CURRICULUM VITAE

Bijoy Kumar Kundu, PhD

I. PERSONAL DATA

Name: **Bijoy Kumar Kundu, Ph.D.**

Title: **Associate Professor**

Department: Departments of Radiology & Medical Imaging and Biomedical Engineering, University of Virginia

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II. EDUCATION

Year	Degree	Institution
2002	MS	University of Virginia, USA
1998	**Ph.D.**	**Bhabha Atomic Res Center, India**
1992	M.Sc.	University of Mumbai, India
1990	B.Sc.	University of Mumbai, India

III. ACADEMIC APPOINTMENTS

Month, Year	Degree	Institution

Jan 2017-pres: Associate Professor (full time), Department of Radiology & Medical Imaging, University of Virginia (UVa), Charlottesville, VA.

Jan 2017-pres: Associate Professor (secondary appointment), Department of Biomedical Engineering, UVa, Charlottesville, VA.

2010-Jan 2017: Assistant Professor (full-time), Department of Radiology and Medical Imaging, UVa, Charlottesville, VA.

2008-pres: Faculty, Cardiovascular Research Center, UVa, Charlottesville, VA

2007-2010: Assistant Professor of Research, Dept. of Radiology and Med Imaging, UVa, Charlottesville, VA
2006-2007: Instructor, Radiology Research, University of Virginia, Charlottesville, VA
2002-2006: Research Associate, Radiology Research, University of Virginia, Charlottesville, VA
1999-2000: Post-doctoral fellow, Institute of Physics, Bhubaneswar, India
1997-1999: Project Scientist, Physics Department, Indian Institute of Technology, Kanpur, India

IV. HONORS AND AWARDS

1) Department of Atomic Energy (DAE, India) Fellowship for pursuing PhD, 1992-1997.
2) Department of Atomic Energy (DAE, India) Postdoctoral Fellowship, 1997-1999.
3) Department of Atomic Energy (DAE, India) Postdoctoral Fellowship, 1999-2000.
4) New Point of View, **Siemens Pre-clinical microPET image of the Year**, $50,000 and a new point of view trophy, "*In-vivo FDG-PET imaging of myocardial hypertrophy*", September 2007, Providence, Rhode Island.
5) Honorable mention, **Siemens Pre-clinical drug discovery image of the year**, a new point of view trophy, "*Multi-modal PET-MR imaging of myocardial hypertrophy*", September 2008, Nice, France.
6) **Siemens pre-clinical** "**Notable entry" image of the year** for, "*In vivo Imaging of Tissue Glucose Metabolism in Type 2 Diabetes*", September 2009, Montreal.
7) Finalist in the **Annual UVA Presidential Poster Competition** for the project, "Metabolic Imaging- A Novel Diagnostic Strategy for Hypertensive Heart: From Mouse to Man", April 29th, 2013.
8) **Invited Speaker** in Spring NanoSTAR symposium, University of Virginia, May 21-22, 2013.
9) **Invited Speaker** College of Allied Health Sciences at Georgia Regents University, February 20, 2014.
10) **Invited Speaker**, "Kinetic models and dynamic brain PET"; Society of Nuclear Medicine and Molecular Imaging (SNMMI), Baltimore, MD, 2015.
11) **Invited Speaker,** "Dynamic FDG Brain PET and Kinetic Models", Society of Neuroscience AM (AMbulatory) PET Satellite Event, San Diego, November 2016.
12) **Oral Presentation**. Kinetic and Wavelet Analysis of Dynamic FDG PET Data in Human Glioblastoma. (Oral presentation) IEEE Medical Imaging Conference, Workshop on Brain Imaging Systems, October 28, 2017
13) **Invited Webinar** for Bruker. Dynamic PET imaging of early metabolic changes in left ventricular hypertrophy , December 13, 2018
14) **Invited speaker**, Bruker Workshop, European Molecular Imaging Meeting, Glasgow, March 21, 2019
15) **Invited speaker**, Howard University, Nov 21, 2019.
16) **Invited speaker,** UVA-Siemens collaborative effort, May 26, 2022.
17) **Invited speaker,** UVA Cancer Center, September 13, 2023

V. PROFESSIONAL AFFILIATIONS (INCLUDING OFFICES HELD)

Year Organization

May 2023 Adhoc Reviewer, Adhoc Reviewer, 2023/10 HLBP-G (1) 2Workgroup 1, SEP/SRG. Program Project, NIH.

Feb 2021 Adhoc Reviewer, Human Studies of Diabetes and Obesity (HSDO) Study Section
Nov 2019 Adhoc Reviewer, S10 High-end Instrumentation (HEI) study section
June 2019 Adhoc Reviewer, Emerging Imaging Technology (EITA) study section
Sept 2018 Adhoc Reviewer, Medical Imaging (MEDI) Study section
2018-2021 Member, Dean's Research Advisory Committee, University of Virginia
2019- Associate Editor, Frontiers in Medicine-Nuclear Medicine
2017- Review Editor, Frontiers in Medicine-Nuclear Medicine
2009- Member, American Heart Association (AHA)
2005- Member, Society of Nuclear Medicine (SNM)
2005- Member, Academy of Molecular Imaging (AMI)
2003- Member, IEEE Nuclear and Plasma Sciences Society (NPSS)

VI. INDEPENDENT RESEARCH PROJECTS

R01 HL123627 Kundu (PI) 9/7/2015-5/31/2021
NIH-NHLBI
Myocardial Metabolic Remodeling in Cardiac Hypertrophy

The goals of the proposed research are to evaluate the time course of metabolic alterations and development of left ventricular hypertrophy (LVH) and heart failure (HF) in hearts of spontaneously hypertensive rats (SHR) and to determine the effect of therapeutic intervention on glucose metabolism, structure and function in SHR hearts using dynamic PET imaging in conjunction with MRI *in vivo*, hemodynamic measurements and *ex vivo* molecular and metabolic analysis.
Role: Principal Investigator

R21 HL102627-01 Kundu (PI) 4/1/2010 - 3/31/2014
NIH-NHLBI
Metabolic remodeling precedes and triggers left ventricular remodeling in cardiac hypertrophy

The major goals of this proposal are to develop and optimize non-invasive PET imaging techniques along with MRI to test the hypothesis that metabolic remodeling precedes and triggers structural and functional remodeling of the heart in cardiac hypertrophy in-vivo and also to evaluate whether metabolic imaging of the myocardium due to pharmacologic interventions could provide an early indication of favorable left ventricular remodeling.
Role: Principal Investigator

Title: Dynamic FDG PET for multimodal deep learning to differentiate tumor progression from treatment effect in human glioblastoma
Major Goals: The proposal aims to develop deep learning strategies for efficient computation of parametric PET maps thereby enabling efficient and accurate multimodal classification of tumor progression from treatment effect in human glioblastoma.

Source: Cancer Therapeutics (CRX) Research Program Pilot Project Awards, UVA CC
Project/Proposal Start and End Date: 1/1/2023-12/31/2023
Role: Principal Investigator

Title: Interictal dynamic FDG-PET in focal epilepsy

Major Goals: We will evaluate interictal iD-PET compared to state-of-the-art static PET in patients and in healthy controls. We will evaluate targets identified in terms of regions having >1.96 standard deviation interside differences in mean glucose metabolism.

Source: Ivy Innovation Funds

Project/Proposal Start and End Date: 2/1/2022-12/31/2023

Role: Principal Investigator

Title: PET Imaging of Reactive Oxygen and Nitrogen Species in AD Mouse Models
Major Goals: The proposal aims to develop dynamic [18F]FEDV-PET imaging to detect a rise of ROS/RNS before the build-up of amyloid plaque and neurofibrillary tangles in mouse models of AD.
Source: P2PE Pilot Grant application, UVA
Project/Proposal Start and End Date: 1/1/2023-12/31/2023
Role: Co-Principal Investigator

Title: FDG and FDOPA PET imaging of functional brain abnormalities
Major Goals: The proposal aims to develop advanced dynamic and quantification techniques for FDG and FDOPA PET imaging in human GBM.
Source: Brain Institute, UVA
Project/Proposal Start and End Date: 1/1/2019-12/31/2021
Role: Principal Investigator

Interim/Bridge Award **Kundu (PI)** **1/5/2015-1/4/2016**
VPR, UVA
Myocardial Metabolic Remodeling in Cardiac Hypertrophy

The goal is to investigate the relationship between changes in myocardial glucose metabolism and cardiac remodeling in response to pressure overload in hearts of spontaneously hypertensive rats (SHR) using advanced PET and MR imaging.
Role: Principal Investigator

J-899, The Thomas F. and Kate Miller Jeffress Memorial Trust **Kundu (PI)** **1/1/2008 – 12/31/2010**
In-vivo FDG-PET Imaging to Evaluate Glucose Uptake, Metabolism and Cardiac Function in a Mouse Model of Myocardial Hypertrophy

The major goals of this proposal are to utilize FDG-PET imaging to evaluate the role of glucose uptake and metabolism in a mouse model of myocardial hypertrophy and also to determine the effect of treatment on glucose uptake and cardiac function in-vivo.
Role: Principal Investigator

Thelma R. Swortzel Grant **Bourque and Kundu (PI)** **7/1/2011-12/31/2013**
UVA School of Medicine
Non-invasive detection of early metabolic remodeling in Left Ventricular Hypertrophy

The primary hypothesis of this study is that our improved method of glucose-uptake quantification will identify metabolic patterns of myocardial hypertrophy that can detect early metabolic remodeling in hypertensive patients without evidence of structural heart disease.
Role: Co-PI

Partners' Fund **Kundu (PI)** **9/01/2008-8/31/2010**
The Robert M. Berne Cardiovascular Research Centers at the University of Virginia
Non-invasive imaging techniques in-vivo in a mouse model of myocardial hypertrophy

The major goals of this project are to develop and optimize non-invasive techniques in-vivo to evaluate glucose metabolism in a mouse model of pressure overload LV hypertrophy
Role: Principal Investigator

VII. RESEARCH ACTIVITIES

A. AREAS OF RESEARCH INTEREST

1. **Model derived blood input function using multiparameter non-linear regression analysis and machine learning: rodent heart and human brain**

The research in my laboratory involves development of improved quantitative positron emission tomography (PET) techniques with spill over (SP) and partial volume (PV) corrections, considering the limited spatial resolution of the rodent and human imaging systems, for non-invasive assessment of image-derived blood input function (IDIF). Recent work from our laboratory computed the blood input from the inferior vena cava (IVC) with partial volume corrections by convoluting the finite size of IVC with a Gaussian distribution representing the spatial resolution of the rodent Albira PET system [1]. In another recent work from our laboratory, we optimized the dual output model with additional peak fitting cost functions for simultaneous estimation of the kinetic parameters and the blood input with SP and PV corrections from total body dynamic PET FDG images of rats *in vivo* [2]. We recently optimized motion correction, image registration and segmentation techniques and developed a multi-parameter compartment model with SP and PV corrections to compute population based blood input function from dynamic PET images of the internal carotid arteries of the human brain obtained using the human Siemens PET system [3]. Recent works from my lab developed machine learning tools for automatic computation of model blood input function from dynamic PET images of rat heart and human brain [4,5].

2. **Applications in rodent models of cardiac and brain injury.**

In recent works, the model corrected blood input function computed from the left ventricular blood pool and IDIF from IVC with PV corrections was utilized to compute myocardial and cerebral FDG uptake rates from total body dynamic PET images of rats *in vivo* [1][2]. In a recent collaborative study, using advanced dynamic FDG PET quantitation and *ex vivo* metabolic molecular analysis, we tested the hypothesis that early metabolic changes precede

cardiac dysfunction and left ventricular hypertrophy in young spontaneously hypertensive rat (SHR) hearts [6]. The effect of metformin in ameliorating metabolic abnormalities and preventing the development of LVH in early hypertension was also recently studied [7]. Recent PET MR imaging work in older SHR hearts indicated that decreased glucose uptake rates correlated with diastolic dysfunction, while systolic function was preserved [8], a similar correlation observed in human hypertensive patients [9]. In a recent work from my laboratory we extended the quantitative methods developed in rodent brain to the human brain and developed improved methods, including motion correction, image registration and segmentation, for high resolution parametric quantification of hypometabolic seizure foci from dynamic FDG brain PET images of patients with temporal lobe epilepsy [3]. **These methods have been adapted to quantify hypermetabolism in human PET studies of GBM, concussion, pain [10-16]** and traumatic brain injury.

3. **Development of deep learning models in human epilepsy and GBM.**

Recent works from my lab developed an end-to-end deep learning pipeline in predicting seizure foci in the human brain. This involves training two supervised networks, one for automatic segmentation of the internal carotid arteries in the human brain for derivation of image derived blood input function (idif) and the second for mapping idif to model corrected blood input with spill over and partial volume corrections. This "production model" can automatically predict seizure foci given a dynamic FDG PET data set [14]. Next, in another recent work a convolution neural network (CNN) was trained with parametric PET rate of FDG uptake (ki) voxels for differentiating tumor progression from treatment effect in human GBM. The network trained only on Ki voxels performed better than MR or standardized uptake value (standard PET SUV) voxels. The network sensitivity and specificity however improved using a dual encoder combining both parametric PET Ki and MR voxels [13].

References:

[1] Huang Q, Massey JC, Minczuk K, Li J, **Kundu BK***. Non-invasive determination of blood input function to compute rate of myocardial glucose uptake from dynamic FDG PET images of rat heart in vivo: comparative study between the inferior vena cava and the left ventricular blood pool with spill over and partial volume corrections. *Phys Med Biol*.2019;21;64(16):165010. **PMC7590261**.

[2] Model Corrected Blood Input Function to Compute Cerebral FDG Uptake Rates from Dynamic Total-Body PET Images of Rats In Vivo. Massey J, Seshadri V, Paul S, Minczuk K, Molinos C, Li J, **Kundu BK*** . Frontiers in Medicine, section. *Front. Med.* 2021;8:618645.

[3] Seshadri V, Zarroli KA, Schetlick RS, Massey JC, Reyes JM, Eluvathingal Muttikal TJ, Patrie JT, Berr SS, Fountain NB, **Kundu BK***, Quigg M*. Dynamic FDG-PET in localization of focal epilepsy: A pilot study. *Epilepsy Behav*. 2021 Sep;122:108204. *corresponding authors.

[4] Machine learning derived model corrected blood input function from dynamic FDG PET images of rat heart Zoraiz Qureshi, Huayi Peng, Miaomiao Zhang and Kundu BK, To be presented at the Society of Nuclear Medicine and Molecular Imaging (SNMMI), June 11-14, 2022.

[5] A method for automatically computing a blood input function for dynamic positron emission tomography (PET). Provisional filing to the UVA patent office on April 7, 2022. Authors: Qureshi, Hyman, Quigg and Kundu BK*

[6] Li J, Kemp BA, Howell NL, Massey J, Minczuk K, Huang Q, Chordia MD, Roy RJ, Patrie JT, Davogustto GE, Kramer CM, Epstein FH, Carey RM, Taegtmeyer H, Keller SR*, **Kundu BK*.** Metabolic Changes in Spontaneously Hypertensive Rat Hearts Precede Cardiac

Dysfunction and Left Ventricular Hypertrophy. *J Am Heart Assoc* 2019;8:e010926. **PMC6405673.**
[7] Li J, Mińćzuk K, Massey JC, Howell NL, Roy RJ, Paul S, Patrie JT, Kramer CM, Epstein FH, Carey RM, Taegtmeyer H, Keller SR*, **Kundu BK***. Metformin Improves Cardiac Metabolism and Function, and Prevents Left Ventricular Hypertrophy in Spontaneously Hypertensive Rats. *J Am Heart Assoc.* 2020;9:e015154. **PMC7428616.**
[8] Li J, Huang Q, Cui S, Luo D, Desai S, Patrie J, Chordia M, Roy J, Kramer C, Epstein F, Taegtmeyer H, Keller SR, **Kundu BK***. Metabolic, Functional and Structural Remodeling of Spontaneously Hypertensive Rat Hearts Over Time. *J Nucl Med* 2018; 59:366.
[9] Hamirani YS, **Kundu BK***, Zhong M et al. Noninvasive Detection of Early Metabolic Left Ventricular Remodeling in Systemic Hypertension, *Cardiology* 2016; 133(3):157-162. **PMC4677787**.

*** New publications on machine learning and parametric brain PET mapping**

[10] R. S. Schetlick *et al*., "Parametric FDG PET Quantification, Segmentation and Classification of Primary Brain Tumors in Human GBM," *2021 IEEE Nuclear Science Symposium and Medical Imaging Conference (NSS/MIC)*, 2021, pp. 1-5, doi: 10.1109/NSS/MIC44867.2021.9875767.
[11] Qureshi Z, Peng P, Zhang M, **Kundu BK**. Machine learning derived model corrected blood input function from dynamic FDG PET images of rat heart. ***J Nucl Med*** Abstract. 2022; 63 (supp 2) 3229. https://jnm.snmjournals.org/content/63/supplement_2/3229.
[12] Qureshi Z, Hyman G, Schiff D, Quigg M, Zhang M, **Kundu BK**. 3D U-Net based internal carotid artery segmentation for derivation of image derived blood input function for human brain dynamic FDG PET. ***World Molecular Imaging Congress*** **(Oral presentation)**. October1, 2022. https://www.xcdsystem.com/wmis/program/cJi6upE/index.cfm?pgid=2765&sid=25510&abid=93680.
[13] Hossain, T., Qureshi, Z., Jayakumar, N., Muttikkal, T., Patel, S.H., Schiff, D., Zhang, M., & **Kundu, B.K**. (2023). Multimodal Deep Learning to Differentiate Tumor Recurrence from Treatment Effect in Human Glioblastoma. *ArXiv, abs/2302.14124*. https://doi.org/10.48550/arXiv.2302.14124.
[14] Jayakumar N, Qureshi Q, Schiff D, Quigg M, Zhang M, **Kundu BK**. A deep learning pipeline for parametric FDG brain PET mapping in localization of focal epilepsy. *J Nucl Med* Abstract 2023;64.
[15] Neumann KD, Vikram Seshadri, Xavier D. Thompson, Donna K. Broshek, Jason Druzgal, James Couper Massey, Benjamin Newman, Jose Reyes, Spenser R. Simpson, Katelyenn S Mccauley, James Patrie, James Radford Stone, **Kundu BK**, Resch JE. *Front. Neurol*. 2023;14:1127708.
[16] Ishaque M,.. **Kundu BK**,.. Elias J, Bilateral Focused Ultrasound Medial Thalamotomies for Trigeminal Neuropathic Pain. A Randomized, Controlled, Pilot Study (under review). Journal of Neurosurgery (March 2023).
[17] Neumann KD, Broshek DK, Newman BT, Druzgal TJ, **Kundu BK**, Resch JE. Concussion: Beyond the Cascade. Cells. 2023 Aug 22;12(17):2128. doi: 10.3390/cells12172128. PMID: 37681861; PMCID: PMC10487087.

B. CURRENT PROJECTS

1) Development of model derived blood input function using multiparameter non-linear regression analysis and machine learning in rodent heart and human brain

2) Determine the time course of metabolic alterations in the spontaneously hypertensive rat (SHR) hearts and relate them to the development of left ventricular hypertrophy (LVH) and heart failure (HF) using dynamic PET imaging and kinetic modeling in conjunction with MRI and molecular and metabolic analyses.

3) Development of deep learning models in human epilepsy and GBM.

C. RESEARCH COLLABORATION/TEAM SCIENCE

In collaboration with a number of investigators in the School of Medicine at the University of Virginia including the Division of Endocrinology and Metabolism, Departments of Biomedical Engineering and Cardiovascular Medicine and the Department of Internal Medicine at the University of Texas in Houston, we have assembled a strong team to evaluate the time course of metabolic alterations in the hearts of SHR and relate these changes to the development of LVH and HF using advanced PET and MR imaging *in vivo* and *ex vivo* molecular and metabolic analysis in conjunction with hemodynamic measurements. The work in my laboratory is funded by the National Institute of Health's National Heart Lung and Blood Institute.

In collaboration with faculties in the Division of Nuclear Medicine in the department of Radiology and Medical Imaging and Department of Neurology at UVA, my laboratory has developed novel tools to differentiate viable from non-viable brain tumors utilizing dynamic FDG PET imaging and advanced wavelet transform analysis methods in patients. These methods will aid in differentiating radiation changes from progressive tumor in gliomas and brain metastasis, which is a significant clinical problem. Recent collaboration with the Department of Neurology at the University of Virginia resulted in the development of an improved methodology to quantify temporal lobe hypometabolism for the first time from time resolved PET images of human brain.

In collaboration with faculties in the Department of Radiology at UVA and a group in Spain (Oncovision Inc and ERESA hospital in Valencia), my laboratory has developed an Artificial Neural Network (ANN) algorithm for segmentation of cancerous breast lesions from the background based on the time activity curves obtained from dynamic FDG breast PET imaging as early as 15-20 minutes post FDG administration to the patient. The scans were performed on an FDA approved dedicated breast MAMmography with Molecular Imaging (MAMMI) PET. There is initial strong evidence that this is a powerful adjunct diagnostic technique improving separation of cancer vs benign vs normal tissue.

VIII. TEACHING ACTIVITIES OTHER THAN CLASSROOM OR CLINICAL, INCLUDING TEACHING OF UNDERGRADUATE (PRE-BACCALAUREATE), GRADUATE, POSTDOCTORAL STUDENTS AND CONTINUING EDUCATION MEDICAL STUDENTS.

A. Teaching Committees

Dissertation committee:

1) Joe Pole, PhD, Physics Department, 2010, UVa
2) Tanwa Arpornthip, PhD, Physics Department, 2016, UVa.

B. Classroom teaching

UG BIOM 4783, Medical Imaging Modalities, Spring 2020
Lecture on Dynamic PET Imaging and Kinetic Modeling

In this classroom teaching I taught 3rd year UG Biomedical Engineering students basics of PET physics, kinetic modeling and applications related to rodent and human heart and brain PET imaging.

C. Other, including development of curriculum or new teaching materials, methods of evaluation, program supervision, etc.

My laboratory has developed novel quantitative methods for measuring myocardial glucose and fatty acid metabolism from dynamic ^{18}F-FDG and ^{11}C-palmitate PET images of mouse heart *in vivo* using 3- and 4-compartment kinetic models respectively. The quantitative methods relies on simultaneous estimation of the blood input function from the dynamic PET images with spill-over (SP) and partial volume (PV) corrections and the kinetic rate constants in a compartment model to measure myocardial glucose and fatty acid metabolism *in vivo*. The method for measuring glucose metabolism in mouse heart was published in the *IEEE Transaction on Nuclear Science* in 2013 and its application thereof in the pressure overloaded mouse heart were published in the *Journal of Nuclear Medicine* and the *Journal of American Heart Association* in 2013. A review article combining the works was published in *Cardiology* in 2015. The method developed in mouse heart was recently translated to a PET study in patients with hypertension (*Cardiology 2016*). The methodology for measuring FA metabolism in mouse heart was recently published in *Molecular Imaging* in 2015. An abstract related to this work was selected to compete for the *highly esteemed* poster award in the cardiovascular track at the Society of Nuclear Medicine and Molecular Imaging (SNMMI) held in Baltimore, Maryland in June 2015. A recent work developing a new method for quantifying FDG uptake rate from dynamic PET images of rodent heart was developed based on a hybrid method combining stochastic and deterministic methods (*Phys Med Biol, 2018*). In addition, my laboratory has also developed methods to measure myocardial blood flow in mouse heart in a 3-compartment kinetic model with SP and PV corrections and applied to a preliminary study in the pressure overloaded mouse heart *in vivo* (*J Nucl Med. abstract, 2013*). Recent works from my laboratory developed improved methods for quantification of metabolic remodeling in the pressure overload rat heart in vivo (*Phys. Med. Biol 2019; JAHA 2019; JAHA 2020*).

My laboratory has also extended the methods developed in rodent heart to the rodent brain (*J Nucl Med abstract 2015; Frontiers in Medicine 2021*) and have developed methods utilizing the early time course features of the kinetics of FDG from dynamic PET images as a new technique for helping the clinicians to differentiate between residual brain tumor versus changes due to radiation therapy in the human brain (*IEEE NSS-MIC 2017; Epilepsy and Behav 2021; Annals of clinical and translational neurology 2022*). In another recent work, my laboratory has developed an artificial neural network (ANN) method based on the time activity

curves from dynamic breast PET images to aid in classification of cancerous lesions from the background (*IEEE, NSS-MIC 2015*).

In an invited Webinar for Bruker in December 2018, I presented research from my laboratory; https://www.bruker.com/events/webinars/early-detection-of-metabolic-remodeling-in-pressure-overload-left-ventricle-hypertrophy-using-dynamic-pet-imaging.html. This webinar was attended by participants all over the world.

These research initiatives represent emerging technologies here at UVa, which will provide our researchers with the tools necessary to answer highly relevant questions pertaining to myocardial and cerebral energy metabolism and establish novel tools for PET imaging in rodents and humans *in vivo*.

Major publications related to these research initiatives are as follows:

1. Quigg M and **Kundu BK**, Dynamic FDG-PET demonstration of functional brain abnormalities, *Annals of Clinical and Translational Neurology* 2022. Article ID: ACN351546, Article DOI: 10.1002/acn3.51546 (in press).
2. Seshadri V, Zarroli KA, Schetlick RS, Massey JC, Reyes JM, Eluvathingal Muttikal TJ, Patrie JT, Berr SS, Fountain NB, **Kundu BK***, Quigg M*. Dynamic FDG-PET in localization of focal epilepsy: A pilot study. *Epilepsy Behav.* 2021 Sep;122:108204. doi: 10.1016/j.yebeh.2021.108204. Epub 2021 Jul 23. PMID: 34311181; PMCID: PMC8436183. *corresponding authors
3. Massey J, Seshadri V, Paul S, Minczuk K, Molinos C, Li J, **Kundu BK***. Model corrected blood input function to compute cerebral FDG uptake rates from total body images of rats in vivo. Frontiers in Medicine, section: Nuclear Medicine. *Front. Med.* 2021;8:618645. doi: 10.3389/fmed.2021.618645. Massey J, Seshadri V, Minczuk K and Li J trained in the Kundu lab as students and research scientist. **PMC in progress. IF 5.1.**
4. Li J, Mińćzuk K, Massey JC, Howell NL, Roy RJ, Paul S, Patrie JT, Kramer CM, Epstein FH, Carey RM, Taegtmeyer H, Keller SR*, **Kundu BK***. Metformin Improves Cardiac Metabolism and Function, and Prevents Left Ventricular Hypertrophy in Spontaneously Hypertensive Rats. *J Am Heart Assoc.* 2020;9:e015154. DOI: 10.1161/JAHA.119.015154. **PMC in progress. IF: 5.11.** Li J is training as a research scientist in the Kundu lab.
5. Huang Q, Minczuk K, Li, J, **Kundu BK***. Non-invasive determination of blood input function to compute rate of myocardial glucose uptake from dynamic FDG PET images of rat heart in vivo: comparative study between the inferior vena cava and the left ventricular blood pool with spill over and partial volume corrections. *Phys.Med.Biol* 2019 Aug 21;64(16):165010. doi: 10.1088/1361-6560/ab3238. Huang Q trained first as a post doctor and then a research scientist in the Kundu lab. **PMID: 31307015.*corresponding author. IF: 2.76.**
6. Li Y, **Kundu BK***. An improved optimization algorithm of the three-compartment model with spillover and partial volume corrections for dynamic FDG PET images of small animal hearts in vivo. *Phys Med Biol* 2018 February 26;63(5):055003. **PMID: 29480159. *corresponding author.** Li Y trained as a post doctoral associate in the Kundu lab.

7. Li Y, Huang T, Zhang X, Zhong M, He J, Keller S, Berr S, **Kundu BK*,** Fatty acid metabolism from dynamic ^{11}C-palmitate PET images of mouse heart *in vivo*. *Mol Imaging.* 2015 Sep 1;14:516-25. **PMC4625801.** IF=1.962.
   Li Y trained as a postdoctoral associate in the Kundu lab and Zhong M trained in the Kundu Lab for her PhD in May 2014

8. **Kundu BK**, Zhong M, Sen S, Davogustto G, Keller SR, Taegtmeyer H*, Remodeling of glucose metabolism precedes pressure overload-induced left ventricular hypertrophy: review of a hypothesis. *Cardiology*. 2015;130(4):211-20. **PMC4394867**. Cited 53 times, IF=2.2.
   This is a review article in collaboration with the Taegtmeyer laboratory at UT Houston.
   Zhong M trained in the Kundu Lab for her PhD in May 2014.

9. Zhong M, Alonso CE, Taegtmeyer H, **Kundu BK***. Quantitative PET Imaging Detects Early Metabolic Remodeling in a Mouse Model of Pressure-Overload Left Ventricular Hypertrophy In Vivo. *J Nucl Med* 2013 April;54(4):609-15. **PMC3727159.** Cited 46 times, IF= 6.16.
   Zhong M trained in the Kundu Lab for her PhD in May 2014.
   Alonso CE was a 2nd year Medical Student trained in the Kundu lab during the summer of 2011.

10. Zhong M, **Kundu BK*,** Optimization of a Model Corrected Blood Input Function from Dynamic FDG-PET Images of Small Animal Heart in vivo. *IEEE Trans Nucl Sci.* 2013 October; 60(5):3417-3422. **PMC3985393.**
    Cited 11 times, IF= 1.3.
    Zhong M trained in the Kundu Lab for her PhD in May 2014

My teaching activities have been in the mentoring of graduate and undergraduate students, post doctoral research associates and clinical fellows. The complete list is indicated in the tables below:

MENTORING
A. Graduate students

Name	Department	Degree	Project
Zoraiz Qureshi, MS	Radiology and Computer Science	Master of Science August 2021-current	Zoraiz is working in my lab from last fall (August 2021) and plans to graduate December 2022 under the joint mentorship of me and Dr. Zhang in the department of ECE/CS. Zoraiz is working on a number of NIH funded projects with the final goal of developing end-to-end machine learning tools for automatic computation of parametric PET maps from dynamic PET data of rodent hearts, brains, and human brains. His work has resulted in an abstract which will be presented at this year's annual SNMMI meeting in June 2022.
Krzysztof Minczuk	Radiology and Medical Imaging **Role: Advisor**	Pre-doctoral Student July 2018-June 2019	Krzysztof is a graduate student selected from the European UVA collaboration and will be working on my NIH funded project in my laboratory.
Min Zhong	Physics, Radiology and Medical Imaging **Role: Advisor**	PhD, 2014	Min's dissertation developed dynamic PET imaging methods for non-invasive quantification of metabolism and blood flow in mouse models of myocardial injury *in vivo*. Ms. Min Zhong published 7 papers during her doctoral work of which 2 were first author publications in the Journal of Nuclear Medicine (JNM) and IEEE Transactions on Nuclear Science. The work in JNM has been cited 17 times.
Landon Locke	Biomedical Engineering, Radiology and Medical Imaging **Role:Co-advisor**	PhD, 2011	Landon's dissertation developed FDG PET imaging methods for non-invasive quantification of glucose metabolism in mouse models of lung injury. Mr. Locke's work resulted in several publications most notable being the work published in Molecular Imaging and Biology, which has been cited 22 times.
James Massey	Radiology and Medical Imaging **Role: Advisor**	Research Assistant, June 2020	Jamie is working in my lab funded by the NIH on assessing metabolic remodeling from dynamic FDG PET images of rodent hearts in vivo.
Vikram Seshadri	Radiology and Medical Imaging **Role: Advisor**	Research Assistant, June 2020	Vikram is working on multiple projects related to dynamic cardiac and brain PET imaging funded by the NIH and the DoD.

Nivetha Jayakumar, MS	Computer Science and Radiology and Medical Imaging **Role: Mentor**	August 2022-current	Nivetha is a 2nd year MS student in computer science performing research in my lab in developing end-to-end deep learning pipeline for automatic detection of seizure foci from dynamic FDG brain PET data. Her work has resulted in an abstract which will be presented at the SNMMI June 2023 in Chicago.
Emery Shelly, BS	Physics, CS and Radiology and Medical Imaging **Role: Mentor**	Jan 2023-current	Emery is a 4rth year physics major with a minor in CS working on improving hybrid optimization algorithms for model fits to dynamic PET data of rodent hearts.
Rugved Chavan, BS	Computer Science **Role: Mentor**	August 2023-current	Rugved is a first year MS student in the department of computer science working on developing a "production model" for an end-to-end AI pipeline for automatic detection of seizure foci for dynamic FDG human brain PET images.

B. Research Associates

Name	Department	Years	Project
Qiao Huang, PhD	Radiology and Medical Imaging **Role: Mentor**	October 2017-March 2019	Qiao is working on multiple projects on quantitative PET from dynamic PET images of rodent hearts of LVH and human brains in GBM and epilepsy. He is funded from my NIH grant and partly from the funds from the UVA Brain Institute. Qiao's work has resulted in several abstracts presented at SNMMI 2018.
J Li, PhD	Radiology and Medical Imaging **Role: Mentor**	Jan 2016-current	Jie is working on molecular and hemodynamic analysis *ex vivo* in conjunction with FDG PET and MR imaging *in vivo,* to test the hypothesis that remodeling in glucose metabolism precedes structural remodeling in the spontaneously hypertensive rat heart. Jie's work has resulted in a manuscript published in JAHA in Feb 2019. She also presented an abstract at the SNMMI meeting in 2019.
Y Li, PhD	Radiology and Medical Imaging **Role: Mentor**	2014-2016 July 2019-June 2020	Yinlin is working on developing PET imaging methods for non-invasive quantification of metabolic alterations in the rodent heart over time. Yinlin's work has resulted in 2 publications and several abstracts. Most notable is a first-author peer-reviewed publication in Molecular Imaging, which was selected for the *high esteemed poster award* from the society of nuclear medicine in 2015. His work also resulted in a publication in Physics in Medicine and Biology in Feb 2018.
Mahendra Chordia, PhD	Radiology and Medical Imaging	2016-2018	Mahendra worked on PET imaging of hypertensive rat hearts and was a co-author in a publication from the lab in JAHA published in Feb 2019.
P Antkowiack, PhD	Radiology and Medical Imaging **Role: Co-Mentor**	2014-2015	Patrick worked on developing PET imaging methods for non-invasive quantification of cerebral glucose metabolism in a mouse model of dystonia. Patrick's work resulted in an abstract presented at the Society of Nuclear Medicine meeting in June 2015.

C. Clinical Fellows

Name	Department	Years	Project
P Batchala, MD	Radiology	Jan 2018-Dec 2018	Prem is working on the UVA Brain Institute funded project Investigation of Recurrent Brain Cancer using Dynamic FDG PET Imaging (PI: Kundu BK and Schiff D)
Y Hamirani, MD	Cardiology	2012-2014	Yasmin studied metabolic remodeling in patients with systemic hypertension using dynamic FDG PET imaging (Swortzel Grant, SOM, UVA, PIs: Kundu BK and Bourque J) Yasmin's work resulted in a publication in Cardiology and also won her the best *Fellow in Training* award at the American College of Cardiology meeting in 2014.
P Komlosi, MD	Neuroradiology	2013-2015	Peter worked on using dynamic FDG PET imaging to study recurrent metastatic brain tumors using kinetic modeling
C Leiva Salinas, MD	Radiology and Medical Imaging	2015-June 2016	Carlos has been instrumental in consenting and recruiting patients for the dynamic brain PET study.

D. Undergraduate and Medical Graduate Students

Name	Department	Years	Project

Harnain C Medical Student Summer Research Program (MSSRP)	Radiology and Medical Imaging **Role: Mentor**	June 2008-Aug 2008	Multimodality Imaging of Myocardial Hypertrophy. The work by Chris Harnain in my lab resulted in securing the Partners' fund from the CVRC at UVA. His work also resulted in an abstract which was presented as a poster at the World Molecular Imaging Congress held in Nice, France in 2008.
Yoke J 4th year UG student	Computer Science **Role: Mentor**	June 2009-Aug 2009	Development of a model corrected blood input function for quantitative cardiac PET imaging. Jonathan Yoke's work in my lab resulted in an abstract which was presented as a poster at the Cardiovascular Molecular Imaging (CVMI) meeting at the National Institutes of Health in 2009.
Alsono CE (MSSRP)	Radiology and Medical Imaging **Role: Mentor**	June 2011-Aug 2011	Metabolic Remodeling Precedes Cardiac Dysfunction in Pressure Overload Left Ventricular Hypertrophy Clayton Alonso's work in my lab resulted in a peer-review publication in the Journal of Nuclear Medicine in April 2013, which has an impact factor of 6.16
Mistri M (MSSRP)	Radiology and Medical Imaging **Role: Mentor**	June 2012-Aug 2012	Non-invasive assessment of myocardial blood flow and metabolism in hypertrophic cardiomyopathy. Manasi Mistry's work in my lab resulted in an abstract which was presented as a poster at the society of nuclear medicine annual meeting in June 2013.
Herbert L (MSSRP)	Radiology and Medical Imaging **Role: Mentor**	June 2015-Aug 2015	Myocardial Metabolic Remodeling in Cardiac Hypertrophy. Logan Herbert's work in my laboratory resulted in 2 first author abstracts which were presented in the Radiology Research week and the MSSRP symposium. Logan's work also won him the *best abstract* in

			the Radiology Research week held in October 2015 and a prize of $1000.
Wakim N 4th year UG Student	Biomedical Engineering **Role: Mentor**	Mar 2015-May 2016	Myocardial Metabolic Remodeling in Cardiac Hypertrophy. Nicole Wakim's work resulted in several abstracts, one of which was presented as a first author at the Biomedical Engineering Symposium held in Florida in October 2015.
Joe Rajendran 2nd year UG, Statistics Major, School of Arts and Sciences	Radiology and Medical Imaging **Role: Mentor**	October 2016-Present	Joe is working on my NIH grant, mainly focusing on the statistical analysis of the imaging data.
Sirish Desai First year UG School of Arts and Sciences	Radiology and Medical Imaging **Role: Mentor**	June 2016-Present	Sirish is working on my NIH funded project focusing on the ex vivo analysis of the heart tissue in the hypertensive rat model.
Ethan Arrington Fourth year UG Biochemistry major School of Arts and Sciences	Radiology and Medical Imaging **Role: Mentor**	Jan 2017-May 2017	Ethan worked on my NIH funded project focusing on the ex vivo analysis of the heart tissue in the hypertensive rat model.
Dingxiang Luo (MSSRP) First year MD	Radiology and Medical Imaging **Role: Mentor**	June 2017-August 2017	Myocardial metabolic remodeling in Cardiac Hypertrophy Dingxiang performed research in my lab focusing on PET and MR imaging the spontaneously hypertensive rat (SHR) heart. He also performed molecular analysis on the harvested SHR rat hearts. This resulted in an abstract which was presented at the annual SNMMI meeting in June 2018.
James Massey 4th year UG Student	4th year UG BME, Radiology and Medical Imaging **Role: Mentor**	June 2018-August 2020	Jamie is working in my lab funded by the NIH on assessing metabolic remodeling from dynamic FDG PET images of rodent hearts in vivo. Jamie’s works resulted in a publication in Physics in Medicine and Biology in 2019.

Yusuf Ali (MSSRP) First year MD	Radiology and Medical Imaging **Role: Mentor**	June 2018-August 2018	Myocardial metabolic remodeling in Cardiac Hypertrophy Yusuf performed research in my lab focusing on PET and MR imaging the spontaneously hypertensive rat (SHR) heart. He also performed molecular analysis on the harvested SHR rat hearts.
Lauren Eller Fourth year UG Biochemistry major School of Arts and Sciences	Radiology and Medical Imaging **Role: Mentor**	Jan 2019-present	Lauren is working on my NIH funded project focusing on the ex vivo analysis of the heart tissue in the hypertensive rat model.
Robert Schetlick Fourth year UG CS major. School of Arts and Sciences	Radiology and Medical Imaging **Role: Mentor**	Jan 2020-present	Robby is working on analyzing dynamic brain PET rodent and human data using advanced analytics.
Huayi Peng, BS	Radiology and Computer Science	Research Assistant August 2021-current	Phyl Peng is a rising 4rth year UG majoring in CS and neuroscience in the department of CS and researching under my mentorship to develop machine learning tools for automatic computation of brain maps in rodents utilizing dynamic PET data. Her work in collaboration with Zoraiz has resulted in an abstract which will be presented at the annual SNMMI meeting in June 2022.
Gabriel Hyman, BS & Colton Bogucki, BS	Biomedical Engineering and Radiology	Capstone students August 2021-May 2022	Gabe and Colt worked as a group as 4th year BME capstone students and developed a machine learning tool for automatic segmentation of the internal carotid arteries from dynamic FDG data of the human brain.
Jack Stalfort, BS	Biomedical Engineering and Radiology and Medical Imaging **Role: Mentor**	November 2020-May 2021	Jack worked on NIH funded project in quantitative evaluation of metabolic changes in the pressure overload rat heart in vivo.
Navya Srivastava, BS	Biomedical Engineering and Radiology and Medical Imaging **Role: Mentor**	August 2021-present	Navya is working for class research credit under the co-mentorship of Drs Kundu and Civelek in the department of BME.

Torrance Fredall, rising 4rth UG	Biomedical Engineering and Radiology and Medical Imaging **Role: Mentor**	August 2022-December 2022	Tori worked for class research credit under the co-mentorship of Drs Kundu and Price in the department of BME. She worked on developing a machine learning model for automatic derivation of blood input from dynamic pet images of rodent heart.
William Terrell, rising first year UG	Engineering and Radiology and Medical Imaging **Role: Mentor**	Jan 2022-current	Will is working on a number of projects related to rodent brain PET data in quantifying ROS activity in mouse models of GBM and alzheimer's) in collaboration with Drs. Price in BME and Kuan in Neuroscience respectively.

E. Awards for graduate students, fellows and post doctors mentored

i) Advisor to **Min Zhong, PhD**, Physics, Radiology and Medical Imaging, May 2014.

Awards: 1) IEEE travel award
2) UVA Presidential Poster Presentation, Finalist
3) Travel Award from Nano STAR at UVA, to the World Molecular Imaging Congress,
4) One among 3 Chinese students in UVA and amongst ~500 all over the world to get the "Chinese Government Award for Outstanding Self-financed Students Abroad". Min will be honored by the Chinese Ambassador in Washington DC, receive a certificate and a cash award of $6000.

ii) **Yasmin Hamirani, MD**, Fellow, Cardiology.
Awards: 1) Best *Fellow in Training* award for her presentation at the ACC meeting, 2014.

Hamirani Y#, Zhong M, McBride A, Bourque J, **Kundu BK*,** Myocardial Metabolic Remodeling in Hypertension Induced Left Ventricular Hypertrophy, Abstract, *J Am Coll Cardiol* 2014 April; 62(12):A1011.http://content.onlinejacc.org/article.aspx?articleid=1856118. #presenting and corresponding author.

iii) **Yinlin Li, PhD**, Post doctoral associate, Radiology and Medical Imaging.

Li Y, Huang T, Zhang X, Zhong M, He J, Berr S, Keller S, **Kundu BK*#,** Fatty Acid Metabolism from Dynamic ^{11}C-palmitate PET Images of Mouse Heart in vivo, (Abstract), Society of Nuclear Medicine and Molecular Imaging (SNMMI) meeting, Baltimore, June 2015. #presenting author.
Selected to compete for the SNMMI *high esteemed* poster award, SNMMI conference, Baltimore, Maryland, June 2015.
http://snmmi.files.cms-plus.com/AnnualMeeting/2015/AM2015_PosterAward_candidates.pdf
Pub#1471, Cardiovascular Track.

iv) Best abstract presented at the Radiology Research Week, October 2015.

Logan Herbert, 2nd year graduate medical student in the Medical Student Summer Research Program at UVA, awarded the grand prize of $1000 for the best abstract presented at the Radiology Research week, Oct 12-19, 2015.
Herbert L#, Wakim N, Li Y, .., Epstein F, Taegtmeyer H, Keller S, **Kundu BK*** Cardiac Metabolic Remodeling Precedes Structural Remodeling in the Spontaneously Hypertensive Rat Model, (Abstract), Radiology Research Week, Oct 19-23, 2015, University of Virginia.
#presenting and corresponding author.

v) Best basic science abstract presented at the Radiology Research Week, November 2018.
Krzysztof Minczuk, PhD student. Award: 1) Best basic science award, University of Virginia, 2018. Title: Tracking Metabolic Adaptation and Maladaptation in Pressure Overload LVH

E. Rotating PhD Students

1) Ruixi Zhou, Biomedical Engineering, August 2016.

2) William Garrison, Biomedical Engineering, November 2016.

3) Cailey Fitzerald, Biomedical Engineering, Spring 2017.

IX. OTHER PROFESSIONAL ACTIVITIES (BOARDS, EDITORSHIPS, ETC.)

2003 Adhoc reviewer, American Association of Physicists in Medicine (AAPM)
2003 Manuscript reviewer, Journal of Magnetic Resonance Imaging (JMRI)
2009- Manuscript reviewer, Circulation Research
2009 Reviewer, NIH Challenge Grants in Health and Science Research (RC1)
2011- Reviewer, Journal of Molecular Imaging
2012- Editorial Board Member, OMICS Publishing Group: Radiology-Open Access
2012- Reviewer, Journal of Nuclear Medicine
2012- Reviewer, PLOS ONE
2013- Member, Review Panel, Radiology and Imaging Basic Science, AHA
2013- Reviewer, Cardiology
2013- Reviewer, BBA-Molecular Basis of Disease
2015- Reviewer, European Journal of Nuclear Medicine and Molecular Imaging
Sept 2018 Adhoc Reviewer, Medical Imaging (MEDI) Study Section
June 2019 Adhoc Reviewer, Emerging Imaging Technology (EITA) Study Section
Nov 2019 Adhoc Reviewer, S10 High-end Instrumentation (HEI) Study Section

Feb 2021 Adhoc Reviewer, Human Studies of Diabetes and Obesity (HSDO) Study Section
May 2023 Adhoc Reviewer, Adhoc Reviewer, 2023/10 HLBP-G (1) 2Workgroup 1, SEP/SRG. Program Project, NIH.

X. SCHOOL, UNIVERSITY, UVA HOSPITALS, DEPARTMENTS, NATIONAL, AND STATE COMMITTEES & COUNCILS

A. Department

1) Research and Development Committee, Department of Radiology and Medical Imaging

2) Committee for Pooled Resources, Department of Radiology and Medical Imaging.

B. National

2009 Reviewer, NIH Challenge Grants in Health and Science Research (RC1**)**
2012- Editorial Board Member, OMICS Publishing Group: Radiology-Open Access
2013- Member, Review Panel, Radiology and Imaging Basic Science, AHA
Sept 2018 Adhoc Reviewer, Medical Imaging (MEDI) Study section
June 2019 Adhoc Reviewer, Emerging Imaging Technology (EITA) study section
Nov 2019 Adhoc Reviewer, S10 High-end Instrumentation (HEI) study section
Feb 2021 Adhoc Reviewer, Human Studies of Diabetes and Obesity (HSDO) Study Section
May 2023 Adhoc Reviewer, Adhoc Reviewer, 2023/10 HLBP-G (1) 2Workgroup 1, SEP/SRG. Program Project, NIH.

XI. FINANCIAL RESOURCES (GRANTS AND CONTRACTS)

A. OTHER CURRENT

Role (PI/CoPI): Title: Period: Amount:

ACTIVE

***Title: Genome Editing the Blood-Brain Barrier with Sonoselective Focused Ultrasound**

*Major Goals: The primary goal of this project is to engineer a platform technology capable of genome editing the blood brain barrier in a safe, endothelial cell-selective, and non-invasive manner, with precise loco-regional targeting provided by MR image-guidance.

*Status of Support: ACTIVE

Project Number: RO1EB030744

Name of PD/PI: Price

*Source of Support: NIH

*Primary Place of Performance: University of Virginia

Project/Proposal Start and End Date: 5/15/2021-1/31/2026

*** Total Award Amount: $2,373,802**

* Person Months:

Year	Person Months
3. 2024	1.20
4. 2025	1.20
5. 2026	1.20

***Title: Fabrication and Testing of a Novel PET insert for Simultaneous PET/MRI**

*Major Goals: The goal of this project is to build and test a novel PET (positron emission tomography) scanner to be used simultaneously with an MRI. This is based on a recent invention of ours to build the PET scanner using a crystal scintillator tube instead of multiple flat panel detectors. The scanner will be built collaboratively between UVa, i3M, and Bruker.

*Status of Support: ACTIVE

Project Number: RO1EB029450

Name of PD/PI: Berr

*Source of Support: NIH/ NIBIB

*Primary Place of Performance: University of Virginia (UVA) and i3M Valencia, Spain.

Project/Proposal Start and End Date: 9/22/2020-6/30/2025

*** Total Award Amount: $2,689,793**

* Person Months:

Year	Person Months
3. 2023	1.80
4. 2024	1.80
5. 2025	1.80

***Title: Novel imaging agents of oxidative stress in the pathophysiology of the central nervous system**

*Major Goals: The primary goal of this study is to develop a novel Positron Emission Tomography (PET) imaging agent to quantify oxidative stress within the CNS, in real-time, which will aid in identifying therapeutic windows for antioxidants to ameliorate the secondary cascade of CNS pathophysiology associated with many CNS diseases.

*Status of Support: ACTIVE

Project Number: R01EB028338

Name of PD/PI: Neumann

*Source of Support: NIH/NIBIB

*Primary Place of Performance:

Project/Proposal Start and End Date: 9/11/2020-9/10/2023

*** Total Award Amount: $1,993,000**

* Person Months:

Year	Person Months
3. 2023	1.20

***Title: Transcranial focused ultrasound for head and neck cancer pain. A pilot study**

*Major Goals: The primary aim of this study is to assess the safety and preliminary effectiveness of transcranial MRI-guided focused ultrasound for pain in head and neck cancer patients with opioid-resistant pain. Specifically, my lab will be responsible for developing improved methods for quantifying total distribution volume from dynamic 11C-Carfentanil brain PET data in human subjects.

*Status of Support: ACTIVE (NCE, Year 2)

Project Number: UH3 NS115118

Name of PD/PI: Elias J

*Source of Support: NIH

*Primary Place of Performance: University of Virginia

Project/Proposal Start and End Date: 9/1/2019- 8/30/2024

*** Total Award Amount: $1,949,451**

* Person Months:

Year	Person Months
2. 2023-24	1.20

***Title: Dynamic FDG PET for multimodal deep learning to differentiate tumor progression from treatment effect in human glioblastoma**

*Major Goals: The proposal aims to develop deep learning strategies for efficient computation of parametric PET maps thereby enabling efficient and accurate multimodal classification of tumor progression from treatment effect in human glioblastoma.

*Status of Support: ACTIVE

Name of PD/PI: Kundu

*Source of Support: Cancer Therapeutics (CRX) Research Program Pilot Project Awards, UVA CC

*Primary Place of Performance: University of Virginia

Project/Proposal Start and End Date: 1/2023-12/2024

* Total Award Amount: $50,000

* Person Months:

Year	Person Months
1. 2023	0.53

***Title: Interictal dynamic FDG-PET in focal epilepsy**

*Major Goals: This proposal is a phase-2a case-control biomarker validation study of a novel method of brain imaging to be used in the non-invasive stage of evaluation of epilepsy surgery that offers an improved ability to locate the seizure focus. The engineering tools form a suite of tools of protected IP that will form the core of our planned medical corporation.

*Status of Support: ACTIVE

Name of PD/PI: Kundu

*Source of Support: Virginia Innovation Partnership Corporation

*Primary Place of Performance: University of Virginia

Project/Proposal Start and End Date: 10/2023 – 9/2024

* Total Award Amount: $100,002

* Person Months:

Year	Person Months
1. 2024	2.53

***Title: Start-up Funding**

*Major Goals: The goal of this project is to develop improved tools to analyze human and rodent dynamic brain and cardiac PET data.

*Status of Support: ACTIVE

Name of PD/PI: Kundu

*Source of Support: UVA Radiology and Medical Imaging

*Primary Place of Performance: University of Virginia

Project Start: 2017

* Total Award Amount: $400,000

B. OTHER COMPLETED (Federal)

R21 HL120003-01A1 (He, J) **He, J (PI)** **2/1/2014 - 1/31/2016**
NIH-NHLBI
Novel systemic delivery of siRNA for atherosclerosis

The objective is to use a novel endogenous nanoparticle to develop systemic siRNA delivery targeting new gene for effective therapy of atherosclerosis.
Role: Collaborator
My specific role in the project was to help Dr. He lab with PET imaging and image analysis.

US Army Med Res and Material Command **Stone, J (PI)** **3/1/2013 - 9/30/2013**
Neuroimaging of biomarkers for combat relevant Traumatic Brain Injury

The primary goal of this project is the development of biomarkers for non-invasive assement of injury in a rat model of TBI.
Role: Collaborator
My specific role in this project was to help Dr. Stone lab with PET imaging and image analysis.

R01 AR050429-09 **Yan, Z (PI)** **7/1/2011 - 6/30/2016**
NIH-NIAMS
p38 MAPK a regulator of muscle contractile and metabolic functions

The goal of the proposed research is to define the molecular basis for the counter-regulatory functions of p38γ and p38α/p38β in skeletal muscle.
Role: Collaborator
My specific role in this project is to help Dr. Yan lab with PET and optical imaging and provide image analysis expertise.

C. OTHER COMPLETED (other)

Commonwealth Health Research Board **SS Berr (PI)** **7/1/2012-6/30/2014**
Development of Biomarkers that Target Tumor Associate Macrophages

The goal is to use mannose coated liposomes to carry a variety of payloads including radioactive elements for imaging or therapeutics that are designed to change the phenotype of macrophages to cause them to be less tumor-supportive.
Role: Collaborator
My specific role in this project was to help Dr. Berr lab with PET imaging and image analysis.

Virginia Bioscience Health Res Corporation **Bennett, Berr et al (PI)** **7/1/2014 - 6/30/2015**
Reversing Bioenergetic Deficits and Improving Cognitive Function in Alzheimer's Disease

UVA will:
1. Optimize ^{31}P-MRS measurements of living rat brain.

2. Determine baseline regional values for ^{31}P-MRS and FDG uptake of normal/untreated rat brain
3. Using maximum rhTFAM dose from above VCU study, treat rats for 4X1 week dosing and determine changes in regional brain ^{31}P-MRS and ^{18}FDG-PET

Role: Collaborator
My specific role in this project was to help the Dr. Berr lab with PET imaging and image analysis.

XII. MEDIA COVERAGE

(A) NATIONAL
NIH R01 award from NHLBI (September 2015-May 2020)

http://health.usnews.com/health-news/patient-advice/articles/2015/11/19/headed-for-a-dangerous-change-of-heart

Headed for a Dangerous Change of Heart?
Emerging science seeks to better understand how to prevent irreversible heart damage
November 19, 2015.

(B) UVA
http://newsroom.uvahealth.com/about/news-room/archives/do-hearts-fail-because-theyre-hooked-on-blood-sugar

Media coverage for R01 from NIH
Do hearts fail because they're hooked on blood sugar?
Oct 12, 2015

(C) Local TV: NBC 29

http://www.nbc29.com/story/30239370/uva-health-system-researching-new-ways-to-prevent-heart-failure

October 12, 2015. UVA Health System Researching New Ways to Prevent Heart Failure

(D) Local newspaper: Cavalier Daily

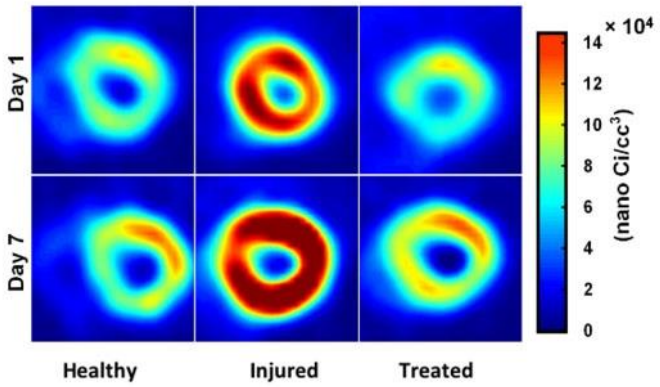
http://www.cavalierdaily.com/article/2015/10/uva-med-school-researchers-awarded-1-9-million-to-study-heart-failure

The Cavalier Daily

Medical School researchers awarded $1.9 million to study heart failure

Bijoy Kundu, colleagues investigate how using glucose instead of fatty acid as fuel can cause cardiac muscle failure

Oct 21 2015



The Cavalier Daily

When injured, the heart begins taking in glucose, and becomes enlarged as depicted in the "Injured" heart slides.

(E) Local Radio news

http://wvtf.org/post/sugar-and-heart

Sugar and the Heart

OCT 21, 2015

(F) *CCF FUNDING.

VIPC press release. https://www.einpresswire.com/article/693626649/vipc-awards-ccf-grant-to-uva-health-for-brain-imaging-technology-to-locate-seizure-focus-in-epilepsy-patients

UVA medicine in motion. https://news.med.virginia.edu/research/bijoy-kundu-phd-and-mark-quigg-md-receive-grant-for-imaging-epilepsy/?j=3029374&sfmc_sub=7187860&l=35_HTML&u=48105008&mid=100026982&jb=1002

XIII. PHYSICAL FACILITIES

Laboratory: Dr. Bijoy Kundu has an office space (100 square ft) located in the Sheridan G. Snyder Translational Research Building, Fontaine Research Park at the University of Virginia (a mile away from the main university campus and the university hospital) and 200 square feet of

image analysis space located in the same building. The image analysis facilities include PCs and workstations to perform image reconstruction, data analysis and modeling in MATLAB programming environment. The state-of-art small animal Albira Trimodal PET/SPECT/CT scanner from Bruker in the University of Virginia Molecular Imaging Center (UVAMIC), is used by Dr. Kundu for his R01 and other projects involved in imaging of rodents. The PET scanner is housed in the Snyder building. The cyclotron, also housed in UVA's Snyder Building, operated in partnership with PETNET, a subsidiary of Siemens Medical Solutions, is used for production of 18F- FDG, 11C-palmitate and 13N-ammonia amongst others on-site. In addition, Dr. Kundu has access to the new research human PET-CT scanner from Siemens, which was operational in early 2018. This scanner is housed in the same building where Dr. Kundu's office and image analysis work space is located. Magnetic Resonance Imaging (MRI) is performed using the state-of-art 7T scanner from Bruker-Siemens in collaboration with faculties in the departments of Biomedical Engineering and Radiology and Medical Imaging at UVA in Medical Research Building -4 (MR4) located a mile away from the Snyder building.

Clinical: Feasibility studies will be performed on n=25 patients using the human mCT (PET/CT scanner).

Animals: An AALAC-approved animal resource facility under the direction of a full-time veterinary staff is available along with all supplies for the routine daily animal care required for the R01 project and other projects involving rodents. The animal vivariums at UVA are located in Aurbach, Snyder and MR-4 buildings, where the *ex vivo* and *in vivo* PET and MR imaging studies respectively are performed.

Computers: 3 computers, one for image acquisition, another one for fast iterative image reconstruction and the third one for numerical computation/modeling in MATLAB and data analysis are presently available for the R01 and other projects in Dr. Kundu's laboratory. The computer with the microPET scanner is used for acquiring data in ListMode format and is used for image reconstruction and display. The second computer is dedicated for high resolution gated image reconstructions and image display using ASIPro from Siemens. The third computer is dedicated to programming, modeling and optimization of image data in MATLAB in the Kundu lab (Dell, AMD Athlon II X4 630 Processor 2.86 GHz, 6 GB RAM). In addition, Dr. Kundu's office is equipped with a computer (Dell, Intel Core-2 Duo CPU E8400@ 3 GHz; 4GB RAM) and a laptop (Dell, Intel Core i5-4210U CPU@1.70 GHz 2.40 GHz, 16GB RAM) for programming in MATLAB, data analysis and preparation of manuscripts. All the image analysis and data modeling is performed in the Kundu laboratory.

Other: The R01 project is performed in close collaboration with Drs. Susanna Keller and Robert Carey in the Department of Medicine, Division of Endocrinology and Metabolism, Drs. Fred Epstein, Chris Kramer and Stuart Berr in the Departments of Biomedical Engineering, Cardiology and Radiology, and James Patrie in the Department of PHS at UVA and Dr. Heinrich Taegtmeyer at UT Medical School in Houston. Metabolite analysis will be performed in collaboration with Metabolon Inc. on a fee for service basis. Imaging collaboration and consultation is obtained from faculty in the departments of Biomedical Engineering, Radiology and Medical Imaging and Cardiology at UVA and UT Houston. Meetings are held at regular

intervals with the co-investigators to discuss and plan experiments. Results obtained from the experiments will be published in peer-reviewed journals and abstracts presented in conferences and meetings. Dr. Kundu is fully supported by the Radiology and Medical Imaging staff which include a grants manager, a secretary, post doctoral associates and students (graduate and undergraduate).

XIV. PERSONNEL CURRENTLY SUPERVISED

Departments of BME, CS, Radiology and Medical Imaging

1) Zoraiz Qureshi, MS, 2021-current, Department of CS and Radiology
2) Huayi Peng, BS, 2021-current, Department of CS and Radiology
3) Gabriel Hyman, BS, 2021-current, Department of BME and Radiology
4) Colton Bogucki, BS, 2021-current, Department of BME and Radiology
5) Navya Srivastava, BS, 2021-current, Department of BME and Radiology

XV. MASTER'S AND PH.D. THESES DIRECTED AND POSTDOCTORAL FELLOWS SUPERVISED

MS Students:
Zoraiz Qureshi, MS, Department of Radiology and Computer Science (Graduation date: December 2022)
Nivetha Jayakumar, MS, Department of Radiology and Computer Science (Graduation date: December 2023)
Rugved Chavan, MS, Department of Radiology and Computer Science (Graduation date: December 2024)

PhD students:
1) Min Zhong, MA,PhD, Department of Physics, Radiology and Medical Imaging, UVA. Graduation date: May 2014.
2) Landon Locke, PhD, Department of Biomedical Engineering and Radiology, UVA (Co-advisor). Graduate Date: May 2011.
3) Krzysztof Minczuk, Graduate Student, European-US exchange program, June 2018-Aug 2019

Post doctoral associates and research scientists
1) Jie Li, PhD, Research Scientist, Jan 2016-current
2) Yinlin Li, PhD, Research Scientist, 2014-current
3) Patrick Antkowiack, Post doctoral Associate, 2014-2015. (Co-mentor)
4) Jie Li, PhD, Research Scientist, 2017-current
5) Qiao Huang, PhD, Research Associate, 2017-2019

UG and prospective graduate Students
Department of Biomedical Engineering and Computer Science.
1) Marcus Bobar, Graduate Student, August 2019
2) James C. Massey, 3rd Year BME UG, June 2018-current
3) Vikram Seshadri, 4th Year BME UG, Feb 2020.
4) Robert Schetlick, 3rd Year CS UG, March 2020-current.

5) Jack Stalfort, 4rth Year BME UG, November 2020-current.
6) Huayi Peng, rising 4rth year CS, August 2021-current.
7) Gabriel Hyman, 4rth year Capstone student, August 2021-current.
8) Colton Bogucki, 4rth year Capstone student, August 2021-current.
9) Navya Srivastava, 3rd year BME UG, August 2021-May 2022
9) Torrance Fredall, 3rd year BME UG, August 2022-Decmber 2022
10) Emery Shelly, 4rth year BME UG, Jan 2023-current

Department of Chemistry
1) Lauren Eller, 3rd Year Chem, June 2019-current
2) Ethan Arrington, 3rd Year Chem, June 2017-May 2018.

XVI. PAPERS PUBLISHED OR IN PRESS

Peer Reviewed

a. Publications in Research Track (July 2021-present)

Underlined people are students and post doctors and research scientists in the Kundu lab.

1. Systems, methods, and computer readable mediums for performing dynamic positron emission tomography, MS Quigg, B Kundu, JC Massey, V Seshadri - US Patent App. 18/267,272, 2024
2. An end-to-end deep learning pipeline to derive blood input with partial volume corrections for automated parametric brain PET mapping, R Chavan, G Hyman, Z Qureshi, N Jayakumar… - arXiv preprint arXiv:2402.03414, 2024.
3. Neumann KD, Broshek DK, Newman BT, Druzgal TJ, **Kundu BK**, Resch JE. Concussion: Beyond the Cascade. Cells. 2023 Aug 22;12(17):2128. doi: 10.3390/cells12172128. PMID: 37681861; PMCID: PMC10487087.
4. Li J, Minczuk K, Huang Q, Kemp BA, Howell NL, Chordia MD, Roy RJ, Patrie JT, Qureshi Z, Kramer CM, Epstein FH, Carey RM, **Kundu BK***, Keller SR*. Progressive Cardiac Metabolic Defects Accompany Diastolic and Severe Systolic Dysfunction in Spontaneously Hypertensive Rat Hearts. *J Am Heart Assoc*. 2023 May 16;12(10):e026950. PMCID: PMC10227297.
5. Jayakumar N, Qureshi Z, Schiff D, Quigg M, Zhang M, **Kundu BK***. A deep learning pipeline for parametric FDG brain PET mapping in localization of focal epilepsy. ***J Nucl Med*** Abstract 2023;64. **IF: 10.6**
6. Neumann KD, Vikram Seshadri, Xavier D. Thompson, Donna K. Broshek, Jason Druzgal, James Couper Massey, Benjamin Newman, Jose Reyes, Spenser R. Simpson, Katelyenn S Mccauley, James Patrie, James Radford Stone, **Kundu BK**, Resch JE. ***Front. Neurol.*** 2023;14:1127708. **IF: 4.09**
7. Qureshi Z, Peng P, Zhang M, **Kundu BK**. Machine learning derived model corrected blood input function from dynamic FDG PET images of rat heart. ***J Nucl Med*** Abstract. 2022; 63 (supp 2) 3229. https://jnm.snmjournals.org/content/63/supplement_2/3229. **IF: 10.6**
8. Quigg M, **Kundu B**. Dynamic FDG-PET demonstration of functional brain abnormalities. ***Ann Clin Transl Neurol***. 2022 Sep;9(9):1487-1497. doi: 10.1002/acn3.51546. Epub 2022 Sep 7. PMID: 36069052; PMCID: PMC9463948. **IF: 5.43**
9. Qureshi Z, Hyman G, Schiff D, Quigg M, Zhang M, **Kundu BK**. 3D U-Net based internal carotid artery segmentation for derivation of image derived blood input function for human brain dynamic FDG PET. ***World Molecular Imaging Congress*** **(Oral presentation)**. October1, 2022.

https://www.xcdsystem.com/wmis/program/cJi6upE/index.cfm?pgid=2765&sid=25510&abid=93680

10. Simpson SR, Kesterson AE, Wilde JH, Qureshi Z, **Kundu BK**, Simons MP, Neumann KD. Imaging Diverse Pathogenic Bacteria *in vivo* with [^{18}F]fluoromannitol Positron Emission Tomography. **J Nucl Med. 2022** Dec 15:jnumed.122.264854. doi: 10.2967/jnumed.122.264854. Epub ahead of print. PMID: 36522188. **IF: 10.6**
11. Iker Etchegaray J, Kelley S, Penberthy K, Karvelyte L, Nagasaka Y, Gasperino S, Paul S, Seshadri V, Raymond M, Marco AR, Pinney J, Stremska M, Barron B, Lucas C, Wase N, Fan Y, Unanue E, **Kundu B**, Burstyn-Cohen T, Perry J, Ambati J, Ravichandran KS. Phagocytosis in the retina promotes local insulin production in the eye. **Nat Metab. 2023** Feb;5(2):207-218. doi: 10.1038/s42255-022-00728-0. Epub 2023 Feb 2. PMID: 36732622. **IF: 19.95**
12. Hossain, T., Qureshi, Z., Jayakumar, N., Muttikkal, T., Patel, S.H., Schiff, D., Zhang, M., & **Kundu, B.K**. (2023). Multimodal Deep Learning to Differentiate Tumor Recurrence from Treatment Effect in Human Glioblastoma. *ArXiv, abs/2302.14124*. https://doi.org/10.48550/arXiv.2302.14124
13. Kiel D. Neumann, Vikram Seshadri, Xavier D. Thompson, Donna K. Broshek, Jason Druzgal, James Couper Massey, Benjamin Newman, Jose Reyes, Spenser R. Simpson, Katelyenn S Mccauley, James Patrie, James Radford Stone, **Bijoy Kundu**, Jacob E Resch. Front Neurol. 2023;14:1127708. **IF: 4.1**
14. Jayakumar N, Qureshi Q, Schiff D, Quigg M, Zhang M, **Kundu BK**. A deep learning pipeline for parametric FDG brain PET mapping in localization of focal epilepsy. *J Nucl Med* Abstract 2023;64. **IF: 10.6**
15. Seshadri V, Zarroli KA, Schetlick R, Massey JC, Reye JM, Muttikkal TJE, Patrie JT, Berr SS, Fontaine NB, **Kundu BK**, Quigg M, Dynamic FDG-PET in localization of focal epilepsy: A pilot study, *Epilepsy & Behavior*, (in press), July 2021. Massey J, Seshadri V and Schetlick R trained in the Kundu lab. **IF: 2.1**
16. R. S. Schetlick *et al*., "Parametric FDG PET Quantification, Segmentation and Classification of Primary Brain Tumors in Human GBM," *2021 IEEE Nuclear Science Symposium and Medical Imaging Conference (NSS/MIC)*, 2021, pp. 1-5, doi: 10.1109/NSS/MIC44867.2021.9875767.

b. Publications in the Tenure eligible AI track (2010-June 2021)

Underlined people are students and post doctors and research scientists in the Kundu lab.

17. Massey J, Seshadri V, Paul S, Minczuk K, Molinos C, Li J, **Kundu BK***. Model corrected blood input function to compute cerebral FDG uptake rates from total body images of rats in vivo. Frontiers in Medicine, section: Nuclear Medicine. *Front. Med.* 2021;8:618645. doi: 10.3389/fmed.2021.618645. Massey J, Seshadri V, Minczuk K and Li J trained in the Kundu lab as students and research scientist. **PMC in progress. IF 5.1.**
18. Senthivinayagam S, Serbulea V, Upchurch CM, Polanowska-Grabowska R, Mendu SK, Sahu S, Jayaguru P, Aylor KW, Chordia MD, Steinberg L, Oberholtzer N, Uchiyama S, Inada N, Lorenz UM, Harris TE, Keller SR, Meher AK, Kadl A, Desai BN, **Kundu BK**, Leitinger N. Adaptive thermogenesis in brown adipose tissue involves activation of pannexin-1 channels. Mol Metab. 2021 Feb;44:101130. doi: 10.1016/j.molmet.2020.101130. Epub 2020 Nov 25. Chordia M trained in the Kundu lab. **PMC7779784. IF: 6.448.**
19. Li J, Mińczuk K, Massey JC, Howell NL, Roy RJ, Paul S, Patrie JT, Kramer CM, Epstein FH, Carey RM, Taegtmeyer H, **Keller SR*, Kundu BK***. Metformin Improves Cardiac Metabolism and Function, and Prevents Left Ventricular Hypertrophy in Spontaneously Hypertensive Rats. *J*

Am Heart Assoc. 2020;9:e015154. DOI: 10.1161/JAHA.119.015154. Massey J, Minczuk K and Li J trained in the Kundu lab as students and research scientist. **PMC7428616. IF: 5.11.**

20. Huang Q, Minczuk K, Li, J, **Kundu BK***. Non-invasive determination of blood input function to compute rate of myocardial glucose uptake from dynamic FDG PET images of rat heart in vivo: comparative study between the inferior vena cava and the left ventricular blood pool with spill over and partial volume corrections. *Phys.Med.Biol* 2019 Aug 21;64(16):165010. doi: 10.1088/1361-6560/ab3238. Huang Q trained first as a post doctor and then a research scientist in the Kundu lab. **PMC7590261.*corresponding author. IF: 2.76.**

21. Molinos C, Sasser T, Salmon P, Gsell W, Viertl D, Massey JC, Mińczuk K, Li J, **Kundu BK**, Berr S, Correcher C, Bahadur A, Attarwala AA, Stark S, Junge S, Himmelreich U, Prior JO, Laperre K, Van Wyk S, Heidenreich M.Front Med (Lausanne). 2019 May 3;6:88. doi: 10.3389/fmed.2019.00088. eCollection 2019.**PMID:31131277.** Li J is training as research scientist in the Kundu lab. Huang Q trained first as a post doctor and then a research scientist in the Kundu lab. Minczuk K was a graduate student in the Kundu lab.

22. Li J, Kemp BA, Howell NL, Massey J, Minczuk K, Huang Q, Chordia MD, Roy RJ, Patrie JT, Davogustto GE, Kramer CM, Epstein FH, Carey RM, Taegtmeyer H, **Keller SR*, Kundu BK***. Metabolic Changes in Spontaneously Hypertensive Rat Hearts Precede Cardiac Dysfunction and Left Ventricular Hypertrophy. *J Am Heart Assoc* 2019 February 19;8(4):e010926. **PMC6405673. *corresponding author.** Li J is training as research scientist in the Kundu lab. **IF: 5.11.** Cited 5 times.

23. Li J, Huang Q, Cui S, Luo D, Desai S, Patrie J, Chordia M, Roy J, Kramer C, Epstein F, Taegtmeyer H, Keller SR, **Kundu BK***. Metabolic, Functional and Structural Remodeling of Spontaneously Hypertensive Rat Hearts Over Time. *J Nucl Med* 2018; 59:366. Li J is training as research scientist in the Kundu lab. ***corresponding author.**

24. Huang Q, Li J, Taegtmeyer H, **Kundu BK*.** Blood input function from dynamic FDG PET images of Wistar Kyoto rat heart to compute rate of myocardial glucose utilization *in vivo*: comparison between region of interest and factor analysis methods. *J Nucl Med* 2018; 59:367. Huang Q trained first as a post doctor and then a research scientist in the Kundu lab. ***corresponding author.**

25. Huang Q, Bauer C, Stolin A, Wuest T, Melroy S, Majewski S, Brefczynski J-L, Kundu BK*. Dynamic FDG brain PET imaging using Helmet_PET: Model corrected blood input function to compute FDG uptake rate during an ambulatory upright task *J Nucl Med* 2018 59:427. Huang Q trained first as a post doctor and then a research scientist in the Kundu lab. ***corresponding author.**

26. Huang Q, Li J, Roy J, Chordia M, Majewski S, Berr SS, McCauley K, Neumann K, Keller SR, **Kundu BK***. Total body dynamic FDG PET imaging of spontaneously hypertensive rats. Abstract *EJNMMI* Phys. 2018; 5[Suppl 1], A7. **PMCID: PMC6023806**. Huang Q trained first as a post doctor and then a research scientist in the Kundu lab.***corresponding author.**

27. Li Y, **Kundu BK***. An improved optimization algorithm of the three-compartment model with spillover and partial volume corrections for dynamic FDG PET images of small animal hearts in vivo. *Phys Med Biol* 2018 February 26;63(5):055003.

PMC6342017.*corresponding author. Li Y trained as a post doctoral associate in the Kundu lab.

28. Hamirani Y, **Kundu BK*,** Zhong M, McBride A, Li Y, Davogustto G, Taegtmeyer H, Bourque J. Non-Invasive Detection of Early Metabolic Left Ventricular Remodeling in Systemic Hypertension. *Cardiology* 2016; 133(3):157-162. **PMC4677787.** Cited 3 times, IF=2.2. Rank 66 of 339 Cardiology and Cardiovascular Medicine journals.

29. Li Y, Huang T, Zhang X, Zhong M, He J, Keller S, Berr S, **Kundu BK*,** Fatty acid metabolism from dynamic ^{11}C-palmitate PET images of mouse heart *in vivo*. *Mol Imaging.* 2015 Sep 1;14:516-25. **PMC4625801.** IF=1.962. Rank 71 of 264 Radiology, Nuclear Medicine and Imaging Journals.

30. Zhang Y, **Kundu BK**, Zhong M, Huang T, Li J, Chordia MD, Chen MH, Pan D, He J, Shi W*, PET imaging detection of macrophages with a formyl peptide receptor antagonist. *Nucl Med Biol.* 2015 Apr;42(4):381-6. **PMC4405787.** Cited 5 times, IF=2.408. Rank 37 of 264 Radiology, Nuclear Medicine and Imaging Journals.
Dr. Kundu and his lab performed PET imaging and image analysis.

31. **Kundu BK**, Zhong M, Sen S, Davogustto G, Keller SR, Taegtmeyer H*, Remodeling of glucose metabolism precedes pressure overload-induced left ventricular hypertrophy: review of a hypothesis. *Cardiology*. 2015;130(4):211-20. **PMC4394867**. Cited 55 times, IF=2.2. Rank 66 of 339 Cardiology and Cardiovascular Medicine journals.
This is a review article in collaboration with the Taegtmeyer laboratory at UT Houston. Zhong M trained in the Kundu Lab for her PhD in May 2014.

32. Sen S**, Kundu BK**$^{\#}$, Wu HC$^{\#}$, Hashmi SS, Guthrie P, Locke LW, Matherne GP, Berr SS, Terwelp M, Scott B, Carranza S, Frazier H, Glover DK, Dillman WH, Gambello MJ, Entman ML,Taegtmeyer H*, Glucose regulation of load-induced mTOR signaling and ER stress in mammalian heart, *J Am Heart Assoc.* 2013 May 17;2(3):e004796. **PMC3698799.** $^{\#}$equal contribution. Cited 82 times, IF=4.306. Rank 25/123 (Cardiac and Cardiovascular Systems)
Dr. Kundu contributed by performing imaging and image analysis in this collaborative work which involved *in vivo* PET imaging and *ex vivo* molecular analysis in the Taegtmeyer lab at UT Houston.

33. Zhong M, Alonso CE, Taegtmeyer H, **Kundu BK***. Quantitative PET Imaging Detects Early Metabolic Remodeling in a Mouse Model of Pressure-Overload Left Ventricular Hypertrophy In Vivo. *J Nucl Med* 2013 April;54(4):609-15. **PMC3727159.** Cited 17 times, IF= 6.16. Rank 4 of 264 Radiology, Nuclear Medicine and Imaging Journals.
Zhong M trained in the Kundu Lab for her PhD in May 2014.
Alonso CE was a 2nd year Medical Student trained in the Kundu lab during the summer of 2011.

34. Zhong M, **Kundu BK*,** Optimization of a Model Corrected Blood Input Function from Dynamic FDG-PET Images of Small Animal Heart in vivo. *IEEE Trans Nucl Sci.* 2013

October; 60(5):3417-3422. **PMC3985393.** Cited 5 times, IF= 1.3. Rank 4 of 52 Nuclear Energy and Engineering Journals.
Zhong M trained in the Kundu Lab for her PhD in May 2014

35. Li X, Zhang Y, Yang Z, Xu Y, **Kundu BK**, Chordia M, Pan D*, Synthesis of PECAM-1-specific 64Cu PET imaging agent: Evaluation of myocardial infarction caused by ischemia-reperfusion injury in mouse. *Bioorg Med Chem Lett*. 2012 Jun 15;22(12):4144-7. Cited 3 times, IF= 2.42.
Dr. Kundu's lab helped in performing PET imaging and image analysis.

36. Locke LW, Williams MB, Fairchild KD, Zhong M, **Kundu BK**, Berr SS*, FDG-PET Quantification of Lung Inflammation with Image-Derived Blood Input Function in Mice, *Int J Mol Imag*, Volume 2011, Article ID 356730, Epub 2011, Dec 10, 2011. **PMC3236466.** Cited 10 times. Co-advised Landon Locke, PhD, Graduated in 2011.
Dr. Kundu helped in performing PET imaging and provided expert advice in PET image analysis.

37. Locke LW, Berr SS, **Kundu BK***, Image-Derived Input Function from Cardiac Gated Maximum a Posteriori Reconstructed PET Images in Mice, *Mol Imag Biol*. 2011 Apr;13(2):342-347. **PMC303677.** Cited 22 times, IF=2.774 . Rank 63 of 264 Radiology, Nuclear Medicine and Imaging Journals.
Co-advised Landon Locke, PhD, Graduated in 2011.

c. Publications in Research track (2007-2010)

38. Locke LW, Chordia MD, Zhang Y, **Kundu BK**, Kennedy D, Landseadel J, Xiao L, Fairchild KD, Berr SS, Linden J, Pan D*, A novel neutrophil-specific PET imaging agent: cFLFLF-PEG-64Cu. *J Nucl Med.* 2009; 50:790-797. **PMC3004780.** Cited 42 times, IF= 6.16. Rank 4 of 264 Radiology, Nuclear Medicine and Imaging Journals.
Dr. Kundu was responsible for PET imaging and provide expertise in image analysis.

39. Cinti MN, Majewski S, Williams MB, Bachmann C, **Kundu BK**, Stolin AV, Popov V, Welch BL, DeVincentis G, Pani R*, Iodine 125 imaging in mice using NaI(Tl)/Flat panel PMT integral assembly. *IEEE Trans Nucl Sci.*, 2007; 54: 461-468. Cited 6 times, IF=1.3. Rank 4 of 52 Nuclear Energy and Engineering Journals.
Dr. Kundu was responsible for SPECT imaging and image analysis.

40. Berr SS, **Kundu BK**, Xu Y, Roy RJ, Williams MB, French BA*, Serial, Multi-Modality Assessment of Myocardial Infarction in Mice using MRI and microPET Provides Complementary Information on the Progression of Scar Formation. Images in Cardiovascular Medicine. *Circulation*, 2007; 115: e428-e429. PMID:17470701**.** Cited 12 times, IF=14.4. Rank 1 of 339 Cardiology and Cardiovascular Medicine journals.
Dr. Kundu was responsible for PET imaging and image analysis.

41. Zhang Y, **Kundu BK**, Fairchild K, Berr SS, Linden J, Pan D*, Synthesis of novel Leukocytes-specific PET Imaging Agents. *Bioorg Med Chem Lett*, 2007; 17(24):6876-6878. Cited 17 times, IF= 2.42.
    Dr. Kundu was responsible for PET imaging and image analysis.

d. Publications as a Research Associate (2003-2006)

42. **Kundu BK**, Stolin AV, Pole DJ, Majewski S, Zorn C, Popov V, Williams MB*, Tri-modality Small Animal Imaging System. *IEEE Trans Nucl Sci*., 2006; 53: 66-70. Cited 19 times, IF=1.3. Rank 4 of 52 Nuclear Energy and Engineering Journals.
    Dr. Kundu was the corresponding author, responsible for planning the experiments, performing them and analyzing the multimodal SPECT, optical and CT images.

43. Stolin AV, **Kundu BK**, Pole DJ, Williams MB***, Characterization and Comparison of X-ray detectors for use in small animal imaging.** *IEEE NSS-MIC*, 2004; 6: 3480-3483. Cited 4 times.
    Dr. Kundu was responsible for performing all the numerical computations and characterizing some of the x-ray detectors in the paper.

44. Stolin AV, Williams MB, **Kundu BK**, Majewski S, Popov V, Weisenberger D*, **Characterization of Imaging Gamma Detectors for Use in Small Animal SPECT.** *IEEE NSS-MIC*, 2003; 3: 2085-2089. Cited 7 times.
    Dr. Kundu was responsible for performing all the numerical computations and characterizing some of the gamma cameras in the paper.

45. Williams MB*, Stolin AV, **Kundu BK**, **Investigation of Spatial Resolution and Efficiency Using Pinholes with Small Pinhole Angle.** *IEEE Trans Nucl Sci*., 2003; 50:1562-1568. Cited 29 times, IF= 1.3. Rank 4 of 52 Nuclear Energy and Engineering Journals.
    Dr. Kundu was responsible for performing all the numerical computations and some of the experiments in the paper.

e. Publications during MS, post doctoral and PhD periods (1992-2002)

46. White KP Jr*, **Kundu BK**, Mastrangelo C, Classification of defect clusters on semiconductor wafers via the Hough transformation, *IEEE Trans Semiconductor Manufacturing*, 2008; 21 (2), 272-278. Cited 16 times, IF=0.977.

47. Jain PK*, **Kundu BK**, Ralston JP, Oscillatory Color Transparency in $\pi A \to \pi p(A-1)$ and $\gamma A \to \pi N(A-1)$, *Phys. Rev. D* 65, 2002, 094027(1-11). Cited 13 times, IF=4.643. Rank 1 of 60 Nuclear and High Energy Physics Journals.

48. Kundu BK, Jain BK*, Resonance Propagation in Heavy-Ion Scattering, *Pramana* Journal of Physics, 2001, 56(6):723:734. Cited 3 times.

49. **Kundu BK**, Samuelsson J, Jain PK, Ralston JP*, Perturbative color transparency in electroproduction experiments, *Phys. Rev D* 62, 2000, 11309-113020. Cited 34 times, IF=4.643. . Rank 1 of 60 Nuclear and High Energy Physics Journals.

50. Jain PK*, **Kundu BK**, Ralston JP, A review of pQCD calculations of electromagnetic form factors of hadrons, *Nucl. Phys. A* 666, 2000, 75-83. Cited 5 times, IF=2.20. Rank 6 of 60 Nuclear and High Energy Physics Journals.

51. **Kundu BK**, Li H-n, Samuelsson J, Jain PK*, The perturbative proton form factor reexamined, *Euro. Phys. Journal C*, 1999, 637-642. Cited 32 times, IF=5.084.

52. **Kundu BK**, Jain BK* and Santra AB, The elementary $p(p,p'\pi+)n$ reaction, *Phys. Rev. C* 58, 1998, 1614-1617. Cited 5 times, IF=3.733. Rank 4 of 60 Nuclear and High Energy Physics Journals.

53. **Kundu BK**, Jain BK*, The 6Li(p, Δ^{++})6He reaction reanalysed, *Phys. Lett. B* 422, 1998, 19-25. Cited 3 times, IF=6.13. Rank 2 of 60 Nuclear and High Energy Physics Journals.

54. Jain BK* and **Kundu BK,** Delta decay in the nuclear medium, *Phys. Rev. C* 53, 1996, 1917-1926. Cited 18 times, IF=3.733. Rank 4 of 60 Nuclear and High Energy Physics Journals.

A. Books and/or Chapters

Co-authored a chapter on, "State-of-Art Instrumentation for PET and SPECT Imaging in Small Animals" with Heinrich R. Schelbert and David K. Glover for the book, *Clinical Nuclear Cardiology*, Edited by Zaret and Beller, published April 2010.

B. Abstracts

* Abstracts Presented

1. Jayakumar N, Qureshi Q, Schiff D, Quigg M, Zhang M, **Kundu BK**. A deep learning pipeline for parametric FDG brain PET mapping in localization of focal epilepsy. *J Nucl Med* Abstract 2023;64.
2. Qureshi Z, Peng P, Zhang M, **Kundu BK**. Machine learning derived model corrected blood input function from dynamic FDG PET images of rat heart. ***J Nucl Med*** Abstract. 2022; 63 (supp 2) 3229. https://jnm.snmjournals.org/content/63/supplement_2/3229.
3. Qureshi Z, Hyman G, Schiff D, Quigg M, Zhang M, **Kundu BK**. 3D U-Net based internal carotid artery segmentation for derivation of image derived blood input function for human brain dynamic FDG PET. ***World Molecular Imaging Congress*** **(Oral presentation)**. October1, 2022. https://www.xcdsystem.com/wmis/program/cJi6upE/index.cfm?pgid=2765&sid=25510&abid=93680

4. Hossain, T., Qureshi, Z., Jayakumar, N., Muttikkal, T., Patel, S.H., Schiff, D., Zhang, M., & **Kundu, B.K**. (2023). Multimodal Deep Learning to Differentiate Tumor Recurrence from Treatment Effect in Human Glioblastoma. *ArXiv, abs/2302.14124*. https://doi.org/10.48550/arXiv.2302.14124
5. Massey J, Seshadri V, Paul S, Eller L, Chordia M, Minczuk K, Molinos C, Li J, **Kundu BK*.** Model corrected blood input function to compute rate of cerebral FDG uptake from dynamic total-body PET images of rats in vivo: comparison with arterial blood sampling. Abstract (accepted) World Molecular Imaging Congress, October 2020. Underline are students and post docs in the Kundu lab. *Corresponding author.

6. Machine learning derived model corrected blood input function from dynamic FDG PET images of rat heart Zoraiz Qureshi[1,2], Huayi Peng[1,2], Miaomiao Zhang[2] and Bijoy Kundu[1,3,4] To be presented at the Society of Nuclear Medicine and Molecular Imaging (SNMMI), June 11-14, 2022.

7. Dynamic cardiac FDG PET and CMR imaging in vivo assess the effect of metformin in failing spontaneously hypertensive rat hearts. **Bijoy Kundu** 1,2 , Jie Li 1 , Vikram Seshadri 1 , Nancy Howell 4 , Soumen Paul 1 , Jack Roy 1 , Christopher Kramer 3 , Frederick Epstein 2 , Robert Carey 4 , Heinrich Taegtmeyer 5 , Susanna Keller 4. World Molecular Imaging Congress October 5-8, 2021

8. Schetlick RS, Muttikkal TE, Reyes JM, Batchala PM, Donahue JH, Patel SH, Schiff D, **Kundu BK**. Parametric FDG PET quantification, segmentation and classification of primary brain tumors in human GBM. IEEE NSS-MIC 2021 October 16-23. IEEE Nuclear Science Symposium-Medical Imaging Conference, October 16-23, 2021.

9. Seshadri V, Massey J, Schetlick R, Reyes J, Patrie J, Muttikkal T, Quigg M, **Kundu BK***. High resolution parametric FDG PET quantification for presurgical localization in epilepsy. Abstract (accepted) World Molecular Imaging Congress, October 2020. Underline are students and post docs in the Kundu lab. *Corresponding author.

10. Li J**,** Minczuk K, Massey J, Paul S, Roy J, Carey R, Taegtmeyer H, Keller SR, **Kundu BK***, Metformin improves metabolic, functional and structural abnormalities in spontaneously hypertensive rat hearts. AHA Scientific Sessions. November 2019. Li J is training as Research scientist in the Kundu lab.
11. Li J, Kemp B, Howell N..& **Kundu BK*.** Metabolic, Functional and Structural Remodeling of Spontaneously Hypertensive Rat Hearts Over Time. Abstract (oral presentation), Society of Nuclear Medicine and Molecular Imaging (SNMMI) meeting, June 2018. ***corresponding author.** Li J is training as associate in the Kundu lab.
12. Huang Q, Li J, Taegtmeyer H, **Kundu BK*.** Blood input function from dynamic FDG PET images of Wistar Kyoto rat heart to compute rate of myocardial glucose utilization *in vivo*: comparison between region of interest and factor analysis methods. Abstract (oral presentation), Society of Nuclear Medicine and Molecular Imaging (SNMMI) meeting, June 2018. ***corresponding author.** Huang Q is a post doctoral associate training in the Kundu lab.

13. Huang Q, Bauer C, Stolin A,..& **Kundu BK*.** Dynamic FDG brain PET imaging using Helmet_PET : Model corrected blood input function to compute FDG uptake rate during an ambulatory upright task. Abstract (oral presentation), Society of Nuclear Medicine and Molecular Imaging (SNMMI) meeting, June 2018. ***corresponding author.** Huang Q is a post doctoral associate training in the Kundu lab.

14. Huang Q, Li J, Roy J,..& **Kundu BK*.** Total body dynamic FDG PET imaging of spontaneously hypertensive rats. Abstract, International conference on Total Body PET, From Mice to Men, June-July 2018. ***corresponding author.** Huang Q is a post doctoral associate training in the Kundu lab.

15. McCauley KS , Huang Q, Li J,..& **Kundu BK***, **Neumann K***. [`^{8}F]FTHA: Radiosynthesis and preclinical imaging of spontaneously hypertensive rats. Abstract, World Molecular Imaging Congress, September 2018. ***senior authors**. McCauley KS is training in the Neumann lab and Huang Q and Li J is training in the Kundu lab.

16. Li J, Kemp B, Howell N..& **Kundu BK*.** Cardiac Metabolic and Functional Changes Precede Left Ventricular Hypertrophy in Spontaneously Hypertensive Rats. Abstract. *Hypertension* conference, September 2018. ***corresponding author.** Li J is training as associate in the Kundu lab.

17. Julie Brefczynski-Lewis, Alexander Stolin, Chris Bauer, Paul Kinahan, Elaine R. Peskind, Garth Terry, Mark Muzi, Robert Harrison, Jinyi Qi, Kuang Gong, Sergei Dolinsky, Michael Rishel, **Kundu BK**, Stan Majewski. A novel portable PET scanner for use in medical unit TBI diagnostics, Abstract (submitted), MILITARY HEALTH SYSTEM RESEARCH SYMPOSIUM (MHSRS), Florida, August 2017.

18. Li Y[#], Chordia M, Li J, Wakim N, **Kundu BK***, An improved optimization method for 3-compartment kinetic model using artificial immune algorithm and interior reflective newton method applied to dynamic FDG PET images of rat heart *in vivo.* Abstract, World Molecular Imaging Congress, September 7-10, 2016, New York City, NY. [#]**presenting and corresponding author.**

19. Herbert L[#], Wakim N, Li Y, ..,Epstein F, Taegtmeyer H, Keller S, **Kundu BK***, Cardiac Metabolic Remodeling Precedes Structural Remodeling in the Spontaneously Hypertensive Rat Model, (Abstract for fall symposium), Medical Student Summer Research Program (MSSRP), November 3, 2015, University of Virginia. [#]**presenting and corresponding author.**

20. Herbert L[#], Wakim N, Li Y, .., Epstein F, Taegtmeyer H, Keller S, **Kundu BK*** Cardiac Metabolic Remodeling Precedes Structural Remodeling in the Spontaneously Hypertensive Rat Model, (Abstract), Radiology Research Week, Oct 19-23, 2015, University of Virginia. [#]**presenting and corresponding author. Best abstract, Radiology Research week, 2015.**

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52. M Mut, J Carpenter, G Redpath, D Mullins, C Slingluff, **Kundu BK**, E Farace,.. Novel approaches to metastatic animal models: A pilot study for brain metastasis in mice, 3D tumor growth in cellulose matrix, and in vivo real-time imaging with bioluminescence NEURO-ONCOLOGY 2005; 7 (3), 290-290. Dr. Kundu helped with optical image data analysis.

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55. **Kundu BK**, KP White*, C Mastrangelo - Circuits and Systems. Defect clustering and classification for semiconductor devices, Mid-west Symposium on Circuits and Systems (MWSCAS), 4-7 August, 2002, Vol 2: II-561-II-564. (Invited). Cited 9 times.

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58. Kundu BK, BK Jain*, 6 Li (p, p'π+) 6 He reaction at Tp= 1.04 GeV, DAE India symposium on nuclear physics: contributed papers; 1994): Vol. 37B.

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XVII. TECHNOLOGY TRANSFER ACTIVITY

A. Inventions

Please list all technologies disclosed to the U.Va Licensing & Ventures Group (or previous institution) on which you are listed as an inventor. Indicate the patent status for each technology as: disclosed, provisional patent application filed, full patent application filed (PCT/international or national) or patent issued. Invention disclosure forms are available online at http://innovation.virginia.edu/disclose.

B. Registered Copyrighted Materials

UVALVG Tech ID	Invention Title	Patent Applications	Inventors
BERR-TBI	**Assessment of Traumatic Brain Injury Using PET Imaging Choline**		Stuart S Berr *; Jiang He; **Bijoy Kundu**; James R. Stone
MAJEWSKI-TOFPET	TOFPET Assembly and Related Method Thereof	United States Patent Application 20200261043 08/20/2020	Stanislaw Majewski *; Bijoy Kundu; Charalampos Tsoumpas
Kundu-Tumor	**Method and System for Brain Tumor Differentiation Using Early Temporal Feature of Time Activity Curve from Dynamic FDG PET Imaging.**	**62/362,897**	****New Disclosure** (7/15/2016)** Yinlin Li; **Bijoy Kundu***; Carlos Leiva-Salinas; Stan Majewski
Kundu-Neural	Automatic Identification and Segmentation of target regions in pet imaging using dynamic imaging protocol and modeling	United States Patent Application 20200261032 **08/20/2020**	Yinlin Li; **Bijoy Kundu***; Stan Majewski
Quigg-Kundu, iPET	**System, Method, and Computer Readable Medium for Dynamic Interictal FDG-PET**	**U.S. Provisional Patent Application Serial No. 62/947,371**	**Mark Quigg and Bijoy Kundu** ****New Disclosure** (12/13/2019)**
UVA LVG TechID:KUNDU-MLEARN	Automation of the blood input function computation pipeline for dynamic FDG PET for human brain using machine learning	Patent Applications: PCT/US2023/017697	Bijoy Kundu*, Zoraiz Qureshi filed April 6, 2023
KUNDU-CNNGBM	**Dynamic FDG PET for multimodal deep learning in recurrent brain cancer**	**Patent application (63/557,699)**	**Bijoy Kundu*, Zoraiz Qureshi** **File on Feb 27, 2024**

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XVIII. INVITED LECTURES AND SYMPOSIUMS

1) **Invited Webinar** for Bruker. Dynamic PET imaging of early metabolic changes in left ventricular hypertrophy , December 13, 2018.

2) **Invited speaker**, Bruker Workshop, European Molecular Imaging Meeting, Glasgow, March 21, 2019

3) **Kundu BK***. Kinetic and Wavelet Analysis of Dynamic FDG PET Data in Human Glioblastoma. (Oral presentation) *IEEE Medical Imaging Conference, Workshop on Brain Imaging Systems*, October 28, 2017; *https://www.eventclass.org/contxt_ieee2017/online-program/session?s=DBIS-01*.

4) **AMPET Satellite Event, Society of Neuroscience conference**, San Diego, September 2016.
Dynamic **FDG Brain PET and Kinetic Models**
Bijoy Kundu, PhD (Invited)

5) **CE session:** Society of Nuclear Medicine and Molecular Imaging (SNMMI) meeting, Baltimore, June 2015.
Dynamic Brain PET: Rationale, Approaches and Technologies
10:15 AM - 10:45 AM **Kinetic Models and Dynamic Brain PET**
Bijoy K. Kundu, PhD* (Invited)
http://snmmi.eventsential.org/Sessions/Details/69186

6) **Kundu BK**, Lankford AR*, Matherne GP, Berr SS. In-vivo PET imaging of glucose uptake in pressure overloaded mice to evaluate metabolic mechanism and cardiac function during myocardial hypertrophy, **(oral presentation)**. 54th Society of Nuclear Medicine (SNM) Conference, Washington DC, June 2-6, 2007; Journal of Nuclear Medicine Meeting Abstracts, 2007; 48:55p.

7) Defect clustering and classification for semiconductor devices
Kundu BK, KP White*, C Mastrangelo - Circuits and Systems. Mid-west Symposium on Circuits and Systems (MWSCAS), 4-7 August, 2002, Vol 2: II-561-II-564. (Invited). Cited 9 times. **(oral presentation)**

8) Kundu BK, P Jain*, JP Ralston, pQCD calculations of exclusive processes, Department of Atomic Energy (DAE), India, symposium on nuclear physics: contributed papers; 1999: Vol. 42B. **(oral presentation)**

9) Kundu BK, BK Jain*, The elementary p (p, p'π+) n reaction at T p= 800 MeV, DAE India symposium on nuclear physics: contributed papers; 1996:Volume 39B. **(oral presentation)**

10) Kundu BK, BK Jain*, 6 Li (p, p'π+) 6 He reaction at Tp= 1.04 GeV, DAE India symposium on nuclear physics: contributed papers; 1994): Vol. 37B. **(oral presentation)**

11) Kundu BK, BK Jain*, The effect of finite life time of delta in (p, p'π+) reaction, DAE symposium on nuclear physics: contributed papers; 1993: Vol. 36B. **(oral presentation)**