

# Request for Designation as Columbia Magnetic Resonance Research Center

## November 27, 2018

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*The proposed Columbia Magnetic Resonance Research Center (CMRRC) will make leading edge magnetic resonance imaging (MRI) technology and its various applications in research available and accessible to all Columbia investigators. It will consolidate resources and improve access and support for a growing community of MRI users spanning the Morningside, Manhattanville, and CUIMC campuses.*

### Overview of the Center

The proposed *Columbia Magnetic Resonance Research Center* is comprised of three scientific cores.

- Core 1, **Translational Science**, will be located at the Columbia University Irving Medical Center (CUIMC) and in the New York State Psychiatric Institute (NYSPI). Beginning in the summer of 2018, six new GE 3T MR systems and a 7T MR system will be installed at this site.
- Core 2, **MR Engineering and Physics R&D**, will be centered around a lab in the School of Engineering and Applied Science (SEAS) on the Morningside Campus. New technologies, methodologies, data science, and imaging physics will be invented and developed here, supporting the other cores.
- Core 3, **Basic Biological Science**, will be located in the Jerome L. Greene Science Center. This core will include the two Siemens 3T MR systems and the Bruker 9.4T animal system, a BRAIN Grant-funded neuro-imager currently being built, and a second planned 7T system. The MR systems of this core will support a wide variety of human and animal investigations. Also included in this core will be the NYS affiliates including a 3T human imager at NKI and Dr. Vaughan's ultra-high field neuro-imaging lab housing a 9.4T human imager, one of the five most powerful human imaging systems in the world.

#### 1. Brief description: mission and objectives

Nuclear Magnetic Resonance allows us to non-invasively observe the structure, function, and chemistry or metabolism of living samples such as the human body in states of health, disease, and therapeutic intervention with extraordinary signal and contrast, and with high spatial, spectral and temporal resolution. Magnetic Resonance (MR) is an essential tool for any research-oriented industry or institution, and hundreds of Columbia investigators across dozens of departments already take advantage of it.

The proposed Center's mission is to develop and to provide Magnetic Resonance as a more powerful and more accessible tool and technique for biomedical research.

The primary objectives of the Center within the first five years of operation are to:

1. Organize investigators: This Center is a new resource for Columbia and the world. It must be founded on sound principles, strong structure and with broad institutional support to fully realize its inherent potential for advancing biomedical science at Columbia and for our international community.
2. Provide facilities & expertise: Through the organized recruitment and management of funding, talent, and capital equipment, this Center will provide Columbia's investigators and collaborators



Professor J. Thomas Vaughan will direct the *Columbia Magnetic Resonance Research Center* and has convened a group of faculty to provide leadership from two Columbia schools and one institute to work together to form a shared Magnetic Resonance Research Center. Dr. Larry Schwartz will co-direct the CUIMC core with emphasis on clinical translation. Dr. Shih-Fu Chang will co-direct the SEAS core with emphasis on engineering and physics R&D until the new tenured level faculty currently being recruited in this area replaces Dr. Chang. In addition to overall direction, Dr. Vaughan will co-direct the Zuckerman Institute core with emphasis on the basic sciences. Dr. Vaughan will also serve as the primary interface with our NYSPI and Nathan Klein Institute affiliates. Professor Vaughan has thirty years of experience in starting, funding and operating luminary imaging centers. He will oversee the Administration and Outreach for this Center.

The **Executive Committee** will include the faculty leaders responsible for the respective cores; Professor Vaughan will chair. The Executive Committee's primary functions will be to implement and refresh the strategic plan, encourage joint proposals, and coordinate use of the shared facilities by the entire Columbia community.

An **Oversight Committee** will consist of research leadership from each of the three main institutional entities, (provisionally Mary Boyce as Dean of Engineering, Mike Shelanski as Senior Vice Dean for Research at P&S, and Rui Costa as Chief Executive Officer of ZMBBI.) It will review and approve the Center's budget annually, and will meet as needed to ensure sufficient coordination between the stakeholder units. Many of the members of the Executive Committee and the Oversight Committee are already familiar with the proposed center as the evolution of its plan has benefitted from a Coordinating Committee since 2016 whose current members are Mike Purdy (EVPR), Larry Schwartz (Radiology), Andrew Laine (Biomedical Engineering), Shih-Fu Chang (SEAS), and Rui Costa (ZMBBI).

The Oversight Committee appoints the director for a 5-year renewable term. The director will be reviewed at the 3-year mark.

The Center will engage a Scientific Advisory Board, which will meet formally once a year to review the scientific progress and future plans of the Center as well as serving as a sounding board throughout the year to give advice on direction to best enable Columbia's intellectual leadership in Magnetic Resonance research.

### 3. Letters of support

See attached letters of support from:

1. G. Michael Purdy, Executive Vice President for Research
2. Rui Costa, Associate Director and CEO, Mortimer B. Zuckerman Mind Brain Behavior Institute
3. Mary C. Boyce, Dean, Fu Foundation School of Engineering and Applied Science and Morris A. and Alma Schapiro Professor, Professor of Mechanical Engineering
4. Lawrence Schwartz, James Picker Professor of Radiology; Chair, Department of Radiology
5. Jeffrey A. Lieberman, Lieber Professor of Psychiatry and the Lawrence C. Kolb Professor of Psychiatry; Chairman, Department of Psychiatry, New York State Psychiatric Institute
6. Donald Goff, Director, Nathan Kline Institute, Marvin Stern Professor, Vice Chair for Research, Department of Psychiatry, NYU Langone Medical Center

### 4. Size of unit

As a result of securing a Center Stimulus Grant, Professor Vaughan has been conducting semi-monthly meetings over the past nine months with a group of a dozen faculty and staff to move forward the planning for the Center and the submission of proposals for funding. Altogether, Professor Vaughan anticipates more than a hundred NIH- and NSF- funded Columbia faculty PIs who will use and support the resources of the new Center and these PIs will be listed on an NIH Center Grant. These faculty have appointments in CUIMC, NYPSI, NKI, GSAS, SEAS and A&S.

#### a. Number of faculty and distribution by rank\*

|   |  |
|---|--|
| Leadership  | 3 primary faculty:<br>3 Professors   |
| Core research and user community  | 16 faculty (includes Leadership):<br>10 Professors, 5 Associate or Assistant Professors,<br>1 Professional Officer of Research     |
| University-wide user community (estimate, based on 2016 survey of interest in the capabilities) | 104 faculty (includes Core community):<br>44 Professors, 56 Associate or Assistant Professors, 4 Professional Officers of Research |
| Estimated students and trainees   | >100   |

[See Appendix A (p.7) for the list of faculty members in each community block, and Appendix B (p. 9) for the list of research areas expressed by the University-wide community.]

#### b. Staffing needs

A fully staffed Center in addition to the Director, Professor Vaughan, includes Kathleen Durkin as Senior Administrator, an Administrative Assistant, a Systems Engineer (Professional Officer of Research), a Physicist (Professional Officer of Research), a Center Grant Manager (staff), RF Safety Officer (Professional Officer of Research or Professor), and an IT Manager (staff) and MR Technician (Staff Officer of Research). Staff needs are reviewed and approved by ZMBBI Associate Director and Chief Executive Officer, Professor Rui Costa, by Radiology Department Chair, Larry Schwartz, and by the Dean's Office for SEAS as appropriate.

## 5. Funding sources

### a. Grants

#### Current sources:

- Pls' grants and other research funds remitted to the Center in the form of user fees
- Center Stimulus Grant (from EVPR), \$50k
- Salary funding for key personnel (from Radiology, ZI, Engineering)

[See list of example NIH awards to leadership and core faculty of the Center in Appendix C, p. 12]

#### Future sources:

- The Center Stimulus Grant and this application to become an official University Center are both intended to support a major effort to win a multi-investigator federally-funded grant. Specific targets are the following typically annual grants:
  - NIH NIBIB P41 Biomedical Technology Resource Center
  - BRAIN Initiative: Research Resource Grants for Technology Integration and Dissemination (U24)
- The Center will regularly apply for a variety of federal grants to specifically support the purchase, development, upgrade and maintenance of MR systems and peripherals, to support the MR Research Center staff, to provide MR system time for seed grants, new system operator and safety training, student instruction, and new equipment. Some current examples from the PI's work include:
  - Ultra-high field, high resolution brain imaging methods and technologies
  - Ultra-high field cardiac imaging methods and technologies
  - Whole body imaging at ultra-high fields
  - Pre-scan RF safety protocol for MRI
  - MR system and imaging for real world environments
  - Head-only MR system for limb mobility
  - New magnets, spectrometers, and imaging physics for world accessible MRI

### b. Philanthropy

Philanthropy has enabled similar centers. The Center will work closely with partner academic units, all of which have development infrastructure and staff, including the Zuckerman Institute.

### c. Intellectual Property

New intellectual property (IP) is a product of the cross-fertilization between fields fostered by Center collaborations. We are already filing intellectual property claims. We have also been approached to negotiate for new technology and methods that will be developed in this Center. IP generated revenues are expected to provide a significant portion of Center support in the future.

### d. Responsibility for Fundraising

Like the federal funding this Center intends to raise, philanthropic activity will be facilitated by having a designation as a University Center. The 7T MRI system is a Zuckerman Institute funding priority.

The Director of the Center, Professor Vaughan, will have primary responsibility for fundraising and will closely partner with his academic chairpersons, deans and leadership of the Zuckerman Institute. He will work with the appropriate Development staff according to the interests of the donor, the academic home of the target gift, and the provider of space.

## 6. Membership

The Center is intended to be as inclusive as possible and will serve all Columbia faculty and collaborators who wish to participate, with no requirement of membership. The NIH requires their funded Centers to be a national resource. Through our faculty research and their national and international collaborators, we will meet this requirement.

## 7. Space

As indicated above, the proposed *Columbia Magnetic Resonance Research Center* is comprised of three scientific cores.

- Core 1, **Translational Science**, will be located in the Neurological Institute Basement (NIB) at the Columbia University Irving Medical Center (CUIMC) and in the New York State Psychiatric Institute (NYSPI). Beginning in the summer of 2018, six new GE 3T MR systems and a second 7T MR system will be installed at this site.
- Core 2, **MR Engineering and Physics R&D**, will be centered around a lab including developmental MR systems, test equipment, and computers in the School of Engineering and Applied Science (SEAS) on the Morningside Campus. New technologies, methodologies, data science, and imaging physics will be invented and developed here, supporting the other cores as well as developing intellectual property.
- Core 3, **Basic Biological Science**, will be located in the Jerome L. Greene Science Center, home of the Mortimer B. Zuckerman Mind, Brain, Behavior Institute (ZMBBI) on the Manhattanville Campus. This core will include the two Siemens 3T MR systems and the Bruker 9.4T animal system now operating, a BRAIN Grant-funded neuro-imager currently being built, and a planned 7T system. The MR systems of this core will support a wide variety of human and animal investigations, mostly (but not exclusively) focused on questions of mind, brain, and behavior. Also included in this Basic Sciences core will be our NYS affiliates including a 3T human imager at NYSPI and Dr. Vaughan's ultra-high field neuro-imaging lab housing a 9.4T human imager, one of the five most powerful human imaging systems in the world, to be sited at Nathan Kline Institute.

### a. Goals for educational programming

As part of the Center Stimulus Grant, the PIs declared the objective of training 50 researchers to use the MR systems. They are ahead of schedule. As of November 2018, 325 researchers have been trained to Safety Level 2, and 44 are certified to operate the system (the 2018 target is 50). Additionally, students and trainees receive various concessions on usage rates for using the systems and a major ongoing priority for the faculty leadership is how to make the MR research more broadly available to students interested in developing or using these systems.

**Appendix A: Names of the CMRRC Faculty listed by category and title.**

**Leadership**

*3 primary faculty*

3 Professors

J. Thomas Vaughan  
Lawrence Schwartz  
Shih-Fu Chang (Interim)

Niko Kriegeskorte  
Rui Costa  
Andreas Hielscher  
Andrew Laine  
Barclay Morrison  
Charles Schroeder  
Christian Stohler  
Christina Hoven

**Core research and user community**

*16 faculty (includes Leadership)*

10 Professors

J. Thomas Vaughan  
Lawrence Schwartz  
Shih-Fu Chang (Interim)  
Akiva Mintz  
Andrew Laine  
Ed Guo  
Elizabeth Hecht  
Kevin Ochsner  
Niko Kriegeskorte  
Rui Costa

Dympna Gallagher  
Elisa Konofagou  
Elizabeth Hillman  
Emlyn Hughes  
Gordana Vunjak-Novakovic  
Henry Ginsberg  
J. John Mann  
Karen Marder  
Lawrence Honig  
Lila Davachi  
Marla Hamberger  
Martin Prince  
Michael Shadlen  
Mitchell Elkind  
Nancy Green  
Nicole Schupf  
Pamela Freda  
Paul Sajda  
R. Graham Barr  
Randolph Marshall  
Richard Mayeux  
Sarah Woolley  
Stephen Rayport  
Steven Marx  
Steven Shea  
Thomas Brannagan  
Vince Ferrera  
Yaakov Stern

5 Associate or Assistant Professors

Adam Brickman  
Christoph Juchem  
Nim Delafield  
Rachel Marsh  
Sachin Jambawalikar

Michael Shadlen  
Mitchell Elkind  
Nancy Green  
Nicole Schupf  
Pamela Freda  
Paul Sajda  
R. Graham Barr  
Randolph Marshall  
Richard Mayeux  
Sarah Woolley  
Stephen Rayport  
Steven Marx  
Steven Shea  
Thomas Brannagan  
Vince Ferrera  
Yaakov Stern

1 Professional Officer of Research

Sairam Geethanath

**University-wide user community** (estimate,  
based on 2016 survey of interest)

*104 faculty (includes Core community)*

45 Professors

J. Thomas Vaughan  
Lawrence Schwartz  
Shih-Fu Chang (Interim)  
Akiva Mintz  
Andrew Laine  
Ed Guo  
Elizabeth Hecht  
Kevin Ochsner

56 Associate or Assistant Professors

Adam Brickman  
Christoph Juchem  
Nim Delafield  
Rachel Marsh

Sachin Jambawalikar  
Allahyar Kangarlu  
Amy Margolis  
Andrew Einstein  
Andrew Gerber  
Andrew Rundle  
Angela Lignelli-Dipple  
Aniruddha Das  
Aviva Sopher  
Claire Riley  
Daphna Shohamy  
Dominik Biezonski  
Dritan Agalliu  
Edward Huey  
Eldad Arie Hod  
Elizabeth Oelsner  
Feng Liu  
Gaurav Patel  
Guillermo Horga  
Jack Grinband  
James Noble  
Jennifer Bain  
Jennifer Woo Baidal  
Joanna Steinglass  
Jonathan Posner  
Joseph Lee  
Joshua Willey  
Julie Spicer  
Justin Golub  
Kimberly Noble  
Lawrence S. Kegeles

Lee Cohen  
Mady Hornig  
Marcela Walker  
Mariam Aly  
Marie-Pierre St-Onge  
Mark Churchland  
Melodie Winawer  
Milan Stojanovic  
Omar Khalique  
Paul Harris  
Qi Wang  
Qolamreza (Ray) Razlighi  
Sameer Sheth  
Stephanie Cosentino  
Tony Wang  
Victoria Leavitt  
Wendy Vargas  
William Kreisl  
Xiaofu He  
Yunglin Gazes  
Zhishun Wang

4 Professional Officers of Research

Sairam Geethanath  
Joanna Dragich  
Mulugeta Abebe  
Ray Lee

**Estimated students and trainees**  
>100

## Appendix B: Broader academic objectives

### Columbia MR Research Center Research Interests

- Vincent Ferrera- is interested in neural mechanisms underlying cognitive flexibility, the ability of an organism to adapt its behavior to changing circumstances
- Pam Butler-studying effects of visual remediation in people with schizophrenia and is studying social reward processing in schizophrenia and autism
- Daphna Shohamy-studies learning and memory. Whether it's how we memorize facts, or slowly learn habits. Recently, she found that there's a lot more "cross-talk" between these two forms of learning than previously thought, raising questions about what different parts of the brain are doing as we learn, and how what we learn affects the decisions we make
- Elizabeth Hillman-focuses on capturing functional information about living tissues using optical techniques
- Nim Delafield-focuses on the development of neural circuits that underlie affective behaviors across childhood and adolescence, with a particular emphasis on limbic-cortical connections (e.g., amygdala-medial prefrontal cortex)
- David Guilfoyle- has particular interest in the study of neuropsychiatric disorders using a combination of human and rodent models. Recent work has placed particular emphasis on magnetic resonance spectroscopy, which examines brain chemistry, and the impact of chemogenetic approaches on brain chemistry
- Lawrence Honig- research interests are in Alzheimer's Disease, Lewy Body Dementia, Frontotemporal Dementia, Creutzfeldt-Jakob disease, and other disorders of nervous system aging and degeneration. He also conducts a number of clinical drug study trials
- Eldad Arie Hod- focuses on hematology and the cognitive effects of iron treatment
- Sarah Woolley-is decoding how the brain interprets sound — and what happens during development when those sounds are disrupted. Her work focuses on understanding how the perception of communication sounds is accomplished in the brain. She studies how the brain codes vocalizations at successive neural processing stages, and how that neural coding is related to experience and species evolution
- Elisa Konofagou-interests are in the development of novel elasticity imaging techniques and applications, such as breast elastography, ligament elastography, electromechanical wave imaging, myocardial elastography, harmonica motion imaging, pulse wave imaging, and focused ultrasound therapy, in particular research on the blood-brain barrier opening
- Edward Huey-studies the genetics of FTLT and is interested in the range of phenotypes associated with mutations that can cause FTLT. He explores the neuroanatomy of complex behavior, neuropsychiatric symptoms, and emotion in patients with brain dysfunction. He is also interested in the role of the dopamine system in the pathogenesis and treatment of the symptoms of FTLT
- James Noble-interests include health literacy, systemic inflammatory markers as contributors to stroke and dementia health disparities, the role of cognitively stimulating activities in dementia care and sports-related concussions
- Elizabeth Hecht- research interests include advanced MR imaging techniques and quantitative oncologic imaging with her current focus on imaging in pancreatic cancer

- Thomas Brannagan- interest is in the evaluation and treatment of peripheral neuropathy, particularly immune-mediated neuropathies and idiopathic neuropathies. His publications have focused on new treatments for chronic demyelinating polyneuropathy (CIDP), painful neuropathies, neuropathy associated with celiac disease and the use of IVIg in Neurological disorders
- Elizabeth Oelsner-is ascertaining the incidence of chronic lower respiratory disease exacerbations in the Multiethnic Study of Atherosclerosis (MESA), and investigating causes and potential prediction models
- Nicole Schupf-focuses specifically on the relationship between estrogen deficiency, indicated by age at onset of menopause, apolipoprotein E genotype and age at onset of Alzheimer's disease in women with Down Syndrome
- Qolamreza Razlighi-aims to investigate the neural and neurophysiological mechanisms underpinning negative BOLD response in fMRI signal
- Andreas Hielscher- does research in Bioengineering, Electrical Engineering and Instrumentation Engineering. He does clinical and pre-clinical imaging of joint diseases, cancer (breast, kidney, stomach, bone, prostate), cerebral hemodynamics (stroke, epilepsy), and vascular reactivity
- Michael Shadlen-studies neurons in the association cortex that process information from the visual cortex to give rise to interpretations, decisions, and plans for behavior. His experiments combine electrophysiology and behavioral and computational methods to advance our knowledge of higher brain function
- Rachel Marsh-focuses on understanding the neurodevelopmental trajectories of psychiatric disorders that arise during childhood and adolescence
- Paul Sajda- focuses on neurocomputational modeling and neuroengineering, pattern recognition, adaptive processing for biomedical image and signal analysis
- Adam Brickman- uses advanced neuroimaging techniques to understand cognitive aging and dementia. He is particularly interested in white matter abnormalities and the intersection between vascular disease and Alzheimer's Disease
- Andrew Laine- research focuses on the mathematical analysis and quantification of medical images, signal and image processing, and computer-aided diagnosis
- Andrew Rundle-is studying the mechanisms through which sedentary lifestyles and obesity cause cancer, as well as the influence of societal factors such as the built environment, neighborhood socio-economic status, and immigration and acculturation on sedentary behavior and overweight/obesity
- Claire Riley-research is focused in neurological, rehabilitative, and psycho-social services to meet the specific needs of patients with MS and related disorders
- Wendy Vargas- focuses on novel MRI techniques and cognitive dysfunction in both childhood and early adult multiple sclerosis
- Yaakov Stern-research focuses on cognition in normal aging and in diseases of aging, particularly Alzheimer's disease. One strong focus of his current research program is investigating the neural basis of cognitive reserve
- Charles Schroeder- uses implementation of multielectrode array recordings in awake behaving monkeys, and more recently the direct integration of these studies with studies entailing intracranial recordings in surgical epilepsy patients at Columbia University Medical Center

- Ricardo Osorio-research interest is the use of neuroimaging and cerebrospinal fluid biomarkers to assist in the study of sleep disturbances as risk factors for cognitive impairment in aging and for dementia
- R. Graham Barr-research is primarily in respiratory epidemiology, relating to risk factors for asthma and chronic obstructive pulmonary disease (COPD)
- Stephanie Cosentino-research has examined the cognitive, behavioral, and metacognitive profiles of various neurodegenerative diseases, particularly Alzheimer's disease and Frontotemporal dementia (FTD)
- Marla Hamberger-research involves language and memory from childhood through late adulthood in epilepsy, and her studies on brain mapping of language and preservation of language function following epilepsy surgery have been funded by the Epilepsy Foundation of America and National the Institute of Neurological Disorders and Stroke
- Lila Davachi- studies behavioral and cognitive neuroscientific investigations of memory encoding, consolidation and retrieval
- Mitchell Elkind-focuses on the relationship between infection, inflammation and stroke. He has participated in several clinical trials of acute and preventive stroke therapy, and has lectured extensively on cerebrovascular disease
- Jack Grinband- research is focused on understanding how sensory information is transformed into a motor response in the presence of distractors
- Richard Mayeux-studies the rates and risk factors for Alzheimer' disease among elderly of mainly African-American and Caribbean Hispanic descent. Dr. Mayeux also directs a genetic study of Alzheimer's disease in Caribbean Hispanic families. He has completed two full genome-wide scans in these families and is working to fine map regions of interest. He recently identified genetic variants in the sortilin-related receptor, SORL1, related to Alzheimer's disease
- Angela Lignelli-Dipple- primary research interests involve correlating anatomic and non-anatomic brain imaging of brain tumors with neuropathologic markers and clinical outcomes
- Karen Marder- focused on the epidemiology and treatment of cognitive, behavioral, and motor impairments in a range of neurodegenerative diseases, including Parkinson's disease (PD), Huntington's Disease (HD), HIV dementia, Alzheimer's disease (AD) and related disorders
- Daniel Salzman- investigating the physiological responses of amygdala neurons during emotional learning
- Neil Shneider- Studies neural degeneration and repair models of neurological disorders such as Amyotrophic Lateral Sclerosis (ALS)

**Appendix C: Examples of NIH-funded awards held by core/leadership faculty of the Center  
(listed by start date)**

| Name               | School | Title  | Award Start Date | Award End Date | Sponsor  |
|--------------------|--------|--|------------------|----------------|--|
| Schwartz, Lawrence | P&S    | Integrating Radiomics into S0819 and Lung-MAP, Biomarker Driven Clinical Trials for Lung Cancer<br>Project #: 1U01CA225431 | 06/01/2018       | 05/31/2023     | NIH  |
| Vaughan, John T    | ZUC    | Imaging Human Brain Function with Minimal Mobility Restrictions<br>Project #: 1U01EB025153                                 | 09/30/2017       | 06/30/2022     | NIH (Sub via University of Minnesota)                |
| Mintz, Akiva       | P&S    | Development of GSK3beta PET Radioligands for In Vivo Imaging in Brain<br>Project #: WUBGSM WFUHS 115188                    | 09/01/2017       | 08/31/2018     | NIH (Sub via Wake Forest)                            |
| Costa, Rui         | ZUC    | High-Speed Volumetric imaging of neural activity throughout the living brain   | 07/15/2017       | 06/30/2020     | NIH (Sub via UC, Berkeley)                           |
| Schwartz, Lawrence | P&S    | Quantitative imaging tools to derive DW-MRI oncological biomarkers<br>Project #: MSKCC BD522043                            | 07/01/2017       | 06/30/2022     | NIH (Sub via Memorial Sloan-Kettering Cancer Center) |
| Shea, Steven J     | P&S    | Atrial fibrillation burden, vascular disease of the brain and cardiac MRI in MESA<br>Project #: UWASH UWSC8531             | 08/01/2015       | 06/30/2018     | NIH (Sub via UW, Seattle)                            |
| Sajda, Paul        | ENG    | EEG/MRI Controlled TMS Real-Time Neural Feedback in Anti-Depressive Treatment<br>Project #: MUSC15-020                     | 04/17/2015       | 01/31/2019     | NIH (Sub via Medical University of South Carolina)   |
| Vaughan, John T    |        | Imaging the brain in real world environments and populations with portable MRI<br>Project #: 5R24MH105998                  | 09/26/2014       | 05/31/2017     | NIH  |
| Lan, Martin        | P&S    | Serotonin 1A Receptor PET Imaging and SSRI Outcome in Bipolar Depression<br>Project #: 5K23MH105688-05                     | 09/25/2014       | 07/31/2019     | NIH  |
| Brickman, Adam     | P&S    | Integrating neuroimaging with studies of cognitive aging in the Dominican Republic<br>Project #: 5R21AG043337              | 09/30/2012       | 08/31/2016     | NIH  |
| Manly, Jennifer    | P&S    | MRI, Genetic and Cognitive Precursors of AD and Dementia<br>Project #: BUSM 4500001205                                     | 09/15/2012       | 05/31/2018     | NIH (Sub via Boston University School of Medicine)   |
| Sajda, Paul        | ENG    | Hyperspectral imaging of the normal and Age-related Macular Degeneration   | 04/01/2012       | 03/31/2015     | NIH (Sub via NYU Medical Center)                     |

| Name            | School | Title   | Award Start Date | Award End Date | Sponsor   |
|-----------------|--------|---|------------------|----------------|---|
| Small, Scott    | P&S    | Longitudinal Imaging of Patients at Clinical Risk for Psychosis.<br>Project #: 5R01MH093398-05                  | 09/22/2011       | 05/31/2017     | NIH   |
| Ochsner, Kevin  | A&S    | An fMRI Study of the Enhancement of Emotion Regulation in Borderline Patients<br>Project #: MSSM 0255-1622-4609 | 09/21/2011       | 05/31/2016     | NIH (Sub via Icahn School of Medicine at Mount Sinai) |
| Small, Scott    | P&S    | Cross Species Imaging of Schizophrenia<br>Project #: SRFMH 25129  | 07/15/2011       | 06/30/2012     | NIH (Sub via Research Foundation for Mental Hygiene)  |
| Small, Scott    | P&S    | fMRI and Mouse Models of Alzheimer's Disease<br>Project #: 5R01AG025161   | 07/15/2010       | 06/30/2016     | NIH   |
| Sajda, Paul     | ENG    | Multimodal Neuroimaging for Mapping Decision Making in the Human Brain<br>Project #: 5R01MH085092-05            | 08/05/2009       | 09/30/2015     | NIH   |
| Vaughan, John T |        | RF Safety for Ultra-high Field MRI<br>Project #'s: 1R01EB007327; 2R01EB007327; 5R01EB007327                     | 04/01/2007       | 01/31/2017     | NIH   |
| Vaughan, John T |        | Human MRI to 9.4T and Beyond<br>Project #'s: 1R01EB006835; 2R01EB006835; 5R01EB006835                           | 12/01/2006       | 08/31/2016     | NIH   |

COLUMBIA UNIVERSITY  
IN THE CITY OF NEW YORK

EXECUTIVE VICE PRESIDENT FOR RESEARCH

July 7, 2018

John H. Coatsworth  
Provost of the University  
Columbia University  
535 West 116<sup>th</sup> Street  
205 Low Library  
New York, NY 10027

Dear John,

I write in support of establishing the *Columbia University Magnetic Resonance Research Center*, a unified structure to convene faculty around the development and use of MR technologies.

As you know, six years ago, I put together a faculty committee to envision imaging research, with a particular focus on magnetic resonance, at Columbia in the coming decades. It was critical to engage in that exercise then because of planned major investments in facilities in the Jerome L Greene Science Center, as well as in multiple locations at CUIMC.

The faculty committee identified a key priority: a unified MR research and program and active facilities that would serve faculty across the University. After several years of planning, then open searches, this interschool faculty group was able to identify Professor Tommy Vaughan as the right leader for this multi-school faculty leadership role. Professor Vaughan was appointed in 2016 in the departments of Biomedical Engineering, and Radiology, and as a full member of ZMBBI. We recruited him with the understanding that he would work to establish Columbia as a premier institution in this field.

Since 2016, Professor Vaughan has been building the user facility in the Jerome L Greene Science Center, a time-sensitive core for members of the Zuckerman Institute as well as non-ZMBBI faculty in A&S, SEAS, CUIMC and NYSPI. He has been working closely with CUIMC and Radiology Leadership to plan for the Advanced Science Center East, a special partnership between Columbia and GE. I have served on Professor Vaughan's Coordination Committee, along with Professors Schwartz (Radiology), Laine (Biomedical Engineering), Chang (SEAS) and Jessell (ZMBBI, [now Rui Costa]).

A major purpose of establishing the *Columbia University Magnetic Resonance Research Center* is to secure a large Federal Grant to support the Center and to facilitate the success of individual proposals of its members who would use the facilities for research. Professor Vaughan has experience and an extremely impressive track record with such center grants, being awarded six of these grants and their competing renewals from the NIBIB and the previous NCCR, at four different universities, UT Southwestern, UAB, MGH/Harvard, and at the U of Minnesota.

# COLUMBIA UNIVERSITY

IN THE CITY OF NEW YORK

EXECUTIVE VICE PRESIDENT FOR RESEARCH

Allowing this Center to be established will open up opportunities for current University faculty, as well as allow for the recruitment of higher caliber, MR—invested, faculty and students across the many fields that will benefit from the Center and Professor Vaughan’s investment in making this a University—wide resource.

I express to you my wholehearted support for Professor Vaughan’s application to consider his already well-established and growing program as a Center of Columbia University. The vision is grand and I wish to do everything I can to support it. Professor Vaughan recently won a competitive Center Stimulus Grant from my office. One faculty reviewer gave the following comment on his application:

“MRI is a powerful tool for basic and clinical research and the impact across the university will be great. The Vaughan plan to pull the players together is the key element. No one player can use the tools in isolation and each needs cooperation of different disciplines--medical, biological, physics, and engineering--to reap the benefits of the tools. The impact will be fundamental and powerful. It's appropriate to use the well-worn word in this case—synergy”

I thank you for your consideration of this high-priority interdisciplinary activity that I believe stands to put Columbia research on the map in an important scientific area. Please do not hesitate to contact me with any question.

Many thanks,



G. Michael Purdy

June 26, 2018

John Coatsworth, PhD  
Provost, Columbia University

**RE: Letter of Support for Columbia Magnetic Resonance Research Center**

Dear John,

I am writing to express our support for the Center designation of the Columbia Magnetic Resonance Research Center (CMRRC), which will be headquartered in the Jerome L. Greene Science Center. I join Mike Purdy and many faculty colleagues in supporting this designation. Please also note that we plan to become actively engaged in fundraising for new facilities, including a 7T. I am very supportive of the strong community that Professor Tommy Vaughan brings together from across the University. The Jerome L. Greene Science Center brings to life a rich culture of creativity and innovation, which will grow with the endeavors of the CMRRC.

Sincerely,



Rui M. Costa, D.V.M., Ph.D.  
Professor, Departments of Neuroscience and Neurology  
College of Physicians and Surgeons, Columbia University Medical Center  
Associate Director and CEO, Zuckerman Mind Brain Behavior Institute  
e-mail : [rc3031@columbia.edu](mailto:rc3031@columbia.edu)

COLUMBIA UNIVERSITY  
IN THE CITY OF NEW YORK

THE FU FOUNDATION SCHOOL OF ENGINEERING AND APPLIED SCIENCE

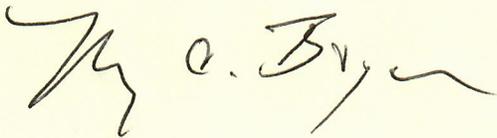
July 9, 2018

John H. Coatsworth  
Provost of the University  
Columbia University  
535 West 116<sup>th</sup> Street  
205 Low Library  
New York, NY 10027

Dear John,

I am writing to express my support for the Center designation of the Columbia Magnetic Resonance Research Center (CMRRC). I am particularly excited about the role that SEAS faculty can play in developing new technologies, methodologies, data science and imaging physics to further the use of magnetic resonance. This will draw not only on our faculty from Biomedical Engineering, but other departments such as Computer Science and Applied Physics & Applied Math. The latter department, as you are probably aware, is currently endeavoring to recruit a faculty member with a cutting edge reputation in the physics of magnetic resonance. We look forward to working with Professor Vaughan on furthering the success of this Center.

Sincerely,

A handwritten signature in black ink, appearing to read "Mary C. Boyce". The signature is fluid and cursive, with a long horizontal flourish at the end.

Mary C. Boyce

Dean of The Fu Foundation School of Engineering and Applied Science  
Morris A. and Alma Schapiro Professor



COLUMBIA UNIVERSITY

*College of Physicians  
and Surgeons*

in affiliation with  
New York-Presbyterian Hospital

Department of Radiology  
630 West 168th Street, MC 28  
New York, NY 10032-3784

[www.cumc.columbia.edu](http://www.cumc.columbia.edu)

To: Provost John Coatsworth  
Re: Designation of a Columbia Magnetic Resonance Research Center  
From: Lawrence H. Schwartz, MD, James Picker Professor of Radiology  
Date: November 14, 2018

I enthusiastically support the establishment of the Columbia MR Research Center as proposed and accept responsibility co-directing this Center.

Sincerely,

Lawrence H. Schwartz, MD  
James Picker Professor of Radiology  
Department of Radiology  
Division of Abdominal Imaging  
Chair, Department of Radiology  
Service Chief and Attending Physician, New York-Presbyterian Hospital



**COLUMBIA UNIVERSITY DEPARTMENT OF PSYCHIATRY  
NEW YORK STATE PSYCHIATRIC INSTITUTE**



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**JEFFREY A. LIEBERMAN, M.D.**

LAWRENCE C. KOLB PROFESSOR AND CHAIRMAN  
COLUMBIA UNIVERSITY DEPARTMENT OF PSYCHIATRY  
DIRECTOR, NEW YORK STATE PSYCHIATRIC INSTITUTE

TELEPHONE: 646-774-5300  
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JLIEBERMAN@COLUMBIA.EDU

July 2, 2018

John H. Coatsworth  
Provost, Columbia University  
535 West 116<sup>th</sup> Street  
205 Low Library  
New York, NY 10027

Dear John,

I am writing to express my support and that of Columbia University Department of Psychiatry and the New York State Psychiatric Institute for the Columbia Magnetic Resonance Research Center (CMRRC). I enthusiastically support the designation of this university-wide effort as a Columbia University Center, given the importance in neuroimaging as a research modality and the extraordinary talent of the CU faculty who use the numerous technical applications of MRI for human and pre-clinical research. I am confident that the outstanding research that could culminate from a world class center and the faculty collaboration that could eventuate, will be transformative in extending our knowledge of the brain and in the development of treatments for brain disorders. Part of what originally attracted me to Columbia was the opportunity to leverage the continuum of fundamental discovery research to clinical practice. As part of the Translational Science Core of the CMRRC, faculty in our department and at the New York State Psychiatric Institute will continue and expand their research that will contribute to our understanding of neural mechanisms underlying mental disorders and the identification of targets for novel therapeutics. Collaboration with the center will allow us to capitalize on advances in high field imaging and advances in analytical methods, as well as educational opportunities for our trainees. I look forward to working with Larry Schwartz, Tommy Vaughan and the other schools of the university and faculty in developing the CMRRC into the leading imaging program in the world.

Sincerely,

Jeffrey A. Lieberman, M.D.  
Lawrence C. Kolb Professor of Psychiatry and Lieber Professor of Schizophrenia Research  
Chairman, Department of Psychiatry  
Director, New York State Psychiatric Institute  
Psychiatrist-in-Chief, New York Presbyterian Hospital

CC T. Vaughan, PhD  
M. Purdy, PhD  
L. Schwartz, MD



**Nathan S. Kline  
Institute**

ANDREW M. CUOMO  
Governor

ANN MARIE T. SULLIVAN, M.D.  
Commissioner

DONALD C. GOFF, M.D.  
Director

July 2, 2018

John H. Coatsworth  
Provost of the University  
Columbia University  
535 West 116<sup>th</sup> Street  
205 Low Library  
New York, NY 10027

Dear Provost Coatsworth,

I am writing to express the strong support of the Nathan Kline Institute for the Center designation of the Columbia Magnetic Resonance Research Center (CMRRC). As you know, we are already planning with Dr. Vaughan to install a 9.4T magnetic resonance imaging (MRI) system at the Nathan Kline Institute, and have recently submitted an NIH High End Instrument grant application together with Dr. Vaughn to further this goal. We look forward to collaborating closely with Dr. Vaughn and his MR Research team at Columbia and at the New York Psychiatric Institute (our sister institution) to add this uniquely powerful MR system to the arsenal of shared instruments for collaborative research involving investigators at the Nathan Kline Institute, Columbia and the greater NYC community.

Sincerely,

Donald C. Goff, MD  
Director, Nathan Kline Institute

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