CYRIL TOUS

"Currently working with clinicians, physicists, and biomedical engineers to challenge the possibilities of MRI for diagnosis and treatment. My goal is to bridge technological innovation from academia into clinical practice."

Contact

cyriltous@gmail.com
041 078 250 53 29
Lausanne, Switzerland
Citizenship: French

Permanent resident:
Canada, New Zealand, France

Employment

Post-doctorate (MR Scientist) at CHU de Vaud — 07/2022

Supervisor: Prof Matthias Stuber (PhD)

Involved tasks: Improving the temporal and spatial resolution of the Free Running Sequence on Prisma, Sola, Vida, Free Max (IDEA, ICE)

- Optimization of all gradients in bSSFP and GRE (BEAT_SN sequence) for 5D golden angle radial trajectory
- Converting 3D radial trajectory to 3D cones trajectory
- 2D spiral slice selective RF
- Dual VENC 5D radial flow sequence (flow and acceleration encoding)
- Intrinsic DTI-MRE 5D radial sequence (no Resoundant required)

MR Scientist and Research Collaborator in Montréal — 12/2018-07/2022

Supervisor: Prof Gilles Soulez (MD)

Involved tasks: Main project: Programming a sequence to track and steer ferromagnetic particles across the hepatic vessels of a swine at 3T on Skyra (IDEA, ICE)

In collaboration with Siemens Canada (Dr Gerald Moran) and Transmedtech Institute, providing MR scientist support services at CRCHUM, CHU Saint Justine, Montreal Heart Institute and IUGM in Montreal

1. Sustain salary through fee for services.
2. Assess whether the Principal Investigators' needs can be fulfilled by the research sequences already available in the Siemens network.
3. Create and program when necessary, in collaboration with the PI and the graduate students involved in the project, a new sequence that achieves the objectives of the research program.
4. Monitor the quality of the generated images.
5. Create synergy across research programs and institutes.
6. Facilitate the dissemination of these new sequences in the Montreal bio-imaging network and within Siemens Healthineers.

PhD at the University of Auckland — 07/2015-12/2018

MRI topic: Evaluation of heart muscles structure in congenital heart disease (ex-vivo & in-vivo)

Supervisor: Dr Beau Pontre (PhD), Prof Alistair Young (PhD)

Involved tasks: Programming cardiac diffusion MRI sequences in C++ at 3T on Skyra (IDEA, ICE)
Scanning volunteers
Writing image post processing pipeline in MATLAB

Researcher at the Auckland MRI Research Group — 04/2014-09/2014

MRI topic: Evaluation of heart muscles structure in congenital heart disease (ex-vivo)

Supervisor: Dr Beau Pontre (PhD), Prof Alistair Young (PhD)

Involved tasks: Scanning volunteers
Writing image post processing pipeline in MATLAB

Degrees

Doctor of Philosophy in Medical Imaging — 2015-2018
University of Auckland, Auckland, New Zealand

Master of Research, Signals & Images in Biology & Medicine — 2013-2014
University of Rennes 1, Rennes, France

M.Sc. and B.Sc. in Biomedical Engineering — 2008-2014
Superior Institute of Electronics and Digital Technology, Brest, France

Master of Business in International Project Management — 2012-2013
ESC School of Business, Rennes, France

B.Sc. in Physics, Optical Sciences — 2010-2011
University of Brittany, Brest, France

Approved research projects

Project: *Magnetic resonance navigation of drug eluting beads for liver cancer therapy: in-vitro optimization and preclinical safety efficacy study* 03/2020-03/2024
Co-investigator: Dr Gilles Soulez (MD)
Grant: Canadian Institutes of Health Research (CIHR**)** -
Total Funding: **$619,500**
Project Description: For advanced stages of the liver cancer, the preferred treatment consist in the injection thought the liver arteries of chemotherapeutic drugs, to embolize the tumor. However, current techniques use x-ray images to navigate a catheter from an artery in the leg to the desired position in the liver. This procedure is time consuming and cannot be repeated too often for patient comfort and safety. We propose a non-invasive treatment that use a catheter implanted directly in the proper hepatic artery to deliver microbeads loaded with magnetic nanoparticles and chemotherapeutic drug. These microbeads will be steered to the tumors using the magnetic force of a MRI scanner. Once in the feeding vessels of the tumor, they start to desegregate, progressively liberating chemotherapeutic drug. This new method will allow for repeated targeted treatments that are a key element in the regression of liver tumors and the prolongation of the patient life

Project: *Improving diagnosis of myocardial dysfunction associated with CHD in children by cardiac DTI: an insight from myocardial fibre architecture to heart function.* 01/2020-07/2023
Co-investigator: Dr Francois Pierre Mongeon (MD)
Grant: Québec Bio Imaging Network Pilot Project
Total Funding: **$12,000**
Project Description: We aim to characterise the structural changes that occur in the hearts of children with congenital heart disease and investigate the effect that these structural changes have on heart function.

Project: *Improving diagnosis of myocardial dysfunction associated with CHD in children by cardiac DTI: an insight from myocardial fibre architecture to heart function.* 02/2019-07/2023
Co-investigator: Dr Beau Pontré (PhD)
Grant: National Heart Foundation of New Zealand
Total Funding: **$109,377**

Project: *Improving diagnosis of myocardial dysfunction associated with CHD in children by cardiac DTI: an insight from myocardial fibre architecture to heart function.* 09/2019-01/2022
Co-investigator: Dr Fabien Labombarda (MD)
Grant: Société Francaise de Cardiologie
Total Funding: **€12,500**

Project: *Impact of mid treatment MR scans and innovative diffusion sequences to assess oropharynx tumor response to radiotherapy treatment.* 09/2019-09/2020
Co-investigator: Dr Houda Bahig (MD)
Grant: Québec Bio-Imaging Network Pilot project
Total Funding: **$12,500**

Project: *3D Architecture of Rotator Cuff Muscles with DTI and Tractography: Feasibility and Reproducibility Study in Rotator Cuff Tear Patients and Asymptomatic Volunteers* 10/2018-10/2019
Co-investigator: Dr Nathalie Bureau (MD) and Prof Elijah Van Houten
Grant: Québec Bio Imaging Network Pilot project
Total Funding: **$12,500**

Co-supervision of junior researchers

Student: Martin Nicoletti (PhD candidate), Université de Lausanne 07/2023-07/2027
Thesis Title: *Optimizing the temporal and spatial resolution of the Free Running sequence with cones trajectory*.
Description: Simulating cones trajectories in Matlab/Python while satisfying gradients hardware constraints.
Recognitions: Presentation at the ISMRM 2024, article in MRM 2024 (pending)
Student: Alexandre Jodoin (Completed M. Sc.), Université de Montréal 09/2020-07/2021
Thesis Title: *3D Architecture of Rotator Cuff Muscles with DTI and Tractography: Feasibility*

and Reproducibility Study in Rotator Cuff Tear Patients and Asymptomatic Volunteers.

Description: Measurement of T1 and diffusion tensor imaging in cadaveric human specimen of the shoulder and healthy volunteers at 3T MRI.

Recognitions: Poster at the ISMRM 2021, article in JMRI 2022

Student: Ivan Dimov (Completed M. Sc.), Université de Montréal — 09/2020-06/2021

Thesis Title: *Magnetic resonance navigation of drug eluting beads for liver cancer therapy: in-vitro optimization and preclinical safety efficacy study*

Description: Measurement of 2D and 4D flow in physiological hepatic phantom, hepatic arteries of in vivo swines and healthy human volunteer on a 3T MRI and CBCT angio room.

Recognitions: Oral presentation European Congress of Radiology 2022, article in European Radiology 2022

Memberships

International Society for Magnetic Resonance Imaging — 01/2016-01/2024

Society for Cardiovascular Magnetic Resonance

Prizes, awards, fellowships

Best poster presentation, CHU de Montréal, for *Magnetic resonance navigation system for supra-selective embolization of the liver: in vivo demonstration*. — 05/2020

Postdoctoral Research Excellence Award from Transmedtech Institute Montréal — 12/2018

Travel award to present poster and oral at the ISMRM. University of Auckland — 02/2018

Personal skills

Siemens ICE Training, Siemens Heathineers Image Calculation Programming — 11/2017

Siemens IDEA training, Siemens Healthineers Sequence Programming Course — 04/2016

Biomedical engineering: Matlab, C++, Python, Unix, HPC, DICOM, Project Management Body of Knowledge — 2008-2024

Career breaks

Parental leaves — 02/2021-04/2021

Websites

https://orcid.org/0000-0003-2664-5272
https://github.com/c-tous/cardiac-diffusion-MRI
https://www.researchgate.net/profile/Cyril_Tous2
https://scholar.google.com/citations?user=I9gYacsAAAAJ&hl=en&oi=ao
https://ca.linkedin.com/in/cyriltous

Patents and licenses

Dr Ning Li and I initiated a request for 2 patents and obtained a market study analysis from our contractor. We designed an automated system to partially inflate a balloon catheter and control blood flow (patent 1). We also designed a Low-cost, Self-adaptive and MRI-compatible Cardiac Gating System to trigger any devices (e.g. MR sequence, drug delivery) at the desired cardiac cycle (patent 2). After waiting 12 months for the contractor, it was concluded that the market was too small and the cost too high (~$50K for US patent, + product development + allocating resources) for the devices to be eligible. A third patent on Magnetic Resonance Navigation is under review. — 2019-2024

Publications

As a post doctorate

Submitted but not yet accepted/published publications.

1. Ning Li, **Cyril Tous**, Ivan P. Dimov, Phillip Fei, Simon Lessard, PhD, Gerald Moran, Samuel Kadoury, PhD, An Tang, MD, Sylvain Martel, PhD, Gilles Soulez, MD. (2024). *Automated system to partially inflate a balloon catheter and control blood flow: a platform for microrobotics in arteries*. **IEEE/ASME Transactions on Mechatronics.**
2. **Cyril Tous**, Guillaume Flé, Matthew McGarry, Philip Bayly, Keith Paulsen, Curtis Johnson, Elijah Van Houten. (2024). *Anisotropic stiffness of freshly excised ex vivo swine hearts estimated via MR elastography and transversely isotropic nonlinear inversion*. **Journal of Cardiovascular Magnetic Resonance.**

Unpublished work

3. **Cyril Tous**, Alexandre Jodoin, Matthew McGarry, Philip Bayly, Keith Paulsen, Curtis Johnson, Nathalie J Bureau, Elijah Van Houten. (2024). *Anisotropic stiffness of the supraspinatus muscle estimated via MR elastography and transversely isotropic nonlinear inversion*. **Journal of Magnetic Resonance Imaging.**

Published work

4. **Ning Li (co first), Cyril Tous, (co first),** Ivan P. Dimov, Phillip Fei, Simon Lessard, PhD, Gerald Moran, Samuel Kadoury, PhD, An Tang, MD, Sylvain Martel, PhD, Gilles Soulez, MD. (2024). *An MRI-guided magnetic microrobot system for targeted navigation in the artery: in vivo demonstration at human-scale*. **Science robotics**
5. **Cyril Tous**, Alexandre Jodoin, Beau Pontré, Detlev Grabs, Mikael Begon, Elijah Van Houten, Nathalie J Bureau (2023). *Characterizing the myoarchitecture of the supraspinatus and infraspinatus muscles with MRI using diffusion tensor imaging*. **Journal of Magnetic Resonance Imaging.** https://doi.org/10.1002/jmri.28840 , https://www.youtube.com/watch?v=2LvwYVPjPp0
6. Ning Li, **Cyril Tous**, Ivan P. Dimov, Phillip Fei, Simon Lessard, PhD, An Tang, MD, Sylvain Martel, PhD, Gilles Soulez, MD. (2023). D*esign of a Low-cost, Self-adaptive and MRI-compatible Cardiac Gating System*. IEEE Transactions on Biomedical Engineering (TBME)**.** 10.1109/TBME.2023.3280348
7. Ning Li, **Cyril Tous**, Ivan P. Dimov, Pierre-Charles Payer, Phillip Fei, Simon Lessard, Gerald Moran, Ning Jin, Samuel Kadoury, An Tang, Sylvain Martel, Gilles Soule. (2023*). Design of a patient-specific respiratory-motion-simulating platform for in vitro 4D flow MRI***.** Annals of Biomedical Engineering. https://doi.org/10.1007/s10439-022-03117-6
8. **Cyril Tous**, Alexandre Jodoin, Detlev Grabs, Elijah Van Houten, Nathalie J Bureau. (2023). *Intersession Repeatability of Diffusion-Tensor Imaging in the Supraspinatus and the Infraspinatus Muscles of Volunteers*. Journal of Magnetic Resonance Imaging. http://dx.doi.org/http://doi.org/10.1002/jmri.2842
9. **Ivan P Dimov (co First), Cyril Tous (co First**), Ning Li, Charlotte Debbaut, Ning Jin, Gerald Moran, An Tang ,Gilles Soulez. (2022). *Assessment of hepatic arterial hemodynamics with 4D flow MRI: In-vitro analysis of motion and spatial resolution related error and in-vivo feasibility study in 20 volunteers*. European Radiology. https://doi.org/10.1007/s00330-022-08890-5
10. Ning Li, **Cyril Tous**, Ivan P. Dimov; Dominic Cadoret; Phillip Fei; Simon Lessard, Zeynab Nosrati, Katayoun Saatchi, Urs O. Häfeli, PhD; An Tang, MD; Samuel Kadoury, PhD; Sylvain Martel, PhD; Gilles Soulez, MD;. (2022). Quantification and 3D localization of magnetically navigated superparamagnetic particles using MRI in phantom and swine chemoembolization models. IEEE Transactions on Biomedical Engineering. http://dx.doi.org/10.1109/TBME.2022.3151819
11. **Cyril Tous (co first), Ning Li (co first),** Ivan P. Dimov, Samuel Kadoury, An Tang, Urs O. Häfeli, Zeynab Nosrati, Katayoun Saatchi, Gerald Moran, Marcus J. Couch, Sylvain Martel, Simon Lessard, Gilles Soulez (2021). *Navigation of Microrobots by MRI: Impact of Gravitational, Friction and Thrust Forces on Steering Succes*. Annals of Biomedical Engineering. https://doi.org/10.1007/s10439-021-02865-1
12. Irvin Teh, William Romero, Jordan Boyle, Jaume Coll-Font, Erica Dall'Armellina, Daniel B Ennis, Pedro F Ferreira, Prateek Kalra, Arunark Kolipaka, Sebastian Kozerke, David Lohr, François-Pierre Mongeon, Kévin Moulin, Christopher Nguyen, Sonia Nielles-Vallespin, Brian Raterman, Laura M Schreiber, Andrew D Scott, David E Sosnovik, Christian T Stoeck, **Cyril Tous**, Elizabeth M Tunnicliffe, Andreas M Weng, Pierre Croisille, Magalie Viallon, Jürgen E Schneider. (2021). *Validation of cardiac diffusion tensor imaging sequences: A multicentre test–retest phantom study*. NMR in Biomedicine. https://doi.org/10.1002/nbm.4685
13. Ivan P Dimov, **Cyril Tous**, Ning Li, Urs O Häfeli, Sylvain Martel, PhD; Gilles Soulez MD, Msc;. (2021). *Future Advances in Diagnosis and Drug Delivery in Interventional Radiology Using MR Imaging-Steered Theranostic Iron Oxide Nanoparticles*. Journal of vascular and interventional radiology. http://dx.doi.org/10.1016/j.jvir.2021.05.027

As a PhD student

14. **Cyril Tous**, Thomas L. Gentles, Alistair A. Young, Beau Pontre. (2020). *Ex vivo cardiovascular magnetic resonance diffusion weighted imaging in congenital heart disease, an insight into the microstructures of tetralogy of Fallot, biventricular and univentricular systemic right ventricle*. Journal of Cardiovascular Magnetic Resonance**.** http://dx.doi.org/https://doi.org/10.1186/s12968-020-00662-8

Doctoral thesis

"Evaluation of myocardial microstructure in congenital heart diseases with diffusion magnetic resonance imaging". (2019). University of Auckland. http://dx.doi.org/10.13140/RG.2.2.29113.80480 Number of Pages: 546 Supervisors: Dr Beau Pontré, Prof Alistair Young.

Conferences

As a *post doctorate*, Oral presentations:

1. **Cyril Tous**, Guillaume Flé, Matthew McGarry, Philip Bayly, Keith Paulsen, Curtis Johnson, Matthias Stuber, Elijah Van Houten. *Anisotropic stiffness of freshly excised ex vivo swine hearts estimated via transversely isotropic nonlinear inversion MR elastography and transversely isotropic nonlinear inversion at 2-mm isotropic voxel resolution* **(2023). The International Society for Magnetic Resonance in Medicine (ISMRM),** Toronto.
2. **Cyril Tous**, Ning Li, Simon Lessard, Urs O. Häfeli, Samuel Kadoury, An Tang, Syvaim Martel, Gilles Soulez. (2020). *Magnetic resonance navigation system for supra-selective embolization of the liver: in vivo demonstration*. **Radiological Society of North America (RSNA)**, Chicago.
3. Ivan Dimov (co first), **Cyril Tous (co first)**, Ning Li, Maxime Barat, Tim Bomberna, Ning Jin, Gerald Moran, An Tang, Gilles Soulez. *High resolution 4D flow MRI as a novel approach to multi-dimensional evaluation of hepatic arterial hemodynamics: in vitro optimization and volunteer feasibility study*.(2022) **The European Congress of Radiology (ECR)**, Wien.

As a *post doctorate*, Poster presentations:

4. Ning Li, **Cyril Tous**, Phillip Fei, Ivan P Dimov, Simon Lessard, Urs O. Häfeli, Gilles Soulez. *U-Net-based deep convolutional neural network for detection of superparamagnetic drug-eluting particles used for liver chemoembolization.* **(2022) (ISMRM),** London
5. Elijah Van Houten, **Cyril Tous**, Alexandre Jodoin, Matthew McGarry, Philip Bayly, Keith Paulsen, Curtis Johnson, Nathalie J Bureau. *Anisotropic stiffness of the supraspinatus muscle estimated via MR elastography and transversely isotropic nonlinear inversion*. **(2021) (ISMRM)**
6. **Cyril Tous**, Ivan Dimov, Ning Li, Simon Lessard, Gilles Soulez. T*urbulences in a one bifurcation 4mm internal diameter phantomafter inflating a balloon catheter: a 4D flow/cine phase in-vitro study atsystemic pressure*.**(2021)(ISMRM)**
7. **Cyril Tous**, Alexandre Jodoin, Detlev Grabs, Elijah Van Houten, Nathalie J Bureau. Feasibility and Reproducibility Study of Diffusion-Tensor Imaging in Rotator Cuff Muscles of Asymptomatic Volunteers. **(2021)(ISMRM)**
8. **Cyril Tous,** Ivan Dimov, Ning Li, Simon Lessard, Gilles Soulez. *High resolution of 4D flow MRI with joint 4D flow simulation to optimize magnetic resonance navigation of microrobots at the bifurcation*.**(2021)(ISMRM)**
9. **Cyril Tous**, Thomas L. Gentles, Alistair A. Young, Beau Pontré. *Ventricular myocyte tractography in specimens of tetralogy of Fallot, dextro and levo transposition of the great arteries and systemic right ventricle*.(**2021) The Society for Cardiovascular Magnetic Resonance (SCMR)**
10. Ning Li, **Cyril Tous**, Ivan P. Dimov, Dominic Cadoret, Simon Lessard, Zeynab Nosrati, Katayoun Saatchi, Urs O. Häfeli, An Tang, Samuel Kadoury, Sylvain Martel, Gilles Soulez. *Accurate Quantification and 3D Localization of Magnetic Microparticles in the Liver* **([Best Poster]). (2021) Université de Montréal**
11. **Cyril Tous**, Alexandre Jodoin, Detlev Grabs, Elijah Van Houten, Nathalie J Bureau. *3D Architecture of Rotator Cuff Muscles with Diffusion-Tensor MR Imaging and Tractography: Feasibility and Reproducibility Study in Asymptomatic Volunteers*. **(2021) Université de Montreal**
12. Irvin Teh, William Romero , Erica Dall'Armellina , Daniel Ennis , Pedro F. Ferreira , Prateek Kalra , Arunark Kolipaka , Sebastian Kozerke , David Lohr , Kevin Moulin , Christopher Nguyen , Sonia Nielles-Vallespin , Beau Pontre , Laura M. Schreiber , Andrew Scott , David Sosnovik , Christian T. Stoeck ,
13. **Cyril Tous**, Elizabeth Tunnicliffe , Vicky Wang , Andreas M. Weng , Alistair Young , Pierre Croisille , Magalie Viallon , and Jürgen E. Schneider. *Reproducibility of diffusion tensor imaging (DTI) on 12 clinical scanners: Towards validation of cardiac DTI sequences*. (**2020)(ISMRM)**
14. Eva Alonso-Ortiz, **Cyril Tous**, Ryan Topfer, Julien Cohen-Adad. *Real-Time Z-Shimming for MagneticResonance Imaging of the Spinal Cord*.(**2020) Organization for Human Brain Mapping**
15. **Cyril Tous**, Ning Li, Simon Lessard, Gilles Soulez. Magnetic resonance navigation system for supra-selective embolization of the liver: in vivo demonstration **[Best Poster]. (2020) University of Montreal**
16. Irvin Teh, William Romero, Erica Dall'Armellina, Daniel Ennis, Pedro F. Ferreira, Prateek Kalra, Arunark Kolipaka, Sebastian Kozerke, David Lohr, Kevin Moulin, Christopher Nguyen, Sonia Nielles-Vallespin, Beau Pontre,

Laura M. Schreiber, Andrew Scott, David Sosnovik, Christian T. Stoeck, **Cyril Tous**, Elizabeth Tunnicliffe, Vicky Wang, Andreas M. Weng, Alistair Young, Pierre Croisille, Magalie Viallon, Jürgen E.Schneider. *Multi-centre evaluation of diffusion tensor imaging (DTI) in an isotropic phantom: Towards validation of cardiac DTI sequences*. **(2020) (SCMR)**

17. **Cyril Tous** Alistair Young Beau Pontre. *Epicardial fat imaging with diffusion weighted MRI.* **(2019) (ISMRM)**

As a *PhD student*, Oral presentations:

18. **Cyril Tous**, Alistair Young, Beau Pontré. *Assessing myocardial fibre architecture in ex vivo specimens of congenital heart disease.***(2018) (SCMR)**

As a *PhD student*, Poster presentations:

19. **Cyril Tous,** Alistair Young, Beau Pontré. *A non-Gaussian bi-exponential diffusion model with CUSP74 sampling for improved myocardial helix angle quantification and segmentation***. (2018)(ISMRM)**
20. **Cyril Tous,** Alistair Young, Beau Pontré. *Validation of myocardial sheetlet with mode and tractography in DKI bi-exponential model*. **(2018) The IEEE International Symposium on Biomedical Imaging (ISBI)**
21. **Cyril Tous**, Alistair Young, Beau Pontré. *The effect of imaging gradients on estimates of cardiac DTI metrics***. (2018)(SCMR)**
22. **Cyril Tous,** Alistair Young, Beau Pontre. *Assessing myocardial fibre architecture in ex vivo specimens of congenital heart disease***. (2018)(SCMR)**