotonics offers a compelling new mode of technology commercialization and partnering between industry and the public-sector biomedical research community in Ontario. In the emerging fields of biophotonics and nanotechnology, LAB is able to respond rapidly and cost-effectively to specific industry through its access to the resources within the Biophotonics Program at the University Health Network, Canada's largest biomedical research and health-care complex comprising the Princess Margaret, Toronto General and Toronto Western Hospitals.

(see www.uhnres.utoronto.ca/biophotonics)

The Biophotonics Program at UHN comprises some 40 research staff and trainees who are creating new light-based technologies for treating and diagnosing disease. The primary, but not exclusive, focus is on cancer. LAB is the main industrial-applications development branch of this Program. It supports 4 scientists/engineers/technologists who are **seamlessly embedded** into the unique infrastructure and expertise of the UHN Biophotonics Program. It provides a **portal** for client companies into UHN that **enables industry-relevant R&D**. LAB also supports **hands-on multi-disciplinary training** in state-of-the-art biomedical technologies for a wide range of graduate, undergraduate, postgraduate and college-level students, biomedical scientists and technicians, and industry personnel.

LAB brings together the research expertise and resources within the UHN Biophotonics Program with industry in Ontario and beyond to create a rapid, flexible and skilled response to the commercialization needs of Ontario industry. LAB staff access the expertise of UHN's senior scientists, support staff and trainees, who in turn rely on LAB's skills to compete for and efficiently complete projects with industry partners.

In short, LAB represents stable expertise devoted full-time to industry impact, enabling UHN to contribute more effectively to commercialization & training activities, within but also beyond its primary mission of research excellence, student training and clinical care. This fulfills the primary mandate of the Ontario Centres of Excellence: facilitating commercialization and HQP training in Ontario by leveraging academic research excellence.

LAB arose from original PRO funding to the Biophotonics Program at UHN in 1995. In response to industry, this evolved beyond project-based support into the Biophotonics Facility of PRO, where skilled staff worked with industry under the umbrella of the Biophotonics Program. This unique approach to industry partnering was very successful, providing direct access for industry to senior scientists, with rapid response to their needs. In 2004, when PRO transferred management of the Biophotonics Facility to UHN, the resulting **embedded applications laboratory** became the model for restructuring of the PRO facilities.

LAB works directly with the Research Business Development Office of UHN to seek out new commercial partners, licensing opportunities for UHN technologies and partnering opportunities with medical-device trade organizations in Ontario. In the past 18 months, LAB has been marketed throughout the Province and also nationally and internationally by participating in trade shows, connecting with medical device associations, and through presentations to major international companies and academic groups visiting UHN. These UHN-initiated contacts are leading to new business opportunities for LAB and its Ontario industry clients.

The future for LAB is to expand beyond biophotonics into additional emerging and converging technologies, where it can partner with an extended range of UHN scientists and physicians. This will enable it to serve a wider range of industry clients and to support other OCE Centres. Examples include biomaterials (including nanotechnology) for regenerative medicine, robotics/informatics/imaging sciences for multi-modality image guided-surgery and multiplexed instrumentation for high-throughput bioassays. The capacity to do this will be significantly enabled by UHN being the principle research partner with MaRS (Medical and Related Science). MaRS Discovery District is a convergence innovation centre located in Toronto's renowned "Discovery District" that connects and fosters collaboration between the communities of science, business and capital through co-location in the MaRS Centre. UHN has set commercialization of its research as a key strategic goal and welcomes the opportunity to partner with others in meeting this goal.

LAB Staff and Scientists

Staff Scientists

Robert Weersink, PhD, Director of Operations

Kai Zhang, PhD, Photonics Engineer

George Netchev, PhD, Optical Scientist

David Giewercer, B.Sc., Medical Physics

Associated Senior Scientists

Prof. Brian C. Wilson, Scientific Director of LAB, Head Division of Biophysics and Imaging, Ontario Cancer Institute

Prof. Lothar Lilge, Division of Biophysics and Imaging, Ontario Cancer Institute

Prof. Alex Vitkin, Division of Biophysics and Imaging, Ontario Cancer Institute

Prof. Bill Whelan, Division of Biophysics and Imaging, Ontario Cancer Institute, and Department of Physics, Ryerson University

Commercialization

LAB offers Ontario companies an effective and efficient portal into the research and clinical activities of the largest biotechnology institution in Canada. In one location, it offers a rapid, flexible and skilled response to the commercialization needs of Ontario industry while letting industry collaborate with top research scientists in biophotonics and medical sciences.

LAB supports commercialization in Ontario by:

A) Industry directed research consulting assistance to Ontario and international companies.

B) Technology brokering between commercial partners of LAB to create new markets for Ontario companies, and

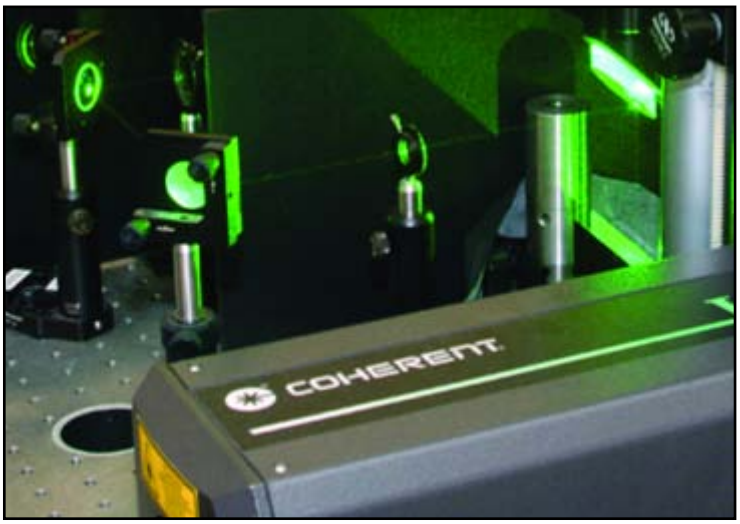
C) Developing new technologies within Ontario's universities that have large commercialization potential.

LAB's flexible response to industry is demonstrated in the range of consulting projects in which it participates: small-scale contract research projects with local industry, medical device prototyping, and large scale clinical trials. In several cases, employees from industry collaborators have been located within the biophotonics program for extended periods of time to work with LAB staff. Some examples include Vasogen (Mississauga) and Xillix (Toronto), who have each placed 2 employees in LAB. This "co-location" facilitates technology transfer to industry by more efficiently completing industry directed tasks and by training industry staff in new areas of biophotonics.

Because LAB collaborates with a large number of companies in a variety of technology fields, it also plays a technology brokering role for its partners. We recognize new opportunities for Ontario companies and link them with potential international partners to create new markets for Ontario companies.

LAB's location within the Biophotonics Program of UHN also gives it a unique opportunity to aid in the commercialization of new technologies being developed at Ontario's academic institutions. These are biophotonics technologies that have been identified by LAB as having strong commercialization potential. Examples presented in this report include those technologies close to commercialization that need prototyping services, and others that have enormous long-term potential requiring an aggressive R&D effort so that Ontario can be a player in the world nanotechnology market.

In the pages to follow, we present several case studies and examples that demonstrate how LAB successfully responds to industry with speed and flexibility, and how LAB effectively impacts on commercialization in Ontario.



Case Study 1: Clinical Photodynamic Therapy in Ontario

Photodynamic Therapy (PDT) uses light-activated drugs to target cancer by either selective localization of the drug or by only irradiating the tumour with light. A collaboration of scientists, clinicians and industry is developing PDT as a minimally invasive treatment for prostate cancer. LAB is a partner in this collaboration, developing devices and creating partnerships with Ontario companies to create a photodynamic therapy industry in Ontario. Researchers at Princess Margaret Hospital are using a new drug, called TOOKAD, for the prostate treatments which only targets blood vessels, and which quickly leaves the body so as to reduce long-term side effects.

The Biophotonics Program has been researching PDT for more than a decade. Photonics Research Ontario has supported the development and commercialization of the PDT research through project specific grants and through sustained support of LAB, which has been in pushing PDT towards clinical applications by developing instruments and offering staff for clinical support.

The French pharmaceutical company, Negma, recognized the strength of PDT research at UHN and initiated preclinical studies at UHN in 1999, of which several were performed by LAB. Negma then chose UHN as the site of its first clinical trials with TOOKAD, partly on the basis of the physics and device support offered by LAB and partly based on the strength of the UHN clinical team, led by Dr. John Trachtenberg, head of Urology at UHN, and principle investigator on the clinical trials. Two phases of clinical trials have been completed treating over 40 men with recurrent prostate cancer. A further validation phase, set to start in 2006, will treat another 80 patients. The trials not only offer hope to prostate patients, they have injected an estimated $1 million into the Ontario economy.

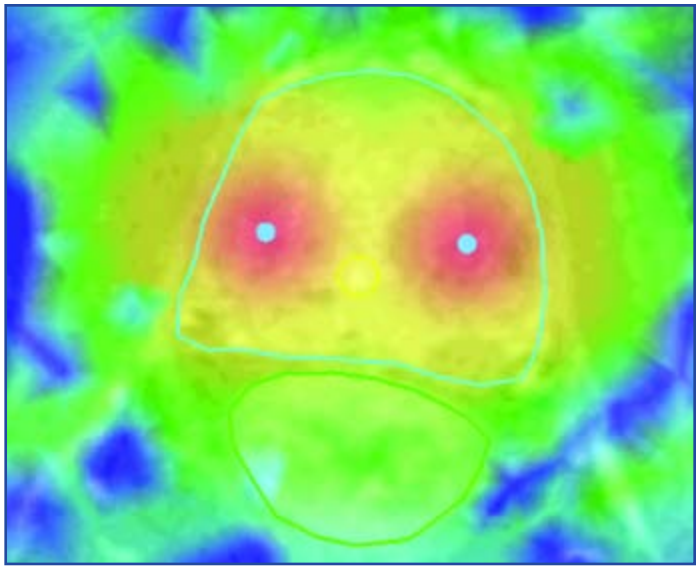
LAB built several light dosimetry devices for the clinical trials, provided laser operation support in the operating room, and performed new studies on using non-invasive means of monitoring drug concentration and blood hemodynamics. The clinical devices for measuring light dose and the clinical support of the LAB team were crucial to the success of the trials. Negma subsequently ordered several of these dosimeters for other clinical trials in other parts of the world.

LAB is also partnering Negma with Ontario companies, such as CADMIT, which is developing software for

planning PDT treatments in the prostate. PRO previously supported a collaboration between CADMIT and the biophotonics group on the software development. Now there was an opportunity to directly apply it in a clinical setting. The treatment planning software is crucial in planning treatments and analysis of the results. LAB and CADMIT are currently coordinating the light monitoring devices with the treatment planning software so that patient-specific optimization of treatments can be delivered every time.

LAB has also initiated talks with local biophotonics companies regarding large scale manufacturing of the dosimeters and provision of multichannel lasers for future trials. It is also the link between Negma and Walsh Medical, local suppliers of PDT delivery fibers. If the clinical trials prove successful, the treatment planning software and light dosimetery units will be crucial for the safe, effective delivery of PDT in the prostate with Ontario companies selling planning and dosimetry packages to Negma.

This project offers an excellent example of how sustained PRO funding to LAB has been leveraged to quickly capture opportunities, create partnerships, generate economic activity and benefit the health of Ontario citizens. LAB has been the bridge between the original funding of PDT research and its eventual clinical application. The presence of these clinical trials in Ontario has been crucial to the development of clinical PDT in Ontario and the supporting industry around PDT.



Highlights

- New minimally-invasive treatment for prostate cancer.
- Foreign investment of over $1million (and growing) into the Ontario healthcare system and PDT research in Ontario.
- Device development and clinical support offered by LAB keep Toronto as primary site for clinical trials.
- Partnerships between the Biophotonics program and clinical departments within UHN are generating new technologies.
- LAB has brokered partnerships between UHN and local Ontario companies that can supply resources for PDT, commercializing local technology for international markets.

Case Study 2: Theralase - From Patent to Product

Theralase originally contracted LAB in 1999 to seek assistance and ideas for monitoring light doses in tissue during low level laser therapy. Theralase has sold low-level laser therapy devices for 10 years and has steadily increased its market share since it entered the US market. While LLLT is an expanding field, methods of describing light dose vary considerably between rival companies, leading to confusion amongst practitioners and patients that wish to use LLLT. This confusion is compounded by the fact that the light dose is not defined at the injury site, but by the light dose delivered to the surface.

Theralase realized that the most important factor was not the light dose at the tissue surface, but the light dose actually delivered to the injured tissue. Accurate light dosimetry, tailored to individual patients would be a new approach in LLLT. A non-invasive method of monitoring the site-specific light dose would be a new product line for Theralase and also a unique product that separated it from other LLLT device manufacturers.

Prof. Lothar Lilge and Robert Weersink applied their knowledge of light dosimetry in tissue to generate a new monitoring concept for Theralase. Both Prof. Lilge and Dr. Weersink have experience on light dosimetry in tissue from their research into photodynamic therapy and were able to apply this experience to Theralase's problem. The concept correlates the light dose under the skin with the intensity of light escaping from different locations on the skin surface. Theralase patented the concept in 2003.

Dr. Weersink and Theralase president & CEO, Roger White, then put together a project to fully develop the light dosimetry concept into a product. Due for completion in 2006, the project requires the development of an algorithm to correlate the surface intensity with the fluence rate under the surface (based on accurate models of light in tissue), assembling an initial prototype incorporating the measurements into a standard Theralase treatment instrument and performing preliminary animal testing. Working with PRO, NRC-IRAP and Theralase, Dr. Weersink and Mr. White were able to secure $250,000 for the project. Theralase anticipates the project will lead to a new product in 2007, with sales exceeding $15 million in the next 3 to 5 years.

"From the first day I started working with Prof. Lilge and Weersink, I have been impressed with their professionalism, integrity and vast knowledge of light tissue dosimetry. Theralase has increased both the size and scope of research and development projects that we have with them and intends to continue this trend of larger projects with LAB, as we pursue the pure understanding of the effect of light on tissue and how we can best commercialize this knowledge to the benefit of Canada."

-Roger White, President, Theralase

LAB's collaboration with Theralase is leading to new projects, and new products. Theralase has recently signed a world-wide license for a new class of photodynamic compounds from Virginia Technology Institute and will be testing the efficacy of these compounds in LAB in 2006. LAB has also introduced Theralase to a British company that requires a medical light source for anti-infectious photodynamic therapy in wounds.

Highlights

- New product line for an Ontario company that will generate up to $15,000,000 in sales.
- New partnerships and collaborations that are increasing economic activity and commercialization of biomedical technology in Ontario.

Case Study 3: Working with Ontario Companies

Pharos (Guelph ON)
PDT for Periodontal Disease

Pharos is a new Ontario company that has its origins in a PRO sponsored collaboration between EFOS (Mississauga), University Health Network (UHN) and the Dept. of Dentistry at the University of Toronto. This collaboration tested concepts in using photodynamic therapy for killing bacteria that lead to periodontal disease. When research showed that PDT was effective, a new company was established as a spin off of EFOS, with patents on the technology. The new company, Pharos, has just initiated a collaboration with UHN, the Department of Dentistry at the University of Toronto and the Department of Materials (with funding from OCE) to make a device that will illuminate the whole mouth during PDT to kill periodontal bacteria. LAB wrote the original research proposal, and will take the lead in assembling the device. LAB is also performing device specification testing on another Pharos product that uses light to treat acne.

Xillix Technologies (Richmond BC, Toronto ON)
Fluorescence Imaging for Disease Detection

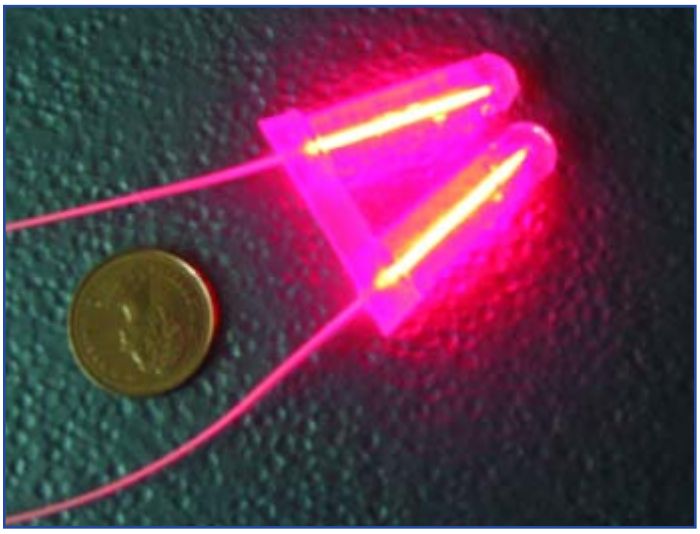
Xillix has a long-standing collaboration with the Biophotonics program at UHN and has extensively used the resources of LAB and its predecessor, the Biophotonics Facility for over 10 years. The collaboration with UHN attracted venture capital for the creation of a new research division of Xillix. This new subsidiary has placed 1 permanent employee and several co-op students within LAB, using its equipment and the expertise of its staff in its research. The collaboration includes a PRO funded project on the development of a hyperspectral imaging instrument for research in endoscopy. While this instrument will be used in Xillix's research program, LAB is also developing the technology as a new small animal imaging instrument that can be sold as a product by Xillix. This device is essential in developing new nanotechnology capabilities within LAB and the Biophotonics Program.

Vasogen (Mississauga ON)
Device for Immunomodulation Therapy

Vasogen has created a unique, patented device called CelacadeTM that offers a cure for inflammatory diseases. The device takes small samples of a patient's blood and stresses it with light and ozone. The sample is then injected back into the patient. Since 1999, Vasogen has used LAB for 2 principal projects: i) light dosimetry measurements on the device, which are essential to the engineering new generations of the device and ii) in vitro and pre-clinical studies on the treatment efficacy, which are important to validate consistent efficacy between device generations. For 4 years, Vasogen located its own scientists directly in the Biophotonics program to collaborate with LAB staff on these projects. Vasogen has now located the staff within MaRS and continues to collaborate with LAB.

Biomedical Photometrics (Waterloo ON)
Fluorescence Imaging for Disease Detection

BPI specializes in developing confocal macroscopic imaging systems for biomedical applications. With funding from ORDCF, BPI is collaborating with the Biophotonics group to create a hyperspectral (many wavelength) fluorescence macroscope for scanning tissue samples and tissue microarrays. LAB has assisted in the development of this instrument by providing optical design expertise, assistance in developing software and electronics expertise. BPI anticipates a launch date for the new instrument in 2007.



Summary of Projects

LAB performed a large variety of contract research in the last 2 years totaling approximately $570,000 of direct contribution to LAB. The majority of these projects were with industrial collaborators. Many of LAB's activities were part of much larger projects within UHN, but with LAB playing a crucial role in their initiation and success. Several smaller projects assisted Ontario SMEs with straight research consulting. These projects are leading to further activities, such as clinical testing of devices in Ontario. LAB provides a unique networking and technology brokering role between these SMEs, clinicians in Ontario, and larger companies that can use their services and products.

Company/Project	Direct LAB Revenue ($1000)	Approx. Total Direct & Leveraged Client Expenditure ($1000)	Summary & Outcomes
Negma Clinical Photodynamic Therapy: Devices and Support	90	1,000	• Clinical PDT Trials in Ontario, treating over 40 men • Improved health for men with prostate cancer • National & International collaboration with clinical partners in Ontario and Quebec, and research partners in Israel and France • Location of LAB for devices and analysis kept Toronto site as the primary site for these and future trials • Discussing with local companies as source for manufacturing devices • Development of treatment planning, delivery and monitoring technologies with local partners
Theralase Light Dosimetry Device for laser therapy	135	250	• Development of depth-resolved light dosimetry device based on surface measurements for laser therapy (ICP with OCE) • Has led to partnership on other future research projects in PDT and devices
QLT Spinal PDT Pre-clinical Trials: Devices and Support	25	120	• Development of cure for spinal metastisis (uncurable at moment); International collaboration with UCDavis • Treatment planning, delivery, etc. with expertise built on prostate trial. • Lasers and dosimeters for pre-clinical trials
Confidential	45	100	• Raman spectroscopy for non-invasive glucose detection • International collaboration
Vasogen Light dosimetry and in vitro studies	110	200	• Co-location of 2 Vasogen employees collaborating with LAB staff • Pre-clinical trials related to determining efficacy of novel treatments
Ryerson University High power laser	25	25	• Development of unique research device for laser hyperthermia studies

Company/Project	Direct LAB Revenue ($1000)	Approx. Total Direct & Leveraged Client Expenditure ($1000)	Summary & Outcomes
Photopharmica Device development for treating bacteria with PDT	13	13	• Novel light delivery devices • International collaboration • Brokering with local partners to provide instrumentation and clinical trials in Ontario
Pharos Device testing and in vitro studies	10	10	• Rapid response on assessing device specifications (power, uniformity, etc.) and treatment efficacy • Initiated discussions with UHN dermatologist on clinical trials
Pharos Photodynamic Therapy for Periodontal Disease	20	20	• Developing a whole mouth illumination device for PDT in the mouth • Partnership with University of Toronto Departments of Dentistry and Materials Science
UHN Microarray Facility Devices and testing of new optical readers for DNA and protein arrays	5	10	• Device for fast-reader • Assisting in testing new optical technologies for reading protein microarrays using quantum dots
BPI Hyperspectral imaging system	20	100	• Support in instrumentation and software development • Investigated new applications for technology
IBBME/University of Toronto (Chan and Sefton) Quantum Dots fluorescence for life sciences	60	300	• 2 major CIHR grants on applying quantum dots for fluorescence imaging and detection of cancer • First development of nanotechnology for life science within OCE program • Goal is to license new technology to other collaborators or to find new partners
E. Nussbaum/ L. Lilge	5	100	• Assistance in light delivery for laser therapy studies on bacteria
J. Audet	1		• Optical modeling of microfluidic fluorescence detection system

Creating Photodynamic Therapy Companies in Ontario: Walsh Medical and Cadmit

LAB has been crucial in ensuring that photodynamic therapy clinical trials were located in Toronto. It is now ensuring that this activity stays in Ontario. The French company sponsoring the clinical trials, Negma Lerads, originally sourced European and Israeli companies for clinical equipment such as lasers, and fibers. LAB is working with local companies to be the source for these items, such as Walsh Medical, which makes light diffusing fibers that can tailor the light delivery to organ shape and CADMIT, which has software for planning minimally invasive treatments such as PDT.

Export Opportunities for Ontario Companies: Theralase

Lab is looking to Theralase as the large-scale manufacturer of the light dosimetry devices it has developed for prostate PDT. Further, a UK collaborator, Photopharmica, requires a clinical light source for its application of PDT for wound infections. Through LAB, Theralase has made a proposal to Photopharmica to be that supplier.

Applying New Photonics Technologies to Medicine

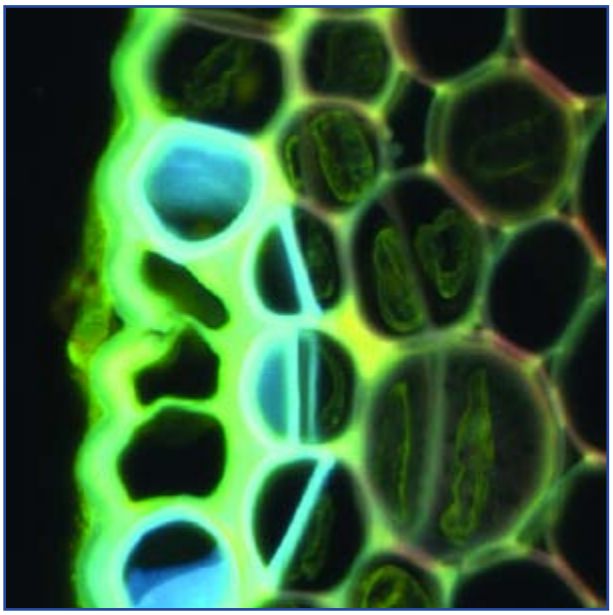
LAB was the contact point for Prof. Zhenghong Lu, of the Department of Materials at the University of Toronto into the biomedical field. Prof. Lu has developed bright organic light emitting diodes. These are flexible light sources that can be manipulated into any shape. LAB recognized their potential for several medical applications and has initiated a collaboration between Prof. Lu, the Department of Dentistry, UHN, and Pharos Inc. on light delivery devices for periodontal PDT.

New Technology Partnerships: Advanced Foods and Materials Network AFMNet (Federal Centre of Excellence)

LAB has begun discussing new collaborations with members of AFMNet (Prof. Dutcher, U. Guelph, and Dr. John Katsaras, NRC) on optical monitoring of biofilms, micelles for drug and contrast agent delivery, and optical tweezers for manipulating proteins.

Translating Medical Device Development within Toronto

The Medical Technology platform at UHN has initiated a partnership with the Institute of Biomaterials and Biomedical Engineering at the University of Toronto, and High Technology Exchange (Markham), with the goal of bringing together medical device developers with clinicians. LAB manager, Robert Weersink is a member of the planning and organizing committee for this activity. To date three public events have been organized that bring together engineers, scientists and clinicians.



New Patented Device for Monitoring Cancer Risk

Trans-Illumination Breast Spectroscopy
Prof. Lothar Lilge

High tissue density has a strong correlation with the risk of getting breast cancer in the future. Traditionally, tissue density is measured by X-ray mammography, which carries its own risks, and has poor compliance. Prof. Lothar Lilge has developed a safe optical technique that measures tissue density by analyzing spectroscopic changes of light transmitting through breast tissue. LAB staff are aiding in the development of this technology by performing advanced analysis of the data and by performing validation measurements. LAB staff were also collaborators on Proof-of-Prinicple CIHR applications with Prof. Lilge. LAB also performed preliminary market assessment of the technology, and initiated discussions with VCs and possible licensees that were interested in the technology.

Imaging Instruments to Harness Nanotechnology Contrast Agents for Disease Detection

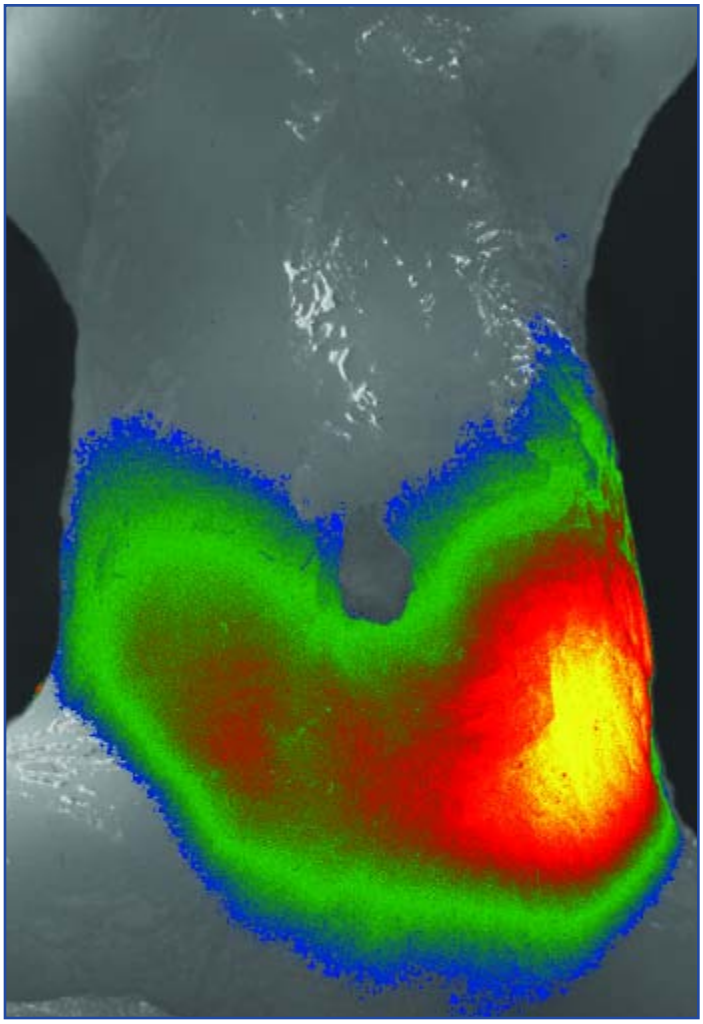
Hyperspectral Imaging of Quantum Dot Fluorescence
Prof. W. Chan, B. Wilson

Early detection of disease is crucial for effective cancer treatment. LAB has been essential in initiating collaboration between the Institute of Biomaterials and Biomedical Engineering (University of Toronto) and the Biophotonics group on using quantum dots as sensitive contrast agents for detecting disease. To date, this has led to two major CIHR grants on applying quantum dots for fluorescence imaging and detection of cancer, and in collaboration with Xillix a PRO grant on developing hyperspectral imaging technologies that will exploit this technology to the fullest. All of these grants stress the ability of LAB to transfer this technology to potential industrial partners. This is the first development of nanotechnology for life sciences within OCE program.

Nanotech-Based Drug Delivery

Development of light-activated microgels
Prof. E. Komecheva, Dept. of Chemistry

LAB is collaborating with Prof. Komecheva to develop light-activated microgels for localized drug delivery. LAB is offering advanced imaging technologies, and ideas on animal validation and testing. The potential commercial benefit of this technology is enormous, and preliminary results will lead to future funding from granting agencies and commercial partners.



Combining Technologies for New Ophthalmology Treatment

Optical Coherence Tomography
Prof. A. Vitkin

LAB is working with Prof. Vitkin on combining the Doppler Optical Coherence Tomography (DOCT) with a Confocal scanning laser ophthalmoscope (CSLO) for monitoring the response of age-related macular degeneration to 2- photon PDT treatment. The sensitivity and accuracy of DOCT in monitoring neovascular response to 2-photon PDT in several pre-clinical models will be measured.

Creating New Imaging Technologies

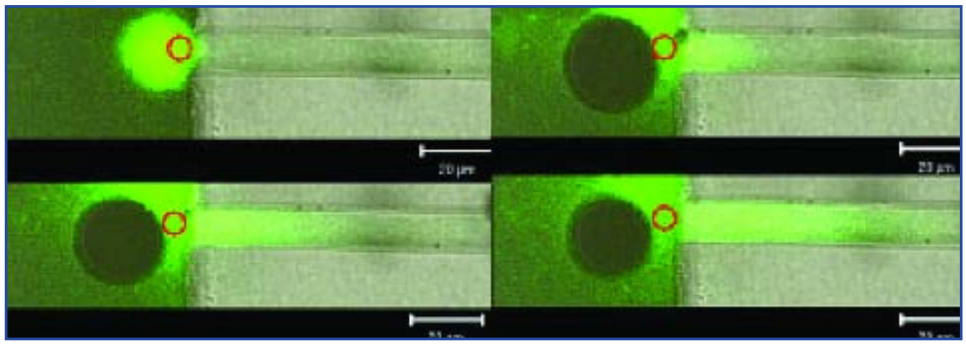
Bioluminescence Microscopy and Confocal Endoscopy
Collaboration with Lowell, Hedley

LAB collaborated with other UHN scientists to develop new imaging techniques, including a bioluminescent microscope (for ATP mapping in tissue sections) and a confocal fluorescence endoscope (for in vivo animal imaging). Based on proof of principle demonstrations for each technique, LAB is collaborating on an application to the Canadian Foundation for Innovation for a live cell imaging centre. LAB will be assembling full scale versions of these technologies that can be used by external researchers. Once the first generation of these instruments has been assembled and tested, LAB will seek commercialization partners for further development of these instruments into products.

Medical Device to Improve Pediatric Practice

Measuring Luminal Airways
Collaboration with Jowett, Forte

When medical student Nathan Jowett was assigned by Dr. Vito Forte of the Hospital for Sick Children to develop a new method of measuring airways in young children, he turned to LAB for assistance. With Mr. Jowett, LAB developed a new spectral triangulation technique for mapping the dimensions of airways and helped him perform pre-clinical tests that validated the concept. Mr. Jowett is seeking a patent on the concept and continues to work with LAB.



Training

LAB participates in training of highly qualified personnel primarily by its daily hands-on interactions with students in the Biophotonics program, and with its industry clients. LAB staff have co-supervised graduate students, co-op students, and employees from industry working within the biophotonics program.

While academic supervisors provide scientific training, LAB staff brings students up-to-speed in optical technologies, photonics in medicine, and device assembly; tools that prepare them for employment in industry. LAB also trains industry clients on medical device development, clinical applications and the latest science in the field of biophotonics.

LAB has also participated in several training initiatives. In the future, it will help in developing new training initiatives for industry and the general public in partnership with the Canadian Institute for Photonics Innovation and the Centre for Biophotonics Science and Technology (UC Davis).

NATO Advanced Study Institute in Biophotonics (Sept.-Oct. 2004)

Graduate and College Students in Industry

Over 120 graduate students and post-doctoral fellows from both industry and universities attended a 10-day school on the fundamentals of biophotonics and its applications in health, environment, security and defense applications. LAB assisted in preparing material and recruited researchers to provide demonstrations that highlighted key biophotonics principles.

Photonics North Conferences (Sept. 2004, and Sept. 2005)

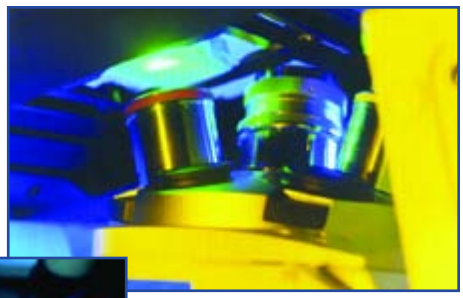
Graduate and College Students with Industry

Robert Weersink was a conference chair at Photonics North 2004 and 2005 in the fields of biophotonics and in Photonics in Medicine. Dr. Weersink also recruited other conference chairs in the fields of biosensors and nanotechnology for biology at Photonics North 2005. Approximately 50 presentations were made at each conference in the areas of biophotonics, with more than 100 attendees at these sessions.

Advanced Optical Microscopy Facility

Biologists and Clinicians interested in Optical imaging

The AOMF is a spin-off from training and technical activities originally performed by LAB. This activity provided the basis for a CFI grant that has established the AOMF as the premier microscopy facility in Toronto. The AOMF has trained hundreds of personnel on microscopy for life sciences. LAB has collaborated with the AOMF in developing new imaging modalities such as bioluminescence microscopy and confocal microendoscopy, which will become part of an expanded live-cell imaging facility at Toronto General Hospital.



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