



Platform of the Sherbrooke Molecular Imaging Centre (CIMS)

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Internet: <http://www.cims.med.usherbrooke.ca/>

Keywords : (Bio)medical, molecular, multimodal Imaging; cyclotron, radio-isotopes, radiopharmaceuticals; positron emission tomography (PET), single photon emission computed tomography (SPECT), X-ray computed tomography (CT), magnetic resonance imaging (MRI), fluorescence optical imaging.

Mission:

To develop and use molecular imaging as a discovery tool for diagnosis, therapy evaluation and personalized medicine.

Expertise:

The CIMS uses a wide variety of imaging modalities as non-invasive investigation tools for preclinical and clinical research, including:

- positron emission tomography (PET)
- single photon emission computed tomography (SPECT)
- X-ray computed tomography (CT)
- magnetic resonance imaging (MRI)
- fluorescence optical imaging

With 2 cyclotrons, the CIMS has the capacity to produce a wide range of radioisotopes for PET (^{18}F , ^{11}C , ^{13}N , $^{61,64}\text{Cu}$, ^{89}Zr ...) and SPECT ($^{99\text{m}}\text{Tc}$) imaging. These radioisotopes can be incorporated in a variety of molecules used as radiotracers for imaging various *in vivo* biochemical and physiological processes. Researchers at CIMS also develop new probes (radiopharmaceuticals, contrast agents and optical probes) specifically targeting various biomarkers to investigate living organisms non-invasively.

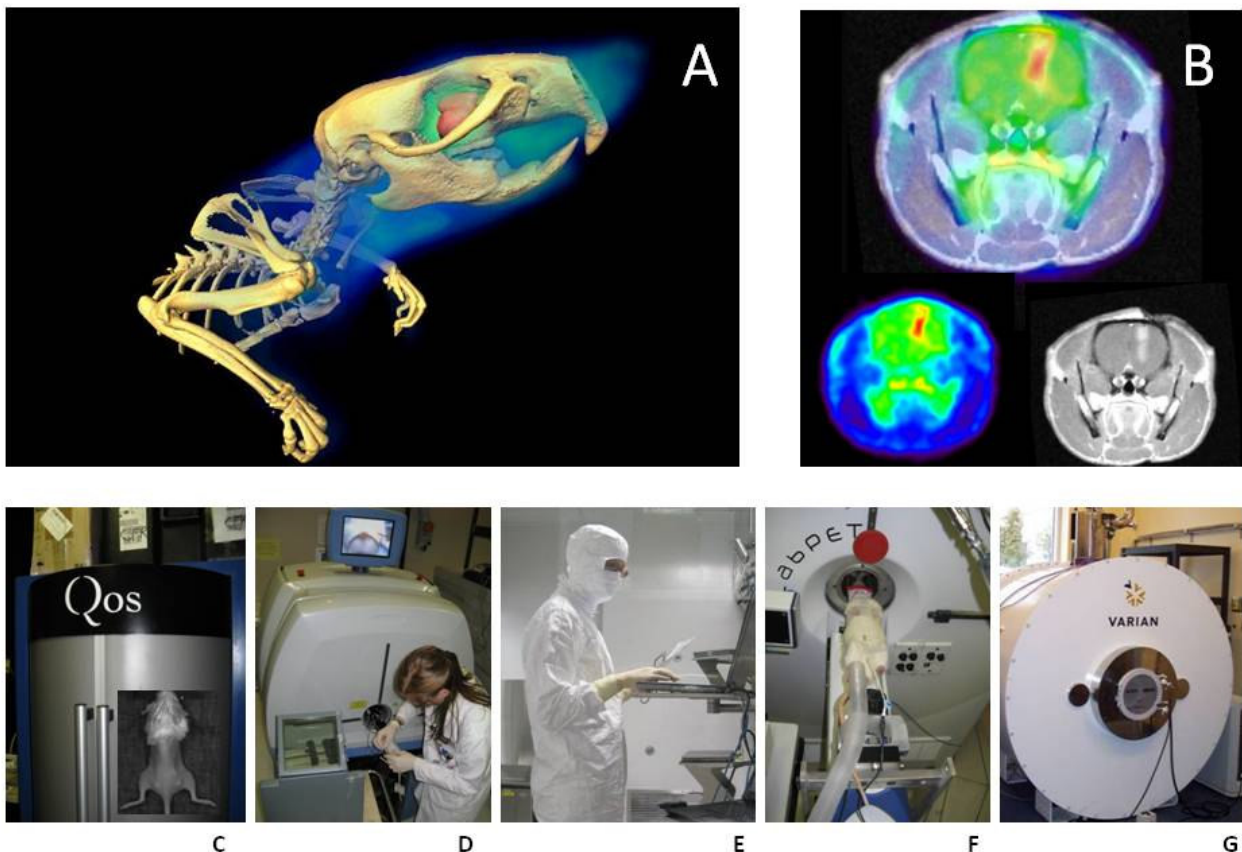
Service description:

The CIMS can provide the complete experimental design for using the various available biomedical imaging modalities, from probe synthesis to image acquisition and quantitative analysis.

The CIMS is an ideal imaging platform for the investigation of normal or pathological physiology and for the evaluation of new drugs or therapies, from the preclinical phase in small animal models to the initial clinical research phases in humans.

Pricing:

The price of imaging services will be established based on the experimental design on a cost recovery basis. A detailed quotation can be provided on demand based on the proposed specific experimental protocols.



The CIMS includes both preclinical and clinical imaging resources, as well as the required infrastructure and personnel required to plan and execute advanced research applications in small animal models and human. (A) PET/CT image fusion in the rat, (B) PET/MRI image fusion of the rat brain, (C) optical fluorescence imager, (D) Triumph™ preclinical PET/CT scanner, (E) clean room for the production of ^{18}F -FDG, (F) LabPET™ preclinical PET scanner, (G) imageur MRI 7T preclinical scanner

Publications :

- L. Arhjoul, O. Sarrhini, M. Bentourkia. Quantitative image enhancement by partial volume correction with continuous wavelet technique in small animal PET imaging. *Current Development in Theory and Applications of Wavelets* 4(2):153-183 (2010)
- M. Bentourkia, O. Sarrhini. Simultaneous attenuation and scatter corrections in small animal PET imaging. *Computerized Medical Imaging and Graphics* 33:477-488 (2009)
- É. Croteau, É. Lavallée, S.L. Ménard, L. Hubert, F. Pifferi, J.A. Rousseau, S.C. Cunnane, A.C. Carpentier, R. Lecomte, F. Bénard. Image-derived input function in dynamic human PET/CT: methodology and validation with ^{11}C -acetate and ^{18}F -fluorothioheptadecanoic acid in muscle and ^{18}F -fluorodeoxyglucose in brain. *European Journal of Nuclear Medicine and Molecular Imaging* 37(8):1539-1550 (2010)
- É. Poulin, R. Lebel, É. Croteau, M. Blanchette, L. Tremblay, R. Lecomte, M. Bentourkia, M. Lepage. Conversion of arterial input functions for dual pharmacokinetic modeling using Gd-DTPA/MRI and ^{18}F -FDG/PET. *Magnetic Resonance in Medicine*, disponible en ligne (2012)
- S. Gibbs, B Chattopadhyaya, S. Desgent, P. N. Awad, O. Clerk-Lamallice, M. Levesque, R.-M. Vianna, R.-M. Rébillard, A.-A. Delsemme, D. Hébert, L. Tremblay, M. Lepage, L. Descarries, G. Di Cristo, L. Carmant. Long-term consequences of a prolonged febrile seizure in a dual pathology model. *Neurobiol. Dis.* 43:312-321 (2011)
- S. Kumar, Y. Dory, M. Lepage, Y. Zhao. Surface-grafted stimuli-responsive block copolymer brushes for thermo-, photo- and pH-sensitive release of dye molecules. *Macromolecules* 44:7385-7393 (2011)
- L. Doré-Savard, V. Otis, K. Belleville, M. Archambault, L. Tremblay, J.-F. Beaudoin, N. Beaudet, R. Lecomte, M. Lepage, L. Gendron, P. Sarret. Behavioural, medical imaging and histopathological features of a new rat model of bone cancer pain. *PLoS ONE* 5(10):e13774 (2010)
- S. Authier, S. Tremblay, V. Dumulon, C. Dubuc, R. Ouellet, R. Lecomte, S.C. Cunnane, F. Bénard, [^{11}C]acetoacetate utilization by breast and prostate tumors: a PET and biodistribution study in mice. *Molecular Imaging and Biology* 10(4):217-223 (2008)
- M. Bentourkia, S. Tremblay, F. Pifferi, J. Rousseau, R. Lecomte, S. Cunnane, PET study of ^{11}C -acetoacetate kinetics in rat brain during dietary treatments affecting ketosis. *American Journal of Physiology – Endocrinology and Metabolism* 296:E796-E801 (2009)
- F. Pifferi, S. Tremblay, E. Croteau, M. Fortier, F. Tremblay-Mercier, R. Lecomte, S.C. Cunnane. Mild experimental ketosis increases brain uptake of ^{11}C -acetoacetate and ^{18}F -fluorodeoxyglucose: A dual tracer PET imaging study in rats. *Nutritional Neuroscience* 14(2):51-58 (2011)
- S.L. Ménard, X. Ci, F. Frisch, F. Normand-Lauzière, J. Cadorette, R. Ouellet, J.E. van Lier, F. Bénard, M. Bentourkia, R. Lecomte, A.C. Carpentier. Mechanism of reduced myocardial glucose utilization during acute hypertriglyceridemia in rats. *Molecular Imaging and Biology* 11(1):6-14 (2009)
- S.L. Ménard, E. Croteau, O. Sarrhini, R. Gélinas, P. Brassard, R. Ouellet, M. Bentourkia, J.E. van Lier, C. Des Rosiers, R. Lecomte, A.C. Carpentier. Abnormal *in vivo* myocardial energy substrate uptake in diet-induced type 2 diabetic cardiomyopathy in rats. *American Journal of Physiology - Endocrinology and Metabolism* 298(5):1049-1057 (2010)
- S.M. Labbé, T. Grenier-Larouche, É. Croteau, F. Normand-Lauzière, F. Frisch, R. Ouellet, B. Guérin, É. E. Turcotte, A. C. Carpentier. Organ-specific dietary fatty acid uptake in humans using positron emission

- tomography coupled to computed tomography. *American Journal of Physiology - Endocrinology and Metabolism* 300(3):E445-E453 (2011)
- V. Ouellet, S. M. Labbé, D. P. Blondin, S. Phoenix, B. Guerin, F. Haman, É. E. Turcotte, D. Richard, A. C. Carpentier. Cold-induced brown adipose tissue thermogenesis in humans. Accepted in the *Journal of Clinical Investigation*.
- R. Lecomte, É. Croteau, M.-È. Gauthier, M. Archambault, A. Aliaga, J. Rousseau, J. Cadorette, J.-D. Leroux, M. D. Lepage, F. Bénard, M. Bentourkia. Cardiac PET imaging of blood flow, metabolism, and function in normal and infarcted rats. *IEEE Transaction on Nuclear Science* 51(3):696-704 (2004)
- E. Croteau, F. Bénard, M. Bentourkia, J. Rousseau, M. Paquette, R. Lecomte. Quantitative myocardial perfusion and coronary reserve in rats with ^{13}N -ammonia and small animal PET: impact of anesthesia and pharmacological stress agents. *Journal of Nuclear Medicine* 45(11):1924-1930 (2004)
- F. Chagnon, M. Bentourkia, R. Lecomte, M. Lessard, O. Lesur. Endotoxin-induced heart dysfunction in rats: Assessment of myocardial perfusion and permeability and role of fluid resuscitation. *Critical Care Medicine* 34(1):127-133 (2006)
- V. Bérard, J.A. Rousseau, J. Cadorette, L. Hubert, M. Bentourkia, J.E. van Lier, R. Lecomte. Dynamic imaging of transient metabolic processes by small animal positron emission tomography for the evaluation of photosensitizers in photodynamic therapy of cancer. *Journal of Nuclear Medicine* 47(7):1119-1126 (2006)
- A. Aliaga, J.A. Rousseau, J. Cadorette, É. Croteau, J.E. van Lier, R. Lecomte, F. Bénard. A small animal positron emission tomography study of the effect of chemotherapy and hormonal therapy on the uptake of 2-deoxy-2-[F-18]fluoro-d-glucose in murine models of breast cancer. *Molecular Imaging and Biology* 9(3):144-150 (2007)
- M. Paquette, R. Ouellet, M. Archambault, É. Croteau, R. Lecomte, F. Bénard. [^{18}F]-fluoroestradiol (FES) quantitative PET imaging to differentiate ER+ and 2 ER α -knockdown breast tumors in mice. *Nuclear Medicine and Biology* 39(1):57-64 (2012)
- É. Croteau, S. Gascon, M. Bentourkia, R. Langlois, J.A. Rousseau, R. Lecomte, F. Bénard. ^{11}C -acetate rest-stress protocol to assess myocardial perfusion and oxygen consumption reserve in a model of congestive heart failure in rats. *Nuclear Medicine and Biology* 39(2):287-294 (2012)
- P. Fournier, V. Dumulon-Perreault, S. Ait-Mohand, R. Langlois, F. Bénard, R. Lecomte, B. Guérin. Comparative study of ^{64}Cu /NOTA-[D-Tyr 6 , β Ala 11 , Thi 13 , Nle 14]BBN(6-14) monomer and dimers for prostate cancer PET imaging. *European Journal of Nuclear Medicine and Molecular Imaging Research* 2(8):1-15 (2012)
- P. Fournier, V. Dumulon-Perreault, S. Ait-Mohand, S. Tremblay, F. Bénard, R. Lecomte, B. Guérin. Novel radiolabeled peptides for breast and prostate tumor PET imaging: ^{64}Cu / and ^{68}Ga /NOTA-PEG-[D-Tyr 6 , β Ala 11 , Thi 13 , Nle 14]BBN(6-14). *Bioconjugate Chemistry* 23 :1687-1693 (2012)
- N. Cauchon, R. Langlois, J.A. Rousseau, G. Tessier, J. Cadorette, R. Lecomte, D.J. Hunting, R.A. Pavan, S.K. Zeisler, J.E. van Lier. PET imaging of apoptosis with ^{64}Cu -labelled streptavidin following pretargeting of phosphatidylserine with biotinylated annexin-V. *European Journal of Nuclear Medicine and Molecular Imaging* 34(2):247-258 (2007)
- K. Smith, N. Malatesti, N. Cauchon, D. Hunting, R. Lecomte, J.E. van Lier, J. Greenman, R.W. Boyle. Mono- and tri-cationic porphyrin-mono-clonal antibody conjugates: photodynamic activity and mechanism of action. *Immunology* 132(2):256-265 (2011)

E. Ranyuk, N. Cauchon, H. Ali, B. Guérin, R. Lecomte, J.E. van Lier. PET imaging using ^{64}Cu -labelled sulfophthalocyanines: synthesis and biodistribution. *Bioorganic & Medicinal Chemistry Letters* 21(24):7470-7473 (2011)

N. Cauchon, É. Turcotte, R. Lecomte, H.H. Hasséssian, J.E. van Lier. Predicting efficacy of photodynamic therapy by real-time FDG-PET in a mouse tumour model. *Photochemical & Photobiological Sciences* 11:364-370 (2012)

N. Cauchon, É. Turcotte, R. Lecomte, J.E. van Lier. La tomographie dynamique d'émission par positrons: un outil pour évaluer l'efficacité de la thérapie photodynamique du cancer. *Médecine Sciences Amérique* 1(1) : 1-12 (2012)

J. A. Chouinard, J. A. Rousseau, J.-F. Beaudoin, P. Vermette, R. Lecomte. Positron emission tomography detection of human endothelial cell and fibroblast monolayers: effect of pretreatment and cell density on ^{18}F FDG uptake. *Vascular Cell* 4(5): (2012) <http://www.vascularcell.com/content/4/1/5>.