

Ran Klein, PhD

Imaging Physicist

The Ottawa Hospital, Department of Nuclear Medicine
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(Revised 2025-01-31)

Department/School: Medicine

January 2025

Curriculum Vitae

NAME:

KLEIN, Ran

Imaging Physicist, Department of Nuclear Medicine, The Ottawa Hospital, Ottawa, Ontario

DEGREES: designation, institution, department, year

Ph.D., Electrical Engineering, University of Ottawa, 2010

M.A.Sc., Electrical Engineering, University of Ottawa, 2005

B.A.Sc., Computer Engineering, University of Ottawa, 2003

EMPLOYMENT HISTORY:

2023-	Cross-appointed to Faculty of Engineering, University of Ottawa
2021-	Associate Professor, Department of Medicine, Faculty of Medicine, University of Ottawa
2020 - 2021	Ottawa DOM, Project Implementation Manager for Artificial Intelligence and Digital Health Initiative
2016-	Adjunct Research Professor, Department of Physics, Carleton University
2015-2021	Assistant Professor, Department of Medicine, Faculty of Medicine, University of Ottawa
2014-	Imaging Physicist, Department of Nuclear Medicine, The Ottawa Hospital <ul style="list-style-type: none">• Clinician Investigator in the Clinical Epidemiology Program (CEP) at the Ottawa Hospital Research Institute (OHRI)
2012-15	Adjunct Professor, Department of Medicine, Faculty of Medicine, University of Ottawa
2011-14	Associate Scientist, Cardiac Imaging, University of Ottawa Heart Institute <ul style="list-style-type: none">- Principle Investigator- Manager, Cardiac Imaging Core Lab- Co-director, Cardiac Imaging Fellows Training
2011-	Adjunct Research Professor, Department of Systems and Computer Engineering, Faculty of Engineering, Carleton University
2012	Consultant - Cardiac PET/CT Scientist & System Development FMI Medical Systems, Inc.
2010-11	Research Associate, Cardiac PET Centre

2002-10	University of Ottawa Heart Institute - Manager, Cardiac Imaging Core Lab Research Assistant, Cardiac PET Centre University of Ottawa Heart Institute
Sep-Dec 2003	Teaching Assistant
Sep-Dec 2004	University of Ottawa
Jan-May 2002	Programmable Logic Controller Application Developer (Co-op) LEAD Controls, Rosh Ha-ayin, Israel
Sept-Dec 2001	Research Assistant, Cardiac PET Centre University of Ottawa Heart Institute
Apr-Aug 2001	Research Assistant (Co-op), Cardiac PET Centre University of Ottawa Heart Institute
Apr-Aug 2000	Field Engineer ADC Teledata, Herzeliya, Israel
1998-99	Field Engineer ADC Teledata, Herzeliya, Israel
1994-98	Commander and Instructor (First-Sergeant) Israeli Air Force
1995-99	Computer Solutions Development and Support Self Employed
1995	Programmer Yani Electrical Engineering, Israel
1994	Development Quality Assurance Dimyon Multimedia, Ramat-Asharon, Israel

ACADEMIC HONOURS:

2023	Canadian Society of Clinical Chemists Best Poster Award - Clinical at the 67 th Annual Meeting in Winnipeg, Manitoba Klamrowski MM*, Klein R , <u>McCudden C</u> , Green JR, Ramsay T, Rashidi B, Akbari A, Hundemer GL <i>Comparison of Machine Learning with Cox Regression Models for Kidney Failure Prediction among Patients with Advanced CKD.</i>
2023	First Place Graduate Student and Post-Doctorate Short Oral Presentation, Department of Medicine, University of Ottawa Jabbarpour A*, Klein R , J Lang, E Moulton, <i>Automatic Identification of Perfusion Defects in Lung Scintigraphy using Artificial Intelligence and Anomaly Detection,</i>
2023	Editor's Choice Award, 3 rd place article in 2022, Naik D*, Ternan S, Degagne R; Zeng W, Klein R , <i>Thyroid Uptake Exceeding 100%: Causes and Prevention, J Nuc Med Tech</i> , 2022;50(2):153-60.
2019	PhD Scientist Award, Department of Medicine, University of Ottawa.
2019	Certificate of Merit (runner-up), Undergrad, Graduate and Postgrad category, Radiology Research Day, The Ottawa Hospital H Juma*, Zuckier L, Klein R , <i>An integrated software tool for synthesis of lesions in patient PET and CT studies</i>

- 2019 Clinical Sciences Long Oral Winner Graduate Level & Higher, Department of Medicine, University of Ottawa
Manwell S*, **Klein R**, Xu T, deKemp R, *Whole-body motion correction in cardiac PET/CT using positron emission tracking: a phantom validation study*
- 2018 Best Technical Imaging Paper in the Journal of Nuclear Cardiology Award, American Society of Nuclear Cardiology
Klein R, Ocneanu A*, et al. *Consistent tracer administration profile improves test–retest repeatability of myocardial blood flow quantification with 82Rb dynamic PET imaging*. *J Nuc Cardiol* 2018; 25, 1532-6551.
- 2017 Institute of Electrical and Electronics Engineering (IEEE) Senior Member
- 2015 Polk Research Award, Best Basic Science Poster Presentation, University of Ottawa Heart Institute Research Day
Ocneanu A, deKemp RA, Adler A, Beanlands SB, **Klein R**, *Reproducible Tracer Injection Profile Improves the Test-Retest Repeatability of Myocardial Blood Flow Quantification with 82Rb PET*
- 2011-2012 Best Technical Imaging Paper in the Journal of Nuclear Cardiology Award, American Society of Nuclear Cardiology
Katoh C, Yoshinaga K, Klein R, et al. Quantification of Regional Myocardial Blood Flow Estimation with Three-dimensional Dynamic Rubidium-82 PET and modified spillover correction Model. J. Nucl. Cardiol., 2012;19:763-74.
- 2012 Siemens Outstanding Academic Research (SOAR) Award
Coulden R, Klein R, Sonnex, Butler C, Time-resolved quantitative CT myocardial perfusion compared with quantitative 82Rubidium-PET: a pilot study. Soc. Of Cardiovascular Computed Tomography Annual Meeting, Baltimore, MD, 2012
- 2009-2010 Best Technical Imaging Paper in the Journal of Nuclear Cardiology Award, American Society of Nuclear Cardiology
Klein R, Renaud JM, Ziadi MC, et al., *Intra- and inter-operator repeatability of myocardial blood flow and myocardial flow reserve measurements using Rubidium-82 PET and a highly automated analysis program. J. Nucl. Cardiol., 2010;17(4):600-616.*
- 2009 Polk Research Award, Best Clinical Science Poster Presentation, University of Ottawa Heart Institute Research Day
- 2009 Outstanding Research Award, Molecular Function and Imaging Annual Symposium, \$500
- 2008-2009 Heart and Stroke Doctoral Scholarship, \$21,000/year
- 2008 JSPS Summer in Japan, Research Exchange Program, ~\$10,000
- 2005-2008 NSERC Canadian Graduate Scholarship (CGS-D), \$35,000/year
- 2004-2005 Ontario Graduate Scholarship, \$15 000/year
– declined in favour of NSERC PGS-M
- 2006-2009 University of Ottawa Excellence Scholarship, Full tuition coverage

2005-2006	University of Ottawa Admission Scholarship, Full tuition coverage
2004-2005	NSERC Postgraduate Scholarship (PGS-M), \$17,300/year
2004-2005	University of Ottawa Excellence Scholarship, Full tuition coverage
2003-2004	University of Ottawa Admission Scholarship, Full tuition coverage
2000-2003	Dean's Honour List, University of Ottawa
1999-2003	Nortel Networks Scholarship, \$ 2,500/year
1999	University of Ottawa Admission Scholarship, \$1,000

PROFESSIONAL HONOURS:

2024	The Medical Post's Interprofessional Team Award – Living Kidney Donation Program, one-day kidney donor evaluation program.
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PROFESSIONAL TRAINING:

2025	CIHR Institute of Gender and Health Core Competency Module for Sex and Gender in Biomedical Research (eLearning)
2025	Medical Devices – N2Canada (eLearning)
2024	Just Culture Refresher (3 hours)
2022	Quality Improvement Initiative (IQ@TOH) (15 hours) - Reducing Lost Appointment Slots in Nuclear Medicine and Molecular Imaging
2022	Essentials of Academic Leadership Phase II (40 hours)
2021	Introduction to Quality Improvement in Healthcare (7.5 hours)
2019	Essentials of Academic Leadership Phase I – Basic Science (32.5 hours)
2016, Nov 17-18	Medical Emergency Treatment of Exposure to Radiation (METER), Health Canada (14 hours)

SCHOLARLY AND PROFESSION ACTIVITIES: past 7 years only (eg. executive and editorial positions but not memberships in societies; invited presentations at national or international conferences. Do not list manuscript and grant application reviews)

Executive Committee

International

2021-2023	Society of Nuclear Medicine and Molecular Imaging – Physics, Instrumentation and Data Science Council (PIDSC), Board of Directors Member
2020-	Society of Nuclear Medicine and Molecular Imaging – Procedure Standards and Guidance Document Oversight Committee
2020	Society of Nuclear Medicine and Molecular Imaging – Physics, Instrumentation and Data Science Council (PIDSC) - Remote Viewing Guidance

2019 American Society of Nuclear Cardiology, H. William Strauss Best Technical Research Award, Committee Member

2018 Targeted Alpha Therapy, Conference Clinical Committee Member

National

2017-2021 Canadian Organization of Medical Physicists, Scientific Advisory, Member

Local

2024- Epic Quality Improvement, Research, and Innovation Subcommittee

2016-2019 Cancer Care Ontario, Lung PET, Community of Practice Member

2014-2019 Ottawa Medical Physics Institute, Communications Officer

Editorial Board

2017-2020 Annals of Nuclear Cardiology

Reviewer

2024- CIHR - Biomedical Catalyst Grant committee

2019- IEEE - Transactions on Radiation and Plasma Medical Sciences

2018- Clinical Oncology

2018- Journal of Medical Imaging and Radiation Sciences

2016- Annals of Nuclear Cardiology

2015- Natural Sciences and Engineering Research Council of Canada (NSERC) grant review

2013- Medical Physics

2013- Journal of Cardiology and Vascular Medicine

2011- International Journal of Cardiovascular Imaging

2010- Journal of Nuclear Cardiology

Professional Membership

2017- Institute of Electrical and Electronics Engineers, Senior member

2010- Society of Nuclear Medicine

2016-2018 Canadian Organization of Medical Physics

Session Moderator

International

2024 Society of Nuclear Medicine and Molecular Imaging, AI in Nuclear Cardiology

International

2019 Targeted Alpha Therapy Conference, Clinical Research Day

Local

2013 Molecular Function and Imaging Annual Symposium

2010 Molecular Function and Imaging Annual Symposium

Invited Consultation (academic and industry)

2024	Boston Scientific – Automated, multidose TheraSphere delivery system
2023	Lakehead University, Thunderbay, Ontario, Canada – Flow quantification phantom on SPECT/CT.
2023	Mediso, Budapest, Hungary – Flow quantification phantom on SPECT/CT.
2021	National Physics Laboratory, Teddington, UK – Flow quantification phantom, image analysis software and QC.
2019, Sept 26-27	Kettering Medical Center, Dayton, Ohio, USA – Clinical implementation of myocardial blood flow on MiE HR+ PET.
2018	Expert Consultant and Medical Device Reviewer, Health Canada
2013, May 19-25	Instituto do Coração, Hospital das Clinicas, Faculdade de Medicina, Universidade de Sao Paulo (USP), Sao Paulo, Brazil – Funded by International Atomic Energy Agency (IAEA) Supporting Human Resource Qualification and Diffusion of Quantitative Emission Tomography to Improve Management of Patients.
2012, Dec 13-22	Université de Lausanne, Lausanne, Switzerland Integration of FlowQuant© into clinical routine.
2012-2013	FMI Medical Systems, Akron, OH Design and development of cardiac image analysis software for cardiac dedicated PET/CT system.
2008-	DraxImage, Montreal, QC Design and evaluation of Rubidium Elution System for cardiac PET perfusion imaging.
2007	Central Research Institute for Roentgenology and Radiology, St. Petersburg, Russia Rubidium Elution system for cardiac PET perfusion imaging.

Education Leadership and Administration:

2014-	Member, Resident Program Committee, Division of Nuclear Medicine, Department of Medicine, University of Ottawa
2011-16	Co-director, Cardiac Imaging Fellows Training, Division of Cardiology, Department of Medicine, University of Ottawa

Teaching

2013-present	PHYS 5203 – Medical Radiation Physics, Carleton University - Tour of UOHI Radiochemistry Lab and Nuclear Cardiology
2018	TMM4300B – Translational and Molecular Imaging, University of Ottawa - Nuclear Medicine - Image acquisition and reconstruction (3 hrs)
2018-present	Nuclear Medicine for Radiology Residents at the Department of Radiology, University of Ottawa (2 hrs).

- 2015- Nuclear Medicine Physics for medical residents at the Nuclear Medicine Residency Program at Division of Nuclear Medicine, University of Ottawa (40 hrs).
- 2014-2018 BIOM5200/BMG5105/SYSC5304/ELG5127 Biomedical Image Processing Graduate Course, Biomedical Engineering, Carleton University & University of Ottawa joint program:
 - Computed Tomography Image Reconstruction (1.5 hrs)
 - Nuclear Imaging Instrumentation (4.5 hrs).
- 2010-2015 Co-director Cardiac Imaging Training Program for clinical fellows in Nuclear Cardiology and Cardiac CT program at the University of Ottawa Heart Institute.

Lectures

International

1. **Klein R**, Survey Meters, American Society of Nuclear Cardiology, 80 hours Physics Course, 2021 (45 minutes)
2. **Klein R**, Personal Dosimeters, American Society of Nuclear Cardiology, 80 hours Physics Course, 2021 (1.5 hours)
3. **Klein R**, Comparison of Myocardial Blood Flow Quantification using PET with ^{82}Rb and ^{15}O -water – Summary. Nuclear Rounds, University of Hokkaido School of Medicine, 2008-08-18
4. **Klein R**, Comparison of Myocardial Blood Flow Quantification using PET with ^{82}Rb and ^{15}O -water. Nuclear Rounds, University of Hokkaido School of Medicine, 2008-07-07
5. **Klein R**, ^{82}Rb – *From Lab to Clinic – Introduction*. Nuclear Rounds, University of Hokkaido School of Medicine, 2008-06-30

Local

6. Klein R, Quantitative lung
7. **Klein R**, Squeezing medical insight out of photons – Quality Control in the Nuclear Medicine Department, OMPI Symposium, 2018-05-24
8. **Klein R**, Thibeau A, Sutherland J, *Emerging Technologies - Panel Discussion*, CAMRT Game Changers Annual Symposium, 2018-05-16
9. **Klein R**, The rise of artificial intelligence in medical imaging. And we thought an isotope shortage was disruptive? O and D Section of the OAMRS, 2018-04-19.
10. **Klein R**, *Myocardial Blood Flow Quantification with PET: Making it more available*, Multi-modality Education Day: Emerging Technologies, CAMRT & OAMRS, 2017-04-28
11. **Klein R**, *Squeezing Insight out of Photons: Emerging technologies and PET/CT and SPECT/CT*, Multi-modality Education Day: Emerging Technologies, TOH & OAMRS O&D Section, 2016-10-05
12. **Klein R**, *Myocardial Blood Flow Imaging and Quantification*. Molecular Function and Imaging Rounds, UOHI, 2012-02-06
13. **Klein R**, *PET Basics*. Nuclear Cardiac Imaging Rounds, UOHI, 2011-11-24
14. **Klein R**, *Basic CT Physics – Part 1*. Cardiac CT Imaging Rounds, UOHI, 2011-11-21
15. **Klein R**, *SPECT and PET Cardiac Tracers*. Nuclear Cardiac Imaging Rounds, UOHI, 2011-01-26

16. **Klein R**, Mackasey K, *Myocardial Blood Flow Imaging and Quantification*. Molecular Function and Imaging Rounds, UOHI, 2011-02-15
17. **Klein R**, *PET Basics*. Nuclear Cardiac Imaging Rounds, UOHI, 2010-11-18
18. **Klein R**, *SPECT and PET Cardiac Tracers*. Nuclear Cardiac Imaging Rounds, UOHI, 2010-01-26
19. **Klein R**, *Validation of Myocardial PET Images*. Research Methods Rounds, UOHI, 2010-03-01
20. **Klein R**, *Concepts in Digital Images*. Molecular Function and Imaging Rounds, UOHI, 2009-11-23
21. **Klein R**, Pursuit of physiologically accurate factor analysis to improve quantification of perfusion. Research in Progress Rounds, UOHI, 2008-04-07
22. **Klein R**, *Volumetric cardiac PET images and pretty pictures*. Molecular Function and Imaging Rounds, UOHI, 2006-11-12
23. **Klein R**, Renaud J, Lortie M, deKemp R *FlowTrace–RBTM Rubidium-82 Generator Manufacturing, Tracer Delivery, and Kinetic Modeling*. Ottawa Nuclear Imaging City Wide Rounds, 2006-09-26

GRADUATE SUPERVISIONS: career numbers; masters, doctoral, postdoctoral - completed/in progress; please distinguish between supervisor, co-supervisor and supervisory committee member

Completed: 6 MASc., 2 PhD
 In Progress: 1 MASc., 4 Ph.D.

Graduate Supervision

1. Martin Klamrowski (PhD Biomedical Engineering), *Derivation and Validation of a Machine Learning Model for the Prevention of Unplanned Dialysis*, Sept 2023 (University of Ottawa).
2. Elmira Amoei (PhD Biomedical Engineering), *Derivation and Validation of a Machine Learning Model for the Guidance of Tacrolimus dosing in renal transplant recipients*, Sept 2023 (Carleton University).
3. Amir Jabbarpour (PhD Physics), *AI for interpretation of lung ventilation/perfusion scintigraphy in pulmonary embolism*. Co-supervised with Tong Xu, Sept 2022 (Carleton University).
4. Wissam Mosleh (MASc Biomedical Engineering), *Heart segmentation in perfusion PET Imaging*. Co-supervised with Jochen Lang & Robert deKemp, January 2022 (University of Ottawa).
5. Siraj Ghassel (MSc Computer Science), *Artificial Count Enhancement of Lung Scintigraphic Images Using Deep Learning Techniques*, co-supervisor with J. Lang and E Moulton, January 2022-December 2023 (University of Ottawa).
6. Elaheh Amini (PhD Biomedical Engineering), *Lung Lobe Segmentation in SPECT/CT*, Co-supervised with Leila Mostaço-Guidolin, Sept 2021 (Carleton University)
7. Quinn de Bourbon (MSc Medical Physics), *Uncovering the Limits of Detection of Artificial Intelligence using Synthetic Lesions in Positron Emission Tomography*, Sept 2021-December 2023 (Carleton University)

8. Martin Klamrowski (MAsc Systems and Computer Engineering), *Derivation and Validation of a Machine Learning Model for the Prevention of Unplanned Dialysis*, Co-supervised with J. Green, A. Akbari, G. Hundemer, C McCudden, May 2021-August 2023 (Carleton University)
9. Odai Salman (PhD Systems and Computer Engineering), *Development of an Integrated System for Automatic Tumor Detection for PET-CT Images*, Co-supervised with A. Adler, Sept 2017-2021 (Carleton University)
10. Hanif Gabrani-Juma (MAsc Biomedical Engineering), *Lesion synthesis in PET-CT*, Co-supervised with A. Adler, Jan 2017- April 2019 (Carleton University)
11. Colin Jones (MAsc Biomedical Engineering), *Correction for patient motion in PET reconstruction*, Co-supervisor with A. Adler and R. deKemp, Jan 2015-Aug 2017
12. Spencer Manwell, (Ph.D. Physics), *Data driven motion correction in dynamic cardiac PET*, Co-supervised with T. Xu and R. deKemp, Sept 2015 – Aug 2020 (Carleton University)
13. Adrian Ocneanu (Ph.D. Electrical Engineering), *Right Ventricle Myocardial Blood Flow and Metabolic Quantification Using Dynamic PET*, Co-supervisor with A. Adler, Jan 2014-Sept 2017 (Carleton University)
14. Anbhu Sritharan (MAsc. Biomedical Engineering), *Gross Patient Motion Correction in Dynamic Cardiac Positron Emission Tomography*, Co-supervisor with A. Adler, Sept 2013- Dec 2015 (Carleton University)
15. Simisani Takobana (MAsc. Biomedical Engineering), *Quantification of Right Ventricular Function in Pulmonary Hypertension using Cardiac PET Images*, Co-supervisor with A. Adler Sept 2010-Dec 2012 (Carleton University)

Honour's Project Supervision

- 2015-Sep – 2016 Apr - Hanif Gabrani-Juma, Tyler Holmwood, Erik Zakher, BSc Biomed Eng candidates, “*Dynamic contrast-enhanced phantom flow quantification software – Quantify*”.

Internship Supervision

- 2021 – Shahin (Sean) Abtahi, 1st year Medical Student, University of Ottawa, “*Perception of synthetic lesions in PET images for evaluation of trainee performance*”
- 2021-2022 – Dhrumil Naik, University of Ottawa, “*Quality Improvement in Nuclear Medicine*”
- 2020-2021 – Soroush Fard, University of Ottawa, “*Deep Vein Thrombosis Direct Referral Tool*”
- 2020-2021 – Vidit Vyas, Ontario Institute of Technology, “*COVID-19 ICU Triage calculator*”
- 2020-2021 – Punit Daga, University of Ottawa, “*COVID-19 ICU Triage calculator*”
- 2020 – Karl Zhu, University of Waterloo, “*Deep Vein Thrombosis Direct Referral Tool*”
- 2020 – Sanat Nayar, University of Ottawa, “*Electronic calculators for Nuclear Medicine Clinic*”

- 2017 – Doaa Nadouri, BSc Candidate, Biopharmaceutical Science (Genetics), University of Ottawa, “*Diastolic dysfunction can precede systolic dysfunction on MUGA in cancer patients receiving trastuzumab based therapy.*”
- 2017 – Erin Osler, BSc Candidate, “*Fiducial marker motion tracking in dynamic PET*”.
- 2016 – Erin Osler, BSc Candidate, “*Quality assurance tracking in nuclear medicine*”.
- 2015 – Simin Razavi, MSc, “*Synthesis of artificial lesions in nuclear images*”.
- 2015 – Rayhan Memon, “*Quality assurance management software in nuclear medicine*”.
- 2015 – Andrew Coathup, BSc, “*Synthesis of artificial lesions in nuclear images*”.
- 2014 – Brittany Reiche, BAsC, “*Coronary Contrast Opacification as an Indicator of Myocardial Perfusion*”.
- 2013-2016 – Hanif Gabrani-Juma, BEng Candidate, “*Dynamic splash viewer for FlowQuant*”, “*CT Angiography Dose Reduction Impact on Image Quality*”, “*Dynamic imaging phantom*”

Undergraduate Co-op Students

- 2010 - Trevor Burn, Physics Department, University of Ottawa, “*Optimizing execution speed of factor analysis of dynamic PET*”.
- 2009 - Charles Malo, School of Information Technology and Engineering, University of Ottawa, “*Heart left ventricle function analysis using gated PET*”.

Volunteers

- 2020 - Sanat Nayar, BAsC, Candidate, Computer Engineering, University of Ottawa, “*Machine Learning based differentiation of synthetic and real liver lesions in FDG PET*”
- 2018 – Ahmed Rezk, BSc Candidate, Physics, University of Ottawa, “*Improved differential kidney function measurements using attenuation correction of planar scintigraphy*”
- 2016-2018 – Doaa Nadouri, BSc Candidate, Biopharmaceutical Science (Genetics), University of Ottawa, “*Diagnostic value of diastolic dysfunction and right ventricular function parameters for cardiotoxicity during chemotherapy*”
- 2016-2017 – Pia Kristensen, MSc, Health Sciences, University of Copenhagen, Denmark, “*Quality control of region of interest area in bone mineral densitometry with DEXA*”
- 2015 – Doaa Nadouri, BSc Candidate, Biopharmaceutical Science (Genetics), University of Ottawa, “*Evaluation of brown fat exclusion tool in FDG PET*”.
- 2013-2014 – Bachar Almazloum, B.A.Sc Candidate, “*Changes in CTA image quality with CT dose reduction strategies*”.
- 2013 – Hisham Turkistani, MAsC. candidate, Biomedical Engineering, Carleton University, “*Generating myocardial images from dynamic water PET*”.
- 2013 – Ryan Gotfrit, B.Sc. candidate, Biomedical Science, University of Ottawa, “*Scoring myocardial perfusion ⁸²Rb-PET images for ARMI trial*”.
- 2013 - Hanif Juma, B.A.Sc. candidate, Biomedical Engineering, Carleton University, “*Left ventricle short axis display of dynamic PET*”.

- 2013 – Inas Morsy, M.Sc., "*Automated localization of coronary vascular obstructions using myocardial blood flow gradients*"

GRADUATE COURSES: past 7 years, by year

Not applicable

EXTERNAL RESEARCH FUNDING: past 7 years only, by year, indicating source (granting councils, industry, government, foundations, other); amount; principal investigator; purpose (operating, equipment, travel, publications, etc...) (Include information on principal- or co-investigator)

Principle Investigator

YEAR	SOURCE	AMOUNT
2025-2030	CIHR - HIV/AIDS and STBBI Research Initiative "Pathways to Functional Cure in Chronic Hepatitis B" P.I.: Coffin, Carla S Role: Co-applicant Portion of funds: \$158,500	\$3,749,969
2024-2026	MITACS Elevate "AI-generated Pseudoplanars for Ventilation/Perfusion Scans" - with Jubilant-Radiopharma as industry partner P.I.: R. Klein	\$160,000
2023-2024	INOVAIT Project Grant "AI Tools for the Workflow, Diagnosis, and Treatment Assessment for Pulmonary Embolism on Ventilation-Perfusion Scintigraphic Imaging" - with Jubilant-Radiopharma as industry partner P.I.: R. Klein	\$125,000
2023-2024	MITACS Elevate "Development of Spatial Normalization Methods for Ventilation-Perfusion Scintigraphic Images" - with Jubilant-Radiopharma as industry partner P.I.: R. Klein	\$30,000
2022-2026	MITACS Elevate "Artificial Intelligence for Lung Scintigraphy and Pulmonary Embolism" - with Jubilant-Radiopharma as industry partner P.I.: R. Klein	\$146,667
2022-2027	Canadian Institutes of Health Research (CIHR) Project Grant	\$195,000

	<i>“Artificial Intelligence for the Prevention of Unplanned Dialysis”</i>	
	P.I.: G. Hundemer	
	Role: Principle Applicant	
2022	Multidisciplinary Research Cluster	\$50,000
	<i>“Canadian Futuristic Health Data Visualization Center”</i>	
	P.I.: Fateme Rajabiyazdi	
	Role: Co-applicant	
2020-2025	Natural Sciences and Engineering Research Council (NSERC) Discovery Program Grant	\$165,000
	<i>“Pushing the limits of detection with PET”</i>	
	P.I.: R. Klein	
2020-2023	Natural Sciences and Engineering Research Council (NSERC) Discovery Accelerator Supplement	\$120,000
	<i>“Pushing the limits of detection with PET”</i>	
	P.I.: R. Klein	
2017-2018	Natural Sciences and Engineering Research Council (NSERC) Engage	\$25,000
	<i>“Integration of Human and Machine Observers for the Interpretation of Medical Images”</i>	
	P.I.: R. Klein	
2016-2017	Ontario Centres of Excellence (OCE) Voucher for Innovation and Productivity 1 (VIP1)	\$20,000
	<i>“Quantitative Medical Imaging Validation Flow Phantom”</i>	
	P.I.: R. Klein	
2014-2015	Canadian Institutes of Health Research (CIHR) Bridge Funding	\$100,000
	<i>“The Effects of Psoriatic Arthritis on coronary Flow Reserve and Markers of Inflammation and Evaluation of the Response to Biological Therapy”</i>	
	P.I.: G. Dwivedi	
	Role: collaborator)	
2014-2018	Canadian Institutes of Health Research (CIHR) Operating Grant	\$534,782
	<i>“Translational Imaging of Coronary Endothelial Function with Positron Tomography”</i>	
	P.I.: R. deKemp	
	Role: collaborator	
2014-2014	Medical Imaging Trail Network of Canada (MITNEC) Mentorship Exchange Program	\$5,000
	<i>“Myocardial Blood Flow Quantification with Computed Tomography”</i>	
	P.I. R. Klein	
2014-2014	Natural Sciences and Engineering Research Council (NSERC) Engage	\$22,500

	<i>“Perfusion Flow Phantom using a Peristaltic Pump Flow Source of Multi-Modality Medical Imaging”</i>	
	P.I.: R. Klein	
2014-2014	Natural Sciences and Engineering Research Council (NSERC) Engage	\$24,500
	<i>“Image Data De-identification for Biomedical Research”</i>	
	P.I.: R. Klein	
2013-2018	Natural Sciences and Engineering Research Council (NSERC) Discovery Program Grant	\$160,000
	<i>“Improving the accuracy of cardiac PET with motion-free imaging”</i>	
	P.I.: R. Klein	
Under Review		
2021	PSI Foundation Clinical Research Grant	\$99,000
	<i>“Artificial Intelligence for the Prevention of Unplanned Dialysis”</i>	
	P.I.: A. Akbari	
	Role: Co-Principle Investigator	

Collaborator

YEAR	SOURCE	AMOUNT
2014/9 - 2018/8	GE Healthcare (formerly General Electric Medical Systems) Collaborative Research Grant	\$100,174
	<i>“Comparison of Myocardial Blood Flow Measurements with Dedicated Solid State SPECT Camera Imaging and 99mTc-Tetrofosmin versus PET Imaging and Rubidium-82”</i>	
	Portion of Funding Received - 0	
	Funding Competitive?: No	
	Co-investigator : G Wells; B Chow; R deKemp	
	P.I.: T. Ruddy	
	Role: Co-investigator	

INTERNAL RESEARCH FUNDING:

2024-2025	University of Ottawa, Faculty of Medicine - AI Seed Funding Project Grant	\$10,000
	<i>“Precommercial Deployment of MIPAS”</i>	
	Role: PI	
2024-2025	University of Ottawa, Faculty of Medicine - AI Seed Funding Project Grant	\$10,000
	<i>“Learning from an Artificial Intelligence Implementation at the Ottawa Hospital”</i>	
	P.I.: G Hundemer	

2024-2027	Role: Co-PI TOHAMO Project Grant <i>“Deep Learning Multi-Task Models for Predictive Kidney Care: The Next-Gen Solution to Unplanned Dialysis Prevention”</i> P.I.: G Hundemer	\$99,000
2024-2025	Role: Co-PI OHRI-ELEVATE Seed funding grant <i>“Reinforcement Learning to Personalize Tacrolimus Dosing for Kidney Transplant Recipient”</i> P.I.: Dr. Ayub Akbari Role: Co-applicant	\$24,345

PUBLICATIONS: Trainees are indicated with an asterisk *

Life-time summary (count) according to the following categories:

Book Chapters	4
Papers in refereed journals	74 (+4 submitted)
Editorials	5
Papers in refereed conference proceedings	10
Abstracts	124 (+3 submitted)
Major invited contributions and/or technical reports	15
Presentations	
International	12 (+12 invited)
National	1 (+6 invited)
Local	2 (+5 invited)
Open source software	3

Rankings

Google scholar: H-index: 31 10 papers cited over 100 times

Published Book Chapters

1. **Klein R**, deKemp RA, Rotstein B, Yoshinaga K, *Kinetics of Conventional and New Cardiac Radiotracers*, Nuclear Cardiac Imaging 6th Edition, Ami Iskandrian and Fadi Hage. 2024:
2. Croteau E, **Klein R**, Renaud JM, Premaratne M, deKemp RA, *Cardiovascular PET-CT, Hybrid Imaging in Cardiovascular Medicine*, Liu YH, Sinusas AJ, 2017:27-56.
3. **Klein R**, deKemp R, *Cardiac PET Imaging: principles and new developments*, Basic Science of PET Imaging, Khalil MM. 2017:451-83.
4. **Klein R**, Pourmoghaddas A, Mc Ardle B, Chow BJW, *Use of radio-labelled compounds and imaging as cardiac biomarkers*, Biomarkers in Disease: Methods, Discoveries and Applications, V. Preedy. 2015:811-40.

Published Papers in Refereed Journals

Reference	PMID
1. Ghassel S*, Jabbarpour A*, Lang J, Moulton E, Klein R , <i>The effect of resizing on the natural appearance of scintigraphic images: an image similarity analysis</i> , <i>Frontiers in Nuclear Medicine</i> , [Accepted].	
2. Amooei E*, Buh A, Klamrowski MM, Shorr R, McCudden CR, Green JR, Babak Rashidi B, Sood MM, Hoar S, Akbari A, Hundemer GL, Klein R , <i>Analytical Modeling Techniques for Enhancing Tacrolimus Dosing in Solid Organ Transplantation: A Systematic Review Protocol</i> , <i>BMJ Open</i> , 2024;14(1):e088775.	39486813
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118. deKemp R, Renaud J, **Klein R**, Lortie M, Beanlands R, *Listmode dynamic-static-gated imaging of myocardial flow reserve, perfusion uniformity, and ejection fraction reserve with Rb-82 PET.* J. Nucl. Med. Meeting Abstracts, 2008;49:190
119. **Klein R**, Bentourkia M, Adler A, DaSilva J, Wassenaar R, Beanlands RS, deKemp RA, *Anatomical accuracy & variability in factor analysis of dynamic structures (FADS) with cardiac ¹⁸FDG PET imaging.* J. Nucl. Med. Meeting Abstracts, 2007;48:408.
120. **Klein R**, *Automated Quantification of Myocardial Viability with FDG PET.* Imaging Network Ontario 6th Annual Symposium Proceedings, 2007; pp. 7.
121. Lecomte R, deKemp R, **Klein R**, Cadorette J, Bergeron M, Lepage M, Selivanov V, Tetrault MA, Viscogliosi N, Fontaine R, *LabPETTM: A high-performance APD-based digital PET scanner for small animal imaging.* J. Nucl. Med. Meeting Abstracts, 2006;47:194
122. **Klein R**, Epstein N, Benelfassi A, Beanlands RS, deKemp RA, *A Rubidium-82 Infusion System for Quantitative Perfusion Imaging with 3D PET.* Proceedings of the 3rd Annual Imaging Network Ontario Symposium, 2004:pp 98.
123. **Klein R**, Beauchesne LM, Ruddy TD, Beanlands RS, deKemp RA, *Direct Paired Comparison of Serial Myocardial perfusion scans in normal volunteers and coronary disease patients.* Proceedings of the Society of Nuclear Medicine 51st Annual Meeting, 2004;45(5):239.
124. deKemp RA, Hart R, **Klein R**, Byck C, Berry M, Beanlands RS, Ruddy TD, *Serial changes in perfusion and wall-thickening with gated-stress SPECT and direct paired comparison (DPC) analysis.* J. Nucl. Med. Meeting Abstracts, 2003;44(5):53.

Abstracts Submitted

125. Al Sulaiman S, Amini E*, **Klein R**, Zeng W, *New quantitative analysis of total striatal 123I-Ioflupane activity with HERMES Affinity software*, SNMMI 2025
126. Moulton E, **Klein R**, Pelletier-Galarneau M, Beanlands RS, deKemp RA, *Multicenter Clinical Validation of an Artificial Intelligence-based Tool for Myocardial Blood Flow Parametric Mapping to Diagnose Coronary Artery Disease with 82Rb Positron Emission Tomography*, SNMMI 2025

127. Kaviani S*, Rahman Y, Pelletier-Galarneau M, Beanlands RS, **Klein R**, Moulton E, deKemp RA. *Validation of AI-Generated Gated Fractional Blood Volume Parametric Maps in ^{82}Rb PET for Accurate Estimation of Biventricular Volume and Function*, SNMMI 2025

Invited Contributions and Technical Reports

1. **Klein R**, Oliver M, La Russa D, Agapito J, Gaede S, Bisonnette JP, Rahmim A, Uribe C, *Technical Quality Control Guidelines for use of Positron Emission Tomography – Computed Tomography (PET/CT) in Radiation Treatment Planning*, Canadian Partnership for Quality Radiotherapy, 2019, <http://www.cpqr.ca/wp-content/uploads/2019/09/PET-2019-09-01-DRAFT.docx>
2. Salman O*, **Klein R**, *Organ segmentation in whole-body PET-CT*, Project final report to Hermes Medical Solutions, 2018.
3. **Klein R**, Zuckier LS, *Hermes in an evolving multi-site organization –The Ottawa Hospital experience*. White paper, Hermes Medical Solutions, 2018
4. Gabrani-Juma H*, **Klein R**, *QuantifyDCE – Tutorial*, Shelley Medical Solutions, 2018
5. Gabrani-Juma H*, **Klein R**, *QuantifyDCE – Flow Quantification validation procedure and manual (including software and tutorials)*, *Software and Operator’s Manual*, Shelley Medical Solutions, 2018
6. **Klein R**, Renaud, J, *FlowQuant™ V.2.4.0 User Manual*, 2014.
7. **Klein R**, Renaud, J, *FlowQuant™ V.2.2.0 User Manual*, 2011.
8. **Klein R**, *VolumeViewer User Manual*, 2007.
9. **Klein R**, Renaud, J, *FlowQuant™ v. 2.0.0 User Manual*, 2007.
10. **Klein R**, *^{82}Rb Elution System User Manual*, 2006.
11. **Klein R**, *^{82}Rb Elution System Software Design Documentation*, Internal documentation, 2005.
12. **Klein R**, *^{82}Rb Elution System Hardware Construction Manual*, Internal documentation, 2005.
13. **Klein R**, *^{82}Rb Elution System Quality Assurance and Testing Manual*, Internal documentation 2005.
14. **Klein R**, *Wall-Thickening Extraction from Smoothed PET Scans*, Internal report to the National Cardiac PET Centre, 2003.
15. **Klein R**, *Control System Implementation for the Tower Semiconductor Fabrication Facility Environment and Production Support Systems*, LEAD Controls Co-op report, 2002.
16. **Klein R**, *Development and Comparison of Various Paired Comparisons Techniques*, Internal report to the National Cardiac PET Centre, 2001.
17. **Klein R**, *Detection of Serial Changes in Absolute Myocardial Perfusion with ^{82}Rb PET*, University of Ottawa Heart Institute Co-op report, 2001.

Technology Transfer, Copyrights and Patents

Patents

Inventors	Name	Assigned to	Country	Filing Date	Patent Number	Grant Date	Status
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Moulton E, S Ghassel, J Lang, Klein R	<i>Methods And Techniques of Resizing of Scintigraphy Images</i>	Jubilant Radiopharma, Montreal, QC		2023-09-21	63/584,367		Provisional
Lefort E, Teoli V, deKemp RA, Klein R	<i>Rubidium Elution System</i>	Jubilant Draximage, Montreal, QC	Canada	2017-04-13			Pending
			US	2017-04-14			Pending
			EU	2018-04-16			Pending
			Australia	2018-04-13			Pending
			Argentina	2017-04-14			Pending
			Pakistan	2017-04-14			Pending
			Lebanon	2018-04-13	11403	2018-04-16	Granted
PCT	2017-04-14			Pending			
Lefort E, Teoli V, deKemp RA, Klein R	<i>Rubidium Elution System Control</i>	Jubilant Draximage, Montreal, QC	EU	2012-10-26	2893540	2018-01-10	Granted
			EU	2012-10-26	3309796		Pending
			Australia	2012-09-05	2012389470B2	2017-08-31	Granted
			Australia (divisional)	2012-09-05	2017213596B2	2019-02-28	Granted
			Colombia	2012-09-05	31789	2017-06-05	Granted
			Japan	2012-09-05	6148341	2017-05-26	Granted
			Mexico	2012-09-05	351398	2017-10-13	Granted
			China	2012-09-05	201280075656.9	2017-10-24	Granted
			Singapore	2012-09-05	10201701766P	2017-04-27	Granted
			Australia (divisional)	2012-09-05			Pending
			Brazil	2012-09-05			Pending
			Canada	2012-09-05			Pending
			China (divisional)	2012-09-05			Pending
			Japan (divisional)	2012-09-05			Pending
			US	2012-09-05	10943707B2	2021-03-21	Granted
			Singapore (divisional)	2012-09-05			Pending
			India	2012-09-05			Pending
			Mexico (divisional)	2012-09-05			Pending
			South Korea	2012-09-05			Pending
			UAE	2012-09-05			Pending
Chile	2012-09-05			Pending			
Costa Rica	2012-09-05			Pending			
Dominican	2012-09-05			Pending			

			Republic				
			Peru	2012-09-05			Pending
			Israel	2012-09-05			Pending
			Malaysia	2012-09-05			Pending
			Hong Kong	2012-09-05			Pending
			Hong Kong	2017-04-14			Pending
			Hong Kong (divisional)	2012-09-05			Pending
deKemp RA, Klein R	<i>Rubidium Elution System Control</i>	Jubilant Draximage, Montreal, QC	US	2006-03-10	7813841	2010-10-12	Granted
			Canada	2006-03-10	2562453	2014-11-18	Granted
			EU	2007-02-26	1996276	2018-08-15	Granted
			India	2007-02-26			Pending

Copyrights

1. deKemp RA, **Klein R**, Epstein N, *RbES*© – *Rb-82 Elution System*. Canadian Intellectual Property Office, Copyright 2003.
2. deKemp RA, **Klein R**, Renaud J, Lortie M, *FlowQuant*© – *Image Analysis Software for Cardiac Positron Emission Tomography (PET)*. Canadian Intellectual Property Office, Copyright 2008.

Technology Transfer

1. deKemp RA, **Klein R**, Renaud J, Myocardial blood flow quantification – technology transfer to Invia Medical Imaging Solutions, Ann Arbor, MI, 2014.
2. FlowQuant© distribution agreement with Siemens Preclinical Solutions, Knoxville, TN, June 2008
3. FlowQuant© distribution agreement with BIOSCAN Inc., Washington DC, October 2010

Media

1. **Klein R**, Enabling Quality Management in Diagnostic Imaging with QATrack+, CAMRT Webinar Series, https://camrt.force.com/CPBase_item?id=a102L000004BL1xQAG, Dec 2018.

Invited Presentations

International

1. **Klein R**, The Limits of Detection in PET, Montefiore Hospital, Radiology Grand Rounds, Feb 28, 2024.
2. **Klein R**, Interview with Famous Physicists series, Editor Hugo Currie, https://www.youtube.com/watch?v=pFMUxCqy_kU
3. **Klein R**, *Advances in SPECT and SPECT/CT Technologies*, Continued Education Session, Society of Nuclear Medicine and Molecular Imaging, New Orleans, LA, June 15, 2020 – deferred due to COVID-19.
4. **Klein R**, *Deep learning in diagnosis, therapy and clinical applications*, Pre-conference symposium, Australian New-Zealand Society of Nuclear Medicine Annual Meeting, Sydney, Australia, April 24, 2020 – deferred due to COVID-19.
5. **Klein R**, *Virtual reality applications in nuclear medicine*, Australian New-Zealand

- Society of Nuclear Medicine, Sydney, Australia – virtual due to COVID-19.
6. **Klein R**, *Quantification of Lung Lobar Function*, Australian New-Zealand Society of Nuclear Medicine, Sydney, Australia, April 26, 2020 – deferred due to COVID-19.
 7. **Klein R**, *⁸²Rb PET myocardial blood flow quantification*, Australian New-Zealand Society of Nuclear Medicine, Sydney, Australia, April 26, 2020 – deferred due to COVID-19.
 8. **Klein R**, *Quantification of V/Q Scans*, Continued Education Session, Society of Nuclear Medicine and Molecular Imaging, Anaheim, CA, June 22, 2019.
 9. **Klein R**, *Introduction to Virtual Tele Nuclear Medicine*, Continued Education Session, Society of Nuclear Medicine and Molecular Imaging, Anaheim, CA, June 23, 2019.
 10. **Klein R**, *Rubidium-82 PET: Bang-for-Buck Technology for Steering Cardiac Care*. University of Sao Paulo, Sao Paulo, Brazil, May 23, 2013.
 11. **Klein R**, *Nuclear cardiology image analysis and software development*. Japanese Society of Nuclear Medicine Annual Meeting, Sapporo, Japan, Oct 12, 2012.
 12. **Klein R**, *Myocardial Blood Flow Quantification with FlowQuant*, General-Electric Medical Imaging, Haifa, Israel, Jan 18, 2012.
 13. **Klein R**, *Clinical Application of ⁸²Rb Positron Emission Tomography*. Meir Hospital Scientific Rounds, Kfar-Saba, Israel, Feb 7, 2010.

National

1. **Klein R**, *Perspective on Medical Isotope Production in Commercial Reactors*, Canadian Nuclear Association Annual Meeting, Ottawa, Ontario, February, 23, 2023.
2. **Klein R**, *Hybrid Imaging – Ligers and Mules*, Mitchener Institute, Wavelengths Conference, Toronto, Ontario, June 3, 2022. <https://vimeo.com/717683725/2f38ec09e7>
3. **Klein R**, *Artificial intelligence in Nuclear Medicine*, Canadian Association of Medical Radiation Technologists and Ontario Association of Medical Radiation Sciences - Annual General Conference, Ottawa, Ontario, May 28, 2020.
4. **Klein R**, *Myocardial Blood Flow Quantification with Positron Emission Tomography (PET): Making More Available*, Canadian Association of Medical Radiation Technologists and Ontario Association of Medical Radiation Sciences - Annual General Conference, Ottawa, Ontario, Apr 28, 2017.
5. **Klein R**, *Negotiating a first contract – Basic Research*. CCS annual meeting, Vancouver,
6. **Klein R**, *Myocardial Perfusion Imaging*, Canadian Association of Nuclear Medicine: Image Acquisition and Processing, Montreal, Quebec, Jan 30, 2015.
7. BC, Oct 22, 2011.
8. **Klein R**, *Rb-82 generator production, tracer delivery and modeling*, Canadian Society of Nuclear Medicine annual meeting, Quebec, PQ. Apr 27, 2006.

Local

1. **Klein R**, *Quantification in Lung V/Q Scans*, Ontario Association of Medical Radiation Sciences, Ottawa District, Ottawa, Ontario, November 16, 2019.
2. **Klein R**, *The rise of artificial intelligence in medical imaging. And we thought as isotope shortage was disruptive?* Ontario Association of Medical Radiation Sciences, Ottawa District, Ottawa, Ontario, April 19, 2018.
3. **Klein R**, *Squeezing insight out of photons: Emerging technologies in PET/CT and SPECT/CT*, Ontario Association of Medical Radiation Sciences, Ottawa District, Ottawa, Ontario, Nov 5, 2016.
4. **Klein R**, *Myocardial Blood Flow: ⁸²Rb PET is just the beginning*. Ottawa Medical

Physics Institute, Ottawa, April 18, 2013.

5. **Klein R**, *Rubidium-82 PET: Bang-for-Buck Technology for Steering Cardiac Care*. IEEE-EMBS Biomedical Engineering Seminar, Carleton University, Ottawa, ON, Jul 15, 2011.

Presentations

International

1. **Klein R**, Rashidi B, Wu S, *Lessons in Digitization of a Triage Protocol for Major Surge in Critical Care During a Pandemic*, eHealth, 2021.
2. **Klein R**, Beanlands RSB, deKemp RA, *Myocardial blood flow quantification and imaging with ^{82}Rb PET – more information with less radiation*, CRPA 2019.
3. **Klein R**, Nadouri D*, Osler E*, Johnson C, Aseyev O, Zuckier LS, Dent S, Dwivedi G, *Persistent LV diastolic dysfunction abnormalities in breast cancer patients following chemotherapy*, S. Nucl. Med. Annual Meeting, Denver, Colorado, USA, 10-14 June, 2017.
4. **Klein R**, Memon R*, Zuckier LS, *Quality control of plasma sample $^{99\text{m}}\text{Tc}$ -DTPA glomerular filtration rate studies*, S. Nucl. Med. Annual Meeting, San Diego, California, USA, 11-15 June, 2016.
5. **Klein R**, Hung G-U, Li D, deKemp R, Hsu B. *Myocardial blood flow (MBF) and coronary flow reserve (CFR) measurement with dynamic SPECT: Operator variability*. S. Nucl. Med. Annual Meeting Abstracts Vancouver, Canada, 8-12 June, 2013.
6. **Klein R**, Yoshinaga K, Katoh C, Adler A, Beanlands R, Tamaki N, deKemp R, *Improved homogeneity of normal MBF using factor analysis with ^{82}Rb PET*. S. Nucl. Med. Annual Meeting Abstracts, Salt Lake City, Utah, USA 5-9 June, 2010.
7. **Klein R**, Katoh C, Yoshinaga K, Adler A, Beanlands RS, deKemp R, *Evaluation of myocardium to blood pool spillover correction in quantification myocardial blood flow with ^{82}Rb PET*. WMIC, Montreal, QC, Canada, 23-29 September, 2009.
8. **Klein R**, Beanlands RS, Adler A, deKemp RA, *Model-based factor analysis of dynamic sequences of cardiac positron emission tomography*. IEEE-NSS-MIC, Dresden, Germany, 19-25 October, 2008.
9. **Klein R**, Bentourkia M, Beanlands RS, Adler A, deKemp RA, *A Minimal factor overlap method for resolving ambiguity in factor analysis of dynamic cardiac PET*. IEEE-NSS-MIC, Honolulu, Hawaii, USA, 27 Oct- 3 Nov, 2007.
10. **Klein R**, Bentourkia M, Adler A, DaSilva J, Wassenaar R, Beanlands RS, deKemp RA, *Anatomical accuracy & variability in factor analysis of dynamic structures (FADS) with cardiac ^{18}F FDG PET imaging*. S. Nucl. Med. Annual Meeting Abstracts, Washington DC, USA 2-7 June, 2007.
11. **Klein R**, Lortie M, Adler A, Beanlands RS, deKemp RA, *Fully Automated Software for Polar-Map Registration and Sampling from PET images*. IEEE-NSS-MIC, San Diego, CA, USA, 29 Oct – 4 Nov, 2006.
12. **Klein R**, Adler A, Beanlands RS, deKemp RA, *Precision control of eluted activity from a Sr/Rb generator for cardiac positron emission tomography*. IEEE-EMBS, San Francisco, California, USA, 1-4 September, 2004.

National

1. **Klein R**, Yoshinaga K, Katoh C, Adler A, Beanlands R, Tamaki N, deKemp R, *Improved*

homogeneity of normal MBF using factor analysis with 82Rb PET. Canadian Cardiovascular Conference, Montreal, QC, Canada, 23-27 October, 2010.

Local

1. **Klein R**, *Trends in Health Care Analytics and AI*, TOH Advanced Leadership Development Program, Critical thinking and data-driven decision-making, Telfer School of Management, Ottawa, ON, Canada, March 19, 2024.
2. **Klein R**, *Trends in Health Care Analytics and AI*, TOH Advanced Leadership Development Program, Critical thinking and data-driven decision-making, Telfer School of Management, Ottawa, ON, Canada, March 28, 2023.
3. **Klein R**, *Automated Quantification of Myocardial Viability with FDG PET. Imaging Network Ontario Annual Symposium*, Toronto, ON, Canada, March, 2007.
4. **Klein R**, Epstein N, Benelfassi A, Beanlands RS, deKemp RA, *A Rubidium-82 Infusion System for Quantitative Perfusion Imaging with 3D PET. Annual Imaging Network Ontario Symposium*, Toronto, ON, Canada, March, 2004.

Open Source Software

1. **Klein R**, *View4D* – 3D and 4D data visualization tool for Matlab, 2013.
2. **Klein R**, *Bland-Altman and Correlation Plot* – Generates correlation and Bland-Altman figures and parameters of grouped data for Matlab, 2014.
3. **Klein R**, *VolViewer* – 3D and 4D data visualization tool for Matlab, 2014.

Other Software

1. Vyas V, Farad S, Daga P, **Klein R**, *COVID-19 ICU Triage Calculator web application* 2021 - <http://covid19icutriage.azurewebsites.net/> (discontinued)

Ran Klein



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