Ali Rezaei

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Research Summary

PhD candidate in Physics at Concordia University (Quantitative Physiology Imaging Lab) specializing in quantitative MRI and cerebrovascular neuroimaging and passionate about the application of quantitative MRI in human brain studies. My research focuses on investigating white matter microstructure, cerebral metabolism, and vascular health in aging and cardiovascular disease.

I have contributed to multiple peer-reviewed publications (including in *Aging and Disease*, *Journal of Cerebral Blood Flow & Metabolism*, *Journal of Neuroscience* and *GeroScience*) and led projects integrating imaging, clinical, and physiological data to study brain–heart interactions and projects developing deep learning models for medical image analysis. My work combines MRI physics, computational modeling, and machine/deep learning to develop reproducible neuroimaging pipelines and applied work to understand how disease affects brain health.

In addition, I have extensive experience mentoring students across CEGEP, undergraduate and graduate levels, leading projects that resulted in peer-reviewed publications, and collaborating in multidisciplinary clinical research environments following Good Clinical Practice standards.

Education

PhD Candidate in Physics Jan. 2021 – Present
Concordia University, Montreal, QC, Canada

M.Sc. in Biomedical Engineering Sep. 2014 – Jun. 2017
Amirkabir University of Technology, Tehran, Iran GPA: 3.38/4

B.Sc. in Biomedical Engineering Sep. 2010 – Sep. 2014
Amirkabir University of Technology, Tehran, Iran GPA: 3.3/4

Publications & Presentations

Journal Articles

1. **Rezaei, A.**, Potvin-Jutras, Z., Tremblay, S. A., Sanami, S., Sabra, D., Huck, J., Gagnon, C., Wright, L., Leppert, I. R., Tardif, C. L., Iglesies-Grau, J., Nigam, A., Bherer, L., Gauthier, C. J. (2026). "Coronary artery disease is linked with demyelination and iron deposition in white matter watershed areas". *Aging and Disesease*, Will be published on August 2027

2. Sanami, S.*, **Rezaei, A.***, Tremblay, S. A., Potvin-Jutras, Z., Sabra, D., Intzandt, B., Gagnon, C., Mainville-Berthiaume, A., Wright, L., Gayda, M., Iglesies-Grau, J., Nigam, A., Bherer, L., Gauthier, C. J. (2026). "Greater cardiorespiratory fitness is associated with higher cerebral blood flow and lower oxygen extraction fraction in healthy older adults". *Journal of Cerebral Blood Flow & Metabolism*. Advance online publication. https://doi.org/10.1177/0271678X251413924

3. Sanami S, Tremblay SA, **Rezaei A.**, Potvin-Jutras Z, Sabra D, Intzandt B, Gagnon C, Mainville-Berthiaume A, Wright L, Gayda M, Iglesies-Grau J, Nigam A, Bherer L, Gauthier CJ. The Impact of Coronary Artery Disease on Brain Vascular and Metabolic Health: Links to Cognitive Function. *Aging and Disesease*. 2025 Dec 17. doi: 10.14336/AD.2025.1173.

4. Sanami, S., Tremblay, S. A., Potvin-Jutras, Z., **Rezaei, A.**, Sabra, D., Gagnon, C., Intzandt, B., Mainville-Berthiaume, A., Wright, L., Gayda, M., Iglesies-Grau, J., Nigam, A., Bherer, L., Gauthier, C. J. (2026). "Cardiorespiratory fitness in relation to cerebral vascular and metabolic health in older adults with coronary artery disease". *GeroScience*, 10.1007/s11357-026-02128-8. https://doi.org/10.1007/s11357-026-02128-8

5. Tremblay, S. A., Potvin-Jutras, Z., Sabra, D., **Rezaei, A.**, Sanami, S., Gagnon, C., Intzandt, B., Mainville-Berthiaume, A., Wright, L., Leppert, I. R., Tardif, C. L., Steele, C. J., Iglesies-Grau, J., Nigam, A., Bherer,

L., Gauthier, C. J. (2025). "Multivariate white matter microstructure alterations in older adults with coronary artery disease." *Journal of Neuroscience.* DOI: 10.1523/JNEUROSCI.0790-25.2025

*Co-first authorship

Submitted articles

1. Potvin-Jutras, Z., Tremblay, S. A., **Rezaei, A.** et al. (2026). "Regional distribution of white matter hyperintensity burden in coronary artery disease and links with coronary revascularization procedure". Submitted to *Journal of Cerebral Blood Flow & Metabolism.*

2. Qin J., Wen J., Duanmu X., Chougar L., Pourmajidian M., Liu L., Vo A., Wennberg K., Wu H., Wu C., Guo T., Zhou C., Zhu Z., Jin Y., Lu N., Wang L., Chen J., Wu J., **Rezaei A.**, Gauthier C. J., Misic B., Yan Y., Xu X., Guan X., Dagher A., Zhang M. (2026). "Multi-scale molecular architecture of cortical iron in Parkinson's disease". Submitted to *Science Advances*

3. Mohammadi, H., Potvin-Jutras, Z., Vincent, T., Sanami, S., Said, S.-N., Benhafed, M., Duquesne, C., Magnan, P.-O., Gayda, M., **Rezaei, A.**, Gagnon, C., Nigam, A., Iglesias Grau, J., Smith, E., Lesage, F., Steele, C., Bherer, L., Gauthier, C. J. (2025). "Synergistic link of cerebral pulsatility and cerebral blood flow with white matter hyperintensity burden in watershed territories: An MRI study." Revisions submitted to *Journal of Cerebral Blood Flow & Metabolism).*

In progress

1. **Rezaei, A.**, Potvin-Jutras, Z., Tremblay, S. A., Sanami, S., Sabra, D., Huck, J., Gagnon, C., Wright, L., Leppert, I. R., Tardif, C. L., Iglesies-Grau, J., Nigam, A., Bherer, L., Gauthier, C. J. (2026). "Coronary artery disease severity is linked with normal-appearing white matter degradation".

2. Al-Khoury Y.*, **Rezaei A.***, Slanina N., Gresseau H., Xiao Y., Thomas B., Gauthier C. J. "Physics-Constrained Quantitative Susceptibility Based Segmentation of Cerebral Veins".
   *Co-first authorship

3. **Rezaei, A.**, Mohammadi H., Al-midany A., Vincent T., Said S.N., Benhafed M., Duquesne c., Magnan P.O., Gagnon C., Iglesies-Grau, J., Nigam, A., Bherer, L., Gauthier, C. J. (2026). "Elevated cerebral pulsatility index is associated with lower cerebral vascular and metabolic health in older adults with cardiovascular risk factors: ACTIONcardioRisk study".

4. **Rezaei, A.**, Al-midany A., Vincent T., Mohammadi H., Said S.N., Benhafed M., Duquesne c., Magnan P.O., Gagnon C., Iglesies-Grau, J., Nigam, A., Bherer, L., Gauthier, C. J. (2026). "Higher cardiovascular risk factor burdens is associated with demyelination and iron deposition in normal-appearing white matter: ACTIONcardioRisk study".

5. **Rezaei, A.**, Al-midany A., Vincent T., Mohammadi H., Said S.N., Benhafed M., Duquesne c., Magnan P.O., Gagnon C., Iglesies-Grau, J., Nigam, A., Bherer, L., Gauthier, C. J. (2026). "Contribution of cardiovascular risk factors on white matter microstructural integrity: ACTIONcardioRisk study".

*Co-first authorship

Presentations

1. **Rezaei, A.**, *et al.*: "Normal-appearing white matter microstructural alterations in watershed regions of coronary artery disease patients and their link to cognition." Presented in *41st Annual Meeting of ESMRMB, 2025, Marseille, France* (International conference)

2. **Rezaei, A.**, *et al.*: "Higher Oxygen Extraction Fraction in Coronary Artery Disease is associated with poorer working memory". *Vascular Training (VAST) conference 2025, Toronto, Canada.* (National conference)

3. **Rezaei, A.**, *et al.*: "White matter alterations in individuals with Coronary Artery Disease". Presented in *XXVIIe Journée de la recherche de l'Institut de Cardiologie de Montréal, 2025, Montréal, Quebec, Canada.* (Local conference)

Conference Abstracts

1. **Rezaei, A**, Sanami, S, Intzandt, B, Tremblay, S, Potvin-Jutras, Z, Sabra, D, Huck, J, Gagnon, C, Mainville-Berthiaume, A, Wright, LN, Vuckovic, D, Iglesies-Grau, J, Vincent, T, Gayda, M, Nigam, A, Bherer, L, Gauthier, CJ (2025): "Alterations in normal appearing white matter microstructure of watershed zones in coronary artery disease and their link to cognition". *XXVIIe Journée de la recherche de l'Institut de Cardiologie de Montréal*, Montréal, Canada. *(Competitive Institutional Abstract)*

2. **Rezaei, A**, Sanami, S, Intzandt, B, Tremblay, S, Potvin-Jutras, Z, Sabra, D, Huck, J, Gagnon, C, Mainville-Berthiaume, A, Wright, LN, Vuckovic, D, Iglesies-Grau, J, Vincent, T, Gayda, M, Nigam, A, Bherer, L, Gauthier, CJ (2025): "Alterations in normal appearing white matter microstructure of watershed zones in coronary artery disease and their link to cognition". *Concordia University School of Health conference*, Montréal, Canada. *(Competitive Provincial Abstract)*

3. **Rezaei, A**, Sanami, S, Intzandt, B, Tremblay, S, Potvin-Jutras, Z, Sabra, D, Huck, J, Gagnon, C, Mainville-Berthiaume, A, Wright, LN, Vuckovic, D, Iglesies-Grau, J, Vincent, T, Gayda, M, Nigam, A, Bherer, L, Gauthier, CJ (2025): "Higher Oxygen Extraction Fraction in Coronary Artery Disease is associated with poorer working memory". *Vascular Training (VAST) conference*, Toronto, Canada. *(Competitive National Abstract)*

4. Potvin-Jutras, Z; Tremblay, SA; Sanami, S; **Rezaei, A**; Sabra, D; Intzandt, B; Wright, L; Gagnon, C; Mainville-Berthiaume, A; Parent, O; Dadar, M; Iglesies-Grau, J; Steele, C.J.; Gayda, M; Nigam, A; Bherer, L; Gauthier, C.J. (2025). "The effects of aerobic fitness and BMI on brain volumes and white matter hyperintensities in coronary artery disease". *ISMRM Conference. (Poster Presentation: 1512)*

5. Potvin-Jutras, Z; Tremblay, SA; Sabra, D; **Rezaei, A**; Sanami, S; Gagnon, C; Intzandt, B; Mainville-Berthiaume, A; Wright, L; Leppert, I.R.; Tardif, C.L.; Gayda, M; Steele, C.J.; Iglesies-Grau, J; Nigam, A; Bherer, L; Gauthier, C.J. (2025). "Multivariate white matter microstructure in coronary artery disease: links to aerobic fitness and cognition". *ISMRM Conference. (Poster Presentation: 3881)*

6. Tremblay, SA*; Potvin-Jutras, Z*; Sabra, D; **Rezaei, A**; Sanami, S; Gagnon, C; Intzandt, B; Mainville-Berthiaume, A; Wright, L; Leppert, I.R.; Tardif, C.L.; Steele, C.J.; Iglesies-Grau, J; Nigam, A; Bherer, L; Gauthier, C.J. (2025). "Multivariate white matter microstructure alterations in older adults with coronary artery disease". *XXVIIe Journée de la recherche de l'Institut de Cardiologie de Montréal. (Poster Presentation)*

7. **Rezaei, A**, Sanami, S, Intzandt, B, Tremblay, S, Potvin-Jutras, Z, Sabra, D, Huck, J, Gagnon, C, Mainville-Berthiaume, A, Wright, LN, Vuckovic, D, Iglesies-Grau, J, Vincent, T, Gayda, M, Nigam, A, Bherer, L, Gauthier, CJ (2024): "Higher Oxygen Extraction Fraction in Coronary Artery Disease is associated with lower cognition and cardiorespiratory fitness in males". *XXVIe Journée de la recherche de l'Institut de Cardiologie de Montréal*, Montréal, Canada. *(Competitive Institutional Abstract)*

8. **Rezaei, A**, Sanami, S, Intzandt, B, Tremblay, S, Potvin-Jutras, Z, Sabra, D, Huck, J, Gagnon, C, Mainville-Berthiaume, A, Wright, LN, Vuckovic, D, Iglesies-Grau, J, Vincent, T, Gayda, M, Nigam, A, Bherer, L, Gauthier, CJ (2024): "Higher Oxygen Extraction Fraction in Coronary Artery Disease is associated with lower cognition and cardiorespiratory fitness in males". *Journée scientifique du RBIQ 2024*, Montréal, Canada. *(Competitive Provincial Abstract)*

9. **Rezaei, A**, Sanami, S, Intzandt, B, Tremblay, S, Potvin-Jutras, Z, Sabra, D, Huck, J, Gagnon, C, Mainville-Berthiaume, A, Wright, LN, Vuckovic, D, Iglesies-Grau, J, Vincent, T, Gayda, M, Nigam, A, Bherer, L, Gauthier, CJ: "Higher Oxygen Extraction Fraction in Coronary Artery Disease is associated with lower cognition and cardiorespiratory fitness in males". *International Society of Magnetic Resonance in Medicine (ISMRM) Annual Meeting & Exhibition 2024*, Singapore, Singapore. *(Competitive International Abstract)*

10. Sanami, S, Tremblay S, Sabra, D, **Rezaei, A**, Intzandt, B, Potvin-Jutras, Z, S, Huck, J, Gagnon, C, Mainville-Berthiaume, A, Wright, LN, Vuckovic, D, Iglesies-Grau, J, Vincent, T, Gayda, M, Nigam, A, Bherer, L, Gauthier, CJ: "Investigating Brain Health in Coronary Artery Disease: Vascular and Metabolic Biomarkers, Cognition, and Implications". *International Society of Magnetic Resonance in Medicine (ISMRM) Annual Meeting & Exhibition 2024*, Singapore, Singapore. *(Competitive International Abstract)*

11. **Rezaei, A**, Tremblay, SA, Sabra, D, Sanami, S, Intzandt, B, Huck, J, Potvin-Jutras, Z, Gagnon, C, Mainville-Berthiaume, A, Wright, L, Vuckovic, D, Iglesies-Grau, J, Vincent, T, Gayda, M, Nigam, A, Bherer, L, Gauthier, CJ: "Assessment of the effects of coronary artery disease on brain oxygen extraction fraction using quantitative

susceptibility mapping." *International Society of Magnetic Resonance in Medicine (ISMRM) Annual Meeting & Exhibition 2023*, Toronto, Canada. *(Competitive International Abstract)*

12. Tremblay, SA, Sabra, D, Sanami, S, **Rezaei, A**, Potvin-Jutras, Z, Gagnon, C, Intzandt, B, Mainville-Berthiaume, A, Wright, L, Vuckovic, D, Iglesies-Grau, J, Vincent, T, Gayda, M, Nigam, A, Bherer, L, Gauthier, CJ: "Differences in cerebellar fiber tract dispersion in coronary artery disease patients are associated with episodic memory and processing speed". *International Society of Magnetic Resonance in Medicine (ISMRM) Annual Meeting & Exhibition 2023*, Toronto, Canada. *(Competitive International Abstract)*

13. **Ali Rezaei**, Abbas N. Moghaddam: "CMR tagging pattern for 3D tracking: Radial-zSPAMM". *Society for Cardiovascular Magnetic Resonance (SCMR) 20th Annual Scientific Sessions*, United States, February 1–4, 2017. *(Competitive International Abstract)*

Honors & Awards

- Best poster award in Aging (engAGE), School of Health conference, Concordia University (2025)
- VAScular Training (VAST) PhD Scholar (2025)
- Quebec Bio Imaging Network (QBIN) Mentorship Program winner (2024)
- International Students Award of Excellence (2021–2024)
- Faculty of Art and Science Graduate Fellowship (2021–2024)

Research Experience

Research Assistant, QPI Lab, Concordia University 2021 – Present

- Developed pipelines for white matter microstructural health analysis using quantitative MRI techniques including Quantitative Susceptibility Mapping, Magnetization Transfer, Relaxometry including R1 and R2* mapping), venography using physics-constraint Deep Learning and cerebral metabolism mapping (OEF and CMRO2) to study individuals with Coronary Artery Disease and with Cardiovascular Risk Factors.
- Mentoring graduate, undergraduate and CEGEP students in multiple projects.
- Conducted MRI data acquisition and blood samples manipulations according to the **Good Clinical Practice** guidelines.

Research Assistant, CBRAIN Platform, McGill University 2022 – 2023

- Developed MATLAB pipelines for cerebrovascular reactivity (CVR) analysis.
- Integrated tools into CBRAIN neuroimaging platform.

Research Assistant, National Brain Mapping Lab (NBML), Iran 2019 – 2020

- Performed functional MRI, Magnetic Resonance Spectroscopy, and Relaxometry analysis using neuroimaging toolboxes (FSL, SPM, CONN).
- Designed Virtual Reality-based neuroimaging experiments to acquire multimodal neuroimaging data including EEG and fNIRS.
- MR-compatible devices for in-scanner experiments (e.g., optical response grips, MR-compatible headphones), in compliance with **ISO-13485**.

Technical Skills

MRI & Imaging: Analysis of Quantitative MRI (QSM, R1, R2, R2* and Magnetizarion Transfer), SWI, fMRI, MRS, MRA
Programming: Python, MATLAB, Bash, C#/C++
Deep Learning: PyTorch
Neuroimaging Tools: FSL, SPM, CONN, jMRUI, SEPIA

Teaching & Mentorship Experience

Mentorship

- **Concordia University Science College Mentorship** 2024–Present
  Mentoring 3 students on MRI/QSM fundamentals and Python-based neuroimaging pipelines.
  - Supervised implementation of advanced QSM reconstruction methods for artifact removal in aging brain datasets. 2 journal papers are in progress from this work.
  - Guided development and validation of MRI processing pipelines (MATLAB → Python) for Alzheimer's disease research.
  - Supported data analysis leading to ongoing manuscript preparation.
- **VAScular Training (VAST) Mentorship Program** 2025
  Mentoring an MSc student (University of Calgary) on MRI data analysis, research proposal development, scientific writing, and academic networking.
- **QBIN CEGEP Mentorship Program (Award Recipient)** Summer 2024
  Mentored 2 students on MRI fundamentals, Python programming, and manual segmentation for deep learning dataset generation. 1 journal paper is in progress from this work.
- **Dawson College Summer Internship** Summer 2025
  Supervised 2 students on neuroimaging applications, Python programming, and deep learning basics; guided dataset preparation for segmentation tasks.
- **National Brain Mapping Laboratory (NBML), Iran** 2020
  Mentored 4 students on neuroimaging fundamentals, MRI data acquisition, research design, ethics procedures, and multimodal data analysis (fMRI, MRS, diffusion MRI).

Teaching

- **Instructor (Tutorials), Introduction to Electricity and Magnetism (PHYS 205), Concordia University** 2022–2023
  Delivered weekly tutorials (5 sessions/week, ∼100 students) focused on problem-solving and conceptual understanding; adapted teaching strategies to diverse academic backgrounds.
- **Teaching Assistant, Concordia University**
  - **Introduction to Mechanics (PHYS 204)** 2023
    Conducted office hours, answered student inquiries, and graded assignments/exams.
  - **Introduction to Electricity and Magnetism (PHYS 205)** 2022
    Supported course delivery through student support, office hours, and grading.
- **Teaching Assistant, Amirkabir University of Technology**
  - **Magnetic Resonance Imaging** 2019
    Led problem-solving sessions on MRI concepts and applications.
  - **Introduction to Biomedical Engineering** 2017–2018
    Delivered weekly tutorial sessions.
  - **Electromagnetics** 2017–2018
    Conducted problem-solving tutorials.