Department of Medical Imaging
Annual Report 2003-2004

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CHAIR’S REPORT

The Department of Medical Imaging at the University of Toronto is by far the largest in Canada, and one of the largest in all of North America. Our Department has 150 full-time faculty members, 45 Residents, and 58 Fellows. The academic activities of our faculty and trainees are closely integrated with clinical activities at five, fully affiliated teaching hospitals. This Annual Report describes the components and organization of our department and the academic activities of our faculty and trainees, while our clinical programs are more fully described in the reports of our teaching hospitals.

We recently completed a review and update of our academic Strategic Plan. Our strategy is to focus on eight to ten areas of translational research where we can attain leadership positions. We plan to do so in collaboration with related groups in Medical Biophysics, Surgery, Radiation Oncology and Neurosciences. These areas of translational research include: advanced methods of cancer imaging and treatment, neuro-imaging, microvascular imaging, musculoskeletal imaging, minimally invasive image guided therapy, and image registration and fusion. In order to achieve our goals we continue to increase the number of faculty with protected research time, principally funded from clinical practice plans, but with financial incentives from our university budget. We provide improved basic research training and mentoring to residents, fellows and faculty, and opportunities for involvement in meaningful, exciting research. Our Residency Program Directors, Drs. Walter Montanera and Suzanne Laughlin, are heading a small task force examining the research content of our residency program, and determining whether we should implement a special “research stream” for select trainees. We are proud of and support the work of our trainees. Dr. Richard Bitar is our first trainee to enroll in a Ph.D program during the residency. Working under the supervision of Drs. Alan Moody and Tim Roberts in the area of non-invasive vascular imaging, Dr. Bitar has demonstrated tremendous success with grants and publications. All of our Fellows are now involved in research projects. Each is required to complete at least one major academic paper for every year in our program.

We continue to face several challenges. One of these is manpower. Although not as severe as the shortages experienced just a few years ago, they persist all across North America, in both academic and private practice. We have been very successful in our recruitment efforts. We have been aggressive locally, nationally and internationally. Generally speaking, we have met our staffing requirements. We also face difficulties in acquiring funding to support our academic mission. For the most part, funding has been achieved by contributions of faculty members’ time “in-kind” from clinical practice plans. We constantly seek other sources. We are also striving to sustain our core research teams. These were initiated with funding from the Canada Research Chair Program, the Ontario Research Development & Challenge Fund, the Canada Foundation for Innovation, and industry. We must sustain these programs.

Our department maintained the support of its faculty for protected research time. This year, the faculty members with departmentally sponsored research time were:

- Dr. Mostafa Atri (Accuracy of Unenhanced Helical CT and Added Value of Enhanced Helical CT in the Assessment of Acute Abdomen)
Dr. Petrina Causer (MRI Evaluation of the Contralateral Breast in Women with a Recent Diagnosis of Breast Cancer)
Dr. Peter Chait (Percutaneous Liver Biopsy in Children: A Prospective and Retrospective Study of Complications)
Dr. Bairbre Connolly (Radiation Dose to Children and Radiologist During PICC Insertions)
Dr. Alan Daneman (Necrotizing Enterocolitis: Comparison of Grey Scale and Doppler Sonography Findings with Clinical Radiographic and Pathological Findings)
Dr. Marcus Dill-Macky (Radiofrequency Ablation of Hypervascular Liver Lesions: Prediction of Success Using Contrast Enhanced Ultrasound)
Dr. Richard Farb (Idiopathic Intracranial Hypertension: The Prevalence and Morphology of Sinovenous Stenosis)
Dr. Roberta Jong (The ACRIN Digital Mammography Imaging Screening Trial)
Dr. Korosh Khalili (The Utility or Futility of a Second Imaging Test in the Assessment of Acute Abdominal Pain in Patients Presenting to the Emergency Department)
Dr. Derek Muradali (Contrast Enhanced Sonography of Breast Nodules and Lymph Nodes: Vascular Morphology and Pathologic Correlation)
Dr. Dawn Pearce (Weight-bearing CT Scan of the Feet)
Dr. Manohar Shroff (Emergency Cervical Spine X-rays in Children: Differences in Interpretation by Subspecialization)
Dr. Jeffrey Traubici (Maximum Intensity Projection Imaging in the Evaluation of Children for Pulmonary Metastatic Disease)
Dr. Lawrence White (Quantitative T2 Mapping of Cartilage Transplantation in an Animal Model)
Dr. Stephanie Wilson (Characterization of Indeterminate Hepatic Nodules in High-Risk Patients for Hepatocellular Carcinoma with Contrast-Enhanced Ultrasound).

We are very proud of the excellent teaching in all of our educational programs. Every year we publicly recognize those teachers selected by our trainees as being the most outstanding. Our departmental teaching awards this year were:

Edward L. Lansdown Award for Outstanding Teaching in the Residency Training Program
- Dr. Damien Maharaj

Outstanding teaching in the residency program
- Dr. Mostafa Atri
- Dr. Edna Becker
- Dr. Robert Bleakney
- Dr. Monique Christakis
- Dr. Dae-Gyun Chung
- Dr. TaeBong Chung
- Dr. Lisa Ehrlich
- Dr. Nasir Jaffer
- Dr. Damien Maharaj
- Dr. Caitlin T. McGregor
Outstanding teaching in the fellowship program

- Dr. Mostafa Atri
- Dr. Robert Bleakney
- Dr. Karina Bukhanov
- Dr. Alan Daneman
- Dr. Masoom Haider
- Dr. Anthony Hanbidge
- Dr. Chia Sing Ho
- Dr. Kartik Jhaveri
- Dr. Korosh Khalili
- Dr. Martin O’Malley
- Dr. David Salonen
- Dr. Kenneth Sniderman
- Dr. Manohar Shroff
- Dr. Robert Willinsky
- Dr. Stephanie Wilson

Achieved distinction for outstanding teaching in both the residency and fellowship programs

- Dr. Mostafa Atri
- Dr. Robert Bleakney
- Dr. Martin O’Malley

The academic promotions this year were (effective July 1, 2004):

Associate Professor - Dr. Roberta Jong
Assistant Professor - Dr. Raymond Chan
Dr. TaeBong Chung
Dr. Eran Hayeems.

In closing, I would like to thank Amy Shea, Gina Sciortino, and Felomena Teixeira - the administrative staff at the university offices. They are wonderful friends and are tremendously helpful in getting the Department’s work done. I greatly appreciate their efforts.

Walter Kucharczyk, M.D., F.R.C.P. (C)
Professor and Chair
Chair ................................................................................................................................................ Kucharczyk, W.
Associate Chair.................................................................................................................................. Roberts, T.

**Radiologists-in-Chief**

Hospital for Sick Children ........................................................................................................ Babyn, P.
Mount Sinai Hospital-University Health Network (Princess Margaret Hospital/
Toronto General Hospital/Toronto Western Hospital) ......................................................... Bret, P.
St. Michael's Hospital .................................................................................................................. Common, A.
Sunnybrook & Women's College Health Sciences Centre ....................................................... Moody, A.

**Program Directors**

Continuing Education ............................................................................................................. Hamilton, P.
Fellowship .................................................................................................................................... Shroff, M.
Neuroradiology ....................................................................................................................... Willinsky, R.
Nuclear Medicine .................................................................................................................... Hershkop, M.
PGY1 ........................................................................................................................................... Laughlin, S.
Radiology Residency ........................................................................................................... Montanera, W.
Radiology Residency (Co-Director) ......................................................................................... Laughlin, S.
Research ........................................................................................................................................ Roberts, T.
Undergraduate ......................................................................................................................... Dowdell, T.
Undergraduate (Co-Director) .................................................................................................. Jaffer, N.

**Division Heads**

Abdominal Imaging .................................................................................................................. Atri, M.
Breast Imaging ........................................................................................................................ Muradali, D.
Cardiothoracic
  Cardiac Imaging .................................................................................................................... Merchant, N.
  Thoracic Imaging ................................................................................................................... Paul, N.
Musculoskeletal Imaging ........................................................................................................ White, L.
Neuroradiology ........................................................................................................................ TerBrugge, K.G.
Pediatric Imaging ...................................................................................................................... Manson, D.
Vascular and Interventional Radiology ..................................................................................... Chait, P.

**Department Administrative Staff**

Business Officer ..................................................................................................................... Sciortino, G.
Secretary ..................................................................................................................................... Shea, A.
COMMITTEES

Executive Committee
Kucharczyk, W. (Committee Chair)
Armstrong, S. (Chief Resident)
Babyn, P.
Bret, P.
Laughlin, S.
Common, A.
Dowdell, T.
Hamilton, P.
Hershop, M.
Jaffer, N.
Laughlin, S.
Montanera, W.
Moody, A.
Roberts, T.
Salem, S.
Shroff, M.

Promotions Committee
TerBrugge, K. (Committee Chair)
Mostafa Atri
Babyn, P.
Jaffer, N.
Rubenstein, J.
Weiser, W.
Yaffe, M.

Undergraduate Teaching Committee
Dowdell, T. (Committee Chair)
Chan, R.
Jaffer, N.
Kachura, J.
Lax, M.
Montanera, W.
Paul, N.
Pearce, D.
Weiser, W.

Specialty Training Committee
Montanera W. (Committee Chair)
Armstrong, S. (Chief Resident)
Christakis, M.
Hayeems, E.
Hershkop, M.
Laughlin, S.
MacDonald, C.
Mikulis, D.
Pearce, D
Betel, C.
Bharatha, A.
Grinblat, L.
Margau, R.
UNIVERSITY OF TORONTO FULLY AFFILIATED HOSPITALS AND INSTITUTES

Hospital for Sick Children ................................................................. 555 University Avenue
Toronto, Ontario
M5G 1X8

Mount Sinai Hospital ..................................................................... 600 University Avenue
Toronto, Ontario
M5G 1X5

St. Michael's Hospital .................................................................... 30 Bond Street
Toronto, Ontario
M5B 1W8

Sunnybrook & Women’s College Health Sciences Centre

Sunnybrook Campus .................................................................... 2075 Bayview Avenue
Toronto, Ontario
M4N 3M5

Women’s College Campus ............................................................ 76 Grenville Street
Toronto, Ontario
M5S 1B2

University Health Network

Princess Margaret Hospital ............................................................. 610 University Avenue
Toronto, Ontario
M5G 2M9

Toronto General Hospital ............................................................... 585 University Avenue, NCSB
Toronto, Ontario
M5G 2N2

Toronto Western Hospital .............................................................. 399 Bathurst Street
Toronto, Ontario
M5T 2S8

Centre for Addiction and Mental Health ........................................ 250 College Street
Toronto, Ontario
M5T 1B8

Positron Emission Tomography Centre ........................................ 250 College Street
Toronto, Ontario
M5T 1B8
## DEPARTMENT OF MEDICAL IMAGING FACULTY

### Academic Rank, Subspecialty Division and Hospital as of June 30, 2004

<table>
<thead>
<tr>
<th>NAME</th>
<th>RANK</th>
<th>DIVISION</th>
<th>HOSPITAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alton, D.J.</td>
<td>Assistant Professor</td>
<td>Pediatric Imaging</td>
<td>Hospital for Sick Children</td>
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<tr>
<td>Arenson, A.M.</td>
<td>Assistant Professor</td>
<td>Abdominal Imaging</td>
<td>Sunnybrook &amp; Women’s College Health Sciences Centre</td>
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<tr>
<td>Armstrong, D.</td>
<td>Assistant Professor</td>
<td>Neuroradiology</td>
<td>Hospital for Sick Children</td>
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<tr>
<td>Ash, J.M.</td>
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<td>Atri, M.</td>
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<td>Blaser, S.</td>
<td>Associate Professor</td>
<td>Vascular Imaging</td>
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<td>Assistant Professor</td>
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<td>Associate Professor</td>
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<td>Bobechko, P.E.</td>
<td>Assistant Professor</td>
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<td>Bret, P.</td>
<td>Professor</td>
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<td>Caldwell, C.B.</td>
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<td>Chan, R.</td>
<td>Assistant Professor</td>
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<td>Mount Sinai Hospital</td>
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<td>Chawla, T.</td>
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<td>Cheng, M.H.L.</td>
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<td>Cheyne, D.</td>
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<td>Chui, M.C.</td>
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<td>Damyanovich, A.</td>
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<td>Deitel, W.</td>
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<td>Dill-Macky, M.</td>
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<td>Doria, A.</td>
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<td>Dowdell, T.R.</td>
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<td>Gilday, D.L.</td>
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<td>Associate Professor</td>
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<td>Haider, M.</td>
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<td>Harris, A.</td>
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<tr>
<td>Name</td>
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<td>Department</td>
<td>Institution</td>
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<td>Assistant Professor</td>
<td>Neuroradiology</td>
<td>Sunnybrook &amp; Women's College Health Sciences Centre</td>
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<td>Temple, M.</td>
<td>Assistant Professor</td>
<td>Pediatric Imaging</td>
<td>Hospital for Sick Children</td>
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<td>TerBrugge, K.G.</td>
<td>Professor</td>
<td>Neuroradiology</td>
<td>University Health Network</td>
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<td>Thomas, K.</td>
<td>Assistant Professor</td>
<td>Pediatric Imaging</td>
<td>Hospital for Sick Children</td>
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<tr>
<td>Thurston, W.</td>
<td>Assistant Professor</td>
<td>Abdominal Imaging</td>
<td>St. Joseph’s Health Centre</td>
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<td>Toi, A.</td>
<td>Associate Professor</td>
<td>Abdominal Imaging</td>
<td>University Health Network</td>
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<td>Traubici, J.</td>
<td>Assistant Professor</td>
<td>Pediatric Imaging</td>
<td>Hospital for Sick Children</td>
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<td>Turner, D.</td>
<td>Assistant Professor</td>
<td>Musculoskeletal Imaging</td>
<td>Sunnybrook &amp; Women’s College Health Sciences Centre</td>
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<td>Wall, J.</td>
<td>Lecturer</td>
<td>Abdominal Imaging</td>
<td>St. Michael’s Hospital</td>
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<td>Weisbrod, G.L.</td>
<td>Professor</td>
<td>Cardiorthacic Imaging</td>
<td>University Health Network</td>
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<td>Weiser, W.J.</td>
<td>Professor</td>
<td>Musculoskeletal Imaging</td>
<td>St. Michael’s Hospital</td>
</tr>
<tr>
<td>White, L.</td>
<td>Associate Professor</td>
<td>Neuroradiology</td>
<td>Mount Sinai Hospital</td>
</tr>
<tr>
<td>Willinsky, R.A.</td>
<td>Professor</td>
<td>Breast Imaging</td>
<td>University Health Network</td>
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<tr>
<td>Wilson, C.</td>
<td>Assistant Professor</td>
<td>Abdominal Imaging</td>
<td>University Health Network</td>
</tr>
<tr>
<td>Wilson, S.R.</td>
<td>Professor</td>
<td>Research/Medical Biophysics</td>
<td>University Health Network</td>
</tr>
<tr>
<td>Wood, M.L.</td>
<td>Professor</td>
<td>Breast Imaging</td>
<td>Sunnybrook &amp; Women’s College Health Sciences Centre</td>
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<tr>
<td>Wright, B.E.</td>
<td>Assistant Professor</td>
<td>Abdominal Imaging</td>
<td>St. Michael’s Hospital</td>
</tr>
<tr>
<td>Wu, L.</td>
<td>Lecturer</td>
<td>Research</td>
<td>Hospital for Sick Children</td>
</tr>
<tr>
<td>Xiang, J.</td>
<td>Assistant Professor</td>
<td>Abdominal Imaging</td>
<td>Sunnybrook &amp; Women’s College Health Sciences Centre</td>
</tr>
<tr>
<td>Yaffe, M.J.</td>
<td>Professor</td>
<td>Research/Medical Biophysics</td>
<td>Sunnybrook &amp; Women’s College Health Sciences Centre</td>
</tr>
<tr>
<td>Yoo, S-J.</td>
<td>Professor</td>
<td>Pediatric Imaging</td>
<td>Hospital for Sick Children</td>
</tr>
<tr>
<td>Yu, E.</td>
<td>Lecturer</td>
<td>Neuroradiology</td>
<td>University Health Network</td>
</tr>
<tr>
<td>Zalev, A.H.</td>
<td>Assistant Professor</td>
<td>Abdominal Imaging</td>
<td>St. Michael’s Hospital</td>
</tr>
<tr>
<td>Zelovitzky, J.L.</td>
<td>Assistant Professor</td>
<td>Cardiorthacic Imaging</td>
<td>University Health Network</td>
</tr>
</tbody>
</table>

**Cross Appointments**

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Department</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bronskill, M.J.</td>
<td>Professor</td>
<td>Medical Biophysics</td>
<td></td>
</tr>
<tr>
<td>Foster, S.</td>
<td>Professor</td>
<td>Medical Biophysics</td>
<td></td>
</tr>
<tr>
<td>Freedom R.</td>
<td>Professor</td>
<td>Pediatrics</td>
<td></td>
</tr>
<tr>
<td>Henkelman, R.M.</td>
<td>Professor</td>
<td>Medical Biophysics</td>
<td></td>
</tr>
<tr>
<td>Johnson, J.A.</td>
<td>Associate Professor</td>
<td>Obstetrics and Gynaecology</td>
<td></td>
</tr>
<tr>
<td>McLaughlin, P.R.</td>
<td>Professor</td>
<td>Medicine</td>
<td></td>
</tr>
<tr>
<td>Noseworthy, M.</td>
<td>Assistant Professor</td>
<td>Medical Biophysics</td>
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</tr>
<tr>
<td>Noyek, A.M.</td>
<td>Professor</td>
<td>Otolaryngology</td>
<td></td>
</tr>
<tr>
<td>Pharoah, M.J.</td>
<td>Professor</td>
<td>Dentistry</td>
<td></td>
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<tr>
<td>Pleves, D.B.</td>
<td>Professor</td>
<td>Medical Biophysics</td>
<td></td>
</tr>
<tr>
<td>Reilly, R.</td>
<td>Associate Professor</td>
<td>Pharmacy</td>
<td></td>
</tr>
<tr>
<td>Tomlinson, G.</td>
<td>Assistant Professor</td>
<td>Biostatistics</td>
<td></td>
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<tr>
<td>Trachtenberg, J.</td>
<td>Professor</td>
<td>Surgery</td>
<td></td>
</tr>
<tr>
<td>Vanek, I.</td>
<td>Assistant Professor</td>
<td>Ophthalmology</td>
<td>University Health Network</td>
</tr>
</tbody>
</table>

**Radiation Sciences Program (Joint Program with Michener Institute)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
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</thead>
<tbody>
<tr>
<td>Babiak, C.</td>
<td>Instructor</td>
</tr>
<tr>
<td>Coracchione, P.</td>
<td>Instructor</td>
</tr>
<tr>
<td>Crowley, S.</td>
<td>Instructor</td>
</tr>
<tr>
<td>Goodin, L.</td>
<td>Instructor</td>
</tr>
<tr>
<td>Havil, D.</td>
<td>Instructor</td>
</tr>
<tr>
<td>King, D-M.</td>
<td>Instructor</td>
</tr>
<tr>
<td>Maynard, L.</td>
<td>Instructor</td>
</tr>
<tr>
<td>Murray, L.</td>
<td>Instructor</td>
</tr>
<tr>
<td>Rodrigues, G.</td>
<td>Instructor</td>
</tr>
<tr>
<td>Sharpe, W.</td>
<td>Instructor</td>
</tr>
<tr>
<td>Shin, H.</td>
<td>Instructor</td>
</tr>
<tr>
<td>Souter, C.</td>
<td>Instructor</td>
</tr>
<tr>
<td>Topple, A</td>
<td>Instructor</td>
</tr>
<tr>
<td>Watson, T.</td>
<td>Instructor</td>
</tr>
<tr>
<td>Wong, B.</td>
<td>Instructor</td>
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</tbody>
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- 12 -
THE DEPARTMENT OF MEDICAL IMAGING AND THE UNIVERSITY OF TORONTO TEACHING HOSPITALS

The academic programs in the Department of Medical Imaging are integrated with its five major teaching hospitals: the University Health Network (UHN), Mount Sinai Hospital (MSH), St. Michael’s Hospital, Sunnybrook & Women’s College Health Sciences Centre, and the Hospital for Sick Children. The medical imaging departments at UHN and MSH are consolidated into a single operational unit under the leadership of Dr. Patrice Bret. The Medical Imaging departments at St. Michael’s Hospital, Sunnybrook & Women’s College Health Sciences Centre, and the Hospital for Sick Children are led by Dr. Andrew Common, Dr. Alan Moody, and Dr. Paul Babyn.

University Health Network/Mount Sinai Hospital

Organizational Structure:

Andy Holt, Administrative Director, left the Department in the Summer of 2003. Scott Jarrett was hired from St. Joseph’s Health Centre. The Radiologist-in-Chief went on a 6-month sabbatical from January 2004-June 30, 2004. During this time, Dr. Anne Keller was the Acting Radiologist-in-Chief. No changes were made on the organizational structure for the Radiologists, however a number of Charge Technologists’ positions were consolidated in order to address budget shortfalls. In addition, one of five Manager positions was closed.

With respect to clinical services, waiting lists for CT and MRI remain a constant challenge. Some CT evening shifts, and as many MRI night shifts as funding allows have been opened, however the waiting time remains well above acceptable standards.

Significant Events/Accomplishments:

- The Management Team was trained in patient centered care.
- UHN Quality Committee: Our department received specific praise from the UHN Patient Relations Department.
- PET/CT clinical trials started at PMH.
- TWH renovation was completed and installation of the new equipment should be completed by Fall of 2004.
- The Management Team was provided new training opportunities.
- A new funding model has been tested for inpatient activity using charge-back to the units. This is done in an effort to better control utilization of MI tests for inpatients.
Sunnybrook and Women’s College Health Sciences Centre

Sunnybrook & Women’s College Health Sciences Centre, Medical Imaging department, is comprised of 6 divisions (Body Imaging, Neuroradiology, Cardiothoracic/VIR, Nuclear Medicine, Musculoskeletal and Breast Imaging) supporting major regional programmes including Oncology, Trauma, Burns and Stroke. The department is research driven encouraging hypothesis generated clinical research and collaboration with the adjacent department of Research Imaging. Access to state of the art research equipment including 3T MRI, 1.5T MRI and PET-CT, complement clinical twin speed MRI’s (2), 3 CT scanners and fully equipped nuclear medicine, angiography and ultrasound departments. The department is fully integrated with PACS and RIS systems. For further information regarding clinical or research imaging, please contact alan.moody@sw.ca.

St. Michael’s Hospital

The Medical Imaging Department at St. Michael's Hospital has undergone considerable remodeling in the past few years. A Siemens PACs system has now been installed, and integrated VR Technology and electronic worklisting will soon render the department filmless and paperless, with markedly improved reporting efficiency. The annual tally of imaging examinations is over 240,000, excluding a very busy cardiac catheterization service which performs over 4000 radiologist-interpreted procedures per year. Virtually all of the imaging equipment has been replaced, with two helical CT scanners, three new MRI units, and three angio suites, including a bi-plane neuro interventional facility. An aggressive recruiting campaign of subspecialist radiologists has brought full-time staffing levels to 17 which has allowed the department to better meet the needs of the University Residency and Fellowship Programs. St. Michael’s is proud of its long-standing commitment to teaching and clinical excellence. The hospital has appointed a renowned Critical Care researcher as VP of Research, and there is renewed commitment to increasing the research profile of the hospital. A new state-of-the-art research building is planned. Other unique hospital attributes which are reflected in the Medical Imaging Department at St. Michael’s are the Inner City Health Programme, the world-renowned Minimal Access Therapeutics Program and the Hereditary Hemorrhagic Telangiectasia Program. Our Neurointerventional Service has grown rapidly in the last few years, and will continue to expand. The Breast Imaging service has recently moved into a new CIBC Breast Centre on the same floor as the Medical Imaging Department. Further, St. Michael’s is downtown Toronto’s helipad-serviced trauma centre, and lithotripsy centre, and has outstanding clinical and research programs in renal disease, and in heart and vascular diseases, which are actively supported by the Medical Imaging Department.
Hospital for Sick Children

The Hospital for Sick Children Department of Diagnostic Imaging provides full imaging service for all children up to the age of 18 years. We currently perform approximately 145,000 examinations per year. The department has 21 full-time staff currently with subspecialists in Pediatric Neuroradiology, Interventional, Cardiac, and body-cross sectional imaging. The Department has an extensive training program with an international group of pediatric radiology fellows and other trainees.

Departmental equipment is state of the art with two 1.5T MR scanners, two CT scanners, (including one 8 slice CT) along with a dedicated Image Guided Therapy suite. This suite allows both interventional radiology and minimally invasive surgical procedures to be combined, and consists of four rooms containing integrated CT fluoroscopy, a biplane unit, and two single plane fluoroscopic units with ultrasound units. The department has an active sonography service with eleven ultrasound units. There is an integrated PACS and RIS system providing image and report distribution throughout the hospital.

Research and training are active interests of the department with many ongoing projects. Dedicated imaging scientists have interests in MR and Magnetoencephalography, Cardiac, Interventional and Functional Neuroimaging.
RESEARCH GRANTS

Members of the Department of Medical Imaging (underlined) were investigators on the following grants, identified by the principal investigator, other investigators, project title, sponsor, total amount of grant, and start and end dates of the funding period.


Bassett A (Principal Investigator), Mikulis DJ (Co-Investigator). Delineating a high risk phenotype in familial schizophrenia. Canadian Institutes of Health Research (CIHR). $140,000.00/yr. April 2002-March 2007.


Chait P. Therapeutic efficicacy of intrapleural alteplase in rabbit empyema model. Hoffmann-LaRoche Limited. $25,000 March 2004.

Causer P co-investigator, P.I. Warner E, Plewes DB. Surveillance magnetic resonance imaging and ultrasound for women at high risk for hereditary breast cancer. CBCRA ($1 300, 000) for 2004-2009. CBCRI ($710,409) for 2001-2004

Causer P co-investigator. (P.I. Dr. C. Lehman). MRI Screening of the Contralateral Breast ACRIN 6667. NIH ($55 000 to our centre). 2003-2006


Chan V, Simons ME. Is ultrasound imaging a practical and more accurate method of nerve localization than nerve stimulation during brachial plexus block. 2003 Canadian
Anesthesiologists’ Society, Smiths Medical Canada Ltd. Canadian Research Award in Pain Research and/or Regional Anesthesia. $10,000.00. July 2003-July 2004.


Connolly B, Swoboda N. Radiation Dose to Children and Radiologist During PICC Insertions. Dept of Medical Imaging, University of Toronto. $8,000 April 1, 2004 – March 31, 2005


Fleshner N (Principal Investigator), Toi A, Sweet J, Evans A, Gleave M, Klotz L, Rao V (Co-Investigators). Incidence and characteristics of prostate cancers detected in men with prostate specific antigen values< 2.5 ng/ml. Canadian Prostate Cancer Research Initiative (CPCRI) and National Cancer Institute of Canada (NCIC). $50,000.00. February 1, 2003 for one year.
Goss PE, Thompson L (Principal Investigators), Bukhanov K, Muradali D (Collaborators). A protocol to study the effects of dietary flaxseed on mammographic density. Canadian Breast Cancer Research Initiative. $218,165.00. 1998 (end date unknown).


Green R, Mikulis D (Principal Investigators). Cognitive vs motor recovery after traumatic brain injury: Is there competition for limited neural resources. The Physician Services Incorporated Foundation (03-32). $42,000.00 (2004); $80,000.00 (2005).

Haider M (Principal Investigator), Toi A, Sweet J, O’Malley M, Trachtenberg J (Co-Investigators). The utility of functional and morphologic MRI in the detection of prostate cancer for patients with elevated PSA and prior negative biopsy. PMH Foundation. $30,000.00. April 2002 (ongoing).


Hurtig MB, White LM, Marks PH (Principal Investigators), Buschmann M, Shirazi S, Dickey J, Weller I, Mohtadi NG (Collaborators). Risk factors and indicators that predict the progression of osteoarthritis after knee injury. Canadian Institutes of Health Research (CIHR), and the Institute of Musculoskeletal Health and Arthritis (IMHA). Total amount $1,500,000.00 (CIHR New Emerging Team NET Grant; Quality of Life Enhancement Competition 2004). 2004-2009.


Kapur S (Principal Investigator), Mikulis D (Co-Investigator). Schizophrenia, reward learning and reward prediction errors - A study using computational models and event related fMRI. Canadian Institutes of Health Research (CIHR). $108,619.00 (3 Years) + $9,961 Equipment.

Kucharczyk W. Functional Imaging Research Network (FIRN) - $34,000,000. With other principal investigators: Donald Stuss, Mark Henkelman and Franco Vacarino. Funding agency: CFI. Continuation. Grant attributed to Dr. Walter Kucharczyk $6,500,000. 2000-2005.
Kucharczyk W. Ontario Consortium for Image Guided Surgery. $40,000,000. Grant attributed to Dr. Walter Kucharczyk $5,000,000. Funding agency: ORDCF. 2001-2006.


Mikulis DJ (Co-Principal Investigator). The Behavioral Research and Imaging Network. Grant Support (BRAIN #01-MAR-0936). Ontario Research and Development Challenge Fund. $95,000.00/yr. 2002-2007.


Shroff M, Kirby K. Imaging of Cervical Spine trauma in children: University of Toronto Department of Medical Imaging Research & Developmental Award of CAD 8000.


Shroff M, Bouffet E. Use of Vinblastine in the treatment of Optic pathway glioma: This study involves pre and post treatment MRI studies with detailed evaluation. Ontario Cancer Society. $100,000.


Wright G (Principal Investigator), Merchant N. Magnetic resonance imaging for ischemic heart disease. Canadian Institutes of Health Research (CIHR). $135,240.00 per year plus equipment x 4 years (2003-2007).
PUBLICATIONS: PEER–REVIEWED PAPERS AND ABSTRACTS


Babyn P, Tse SML, Doria A, Boros C, Parker S. Anti-tumor necrosis factor alpha therapy leads to improvement of both enthesitis and synovitis in children. Arthritis and Rheumatism. 2003, S92- S93.


PUBLICATIONS: NON-PEER–REVIEWED, BOOKS, CHAPTERS


Gilday DL. Pediatric nuclear medicine. Nuclear Medicine, pgs. 365-383 Ed: Leslie WD, Greenberg ID Landes Bioscience 2003


Yoo S-J, Freedom RM, Li J. Late complications following the fontan operation. 85-91. Ed.: Gatzoulis MA, Webb GD, Daubney PEF Diagnosis and Management of Adult Congenital Heart Disease Churchill Livingstone 2003

INVITED PRESENTATIONS AND VISITING PROFESSORSHIPS


Armstrong D. Interesting pediatric brain cases, a tutorial. Montreal Childrens Hospital, October 21, 2003.


Armstrong D. Hypoxic ischemic encephalopathy of the fetus, premature, and full term infant. Pediatric Neurology, Sao Paolo, August 2003.


Babyn P. “Imaging of Pediatric Arthritis” Brigham & Women’s Hospital – Boston Massachusetts General Hospital March 23 – 24, 2004


Bret P. Visiting Professor. MRI of the biliary tract; Current status of pancreatic imaging (US, CT, MRI); The future of abdominal imaging; PACS infrastructure and models. Hatyai, Songkhla, Thailand. March 16, 2004.


Bret P. Visiting Professor. Current status of pancreatic imaging (US, CT, MRI); Imaging and acute pancreatitis; Practical biliary imaging US versus MRI; The future of abdominal imaging; PACS infrastructure and models; PACS implementation issues; MRI of the biliary tract; MRI of the pancreas. Bangkok, Thailand. March 22-23, 2004.


Bret P. Visiting Professor. PACS infrastructure & implementation issues. SGH, National University of Singapore, Singapore. April 6, 2004.


Causer P. Update Results of MR Screening Program, Breast MRI: Structured Approach in Interpretation, 23rd International Congress of Radiology, Montreal, Quebec, June 2004.

Causer P. Breast MRI, Visiting Professor, Queen’s University, Kingston, Ontario, April 2004

Causer P. Women’s Imaging, Interventional Breast Ultrasound Workshop, the Marriot Hotel, February 2004
Causer P. Breast MRI Intervention, CAR, Halifax, Nova Scotia, October 2003

Causer P. Section for Magnetic Resonance Technologists, the Metro Toronto Convention Centre, Breast Imaging, July 2003

Chang M. Distinguished Seminars in Bioengineering, Institute of Biomaterials and Biomedical Engineering, University of Toronto, Toronto, Canada, 6 Nov, 2003. Magnetic Resonance Imaging for Non-Invasive Assessment of Tissue Status


Chait P. AVIR 14th Annual Scientific Meeting- Pediatric Intervention presentation at SIR, Phoenix, Arizona, March 2004.


Chait P. Vascular Imaging, Department of Biophysics, University of Toronto, Sunnybrook Hospital, Toronto, Ontario, April 2004.


Cheyne D. MEG studies of ADHD. NIH funded workshop on cerebeller-striatal-prefrontal dysfunction in ADHD, NYU Child Study Center, New York City, USA; July, 2003.


Daneman A. The Royal Australian and New Zealand College of Radiologists – Kodak Visiting Professor 2003

Daneman A. iRANZCR 54th Annual Scientific Meeting Brisbane, Queensland, Australia, September 18-21, 2003

Daneman A. Lectures: An approach to imaging abdominal masses in children; Intussusception: Evolution and current concepts in diagnosis and management; Disappearing masses of the abdomen in fetuses, neonates and infants; Malrotation: Spectrum of appearances, techniques and pitfalls in diagnosis and management. Guest Faculty Kodak Professor 2003

Daneman A. Lecture: Approach to imaging the acute abdomen in children. PERTH, WESTERN AUSTRALIA Royal Perth Hospital, Perth, Australia, October 2, 2003

Daneman A. Lecture: The role of gray scale and Doppler sonography in imaging of necrotizing enterocolitis. Princess Margaret Hospital, Perth, Australia, October 3, 2003

Daneman A. Lectures: Malrotation: Spectrum of appearances, techniques and pitfalls in diagnosis and management, Cross-sectional imaging of the GI tract in children, Tutorial to Radiology Registrars, The role of gray scale and Doppler imaging in necrotizing enterocolitis. Royal Children’s Hospital, Melbourne, Australia, October 13, 2003
Daneman A. Lecture: Complications related to treatment in paediatric oncology patients. Peter MacCallum Cancer Institute, Melbourne, Australia, October 13, 2003

Daneman A. Lecture: College Lecture: Imaging of the acute abdomen in pediatrics. Royal Melbourne Hospital, Melbourne, Australia, October 13, 2003


Daneman A. Lectures: Imaging of the acute abdomen in pediatrics, Disappearing masses of the abdomen in fetuses, neonates and infants, An approach to imaging abdominal masses in pediatrics, The role of gray scale and Doppler imaging in necrotizing enterocolitis. Star Ship Children’s Hospital, Auckland, New Zealand, October 16-17, 2003


Doria A. Hypothesis-Driven Research. 45th Annual Meeting of the Society for Pediatric Radiology Workshop – San Francisco, CA, USA 2003


John P. Intestinal failure: Chronic complications and clinical management NIDDK Intestinal Failure Workshop, American Society for Parenteral and Enteral Nutrition, Feb 2004


Jong R. Breast Imaging Update 2003, Montreal, Quebec August 2003
  a) Masses
  b) Problem Solving in Mammography
  c) Controversies in Ultrasound
  d) Digital Mammography – Radiologist’s Perspective
  e) Magnetic Resonance Imaging & Screening


(a) CNS infections  
(b) The pituitary gland  
(c) MRI physics  
(d) Expert film panel

International Diagnostic Kourse Davos (IDKD). Dovas, Switzerland. March 2004. The pituitary gland and central skull base. (I was evaluated as best teacher out of 40 internationally recognized faculty).


Macgowan C. Cardiovascular Applications of MRI Toronto MRI Scientific Retreat, Toronto, Canada – October 02, 2003. Sponsor: Sunnybrook & Women’s College Health Sciences Centre.


MacDonald C. Symposium on Pediatric Cardiovascular MR. MR Evaluation of Pediatric Cardiac Tumors The Hospital for Sick Children October 2003


Moody A. British Association of Emergency Medicine, Nottingham, 2003.


Moody A. MRA Club, London, Ontario


Navarro O. Visiting Professor, Queen’s University, Kingston. Neonatal Gastrointestinal Imaging. June 29, 2004


Ranson M. DI Grand Rounds, HSC “Pediatric Musculoskeletal Trauma” October 22, 2003

Ranson M. Dept. of Rheumatology Imaging of Rheumatologic Diseases March 16, 2004 and May 18, 2004


Shroff M. Pediatric Neuroradiology Resident Teaching Session: Milwaukee, 1st August 2003

Shroff M. Lecture on: Pediatric Cervical Spine Trauma: 2 pm to 3 pm, followed by “Pediatric Neuroradiology Quiz for Residents: 3.15 pm to 5.00 pm. McMaster University, Hamilton., 24th September 2003


Shroff M. CME talk on “Pediatric Cervical Spine Trauma”: 4th October 2003, Annual Conference of Canadian Association of Radiology, at Halifax, Nova Scotia, Canada

Shroff M. Invited lecture in the plenary session of the 57th Annual Congress, Indian Radiological & Imaging Association, January 11th, 2004, Hyderabad, India, on “Imaging of Pediatric Stroke”


Shroff M. Alberta Children’s Hospital, Calgary; 3 day visiting professor program: which included case discussions in the morning and 3 hours resident teaching sessions on every day in the afternoon, and lectures at noon time. Lectures given were: Imaging of Pediatric Stroke, Neonatal CT & MRI imaging, Imaging of Inherited Metabolic diseases: 17th to 19th March 2004

Shroff M. McMaster University, Hamilton,: Resident teaching Quiz session and lecture on “Pediatric Cervical Spine trauma” – 12th May 2004.
Shroff M. Queen’s University, Kingston, Canada, 20th & 21 May 2004: Visiting Professor to their Department of Radiology with two days of lectures and case presentations for their residents and a lecture for all radiology staff on “Pediatric Stroke”


terBrugge K. Natural history of DAVs; Venous injuries thromboses and hemorrhages; DAVs and cortical venous drainage; Spontaneous thrombosis; Post op trauma (pituitary surg); Abused children, para spinal and epidural lesions; spinal cord vascular tumours; SC cavernoma, hemangioblastomas; Para spinal AVM, DAVs sacral; SCAVM. 2003-2004 International Master Degree in Neurovascular Diseases. Chiangmai, Thailand. November 9-14, 2003.


White L. Visiting Professor. Pre and postoperative MR imaging assessment of the cruciate ligaments. Department of Medical Imaging, Queens University, Kingston, Ontario, Canada. October 30, 2003.


Willinsky R. Anterior circulation aneurysm distal to the paraclinoid location-endovascular treatment-complication and efficacy-which patients should be treated with embo and how effective is the treatment? Neurovascular update: Aneurysms: Current Challenges and Future Directions. Harvard Medical School, Boston, Massachusetts, USA. June 17-18, 2004.


Wilson S. Evaluation of hepatic nodules: Pathologist or Radiologist or both. 54th Annual Meeting of the American Association for the Study of Liver Diseases. Boston, Massachusetts, USA. October 2003.


Yoo SJ. Fetal cardiac imaging. University of Toronto, Refresher Course on Obstetrics and Gynecological Ultrasound September, 24-26, 2003


Yoo SJ. Pediatric CT and MR Pediatric Grand Round, Seoul National University, Seoul, Korea September 23, 2003

Yoo SJ. Fetal aortic arch anomaly. Samsung Cheil Women’s Health Care Center, Seoul, Korea September 24, 2003

Yoo SJ. MRI evaluation of pulmonary circulation. Sejong Heart Institute September 19, 2003


Yoo SJ. Pediatric cardiac CT and MR. Canadian Association of Radiology Congress, Halifax October 3, 2003


Yoo SJ. Plain film interpretation of congenital heart disease Resident and Fellow Round, Cornell University, New York October 16, 2003

Yoo SJ. Normal cardiac anatomy for imaging. SPR Symposium on Pediatric Cardiovascular MR Oct 25-29, 2003


Yoo SJ. Case-based review, pediatric, cardiovascular. Radiological Society of North America, Chicago November 29-December 5, 2003
Yoo SJ. Normal cardiac anatomy for imaging. Resident and Fellow Round, Women’s and Children’s Hospital, Buffalo January 9, 2004

Yoo SJ. Plain film interpretation of congenital heart disease Resident and Fellow Round, Women’s and Children’s Hospital, Buffalo January 9, 2004

Yoo SJ. Pediatric cardiac MR. Women’s and Children’s Hospital, Buffalo January 9, 2004

Yoo SJ. Normal cardiac anatomy for imaging. 2nd SPR Symposium on Pediatric Cardiovascular MR, Houston April 1-5, 2004

Yoo SJ. Sequential segmental approach to congenital heart disease. 2nd SPR Symposium on Pediatric Cardiovascular MR, Houston April 1-5, 2004

Yoo SJ. Postoperative MR evaluation. 2nd SPR Symposium on Pediatric Cardiovascular MR, Houston April 1-5, 2004

Yoo SJ. Pediatric Cardiovascular MR Practicum. 2nd SPR Symposium on Pediatric Cardiovascular MR, Houston April 1-5, 2004

Yoo SJ. Cardiac CT. 2nd SPR Symposium on Pediatric Cardiovascular MR, Houston April 1-5, 2004

Yoo SJ. Basic MR cardiac functional evaluation. Society for Pediatric Radiology, Refresher Course, Savannah April 27-May 1, 2004

Yoo SJ. Future trends, cardiac imaging. 23rd Congress of Radiology, Montreal June 25-29, 2004


Babyn PS, Tse SML, Doria AS, Boros C, Parker S, Feldman B, Laxer RM. 2003 – Park City and Beyond IX – Annual Meeting of the American Academy of Pediatrics - Snowmass, Colorado, USA. Anti-tumor necrosis factor alpha therapy leads to improvement of both enthesitis and synovitis in children with enthesitis-related arthritis


Bartlett ES, Fox AJ. Quantification of Carotid Stenosis on CT Angiography. 5th World Stroke Congress, 2004, program.


Chaloupka J, Lee SK, Ugurel M, Hsu SW. Single-centre experience with Matrix detachable coils in more than 100 aneurysms technical evaluation and outcomes. 7th Annual Meeting of the AANS/CNS section on Cerebrovascular Surgery and the ASITN. San Diego, California, USA. February 2004.


Chan RP. Lung and brain manifestations of HHT. 11th Annual International HHT Conference. October 17-19, 2003; Dallas, Texas.

Chan RP. Pulmonary AVM embolotherapy: The Toronto HHT Centre experience. Advanced course for the diagnosis and treatment of hereditary hemorrhagic telangiectasia. June 28-30, 2004; Yale University School of Medicine, New Haven, CT.


Dubcenco E, Petroniene R, Jeejeebhoy KN, Zalev AH, Gardiner GW, Irvine EJ, Baker JP. Diagnosing Crohn’s disease (CD) of the small bowel: should capsule endoscopy be used? CE vs


Hanson J, Power N, Atri M. Ultrasound guided thrombin injection of iatrogenic groin pseudoaneurysm: Doppler features, technical tips, and causes of failure. ARRS 2004 Miami Beach, Florida (Exhibit).


Kam A, Causer P, Hill K, Warner E. MRI detected ductal carcinoma in situ: 5 year progress findings on annual screening of women at high risk for hereditary breast cancer. (Award for certificate of Merit) (ARRS 2004, Miami Beach Florida)


Lan F, Chan RP, David E, Common AA. Comparison of Tris-acryl microspheres and polyvinyl alcohol for uterine fibroid embolization. 29th Annual Scientific Meeting of the Society of Interventional Radiology; March 27, 2004; Phoenix, AZ.


Martel AR, Morgan PS, Daniels LR, Delay GS, Moody AR. Measuring clot volumes using watershed segmentation algorithms. ISMRM 2003

McGregor C, Atri M, Power N, McInnes M, Rahnavardi K, Law C. Mechanical small bowel obstruction: Comparison of unenhanced and enhanced multidetector helical CT. ARRS 2004 Miami Beach, Florida


Milic A, Chan RP, Prasad V, Faughan ME. Reperfusion of pulmonary arteriovenous malformations following embolotherapy: Imaging features and management. 29th Annual Scientific Meeting of the Society of Interventional Radiology; March 27, 2004; Phoenix, AZ.


Morgan PS, Moody AR, Martel AL, Cooper AD. Dynamic contrast enhanced whole brain perfusion using a rapid 3D T1-weighted sequence. Proc ISMRM 2003 page 2196.


Navarro O, Daneman A, Miller SF. Small bowel volvulus in complicated meconium ileus: Demonstration on contrast enema. 41st Congress European Society of Paediatric Radiology, Heidelberg, Germany, June 2004

Navarro O, Epelman M, Miller SF. Imaging of the diaphragm in neonates and young infants, with special emphasis on diaphragmatic motion. Society for Pediatric Radiology 47th Annual Meeting, Savannah, Georgia, April-May 2004


Tejada J, Chaloupka J, Lee SK, Ugurel M, Hsu SW. Emergency repair of an iatrogenic MCA dissecting aneurysm after angioplasty using the neuroform self-expanding microstent. 42nd


Thomas K, Parnell-Parmley J, Haidar S, Charcot E, Krajewski C, BenDavid G. Calculation of effective doses for paediatric radiological investigations or So how many Chest X-rays is that? European Society of Paediatric Radiology, Heidelberg, Germany 2004


Traubici J, Epelman M, Daneman A, Malviya M, Parvez B. Portal vein thrombosis (PVT) in neonates and young infants spectrum of radiological findings with emphasis on high resolution ultrasound (HRUS). The Society for Pediatric Radiology April 28-May 1, 2004 Savannah, GA


Yang Y, Foltz W, Hong J, Stainsby J, Dharmakumar, Merchant N, Wright G. MR feasibility study of global left ventricular myocardial oxygen consumption in normal volunteers:


AWARDS AND SPECIAL RECOGNITION

Causer P. Department of Medical Imaging Research & Development Award, 2003 – present.


RESEARCH PROGRAM

The Research Program

Many of the faculty, residents, and fellows in the Department of Medical Imaging devote considerable effort to research. Research is an important mission of the Department of Medical Imaging. The nature of this research depends primarily on the interest and expertise of individuals and on resources at particular hospitals. In addition, the department promotes certain research topics, including the development and evaluation of imaging methods, such as magnetic resonance (MR) imaging, percutaneous and transvascular treatment methods, use of contrast agents, and most recently, minimally-invasive diagnosis and therapy.

Approximately eight years ago, an aggressive program to enhance research within the Department was initiated. The Research Program was created in 1992 with two main objectives:

- to encourage more faculty to participate in research related to radiological observations and procedures;
- to allow at least a few of the faculty to perform intensive medical imaging research

The two objectives are being pursued through several initiatives, involving contributions to the salary of a small number of faculty, shared access to certain resources, and an annual forum for highlighting research accomplishments. A synopsis of the key initiatives is presented below. Also included below are the research grants and publications of the faculty who are not listed with one of the affiliated hospitals.

The Medical Imaging Research and Development Awards (Protected Research Time)

The Medical Imaging Research and Development Awards have been our most successful initiative. These awards allow a select group of radiologists to devote at least one day each week to a particular research project. The radiologists listed in the table below were awarded the Medical Imaging Research and Development Award in 2003-2004.

<table>
<thead>
<tr>
<th>Award Holder</th>
<th>Hospital</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mostafa Atri</td>
<td>SWCHSC</td>
<td>Accuracy of Unenhanced Helical CT and Added Value of Enhanced CT in the Assessment of Acute Abdomen</td>
</tr>
<tr>
<td>Susan Blaser</td>
<td>HSC</td>
<td>Correlation of Radiologically Determined Labyrinthine Dysplasias with Audiometric Data and Prediction of Response to Cochlear Implantation</td>
</tr>
<tr>
<td>Petrina Causer</td>
<td>SWCHSC</td>
<td>ACRIN 6667: MRI Evaluation of the Contralateral Breast in Women with a Recent Diagnosis of Breast Cancer</td>
</tr>
<tr>
<td>Bairbre Connolly</td>
<td>HSC</td>
<td>Prospective Evaluation of the Safety and Efficacy of Sonographically Guided Tendon Sheath Injections in Children</td>
</tr>
<tr>
<td>Marcus Dill-Macky</td>
<td>UHN/MSH</td>
<td>Radiofrequency Ablation of Hypervascular Liver Lesions: Prediction of Success Using Contrast Enhanced Ultrasound</td>
</tr>
<tr>
<td>Name</td>
<td>Institution</td>
<td>Title</td>
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<tr>
<td>Richard Farb</td>
<td>UHN/MSH</td>
<td>Idiopathic Intracranial Hypertension: The Prevalence and Morphology of Sinovenous Stenosis</td>
</tr>
<tr>
<td>Roberta Jong</td>
<td>SWCHSC</td>
<td>The ACRIN Digital Mammography Imaging Screening Trial</td>
</tr>
<tr>
<td>Korosh Khalili</td>
<td>UHN/MSH</td>
<td>The Utility or Futility of a Second Imaging Test in the Assessment of Acute Abdominal Pain in Patients Presenting to the Emergency Department</td>
</tr>
<tr>
<td>Derek Muradali</td>
<td>SMH</td>
<td>Contrast Enhanced Sonography of Breast Nodules and Lymph Nodes: Vascular Morphology and Pathologic Correlation</td>
</tr>
<tr>
<td>Dawn Pearce</td>
<td>SMH</td>
<td>Weight-bearing CT Scan of the Feet</td>
</tr>
<tr>
<td>Manohar Shroff</td>
<td>HSC</td>
<td>Emergency Cervical Spine X-rays in Children: Differences in Interpretation by Subspecialization</td>
</tr>
<tr>
<td>Lawrence White</td>
<td>UHN/MSH</td>
<td>Quantitative T2 Mapping of Cartilage Transplantation in an Animal Model</td>
</tr>
<tr>
<td>Stephanie Wilson</td>
<td>UHN/MSH</td>
<td>Characterization of Indeterminate Hepatic Nodules in High-Risk Patients for Hepatocellular Carcinoma with Contrast-Enhanced Ultrasound</td>
</tr>
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**RSNA Resident/Fellow Research Award**

The RSNA Research and Education Fund offers an award annually to recognize and encourage outstanding residents and fellows in radiology research. The award is for one resident or fellow in each training program in North America who is deemed to have participated meaningfully in research during the previous year.

**Research Day**

Our Annual Research Day was held on April 29, 2004. It consisted of presentations from senior residents, the faculty who received the Medical Imaging Research and Development Awards, and many other members of the department. An excerpt from the Program for Research Day is included at the end of this section.

**Positron Emission Tomography Centre, Centre for Addiction and Mental Health**

The University of Toronto Positron Emission Tomography (PET) Centre is under the direction of Dr. Sylvain Houle. Investigations concentrate on schizophrenia, mood and anxiety disorders, cognitive neuroscience, aging and dementia, movement disorders, and PET methodology.

**Imaging/Bioengineering Research, SWCHSC**

Imaging research is a major focus of the Imaging/Bioengineering Research group at Sunnybrook and Women’s College Health Sciences Centre (SWCHSC). Scientists in this group have University of Toronto appointments in the Department of Medical Biophysics, or the Department of Medical Imaging, or both. The faculty in this group make use of exceptional resources for research at SWCHSC and conduct research involving x-ray, nuclear medicine, magnetic resonance, and ultrasound technology. This group is internationally recognized for its excellent graduate student program.
Real-Time / Interventional Group

Chris Macgowan: This project deals with the development of real-time techniques for flow visualization. This involves phase contrast methods, velocity-spectroscopy via pencil-beam excitation, and Doppler techniques. The applications of these techniques include the characterization and quantification of regurgitation and shunts within the heart. These techniques can also be applied to the determination of pulse wave velocities in the aorta, which has implications for diseases such as Marfan’s syndrome.

Fabio Settecasse / Marshall Sussman / Tim Roberts: Endovascular procedures performed under fluoroscopic guidance often require the use of metal guidewires for steering catheters along their desired paths. The use of metal guidewires in interventional MRI is rendered problematic due to RF resonant heating of conductive metals in the MR environment, and by susceptibility artifacts. This project deals with the development of techniques for non-guidewire catheter steering. These involve the application of electric currents to the catheter, and relying on Lorentz forces to torque the wire in the presence of the main magnetic field associated with MRI. The main issues currently being addressed are the design, characterization, and optimization of the catheter design.

Marshall Sussman / Tim Roberts: An ongoing challenge in real-time imaging is improving the spatial / temporal resolution of the scans. This project deals with the development of novel k-space trajectories for accomplishing this task. Specifically, the use of undersampled trajectories is being explored for use in real-time imaging. These trajectories trade off small amount of artifacts against decreased data acquisition requirements.

Gal Sela / Marshall Sussman / Walter Kucharczyk: In surgical procedures, one must often navigate through the body based on information contained within previously acquired medical images. A major challenge associated with this task is correlating the information contained within the images with the actual coordinate system of the body. For this project, a surgical navigation system has been developed which tracks the position of surgical instruments during the surgical procedure via an infrared camera. This tracking information is displayed graphically and in real-time on top of the previously-acquired images. This allows the surgeon to directly correlate the surgical and image coordinate systems. This navigation system has been used successfully in brain biopsy procedures, as well as lymph node excisions from the abdomen.

Jeff Stainsby/ Labonny Biswas: This project involves the development of a real-time MR system from scratch. This involves two major components: The development of an external real-time interface, and achieving interactivity between the MR scanner and this interface. This system forms the basis of much of the real-time projects ongoing at UHN.

Hai-Ling Margaret Cheng: The primary focus of my research is rapid MRI quantitation methodologies (measurement of tissue relaxivity) as applied to physiological imaging of perfusion, characterization of angiogenesis, assessment of diseased or damaged tissue, and assessment of drug efficacy. Alongside these technical developments, I am also investigating more accurate and robust models and methods for characterizing the microcirculation and
measuring temperature. Rapid, volumetric, and motion-robust acquisitions are highly desirable. Clinical applications include imaging of cancer, cardiac infarcts, and neurological disorders such as epilepsy; assessing the efficacy of antiangiogenic tumor drugs or localizing labeled targeted agents; and monitoring heat-related interventional treatment.

**Faculty List**
(Academic Rank as of June 30, 20043)

<table>
<thead>
<tr>
<th>Name</th>
<th>Academic Rank</th>
<th>Position and Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timothy Roberts</td>
<td>Professor</td>
<td>Director, Research Program, UHN</td>
</tr>
<tr>
<td>John A. Rowlands</td>
<td>Professor</td>
<td>Senior Scientist, SWCHSC</td>
</tr>
<tr>
<td>Michael L. Wood</td>
<td>Professor</td>
<td>MR physicist</td>
</tr>
<tr>
<td>Martin J. Yaffe</td>
<td>Professor</td>
<td>Senior Scientist, SWCHSC</td>
</tr>
<tr>
<td>Sylvain Houle</td>
<td>Associate Professor</td>
<td>Director, PET Centre Centre for Addiction and Mental Health</td>
</tr>
<tr>
<td>Curtis B. Caldwell</td>
<td>Assistant Professor</td>
<td>Physicist, SWCHSC</td>
</tr>
<tr>
<td>Adrian Crawley</td>
<td>Assistant Professor</td>
<td>MR physicist, UHN</td>
</tr>
<tr>
<td>Andrea Kassner</td>
<td>Assistant Professor</td>
<td>MR physicist, UHN</td>
</tr>
<tr>
<td>Christopher MacGowan</td>
<td>Assistant Professor</td>
<td>MR physicist, HSC</td>
</tr>
<tr>
<td>Marshall Sussman</td>
<td>Assistant Professor</td>
<td>MR Physicist, UHN</td>
</tr>
<tr>
<td>George Tomlinson</td>
<td>Assistant Professor</td>
<td>Biostatistics</td>
</tr>
</tbody>
</table>

Dr. Marshall Sussman, MR Physicist at the University Health Network, has recently joined the Department of Medical Imaging as an Assistant Professor. Dr. Michael Noseworthy has left the Department of Medical Imaging to accept a position at the MacMaster University, Hamilton.
## Grants

Members of the Department of Medical Imaging (underlined) were investigators on the following grants, identified by the principal investigator, other investigators, project title, sponsor, total amount of grant, and start and end dates of the funding period.


**Bitar R** – CHAR/Amsterdam Health Development Award, First Canadian Recipient, $12,000.

**Caldwell CB, Mah K, Turksen IB, Ung YC, Danjoux CE, Ehrlich LE** – Principle Investigators. “A Fuzzy logic expert system for radiation targeting” Philips Medical Systems, Inc. $125,000/year (2 years total) 2004-2005


**Cheyne D** - Co-Investigator. CIHR – New Emerging Team (NET) Grant “Inattention, impulsiveness, and restlessness in childhood: heritability, genetics, neuropsychology and psychophysiology (KIDNET).” $1,249,585, 2002 – 2007.


**Crawley A** – Co-investigator. CIHR Operating Grant, PI: L deNil  Neuroimaging studies of auditory processing in individuals who stutter, $82,344 pa 2004-2009

Henkelman RM (Principal Investigator), Bronskill MJ, Burns PN, Foster FS, Plewes DB, Rowlands JA, Wright GA, Yaffe MJ. NCI Canada (Terry Fox Program Project) “Medical Imaging for JA Cancer” $C 1,425,844 pa 07/2001 – 06/2006

Kasap SO, Rowlands JA. NSERC (Strategic Grant) “Direct Conversion Flat Panel X-ray Image Detectors for Medical Imaging” $C 87,500 pa 10/2002 - 10/2005

MacGowan C – Co-Investigator: Sun Microsystems Canada Equipment Competition: Computing Infrastructure for Cardiovascular and Brain Research. $193,000, 2002/03

MacGowan C – Collaborator, Canadian Institutes of Health Research, Development of MR Imaging to Measure Arterial Pulse Pressure and Vessel Distension: $40,000 annually, 2001/09 - 2003/08

Mah K, Caldwell CB, and Danjoux C – Principle Investigators. “Can \(^{18}\)FDG-PET images provide the 3D extent of lung tumour motion for individualized radiation targeting?” National Cancer Institute of Canada Operating Grant. $63,000/year (2 years total). 2002-2003


Oram-Cardy J. CIHR Post-Doctoral Fellowship, $47,500 stipend plus $3,500 pa, 2003-2005

Pisano ED, Yaffe MJ, et al. Trial of Digital Mammography versus Screen-Film Mammography, US National Institutes of Health/ACRIN CA80098, $208,900 USD, 06/01/01 - 05/30/04

Roberts TPL. CIHR Fellowship. Postdoc: Oram J, “Functional neuroimaging of language disorders” 5/03-6/04, $100,000 CDN

Roberts, TPL. Canada Research Chair in Imaging Research. $500,000. 1/2002-12/2006

Roberts TPL. National Alliance For Autism Research (NAAR), Principal Investigator, "Neural correlates of phonological processing in individuals with autism". 7/01-6/03, $ 96,273

Roberts TPL. National Alliance For Autism Research (NAAR), Principal Investigator, "MEG Correlates of Linguistic Processing At and Below the Word Level in Autism" 7/01-6/03, $ 119,918


Rowlands JA (Principal Investigator), Zhao W, Pang G and Fahrig R. National Institutes of Health “Low cost x-ray imager using liquid crystals: Application of x-ray light valves to very low cost chest x-ray imagers” SUS 225,000 pa 08/2003 - 06/2008
Rowlands JA (Principal Investigator), Robert N, Fort S. Image Guided Optimisation of X-ray Cardiac Angiography, Canadian Institutes of Health Research (Operating Grant), $C 75,121, 01/10/2002 – 30/09/2005

Rowlands JA. + 9 Co-applicants, Imaging Research Centre for Cardiac Interventions, Ontario Innovation Trust, $C 6,109,294 total, 06/2002 - 06/2005

Rowlands JA – Co-Investigator (Wright G, PI) Ontario R&D Challenge Fund “Cardiac Imaging Centre of Excellence (Cardiac Flat Panel Imagers)” $C 3,118,244 pa 01/2001 - 12/2005


Zhao W, Rowlands JA, Street R, National Institutes of Health “Flat panel x-ray imaging detector with avalanche gain” $US 350,000 pa 08/2003 - 06/2008

Publications


Schwartz RA, Greenwald ER, Fletcher PJ, Houle S, DaSilva JN. Up-regulated dopamine D1 receptor binding can be detected in vivo following repeated SCH 23390, but not SKF 81297 or 6-hydroxydopamine, treatments. Eur J Pharmacol. 2003 Jan 17;459(2-3):195-201.


Books or Book Chapters


Abstracts and Scientific Presentations


Hunt D, Rowlands JA. The use of avalanche multiplication to eliminate noise in a-Se based flat panel x-ray detectors in the application of fluoroscopy. Young Investigators' and Image-Guided Therapy Symposium organized by The Great Lakes Chapter of the American Association of Physicists in Medicine (AAPM) held at London Regional Cancer Centre, November 2004. 15 young investigators participated in the symposium and Dylan received the Young Investigators Prize.


**Patents**


Roberts TPL, Cavagna F, “Biliary acid compounds for MRI determination of microvascular permeability”, WO 01/82974 A2, issued July 2004

Roberts TPL, Flagg E, Sussman MS, “A device to eliminate coil displacement artifacts from parallel MRI”, patent pending (filed 11/2003)
JA Rowlands, Wei Zhao, “An Indirect Flat-panel Detector with Avalanche Gain” (disclosure filed 2003)

Sussman MS, Merchant N, Wright GA, White LM. Method for Motion Correction in Magnetic Resonance Imaging Based on Selecting Data from the Similarity of Direct Navigator Echoes, (disclosure filed, 2004)

**Invited Presentations**


Kassner A. Imaging cerebrovascular reactivity – University of Lund, Sweden

Kassner A. Advanced imaging in cerebrovascular disease – GE Healthcare, Malmoe, Sweden

Kassner A. Biological imaging of brain tumors - Rostoker Lecture, UofT


Roberts TPL. “Advances in MRI” GE Multimodality Seminar, Toronto, Canada, November 2003.

Roberts TPL. “High field MRI”, Neuroscience Grand Rounds, TWH, Toronto, Canada, November 2003

Roberts TPL. “Imaging Brain Waves” The Annual nd Fanny Rostoker Lecture, Toronto, Canada, October 2003.

Roberts TPL. “Physiologically Specific Imaging” MSY1010 Institute of Medical Science, University of Toronto, October 2003.


Roberts TPL. “Microvascular Permeability”, Neuro MiniSymposium, Technical Institute, Zuerich, Switzerland, August 2003.


Roberts TPL. “Biological Imaging”, Finding a Cure for Glioblastoma Summit, Cleveland Clinic, Cleveland, OH, July 2003


Yaffe MJ. Detector Technology for Digital Mammography, 7th International Workshop of Digital Mammography, Raleigh NC, June 2004


**Teaching -- Hours of Lectures**

<table>
<thead>
<tr>
<th>Faculty Member</th>
<th>Students</th>
<th>Residents, Fellows, Faculty</th>
<th>Technologists</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.B. Caldwell</td>
<td>4</td>
<td>10 (30 additional hours every 2 years)</td>
<td>10</td>
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<td>S. Houle</td>
<td>10</td>
<td>20</td>
<td>10</td>
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<tr>
<td>T.R. Roberts</td>
<td>6</td>
<td>10</td>
<td>2</td>
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<tr>
<td>J.A. Rowlands</td>
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<tr>
<td>M.L. Wood</td>
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<tr>
<td>M.J. Yaffe</td>
<td>10</td>
<td>38</td>
<td>3</td>
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</tbody>
</table>
Current research projects:

1. **Prediction of hemorrhage in acute ischemic stroke using permeability MRI**

   Increased risk of intracranial hemorrhage limits the general use of tissue plasminogen activators (t-PA) in acute ischemic stroke (AIS). Preliminary results of this study show that early blood-brain-barrier (BBB) defects in AIS can be assessed using quantitative DCE MRI. Significantly increased permeability was found in 3 cases which later hemorrhaged. This method indicates the potential to identify patients at higher risk of HT and may allow to use physiological imaging rather than time from onset of symptoms to guide the decision to treat with t-PA.

   **Collaborators:** David Mikulis, TWH; Frank Silver, TWH; Keri Taylor, TWH, Tim Roberts

2. **CVR and perfusion measurements in MM disease**

   There are two primary methods currently used for assessing blood flow abnormalities in patients with Moyamoya disease. These are resting perfusion techniques and vasoactive challenge methods. This study integrates resting perfusion measurements using dynamic contrast-enhanced susceptibility MRI with measurements of cerebral vascular reactivity with a CO₂ challenge using BOLD MRI to provide a comprehensive characterization of the vascular dysfunction in Moyamoya disease.

   **Collaborators:** David Mikulis, TWH; Adrian Crawley, TWH, Tim Roberts (UofT)

3. **Tissue classification in brain tumors**

   Physiological MR imaging including diffusion (to assess tumor cellularity), dynamic contrast-enhanced (DCE) MRI (to assess blood volume and microvascular permeability related to angiogenesis) and spectroscopy (to assess metabolism) offer insights into aspects of tumor physiology and metabolism, thus allowing characterization of tumor dysfunction. These techniques will assist with tumor grading as well as surgical planning and monitoring of cancer related therapies. Furthermore the use of combinatorial approaches such as factor analysis may yield even higher specificity in determining prognosis and treatment response.

   **Collaborators:** Ab Guha, Tim Roberts, Amparo Wolf

4. **CVR BOLD imaging in healthy volunteers**

   Combining CO₂ manipulation with BOLD MRI is a promising for assessing regional differences in cerebrovascular reactivity (CVR) which is a measurement of the brains autoregulatory
capacity which is important for the assessment of vascular disorders in which autoregulation is compromised or exhausted. Since this technique is beginning to be used pre-operatively to guide surgical decision making and to assess efficacy of revascularization, knowledge concerning reproducibility is essential. This study provides quantitative CVR measurements by correlating BOLD MR signal intensity with square wave changes in end-tidal pressure of CO2 ($p_{ET}$ CO$_2$) and demonstrates excellent reproducibility of this method.

Collaborators: Julien Poublanc, Adrian Crawley, David Mikulis

5. ASL

Flow-sensitive alternating inversion recovery (FAIR) is a pulsed arterial spin-labeling method which acquires pairs of inversion recovery images following a slice-selective and non-selective inversion pulse. The difference image for each individual pair usually has a low signal-to-noise ratio (SNR) and therefore multiple pairs of images are acquired and averaged. In this paper we compare a gated version of FAIR vs a non-gated FAIR approach to improve SNR by impacting both the individual difference signal for each pair as well as the averaged signal for all pairs. Gated-FAIR improves SNR at TI values less than approximately 1.0 seconds.

Collaborators: Nasim Maleki, Jeff Stainsby, Tim Roberts

6. Imaging of angiogenesis in experimental arthritis

Juvenile idiopathic arthritis is a chronic disease that may impair any joint of the body. It produces inflammation of the synovium, which is a highly vascularized membrane that overlies the bones at the joints. The inflamed synovium in arthritis erodes the adjacent cartilage and bone. The sooner the arthritis is treated, the milder is the progression of the disease. Although conventional imaging modalities exist to evaluate the degree of inflammation and degeneration of the articular cartilage, such as anatomic magnetic resonance imaging, they are unable to depict articular changes before the joint is destroyed. In this study we plan to induce arthritis in rabbit knees and to determine whether functional magnetic resonance imaging such as permeability or BOLD imaging is able to monitor the response of the joints to treatment using non-steroidal antiinflammatory drugs and a technique of continuous movement of the rabbit legs by means of a machine which is called continuous passive motion.

Collaborators: Andrea Doria, Tim Roberts, Adrian Crawley

7. Andrew Baines

Hemoglobin-based-oxygen-carriers (HBOC) are being developed as a substitute for human blood to replace blood loss and ensure adequate oxygen delivery. Vasoconstriction limits the effectiveness of HBOC. To reduce the vasoconstrictor response the NO and O2 affinity and diffusivity of HBOC have been modified. The effect of these HBOC on intrarenal pO2 and blood
flow distribution is not known. We therefore aim to develop methods for quantitating intrarenal blood flow and hemoglobin oxygenation following infusions of HBOC in a rat model. Renal deoxyHb levels will be rapidly assessed during and subsequent to HBOC injection using BOLD-MRI. Renal blood flow will be quantified with dynamic MRI (Gd-DPTA injection). Blood pressure will be monitored with an MRI compatible transducer. Hb content of cortex and medulla will be measured at the end of experiments.

Collaborators: Andrew Baines, Chris McGowan

8. fMRI pre-op mapping

Currently surgery is often used in the management of patients with brain tumours. However, there is a trade-off between the margin of excision used to ensure complete removal and the potential loss of function that may arise as a consequence of removing normal surrounding brain tissue. There are several invasive approaches used in neurosurgery to define eloquent areas of the cortex prior to surgical excision. One approach is to perform electrophysiological mapping of the cortex in the awake patient at the time of the operation. A second approach routinely used prior to surgery for epilepsy is the Wada test, where the predominant side of the brain used for language and memory is identified by the invasive sequential injection of sodium amytal (which transiently stops the brain from working) into each of the two main blood vessels supplying different sides of the brain, during standard neuropsychological testing. This test is highly invasive and very costly. An alternative non-invasive approach is to use fMRI to localise activations associated with important tasks such as limb movement or speech production. A number of groups have now reported the effectiveness of fMRI in correctly identifying the localisation of the main motor strip or language area pre-operatively in patients with lesions near these eloquent regions. We are currently investigating this in brain tumor patients with the view that further refinement of these techniques may lead to the discontinuation of the former expensive and invasive approaches.

Collaborators: Elissa Flagg, Tim Roberts, Ab Guha

9. Blood transit time maps

Cerebrovascular reactivity (CVR) is a measure of the brain’s autoregulatory capacity and can be measured using BOLD MRI combined with inhaled CO₂ manipulation. Although the magnitude of the BOLD signal is primarily employed to assess the reactivity of the cerebral vasculature, the temporal delay of the BOLD response may contain useful information concerning blood transit times. In this study, we calculated the time delay differences between vascular territories of the anterior, middle, and posterior cerebral arteries as well as white compared to overall grey matter, which were in line with what authors have reported previously for DSC imaging.

Collaborators: Julien Poublanc, Adrian Crawley, David Mikulis
1) **ROI-based analysis of fMRI activation signal height and extent using a mixture model approach.**

   a) We have demonstrated that false negative errors that occur with simple thresholding can be successfully avoided by fitting the distribution of signals within a ROI to a mixture model (i.e. either non-activated or activated voxels). This is particularly important for unbiased spatial extent estimation. We have also shown that height x extent as a measure of overall activation is far more robust than the usual estimate of number of suprathreshold pixels.

   b) Paper almost finished; abstract to be submitted to HBM 2005.

2) **Cerebral vascular reactivity (CVR) delay maps (with Julien Poublanc and Andrea Kassner)**

   a) For specific grey and white matter ROIs, we have measured relative delays in the onset of BOLD signal increase due to vasodilation caused by increased pCO2 that compare to known values in blood transit times.

   b) Future work: extend method to generate actual delay time maps rather than ROI analyses; reanalyze patient CVR data to produce delay maps for correlation with blood transit time maps calculated from gadolinium DSC scans. Abstract submitted to ISMRM 2005.

3) **Oxygen extraction mapping (with Andrea Kassner and David Mikulis)**

   a) We repeated other investigators’ experience with using CO2 reactivity + ASL to calibrate the BOLD effect (in terms of each subject’s particular baseline dHb concentration) to enable change in CMRO2 to be estimated from a standard fMRI experiment.

   b) Realizing that the method cannot produce baseline CMRO2 measurements, we intend to shift our focus to methods that measure OEF from large veins or possibly use a range of CO2 to produce a range of blood flow in the tissue of interest in order to estimate OEF from the slope of BOLD signal as a function of blood flow. Our preliminary work with the baseline dHb calibration procedure has indirectly motivated a CVR reproducibility study - being conducted by Julien Poublanc and Andrea Kassner – at two points in female subjects’ menstrual cycle.

My areas of research activity are as follows:

1) Cardiac:

I have primarily been involved in two different areas of research for cardiac imaging: motion compensation and T2 mapping. I will discuss each of these in turn.

The first area of my research deals with the development of techniques for motion compensation. This technique is known as the SIMNAV method. The advantage over conventional methods is that it uses the image data itself, rather than external devices such as ECG, to correct for motion. As a result, it is potentially more accurate and robust than conventional motion compensation methods. An additional advantage is that this approach may be applied to any type of motion. As a result, there are a broad range of applications. To date, we have explored the applications of cardiac imaging and the assessment of joint kinematics with this technique. Other areas, such as abdominal and neuro imaging, are planned for the future. At the present time, we have hired a research engineer out of the ORDCF cardiac budget to work on this project. In the past year, this work has resulted in 2 abstract publications and 1 patent filing.

A second area of interest in cardiac imaging is T2 mapping. To date, we have successfully implemented at UHN a T2 mapping pulse sequence, as well as T2 mapping post-processing software. The T2 value of tissue can potentially provide information in a broad range of disease processes. At the present time, we are using it to assess the state of the myocardium in patients with cardiomyopathies. In the future, we intend to apply these techniques to other clinical applications including patients with thalassemia, and the quantification of blood oxygen level. In the past year, this work has resulted in 1 manuscript publication.

2) Musculoskeletal:

I have primarily been involved in three different areas of research for MSK imaging: T2 mapping, diffusion-weighted imaging, and joint kinematics. I will discuss each of these in turn.

The first area of my research in MSK imaging is T2 mapping. As with the cardiac T2 mapping projects discussed above, we have implemented a T2 mapping pulse sequence, as well a number of different versions of T2 mapping post-processing software. A major focus of this study was the evaluation of cartilage degeneration in surgically-treated horse knees. This project was carried out under funding provided by a Canadian Arthritis Foundation (CAN) grant. T2 maps were obtained from a total of 10 horse knees. At the present time, analysis of the data is ongoing. Manuscript preparation will follow. All of this work was performed under the assumption of pure monoexponential T2 decay. We have also begun some investigations into more sophisticated T2 mapping techniques, employing multi-exponential T2 decay. This was the focus of a co-op student project. Data analysis is under way.

A second area of interest is in diffusion-weighted imaging of cartilage. Since cartilage is relatively thin (~2-3mm), high-resolution images are required. Unfortunately, this presents a
significant challenge for conventional diffusion-weighted imaging techniques, specifically single-shot EPI (SS-EPI). This is challenging because SS-EPI is sensitive to off-resonance effects, which gives rise to image warping and blurring. As a consequence, we have begun to explore the use of a new pulse sequence, diffusion-weighted (DW) PROPELLER to cartilage. DW-PROPELLER is a multi-shot fast spin echo technique. Preliminary results have demonstrated significantly less off-resonance sensitivity than conventional SS-EPI. In the past year, this work has resulted in 2 abstract publications.

A third area of interest in MSK is the imaging of joint kinematics. The technical development for this project is derived from the SIMNAV technique, developed as part of the cardiac research project described above. As mentioned earlier, this general motion compensation strategy can be applied to almost any type of motion. Currently, we are investigating its use in the imaging of joint kinematics.

3) Interventional MRI:

I have primarily been involved in two different areas of research for interventional imaging: Surgical navigation and catheter steering. I will discuss each of these in turn.

In surgical procedures, one must often navigate through the body based on information contained within previously acquired medical images. A major challenge associated with this task is correlating the information contained within the images with the actual coordinate system of the body. For this project, a surgical navigation system has been developed which tracks the position of surgical instruments during the surgical procedure via an infrared camera. This tracking information is displayed graphically and in real-time on top of the previously-acquired images. This allows the surgeon to directly correlate the surgical and image coordinate systems. This navigation system has been used successfully in brain biopsy procedures, as well as lymph node excisions from the abdomen.

Endovascular procedures performed under fluoroscopic guidance often require the use of metal guidewires for steering catheters along their desired paths. The use of metal guidewires in interventional MRI is rendered problematic due to RF resonant heating of conductive metals in the MR environment, and by susceptibility artifacts. This project deals with the development of techniques for non-guidewire catheter steering. These involve the application of electric currents to the catheter, and relying on Lorentz forces to torque the wire in the presence of the main magnetic field associated with MRI. The main issues currently being addressed are the design, characterization, and optimization of the catheter design.

4) Miscellaneous:

I am also involved in various other miscellaneous projects. These include the development of novel data acquisition strategies (Spiral-PR), the development of real-time MR techniques, the development of motion tracking algorithms, the development of parallel imaging methodologies, the investigation of novel diffusion-weighted imaging strategies, and the development of MEG signal processing strategies. In total, this work has resulted in 6 manuscripts (2 published, 2 in press, 2 submitted), 5 abstracts, and 1 patent filing.
# Department of Medical Imaging Annual Research Day 2004

**Date:** Thursday, April 29, 2004  
**Location:** Sadowski Auditorium, 18th Floor, Mount Sinai Hospital  
**Starting Time:** 12:30 pm with welcome by Walter Kucharczyk

<table>
<thead>
<tr>
<th>Session Chairs: Mostafa Atri and Martin O’Malley</th>
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<tbody>
<tr>
<td><strong>Body Imaging I</strong></td>
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<tr>
<td>12:35 Ants Toi</td>
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<tr>
<td>How Early Are Fetal Cerebral Sulci Visible and When Can Lissencephaly Be Suspected?</td>
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<tr>
<td>12:43 Katherine Fong</td>
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<tr>
<td>Ultrasound Detection of Fetal Anomalies in the First Trimester in Conjunction with Nuchal Translucency Screening: A Feasibility Study</td>
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<tr>
<td>12:51 Mostafa Atri</td>
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<tr>
<td>Mechanical Small Bowel Obstruction: Comparison of Unenhanced and Enhanced Multidetector Helical CT</td>
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<td>12:59 Alexander Coret</td>
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<td>Does Stress Increase the Size of the Adrenal Glands on Cross Sectional Imaging?</td>
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<tr>
<td>1:07 Wayne Deitel</td>
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<tr>
<td>The Radiologic Appearance of Recurrent Ileal Crohn's Disease</td>
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<tr>
<td>1:15 Sangeet Ghai</td>
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<tr>
<td>Ultrasound Imaging in Uterine Artery Embolization Patients: Pre-Procedure Evaluation and Post-Procedure Imaging Findings</td>
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<tr>
<td>1:23 Hyun-Jung Jang</td>
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<tr>
<td>Characterization of Indeterminate Hepatic Nodules in High-Risk Patients for Hepatocellular Carcinoma with Contrast-Enhanced Ultrasound</td>
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<tr>
<td>1:31 Tae Kyoung Kim</td>
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<tr>
<td>Contrast Enhanced Pulse Inversion Sonography of Liver Tumors: Why Is There Discordance with Contrast-Enhanced CT or MR Scan?</td>
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<tr>
<td>1:39 Blair MacDonald</td>
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<td>Relationship between Vascular and Biliary Anatomy in Live Liver Donors</td>
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<tr>
<td>1:47 Martin O’Malley</td>
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<tr>
<td>Small (10 - 20mm) Arterial Phase Enhancing Nodules on Triphasic CT in Patients at Risk for Hepatocellular Carcinoma</td>
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**Break (15 minutes)**

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<thead>
<tr>
<th><strong>Body Imaging II</strong></th>
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<tbody>
<tr>
<td>2:10 Monica Epelman</td>
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<tr>
<td>Portal Vein Thrombosis (PVT): Spectrum of Clinical and Radiological Findings in Neonates and Young Infants with Emphasis on High Resolution Ultrasound (HRUS)</td>
</tr>
<tr>
<td>2:18 Michael Stefanos</td>
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<tr>
<td>Agreement Rates between Functional and Morphological Imaging for Pretreatment Assessment of Non-Hodgkin’s Lymphoma Patients</td>
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<tr>
<td>2:26 Aaron Glickman</td>
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<tr>
<td>Dynamic MR Perfusion Imaging of Anterior Cruciate Ligament Autografts</td>
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<tr>
<td>2:34 Petrina Causer</td>
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<tr>
<td>6 Year Results Comparing Annual Breast Mammography, Ultrasound, MRI and Clinical Exam for Screening Women at High Risk for Hereditary Breast Cancer</td>
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<tr>
<td>2:42 Lenny Grinblat</td>
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<tr>
<td>The Radiology of Severe Acute Respiratory Syndrome (SARS): Radiographic Examination of 46 Confirmed Cases in Toronto, Canada</td>
</tr>
<tr>
<td>2:50 Anuradha Rao</td>
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<tr>
<td>High Resolution Computed Tomographic Findings in Patients Exposed to Mustard Gas with Pulmonary Function Test Correlation</td>
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<tr>
<td>2:58 Sarah Koles</td>
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<tr>
<td>Pneumothorax Post Thoracic FNA: Is There A Role For Post Biopsy CT?</td>
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<tr>
<td>3:06 Naeem Merchant</td>
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<td>MRI and the Evaluation of Atrial Septal Defects</td>
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<td>3:14 Demetris Patsios</td>
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<td>Lung Cancer Screening using Low-Dose Computed Tomography in Toronto: The Experience So Far</td>
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<tr>
<td>3:22 Marshall Sussman</td>
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<tr>
<td>A New Method for MR Imaging of Moving Anatomy</td>
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</table>
Neuroimaging  
Session Chairs: David Mikulis and Tim Roberts

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<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Title</th>
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<tbody>
<tr>
<td>3:30</td>
<td>Ellen Charkot</td>
<td>Pediatric Patient Doses in Interventional Neuroradiology</td>
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<tr>
<td>3:38</td>
<td>Elissa Flagg</td>
<td>Auditory Processing of Native Language Speech-Sound Combinations: An MEG Study</td>
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<tr>
<td>3:46</td>
<td>Andrea Kassner</td>
<td>Blood-Brain-Barrier Hyperpermeability in Acute Stroke</td>
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<tr>
<td>3:54</td>
<td>David Mikulis</td>
<td>Can MRI Replace CT for the Exclusion of Acute Intraparenchymal Hemorrhage in Patients Presenting with Acute Stroke Syndrome?</td>
</tr>
<tr>
<td>4:02</td>
<td>Janis Oram Cardy</td>
<td>Magnetoencephalography Reveals Rapid Temporal Processing Impairment in Autism</td>
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<tr>
<td>4:10</td>
<td>Clara Ortiz</td>
<td>Neurological Compromise in Extramedullary Hematopoiesis</td>
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<tr>
<td>4:18</td>
<td>Adrian Crawley</td>
<td>Effect of Task-Correlated Motion on FMRI Data</td>
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4:26  
Break (20 minutes)

Vascular and Interventional Radiology  
Session Chairs: Peter Chait and Andrew Common

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
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<tbody>
<tr>
<td>4:46</td>
<td>Rob Beecroft</td>
<td>Risk of Intrauterine Infectious Complications After Fibroid Embolization in Patients with Submucosal Fibroids</td>
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<tr>
<td>4:54</td>
<td>Richard Bitar</td>
<td>MR of Complicated Plaque</td>
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<tr>
<td>5:02</td>
<td>Marc Freeman</td>
<td>Percutaneous Vertebroplasty Results in the Reversal of Height Loss and Spinal Deformity in Patients with Osteoporotic and Pathologic Compression Fractures</td>
</tr>
<tr>
<td>5:10</td>
<td>C.S. Ho</td>
<td>Percutaneous Ethanol Injection of Medium to Large Hepatomas Using a Multi-Pronged Needle: Efficacy and Safety</td>
</tr>
<tr>
<td>5:18</td>
<td>Jeff Jaskolka</td>
<td>Needle Tract Seeding After Radiofrequency Ablation of Hepatic Tumors</td>
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<tr>
<td>5:26</td>
<td>John Kirby</td>
<td>CT Angiography for Endoleak: Is a Tri-Phasic Study Required?</td>
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<tr>
<td>5:34</td>
<td>Fred Lan</td>
<td>Comparision of Tris-Acryl Gelatin Microspheres and Polyvinyl Alcohol for Uterine Fibroid Embolization</td>
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<tr>
<td>5:42</td>
<td>Marc Ossip</td>
<td>Radiofrequency Ablation of Liver Tumors: Survival, Local Progression, and Factors for Failure of Effectiveness</td>
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<tr>
<td>5:50</td>
<td>Vikash Prasad</td>
<td>Coil Embolotherapy of Pulmonary Arteriovenous Malformations: Efficacy of Platinum Versus Stainless Steel</td>
</tr>
<tr>
<td>5:58</td>
<td>Dheeraj Rajan</td>
<td>Outcomes of Dysfunctional Autogenous Hemodialysis Fistulas After Angioplasty: Are there Clinical Predictors of Patency?</td>
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<tr>
<td>6:06</td>
<td>Andrea Milic</td>
<td>Reperfusion of Pulmonary Arteriovenous Malformations Following Embolotherapy</td>
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<tr>
<td>6:22</td>
<td>Dan Mozeg</td>
<td>Assessing the Value of CT-Enteroclysis in the Diagnosis of Small Bowel Disease</td>
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<tr>
<td>6:30</td>
<td>Ashley Robinson</td>
<td>MR Imaging of the Fetal Cerebellar Vermis in Utero: Description of some useful Anatomical Criteria for Normal and Abnormal Development</td>
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<tr>
<td>6:38</td>
<td>Susan Blaser</td>
<td>Cochlear Nerve Hypoplasia in CHARGE Association</td>
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<tr>
<td>6:46</td>
<td>Stephanie Wilson</td>
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6:54  
Walter Kucharczyk  
Closing comments
RESIDENT TRAINING PROGRAM

General Description

There were 53 residents in our program in the 2003-2004 year. The five-year program consists of one year of preliminary clinical training (PGY1), followed by four years of training in medical imaging.

The university-wide integration and rotational system ensures that each resident will have access to all the strengths of our large and expert faculty and the huge volume of clinical pathology. Residents have the opportunity to train at several large modern hospitals, doing so in groups of 5 – 10 trainees of all levels, thus maintaining a close working environment with peers and faculty. All hospitals are equipped with state-of-the-art equipment. Residents work daily with the best of general radiographic, ultrasound, CT and MRI technology. Several hospitals have digital image archiving and communication systems.

PGY1

PGY1 Clinical training is divided into two blocks, one eight-nine month block at core teaching hospitals and a two-three month block at a community hospital. During 2003 - 2004, the core teaching hospitals have been the Mount Sinai Hospital and the St. Michael’s Hospital. Community training is principally done at the North York General Hospital. The content of the PGY1 program included Medicine (General Medicine and Respirology); Surgery (General Surgery, Orthopaedics, Urology, Neurosurgery, Obstetrics and Gynaecology); one month of Paediatrics; one month of Anatomy at the U of T Anatomy Department; and two months of elective choices. In the final month of PGY1, all residents come together for a Radiology Orientation Program, which introduces the trainees to physics, imaging equipment, clinical lectures, program issues and the core hospitals. The PGY1 rotation opportunities are reviewed annually, attempting to make the best of training choices in the clinical services.

PGY2

This is the first year of training in medical imaging. During 2003 - 2004, a PGY2 trainee spent the entire year at one or two of the three core teaching Departments (Mount Sinai – University Health Network, Sunnybrook and Women’s College Health Sciences Centre and St. Michael’s Hospital). There is a graduated increase in responsibility over the course of the year. In order to prepare residents to take night call (which starts in September), the year begins with a 10 week introductory program covering thoracic, GI, GU, CNS, MSK, CT and nuclear imaging. The remainder of the year consists of one or two month rotations in each of the above organ systems, as well as a one-month rotation in ultrasound.
PGY3

In 2003-2004, residents in this training year divided their rotations into three to six month blocks at hospitals different from that of their PGY2 training year. This allows the trainee an opportunity to see a different spectrum of pathology and to work with a different group of faculty. Rotations during the PGY3 year have included Breast Imaging, Neuroradiology, Ultrasound, Vascular-Interventional, and Nuclear Medicine as well as additional training in CT, MSK, GI and Chest. MRI training is included within all organ system rotations and is a strong component of all core hospitals.

PGY4

During this year, each resident spent a four-month block in Paediatric Radiology at the world famous Hospital for Sick Children. The other eight months is at one or two of the core hospitals. This year includes a two-month block of dedicated Angio-Interventional training. The resident also has four to six months of General Radiology rotations. The Armed Forces Institute of Pathology (AFIP) six-week rotation for Radiology-Pathology is scheduled during the General radiology time.

PGY5

The resident is usually allowed to use this year for electives, but this is conditional upon the resident having achieved an acceptable standard of competence in medical imaging. It may be spent concentrating on areas of relative weakness, or on subspecialty areas. Most residents include electives in obstetric ultrasound, cardiac imaging and Body MRI in this final year.

Armed Forces Institute of Pathology

All residents are encouraged to attend the Armed Forces Institute of Pathology in Washington, D.C., where they receive a six-week, intensive, didactic course in pathology correlated to imaging. This generally occurs during the PGY4 year. Some financial support is available. To date, we have been successful in reserving a sufficient number of positions at AFIP to permit all of our residents to attend at some point in their training.

Physics Instruction

All residents must be knowledgeable about the physics of medical imaging. To that end, intensive physics instruction is provided. One week courses are provided for the PGY1 and PGY3 years and there is also a five-day review course in the PGY3 or PGY4 year of training. These courses are organized by Martin Yaffe, Ph.D. (Department of Medical Imaging) and taught by the faculty of our department, the faculty of the Department of Medical Biophysics, and guest speakers.
Conferences

Residents are encouraged to attend imaging conferences, both to be involved in presenting papers or posters and also for the benefit of knowledge and interaction with the imaging community at large. During the PGY3 year, each resident is given the opportunity to attend a major imaging conference with the provision of financial support. The resident is not required to present at the conference to receive this support but does prepare a report following the meeting to highlight what they gained in their attendance. In addition, residents presenting papers or posters at recognized meetings generally receive financial support through affiliations with hospital imaging departments.

Seminars and Half-Day Program

Wednesday afternoons from September to June have been the focus for the academic program. There is a formal two to three hour weekly clinical seminar for PGY1, PGY2 and PGY3 residents. Most seminars are organized around organ systems and imaging modalities.

As well, there are special sessions for all resident years on non-clinical topics such as ethical and legal issues, practice management and career planning. Speakers from outside the Department add interest to the content of these featured sessions.

A 10 hour review series is provided for PGY5 residents each spring in preparation for the ABR and Royal College examinations.

Research

Residents in Medical Imaging are required to have a good foundation of research methodology and critical appraisal in order to either critically evaluate scientific medical literature or pursue independent research activities. Principles and issues of health technology assessment, quality improvement and clinical audits are also core components of the clinical research curriculum. Dr. David Mikulfs is responsible for the design and delivery of the course curriculum, workshops, tutorials and lectures on these topics. Instruction in this curriculum is given throughout the Residency Program. In total, residents in Medical Imaging receive over 30 hours of course instruction.

Each resident is required to become involved in a research project beginning no later than the PGY3 year. All residents receive protected time to work on their project. The research is conducted in conjunction with one or more staff persons with a view to presenting the project during the PGY4 or PGY5 years at our Annual Research Day. The residents are encouraged to publish their results and to present them at national or international meetings.

Rounds

Teaching rounds, or small group conferences, are held at each of the core hospitals once or twice a day. University Division rounds are held for the entire department six to eight times annually at a central location.
View Box Teaching

Every resident in the PGY2 through to the PGY5 years receives daily teaching from faculty at the view box and in the procedure rooms. Teaching is based on the day’s cases, but may be supplemented with related cases from faculty teaching files. The amount of teaching varies from rotation to rotation but on average there are one to two hours of this type of one-to-one teaching daily. This program is widely recognized for the quality of teaching provided to residents. In addition, residents learn to teach others and are expected to teach students and observers in the Department.

Journal Club

This is organized by the residents and is held approximately five times annually.

Visiting Professor Program

This program of six lectures between October and April is organized by the CME Director of our department and is provided for all imaging specialists including community radiologists. Residents attend the lecture and reception. Visiting Professors from outside Toronto usually present resident teaching sessions at two or three of the teaching hospitals during their visits to Toronto.

Organ Imaging Review Course

This is a week-long, internationally recognized review course. It is given in September or October of each year. It is primarily intended as a CME course for practicing radiologists but also contains a wealth of valuable teaching material for residents. All residents are given some time off clinical services to attend, and can do so at no cost.

Program Evaluation

In addition to that carried out by the Radiologists-in-Chief and the teaching co-ordinators at each hospital, the residents complete an assessment of each rotation, and an annual assessment of the faculty’s teaching.

Program Supervision

This is the direct responsibility of the Program Director who is, in turn, responsible to the Departmental Chair and the Departmental Executive Committee. The Program Director is assisted by the Resident Training Committee, which is composed of a representative from each of the teaching hospitals, a PGY1 coordinator responsible for all PGY1 issues, as well as from Nuclear Medicine and the Research Committee. In addition, the University of Toronto Chief Resident in Medical Imaging and a resident representative from each year of training are full members of the committee.
There are Division Heads appointed for Cardiothoracic, Musculoskeletal, Abdominal, Pediatric, Vascular-Interventional, Breast Imaging and Neuroradiology. These Division Heads and the Program Director for Nuclear Medicine are responsible for rotation goals and objectives, suggested reading lists and recommendations regarding the resident lectures and seminars. Division Heads advise the Program Director and Resident Training Committee.

**Resident Evaluations**

- Evaluation consists of the following:
  - An in-training evaluation completed following each rotation.
  - A summary in-training evaluation at the end of each year of training.
  - Results of the American College of Radiology multiple choice in-training examination, taken in the spring of each year.
  - Results of a yearly oral examination based on the Royal College format (PGY2-5).
  - Results of a written examination in physics following the PGY1 course.
  - A practice OSCE examination in the spring of each year (PGY3-5).

**Resident Awards**

Outstanding residents are recognized by awards for clinical excellence, teaching and research.

1) **Gordon Potts Award**

   This award of a commemorative plaque is made to the outstanding final-year resident, based on a combination of the following academic and personal strengths: Interpersonal skills, willingness to explore new methods and ideas, dedication to patient service and academic activities, intellectual capacity and publications in residency.

   2003 - 2004 recipient: Dr. Selina Lem / Dr. Angela HO, PGY5

2) **Resident Teacher-Mentor Award**

   This award will be made to a final year graduating resident, based on a combination of the following strengths and contributions: dedication to teaching, resident advocate and mentor, contribution to Resident Program and commitment to personal continuing educational growth.

   2003 - 2004 winner: Dr. Selina Lem, PGY5

3) **Research Awards**

   Each year residents as well as fellows are nominated to receive the RSNA Research Award for Research excellence within the University Of Toronto Department Of Medical Imaging.
2003 – 2004 winner: Dr. Sangeet Ghai, Abdominal Imaging Fellow

Summary

The University of Toronto training program in Medical Imaging is designed to provide the best possible training in all aspects of imaging. The program is an intensive one, with considerable emphasis on teaching, in addition to exposure to a huge volume of clinical pathology. The university-wide integration and rotational system ensures that each resident will have access to all of the strengths of our departments.
RESIDENTS

PGY1 Level

Aditya Bharatha, MD  
University of Toronto, 2003
Philip Buckler, MD  
University of Toronto, 2003
Patrick Cervini, MD  
University of Toronto, 2003
Errol Colak, MD  
University of Toronto, 2003
Kebby King, MD  
University of West Indies, 1997
Jeff Mandelcorn, MD  
University of Toronto, 2003
Alex Menard, MD  
University of Ottawa, 2003
Peyvand Pordeli, MD  
University of Iran, 1992
Jeremy White, MD  
University of British Columbia, 2003

PGY2 Level

Meg Chiavaras, MD  
University of Massachusetts, 2002
Christopher Dyck, MD  
University of Toronto, 2002
Lenny Grinblat, MD  
McMaster University, 2002
Winnie Lee, MD  
University of Toronto, 2002
Andrea Milic, MD  
University of Ottawa, 2002
Shantel Minnis, MBBS  
University of West Indies, 1998
Emma Robinson, MD  
University of Toronto, 2002
Neil Rosta, MD  
Queen’s University, 1994
Brian Yeung, MD  
Queen’s University, 2002
Katerine Zukotynski, MD  
University of Toronto, 2002
PGY3 Level

Gagan Ahuja, MD
    University of Toronto, 2001
Harpreet Baweja, MD
    McMaster University, 1994
Richard Bitar, MD
    University of Toronto, 2001
Louis-Martin Boucher, MD/PhD
    University of Toronto, 2001
Debra Chang, MD
    University of Toronto, 2000
Meaghan Hyland, MD
    University of Ottawa, 2001
Jeffery Jaskolka, MD
    University of Western Ontario, 2001
Ryan Margau, MD
    University of Toronto, 2001
Elaine Martinovic, MD
    University of Calgary, 2001
Matthew McInnes, MD
    University of Toronto, 2001
Rola Shaheen, MD
    University of Jordan, 1996

PGY4 Level

Susan Armstrong, MD
    University of Toronto, 2000
Marc Freeman, MD
    University of Toronto, 2000
Aaron Glickman, MD
    University of Western Ontario, 2000
Anish Kirpalani, MD
    McMaster University, 2000
Sarah Koles, MD
    University of Calgary, 2000
Dan Mozeg, MD
    University of Toronto, 2000
Vikash Prasad, MD
    Dalhousie University, 2000
Michael Stefanos, MD
    University of Toronto, 2000
PGY5 Level

Peter Ballyk, MD
    University of Toronto, 1999
Carrie Betel, MD
    University of Toronto, 1999
Anita Chae, MD
    University of Western Ontario, 1999
Zdenko Filakovic, MD
    Ontario International Medical Program, 1999
Angela Ho, MD
    University of Toronto, 1999
Zeinab Layton, MD
    University of Western Ontario, 1999
Selina Lem, MD
    Queen’s University, 1999
Bonnie O’Hayon, MD
    University of Toronto, 1999
Erika Mann, MD
    Queen's University, 1998
Markian Shulakewych, MD
    University of Manitoba, 1994
Steven Singer, MD
    University of Ottawa, 1998
Sameh Tadros, MB, BCh
    Ontario International Medical Program, 1999
Lana Wilkinson, MD
    McMaster University, 1999
NUCLEAR MEDICINE TRAINING PROGRAM

General Description

Nuclear medicine is a branch of medical practice primarily concerned with the use of unsealed radioactive sources in the study, diagnosis, and treatment of disease. Our program currently provides dual-certification in radiology and nuclear medicine. This is a six year (including PGY1) program with two years of subspecialty training in nuclear medicine (provided that the subspecialty training is taken following the completion of at least 18 months in Diagnostic Radiology, effective June 1, 1998).

The Nuclear Medicine Program provides formal instruction and training for both radiology and nuclear medicine residents. Formal lectures cover various aspects of nuclear medicine including cardiac and oncologic nuclear medicine, functional neuroimaging, radiopharmacy, nuclear physics, and general nuclear medicine. Residents have specific goals, objectives and reading lists during their rotation at one of the teaching hospitals. There are biweekly teaching rounds for both radiology and nuclear medicine residents at these hospitals. The residents acquire skills by participating in daily clinical work. Didactic instruction is supplemented by teaching files at each hospital. Residents are encouraged to attend evening lectures given monthly or bi-monthly by internationally renowned guest speakers, who lecture on current topics in nuclear medicine at Toronto Nuclear Medicine Society Meetings. Journal clubs are occasionally organized where academic staff discuss interesting cases and/or current journal articles.

General Objectives

The goal of the nuclear medicine resident is to be able to function independently as a medical specialist with the ability to advise on, supervise, perform, and interpret all diagnostic procedures, and to achieve a level of competence in the performance of radiotherapy with unsealed radioactive sources so as to act as a consultant to referring physicians. The resident must acquire excellent communication and technical skills, and the knowledge and professionalism appropriate to a lifetime career in nuclear medicine.

Dual Radiology and Nuclear Medicine Residency

Applicants will be considered from candidates who are already in the Diagnostic Radiology Training Program at the University of Toronto, usually, one slot per year is reserved for the dual certification program.
RADIOLOGY SCIENTIST TRAINING PROGRAM

Objectives

The purpose of the Radiological Scientist Training Program (RSTP) is to provide a small group of radiology residents with the opportunity to develop skills important to the pursuit of independent research. These skills encompass research methodology, publications, grant writing, and presentations. The research training is intended to complement the excellent clinical training for which the Department of Medical Imaging is already recognized.

Organization

The RSTP is a six-year program with two years of research and four years of clinical training. The Royal College of Physicians and Surgeons of Canada will accept one year of research towards fulfilling the requirements of the five year program in diagnostic radiology. The RSTP is able to accommodate as many as two residents per year. The first two years of the RSTP are identical to the regular radiology training program. The difference is in the PGY3 and PGY4 years which, in the RSTP, are entirely devoted to research. Research opportunities are available in many departments relevant to radiology. Under certain circumstances, residents in the RSTP may pursue a M.Sc. or Ph.D. degree. The final two years, PGY5 and PGY6, are designated for clinical training to fulfill the requirements of the Royal College of Physicians and Surgeons of Canada.

Eligibility and Application Procedure

Applications will be considered from candidates already accepted into the regular radiology training program and will occur during the PGY2 training year. A maximum of two places per year will be reserved for residents in the RSTP. Applicants need not have prior experience in research or a special background, but are expected to be self-motivated.

Remuneration

Residents in the RSTP will be remunerated commensurate with residents in the regular radiology training program, up to a maximum of the PGY5 level.

Selection of Research Project and Supervisor

Residents in the RSTP should select a project and a supervisor as soon as possible, and before the PGY3 year. The Director of Research and the Chair of the department can offer assistance with this selection. A supervisor may be selected from various University of Toronto departments, including Medical Imaging, Medical Biophysics, Anatomy, Physiology, Biochemistry, Computer Science, Clinical Epidemiology, or Electrical Engineering, specifically the Institute of Biomedical Engineering. The supervisor must have operating funds to support the research, but is not expected to provide remuneration for the resident. Candidates will be strongly encouraged also to apply for a fellowship from an agency such as the Medical Research...
Council, but acceptance into the RSTP will not be conditional upon success in obtaining such a fellowship.

**Graduate Degrees**

Residents in the RSTP are encouraged to pursue a graduate degree. The procedure depends somewhat on the department in which the research is to be conducted, but requires a separate application to that department and the School of Graduate Studies or Institute of Medical Sciences. Residents are responsible for fulfilling all requirements of the department in which they are registered as graduate students.

**Clinical Responsibilities**

During the two years of research training, residents in the RSTP will have minimal clinical responsibilities, probably limited to one on-call evening/night per week. In addition, residents in the RSTP are encouraged to maintain contact with clinical activities through attendance at select departmental rounds and teaching sessions. Such attendance will not be compulsory for RSTP residents in the two research years, as it is for residents in the regular training program.
OBJECTIVES OF TRAINING & SPECIALTY TRAINING
REQUIREMENTS IN DIAGNOSTIC RADIOLOGY

Definition

Diagnostic Radiology is a branch of medical practice concerned with the use of imaging techniques in the study, diagnosis and treatment of disease.

General Objectives

On completion of the educational program, the graduate physician will be competent to function as a consultant in Diagnostic Radiology. This requires the physician to have the ability to supervise, advise on and perform imaging procedures to such a level of competence, and across a broad range of medical practice, as to function as a consultant to referring family physicians and specialists.

Communication skills, knowledge, and technical skills are the three pillars on which a radiological career is built, and all are dependent on the acquisition of an attitude to the practice of medicine which recognizes both the need to establish a habit of continuous learning and a recognition of the importance of promoting a team approach to the provision of imaging services.

Residents must demonstrate the knowledge, skills and attitudes relating to gender, culture and ethnicity pertinent to Diagnostic Radiology. In addition, all residents must demonstrate an ability to incorporate gender, cultural and ethnic perspectives in research methodology, data presentation and analysis.

Specific Objectives

At the completion of training, residents will have achieved the following competencies so as to function effectively as:

i) Medical Expert/Clinical Decision-Maker

General Requirements

- Demonstrate diagnostic and therapeutic skills for ethical and effective patient care.
- Access and apply relevant information to clinical practice so as to have competence in clinical radiological skills.
- Demonstrate effective consultation services with respect to patient care, education and legal options.

Specific Requirements

- Understand the nature of formation of all types of radiological images, including physical and technical aspects, patient positioning, contrast media.
- Knowledge of the theoretical, practical and legal aspects of radiation protection, including other imaging techniques and their possible harmful effects.
• Knowledge of human anatomy at all ages, both conventional and multi-planar, with emphasis on radiological applications.
• Knowledge of all aspects of clinical radiology, including understanding of disease, appropriate application of imaging to patients, importance of informed consent, complications such as contrast media reactions, and factors affecting interpretation and differential diagnosis.
• Understand the fundamentals of quality assurance in radiology.
• Understand the fundamentals of epidemiology, biostatistics and decision analysis.
• Show competence in manual and procedural skills and in diagnostic and interpretive skills.
• Demonstrate the ability to manage the patient independently during a procedure, in close association with a specialist or other physician who has referred the patient. The radiologist should know when the patient’s best interests are served by discontinuing a procedure, or referring the patient to another physician.
• Understand the acceptable and expected results of investigations and/or interventional therapy as well as unacceptable and unexpected results. This must include knowledge of and ability to manage radiological complications effectively.
• Understand the appropriate follow-up care of patients who have received investigations and/or interventional therapy.
• Show understanding of a sound and systematic style of reporting.
• Competence in effective consultation, conduct of clinico-radiological conferences, and the ability to present scholarly material and lead case discussions.

ii) Communicator

• Establish appropriate therapeutic relationships with patients/families.
• Listen effectively.
• Obtain the appropriate information during consultation with referring physicians in order to be able to make recommendations regarding the most appropriate testing and/or management of patients.
• Discuss appropriate information with patients/families and the health care team, and be able to obtain informed consent for tests and procedures when this is needed.

Specific Requirements

• Have the ability to produce a radiological report which will describe the imaging findings, most likely differential diagnosis, and when indicated, recommend further testing and/or management.
• Understand the importance of communication with referring physicians, including an understanding of when the results of an investigation or procedure should be urgently communicated.
• Communicate effectively with patients and their families and have a compassionate interest in them.
• Recognize the physical and psychological needs of the patient and their families undergoing radiological investigations and/or treatment, including the needs of culture, race and gender.
iii) Collaborator

General Requirements
- Consult effectively with other physicians and health care professionals.
- Contribute effectively to other interdisciplinary team activities.

Specific Requirements
- Have the ability to function as a member of a multi-disciplinary health care team in the optimal practice of radiology.

iv) Manager

- Utilize resources effectively to balance patient care, learning needs, and other activities.
- Allocate finite health care resources wisely.
- Work effectively and efficiently in a health care organization.
- Utilize information technology to optimize patient care, life-long learning and other activities.

Specific Requirements
- Be competent in conducting or supervising quality assurance including an understanding of safety issues and economic considerations.
- Be competent in computer science as it pertains to the practice of radiology.

v) Health Advocate

General Requirements
- Identify the important determinants of health affecting patients.
- Contribute effectively to improve the health of patients and communities.
- Recognize and respond to those issues where advocacy is appropriate.

Specific Requirements
- Understand and communicate the benefits and risks of radiological investigation and treatment including population screening.
- Recognize when radiological investigation or treatment would be detrimental to the health of a patient.
- Educate and advise on the use and misuse of radiological imaging.

vi) Scholar

General Requirements
- Develop, implement and monitor a personal continuing education strategy.
- Critically appraise sources of medical information.
- Facilitate learning of patients, house staff/students and other health professionals.
- Contribute to development of new knowledge.

Specific Requirements
- Competence in evaluation of the medical literature.
- The ability to be an effective teacher of radiology to medical students, residents, technologists and clinical colleagues.
- The ability to conduct a radiology research project, which may include quality assurance.
• Appreciation of the important role that basic and clinical research plays in the critical analysis of current scientific developments related to radiology.

vii) Professional

General Requirements
• Deliver highest quality care with integrity, honesty and compassion.
• Exhibit appropriate personal and interpersonal professional behaviours.
• Practice medicine ethically consistent with the obligations of a physician respecting the needs of culture, race and gender.

Specific Requirements
• Be able to accurately assess one’s own performance, strengths and weaknesses.
• Understand the ethical and medical-legal requirements of radiologists.

Training in Canada

The foregoing represents the general and specific objectives that all candidates for the Royal College examinations in Diagnostic Radiology are expected to meet. For those training in Canadian programs, these objectives will be accomplished in a staged manner. Residents in Canadian programs may obtain the document describing this approach from their program directors.
SPECIALTY TRAINING REQUIREMENTS IN DIAGNOSTIC RADIOLOGY

These specialty training requirements apply to those who began training on or after 1 June 1997.

The five years of approved training require, at first, a closely supervised practice, with the opportunity for increasing responsibility in the final years, so that the resident near the end of training can function as a general radiology consultant, requesting help from staff radiologists when necessary. The residency may be followed by one or more years of fellowship training in a subspecialty discipline, as the residence training is not intended to provide a subspecialty level of expertise.

This period must include:

1) One year of basic clinical training:
   The purpose of this year is to give the resident a degree of independent responsibility for clinical decisions; an opportunity for further development of the skills required in making effective relationships with patients; the consolidation of competence in primary clinical and technical skills across a broad range of medical practice; and an understanding of the nature of the relationship between a referring physician and a clinical radiological consultant.

2a) Three years of approved resident training in “general diagnostic imaging”, this must include:
   Respiratory, cardiovascular, gastro-intestinal and biliary, genitourinary, musculoskeletal, mammography, neurological and pediatric radiology, as well as the following modalities: fluoroscopy, ultrasound, CT and MR imaging.
   Because of the varying training programs in the recognized university training centres, these 36 months may be allocated as block periods of at least three months or their equivalents.

2b) One year of approved residency that may consist of one to twelve month periods in any of the following, as long as these are appropriately integrated by the Residency Training Committee:

- further training in diagnostic radiology
- diagnostic ultrasound
- CT
- MR
- nuclear medicine
- cardiac and/or vascular radiology
- interventional radiology
- neuroradiology
- pediatric radiology
• pathology or other clinical specialty relevant to the practice of radiology (for up to three months)
• a full-time research project, relevant to diagnostic imaging, and acceptable to the program director and the Credentials Committee.

**NOTE**: In view of the amount and variety of radiology to be covered and the skills required at the time of the final examination, it will seldom be appropriate to spend the entire 12 months of the fifth year in any one of these areas.
RESIDENT RESEARCH PROGRAM

While training in clinical radiology remains the main focus of the residency, research is considered to be of paramount importance as well. It is essential that residents gain experience in as many aspects of research as possible, including searching the literature, data analysis and manuscript preparation. A resident cannot know if he/she would enjoy an academic career without firsthand experience. The feeling of satisfaction that accompanies completion of a project, and contribution of information to the medical/scientific literature, can only be appreciated if personally experienced.

The Research Program consists of three aspects; a seminar series, resident support, and a formal presentation day.

Seminar Series

Residents in Medical Imaging are required to have a good foundation of research methodology and critical appraisal in order to either critically evaluate scientific medical literature or pursue independent research activities. Principles and issues of health technology assessment, quality improvement and clinical audits are also core components of the clinical research curriculum. Workshops, tutorials, and lectures on these topics are organized by the department’s epidemiologist who is responsible for the design and delivery of the course curriculum. Attendance at these sessions is compulsory and instruction of this curriculum is given throughout the Residency Program.

Support

Department faculty are asked to submit research topics from which residents may choose a project, which he or she finds interesting. The residents are given the opportunity to create their own topic or to choose one from this faculty-generated list. Residents are freed from clinical responsibilities for their work. Each resident presents a short, informal outline of the intended project to the Resident Research Committee in November of their PGY3 year so that project feasibility can be assessed before too much time has been devoted to it. Helpful suggestions are offered by Committee Members. Data collection for the project begins in January of the PGY3 year and extends to December of the same year. During June, the residents present an interim report, again informal, to the Committee, to confirm that data collection has begun and is progressing satisfactorily. In November/December the residents present a third informal discussion for assessment of project status and to determine if an abstract can be generated for submission to a national/international meeting. It is at this time that the Committee determines if the project is satisfactory. Incomplete studies may be considered satisfactory depending on the circumstances described by the resident. Finally, the study is presented formally in the following Spring at the Annual Research Day.
**Presentation Day**

Our 16th annual Department of Medical Imaging Research Day was held on April 29, 2004. The resident presentations included:

<table>
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<tr>
<th>Name</th>
<th>Title</th>
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<tr>
<td>Michael Stefanos</td>
<td>Agreement Rates between Functional and Morphological Imaging for Pretreatment Assessment of Non-Hodgkin’s Lymphoma Patients</td>
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<tr>
<td>Aaron Glickman</td>
<td>Dynamic MR Perfusion Imaging of Anterior Cruciate Ligament Autografts</td>
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<tr>
<td>Lenny Grinblat</td>
<td>The Radiology of Severe Acute Respiratory Syndrome (SARS): Radiographic Examination of 46 Confirmed Cases in Toronto, Canada</td>
</tr>
<tr>
<td>Sarah Koles</td>
<td>Pneumothorax Post Thoracic FNA: Is There A Role For Post Biopsy CT?</td>
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<tr>
<td>Marc Freeman</td>
<td>Percutaneous Vertebroplasty Results in the Reversal of Height Loss and Spinal Deformity in Patients with Osteoporotic and Pathologic Compression Fractures</td>
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<tr>
<td>Jeff Jaskolka</td>
<td>Needle Tract Seeding After Radiofrequency Ablation of Hepatic Tumors</td>
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<tr>
<td>Vikash Prasad</td>
<td>Coil Embolotherapy of Pulmonary Arteriovenous Malformations: Efficacy of Platinum Versus Stainless Steel</td>
</tr>
<tr>
<td>Andrea Milic</td>
<td>Reperfusion of Pulmonary Arteriovenous Malformations Following Embolotherapy</td>
</tr>
<tr>
<td>Dan Mozeg</td>
<td>Assessing the Value of CT-Enteroclysis in the Diagnosis of Small Bowel Disease</td>
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While presentation at this meeting is an end unto itself, many of the projects have since been presented at national and international meetings and have been published in peer-reviewed journals. Since the research program was instituted, more than 60 of the resident’s projects have appeared in peer-reviewed journals. Of those not published, many have been presented either orally or as a poster at national/international meetings.
FELLOWSHIP PROGRAM

With access to several thousand inpatient beds, the affiliated hospitals of the University of Toronto form one of the largest teaching facilities in the world, thereby serving as an ideal setting for advanced subspecialty training in Medical Imaging. The program has national and international stature both clinically and in research, and attracts fellows from around the world.

In 2003-2004 the seven divisions of the University of Toronto Department of Medical Imaging offered a comprehensive array of fellowships:

- Abdominal Imaging
- Breast Imaging
- Cardiac Imaging
- Cross-sectional Imaging
- Magnetic Resonance Imaging
- Musculoskeletal Imaging
- Neuroradiology (Diagnostic)
- Neuroradiology (Interventional)
- Pediatric Imaging
- Thoracic Imaging
- Vascular/Interventional Radiology
- Women's Imaging
- Combined Clinical/Research

The flexibility of the program permits tailoring of the fellowship experience to accommodate most needs. Research is encouraged as an integral component of the fellowship program and to this end protected research time is available to all Medical Imaging fellows.

2003–2004 Department of Medical Imaging Fellows

Abdominal Imaging Fellows

- Karam Al-Hiary
- Colm Boylan
- Ajay Chauhan
- Alexander Corat
- Kavita Dhamanaskar
- John Hanson
- Hyun-Jung Jang
- Rana Karam
- Tae Kyoung Kim
- John Kirby
- Blair MacDonald
- Fenella Moulding
- Sue Roach

Cardiac Imaging Fellow

- Tracy Elliot
Cross-sectional Imaging Fellows

- John Clarke
- Catriona Davies
- Sarah McGlone

Magnetic Resonance Imaging Fellow

- Anatomy Kam

Musculoskeletal Imaging Fellows

- Sam Chhaya
- Kawan Rakhra
- Tom Powell

Neuroradiology (diagnostic) Fellows

- Eria Bartlett
- Judith Corat-Simon
- Ilan Shelef
- Marlise Santos
- Eugene Yu

Neuroradiology (interventional) Fellows

- Ronit Agid

Thoracic Imaging Fellows

- Sharad Maheshwari
- Demetris Patsios
- Anuradha Rao
- Angela Riddell

Vascular/Interventional Radiology Fellows

- Robert Beecroft
- Sangeet Ghai
- Frederick Lan
- Marc Ossip
- Kongteng Tan
- Robert Yu

Women's Imaging Fellow

- Nicole Brofman
- Sandeep Ghai
- Munire Gundogan
- Anat Kornecki
- Jillian Pugh
- Vincent Shin

Pediatric Imaging Fellows

- Joao Amaral
- Monica Epelman
- Lucia Fontalvo
• Katharine Foster
• Anne Geoffray
• Salwa Haidar
• Mohannad Ibrahim
• Christian Kellenberger
• Clara Ortiz
• Rodrigo Ozelame
• Ashley Robinson
• Sheldon Wiebe
UNDERGRADUATE PROGRAM

Year I Medicine

The first year medical program consists of three main contiguous block courses of study. These include Structure and Function, Metabolism and Nutrition and Brain and Behavior. Medical imaging participates in the Structure and Function and Brain and Behavior courses.

Structure and Function

This course teaches anatomy, histology, and cardio-respiratory physiology.

Anatomy - Radiology Seminar

The anatomy radiology seminar series has been extensively revised and standardized. Fourteen lecturers gave a total of 24 hours of interactive seminars to the first year medical class using this new curriculum. These six seminars taught radiographic anatomy of the thorax, abdomen, pelvis-urinary tract, upper extremity, lower extremity and of the head and neck. Faculty lecturers participating in this seminar series included the following radiologists; Dr. Ray Chan, Dr. Tanya Chawla, Dr. TaeBong Chung, Dr. Wayne Dietel, Dr. Tim Dowdell, Dr. Nasir Jaffer, Dr Walter Kucharczyk, Dr. Lynne Noel de Tilly, Dr. Narinder Paul, Dr. Dawn Pearce, Dr. Joel Rubinstein, Dr. Manu Schroff, Dr. William Weiser and Dr. Louis Wu.

Full Class Lecture - Medical Imaging Modalities

This one hour lecture was given by Dr. Nasir Jaffer. It outlines basic technical aspects of the major medical imaging modalities including X-ray, CT, MRI, ultrasound and nuclear medicine.

Brain and Behavior

From time to time, the Department of Medical Imaging has provided tutors for the Brain and Behavior course. Neuroradiology teaching tools have been developed by members of the department of Medical Imaging and are used in this course on an ongoing basis.

Year II Medicine

Year II teaching centers around the two main programs in the Year II curriculum: The Pathobiology of Disease (the first half of the year), and The Foundations of Medical Practice (the second half of the year).
The Pathobiology of Disease Course

This fourteen-week course teaches pathology, immunology, genetics and other similar subjects. The Department of Medical Imaging has worked on an ongoing basis to develop and provide the medical imaging teaching resources required for delivery of this PBL. (Problem based learning), oriented curriculum.

Pathobiology of Disease - Imaging Case material

In past years, a series of images with annotations was exhibited on a viewer in the Medical Science Building. The content of this series roughly paralleled and/or emphasizes the imaging aspects of the material taught in the Pathobiology of Disease course. Efforts are currently under way, in cooperation with course organizers, to revise and update these cases using current imaging technology. In the near future, this case material will be presented to students in a web-based format.

Seminar in Chest Imaging

Dr. Narindar Paul and Dr. TaeBong Chung each gave a 2 hour seminar on chest imaging to half of the year 2 class, at the beginning of the Pathobiology of Disease Course. This seminar included a review of the radiographic anatomy and radiographic findings associated with the pathology of common diseases of the lung. Numerous radiographs of common lung diseases were presented.

Seminar in the Imaging of Cancer

This seminar emphasized the role medical imaging plays in the staging and follow-up of neoplastic disease. Dr. Martin O’Malley, Dr. Tanya Chawla and Dr. Petrina Causer each gave this 2 hour seminar to members of the year 2 class.

Foundation of Medical Practice Course

This 21-week course teaches core clinical subjects such as medicine and surgery.

PBL Tutors

Faculty members in the Department of Medical Imaging participated as tutors by leading core multidisciplinary seminars in the Foundations of Medical Practice curriculum.

Dr. Frank Goldberg, Dr. Wayne Deitel and Dr. Danny Marcuzzi provided 102 hours of teaching time as tutors, plus an additional 55 hours of preparation for this course.
Year II Seminars

The chest imaging seminar, previously given through the academies was standardized last year. The seminar series was prepared and supervised by Dr. TaeBong Chung. This 2 hour seminar was given to 4 groups of 50 students by four radiologists. Dr. TaeBong Chung, Dr. Tim Dowdell, Dr. William Weiser and Dr. Narindar Paul participated in this seminar series.

Full Class Lecture in Trauma Radiology

The trauma imaging seminar, previously given through the academies was standardized last year into a full class lecture.

A 2 hour, full class, lecture was given introducing key elements of trauma imaging. Topics covered included imaging of the cervical spine and brain, chest trauma and imaging of abdominal trauma. Participating radiologists in this lecture included Dr. Lynn Noël de Tilly, Dr. William Weiser and Dr. Paul Hamilton.

Clerkship

The two-year clerkship consists of 78 weeks of clinical rotations. The department of medical imaging provides an array of teaching activity during the clerkship program.

Year III Clerkship

Essentials of Radiology Lecture Seminar Series

At the request of the Faculty of Medicine and in response to feedback from undergraduate medical students requesting more teaching in medical imaging, a new lecture and seminar series was developed and launched this year. Under the direction of Dr. Tim Dowdell and Dr. Nasir Jaffer, five half day teaching sessions were presented to the year three class to help prepare them prior to the commencement of their clinical clerkship. This new series utilized a, one hour, full class lecture format followed immediately by a two hour, case review, seminar in which the class was divided into four groups.

The curriculum for this series brought together elements from the first and second undergraduate years in medical imaging instruction and emphasised core elements of medical imaging geared to the needs of clinical clerks. Full class lectures in this new program were developed and delivered by the following radiologists in the following subject areas. Dr. Tim Dowdell – Medical Imaging Modalities, Dr. Elizabeth David – Interventional Radiology, Dr. William Weiser and Dr. Harry Schulman – Chest Imaging, Dr. Nasir Jaffer and Dr. Tanya Chawla – Abdominal Imaging, Neuroradiology – Dr. Manu Schroff, Muskuloskeletal Imaging – Dr. Robert Bleakney.
Seminars for this series were jointly developed and lead by the following radiologists.

**Interventional radiology and Modalities** – Dr. Elizabeth David, Dr. Matthew Benjamin, Dr. E. Hayeems and Dr. Tim Dowdell

**Chest Imaging** – Dr. TaeBong Chung, Dr. William Weiser, Dr. Harry Schulman and Dr. Narindar Paul.

**Abdominal Imaging** – Dr. Nasir Jaffer, Dr. Tanya Chawla, Dr. Wayne Deitel and Dr. Myles Margolis.

**Neuroradiology** – Dr. Manu Schroff, Dr. Tom Marotta, Dr. Walter Kucharczyk and Dr. Suzanne Laughlin.

**Muskuloskeletal Imaging** - Dr. Robert Bleakney, Dr. Joel Rubinstein, Dr. Matthew Lax and Dr. Tim Dowdell.

**Elective Students**

A significant number of third year medical students at the University of Toronto took electives in radiology at the various teaching hospitals during the 2003-2004 Academic year.

**Hospital Based Seminars**

Various Year III seminars have been held in the teaching hospitals as part of the Medicine - Surgery block rotations. These include a series of chest seminars, interventional, gastrointestinal, as well as neuroradiology seminars.

**Year IV**

**Medical Imaging Electives**

Electives in Medical Imaging are among the most popular medical under-graduate electives at the University of Toronto. In addition to teaching basic radiology skills these electives also serve to promote awareness about medical Imaging within the undergraduate medical community. Elective students are also given an opportunity to consider specialty training in radiology during these teaching blocks.

These electives remain very popular in the undergraduate elective program.

**University of Toronto Electives**

Fifty four Toronto medical students took radiology electives in their third and fourth year at the various teaching hospitals during the 2003-2004 academic year.
Visiting Elective Students

Twenty five, medical students from outside medical schools, many of whom were overseas foreign students in their senior undergraduate year, took part in visiting electives during the 2003–2004 academic year.

The Bruce Tovee LMCC Review Lectures

The Undergraduate Committee in Radiology has participated in this review course for many years. Three hours of radiology review lectures were given to final year medical students. The majority of these were University of Toronto students. The review course has also been very well received and attended by final year students from McMaster and other local medical schools. The lectures were given in the evening at the main medical lecture theatre of the University. Three, one hour lectures were given. These are listed below.

i) Musculoskeletal Radiology – Dr. Robert Bleakney
ii) Chest Radiology – Dr. TaeBong Chung
iii) Gastrointestinal Radiology – Dr. Nasir Jaffer

The final year students have had access to a series of notes, the MCCQE Study Guide. The medical imaging portion of this lecture series and syllabus were updated and revised by the participating radiologists.

Other Teaching Activities and Involvement

Physiotherapy Student Seminars

A series of seminars are given to the physical therapy students at the University of Toronto by radiologists at the various Academies each year.

Career Sampling Electives in Radiology

On a somewhat informal basis, undergraduate students, many in Year I have spent various periods of time, from several days to weeks, in all of the teaching hospital radiology departments as part of a career sampling experience.

Undergraduate Teaching Computer File for Radiology

A comprehensive interactive computerized teaching program, called Radiofile has been developed by the Department of Medical Imaging. This program allows undergraduate students to have a uniform exposure to core medical imaging teaching material. The students can access this program either in the various radiology departments, or in the Academy computer laboratories. The program is available centrally, in the computer laboratory in the Medical Sciences Building.
The Internet and Undergraduate Education in Radiology

Under the direction of Dr. Nasir Jaffer, the Department of Medical Imaging hosts an internet web site on which various program descriptions are posted. This web site is also playing an expanding role in the Internet delivery of imaging seminars and programs as well as in the evaluation of undergraduate Medical Imaging teaching programs.

The Future Direction of the Medical Imaging Undergraduate Teaching Program

Efforts have been under way to standardize the major components of the undergraduate medical imaging teaching program through the development and implementation of standardized curriculum and electronic teaching tools. This task is largely complete. This effort has and will continue to further optimize the efficiency, scope and value of the undergraduate teaching program in Medical Imaging at the University of Toronto.
CONTINUING EDUCATION PROGRAM

Organ Imaging Review
September 7 - 10, 2003

Course Description

This four day course focuses on aspects of primary interest to both radiologists and radiologists-in-training. The course content includes general concepts of diagnostic imaging with emphasis on recent advances. The participant learns new ideas and has the opportunity to enhance their knowledge in selected common clinical situations. The participant is also able to participate in problem-solving with daily case reviews in each of the organ systems.

Course Chairman: Walter Kucharczyk, M.D.
Course Director: Paul Hamilton, M.D.

University of Toronto Faculty

Asch, Murray, M.D., Assistant Professor
Becker, Edma. M.D., Associate Professor
Bleakney, Robert, M.D., Assistant Professor
Causer, Petrina, M.D., Lecturer
Chawla, Tanya, M.D., Assistant Professor
Christakis, Monique, M.D., Assistant Professor
Chung, Tae-Bong, M.D., Lecturer
Dill-Macky, Marcus, M.D., Assistant Professor
Ehrlich, Lisa, M.D., Associate Professor
Farb, Richard, M.D., Assistant Professor
Fox, Allan, M.D., Professor
Ghai, Sandeep, M.D., Clinical Fellow
Haider, Masoom, M.D., Assistant Professor
Hamilton, Paul, M.D., Assistant Professor
Hanbidge, M.D., Assistant Professor
Herman, Stephen, M.D., Assistant Professor
Hershkop, Marlon, M.D., Assistant Professor
Jong, Roberta, M.D., Assistant Professor
Kassel, Edward, M.D., Associate Professor
Khalili, Korosh, M.D., Assistant Professor
Kulkarni, Supriya, M.D., Assistant Professor
Laughlin, Suzanne, M.D., Assistant Professor
Lax, Matthew, M.D., Assistant Professor
Lazinski, Dorothy, M.D., Lecturer
Merchant, Naeem, M.D., Assistant Professor
McGregor, Caitlin, M.D., Lecturer
Mikulis, David, M.D., Associate Professor
Montanera, Walter, M.D., Associate Professor
Muradali, Derek, M.D., Assistant Professor
Noël de Tilly, Lyne, M.D., Assistant Professor
O’Malley, Martin, M.D., Assistant Professor
Pantazi, Sophia, M.D., Lecturer
Paul, Narinder, M.D., Assistant Professor
Provost, Yves, M.D., Lecturer
Pugash, Robyn, M.D., Assistant Professor
Marilyn Ranson, M.D., Assistant Professor
Roberts, Heidi, M.D., Associate Professor
Rubenstein, Joel, M.D., Associate Professor
Salonen, David, M.D., Assistant Professor
Sarrazin, Josée, M.D., Assistant Professor
Weisbrod, Gordon, M.D., Professor
White, Lawrence, M.D., Associate Professor
Willinsky, Robert, M.D., Associate Professor
Wilson, Christine, M.D., Assistant Professor
Wright, Barbara, M.D., Assistant Professor
Zelovitsky, Leon, M.D., Assistant Professor

Guest Faculty

Federle, Michael., M.D.
Professor
Department of Radiology
University of Pittsburgh Medical Center
Pittsburgh, Pennsylvania
Women’s Imaging: Advances in Gynaecological Imaging and Transvaginal Ultrasound
February 13-15, 2004
Co-sponsored by Departments of Medical Imaging and Obstetrics and Gynaecology

Course Description

This 2 ½ day program on women’s imaging will provide participants with the most up-to-date practice standards in gynaecological and early fetal imaging. It will emphasize the integration of ultrasound into current clinical management and will explore some of the latest technological and clinical advances in women’s imaging. It will be of interest to radiologists, obstetricians and gynaecologists and ultrasonographers.

Directors: Phyllis Glanc M.D., Shia Salem M.D., Department of Medical Imaging
Jo-Ann Johnson M.D., Greg Ryan M.D., Department of Obstetrics and Gynaecology

University of Toronto Medical Imaging Faculty

Atri, Mostafa, M.D., Associate Professor
Causer, Petrina, M.D., Lecturer
Fong, Katherine, M.D., Associate Professor
Glanc, Phyllis, M.D., Assistant Professor
Haider, Massoom, M.D., Assistant Professor
Hamilton, Paul, M.D., Assistant Professor
Hanbidge, Anthony, M.B., Assistant Professor
Jong, Roberta, M.D., Assistant Professor
McGregor, Caitlin, M.D., Lecturer
Muradali, Derek, M.D., Assistant Professor
Salem, Shia, M.D., Associate Professor
Toi, Ants, M.D., Associate Professor
Wilson, Stephanie, M.D., Professor
Wright, Barbara, M.D., Assistant Professor

Guest Faculty

Peter Doubilet, M.D.
Professor of Radiology, Harvard Medical School
Vice-Chair of Radiology
Brigham and Women’s Hospital
Boston, Massachusetts

Faye Laing, M.D.
Professor of Radiology, Harvard Medical School
Brigham and Women’s Hospital
Boston, Massachusetts
INVITED LECTURERS AND VISITING PROFESSORS

October 6-7, 2003  Dr. Robert Pugatch  
Department of Radiology  
School of Medicine  
University of Maryland  
“Critical Care Imaging”  
“Diffuse Lung Disease”  
“Pulmonary Infections”  

November 3-4, 2003  Dr. Gillian Newstead  
Department of Radiology  
Section of Breast Imaging  
University of Chicago  
“Breast MRI”  
“Digital Mammography and CAD”  
“Subtle and Indirect Signs of Malignancy Including Interventional Evaluation”  

January 12-13, 2004  Dr. Jonathan Kruskal  
Radiology  
Beth Israel Deaconess Medical Center  
Harvard Medical School  
“Imaging the Complications of Liver Transplantation”  
“How to Perform Doppler Ultrasound of Liver”  
“Endorectal and Anal Ultrasound – Techniques and Clinical Applications”  

February 2-3, 2004  Dr. William S. Ball  
Department of Radiology  
Children’s Hospital Medical Center  
“Clinical Application of MRS in Pediatrics”  
“Hemodynamics of Perfusion in the Pediatric Brain”  
“Primer of Neurochemistry for the Neuroradiologist”
March 1-2, 2004
Dr. Jon A. Jacobson
Department of Radiology
University of Michigan Medical Center

“Pitfalls in Musculoskeletal MRI”

“Practical Musculoskeletal Sonography with MRI Correlation”

“Radiology of Subtle Fractures and Fracture with Hidden Implications”

April 5-6, 2004
Dr. Bruce Forster
Department of Radiology
Vancouver Hospital
The University of British Columbia

“Coronary Artery Calcification: What’s the Score?”

“Eye Strain and the Radiologist: revalent and Preventable”

“The Trouble with Tendons”

May 3-4, 2004
Dr. Dermot Malone
Consultant Radiologist
St. Vincent’s University Hospital

“Radiofrequency Ablation of Liver Metastases and Hepatocellular Carcinoma. Quo Vadis”

“Bowel Obstruction – Choosing and Using Diagnostic Tests”

“Developing an Effective Strategy for Imaging Focal Liver Lesions: Experience with the Combined use of MR Contrast Agents”