<table>
<thead>
<tr>
<th>Title</th>
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<tbody>
<tr>
<td>Baradaran, Hediye #2659 - Imaging assessment of vascular aging and vulnerable plaque</td>
<td>1</td>
</tr>
<tr>
<td>VPCAT 2021 Senior Mentor Selection Form</td>
<td>5</td>
</tr>
<tr>
<td>VPCAT 2021 Combined PDF Application</td>
<td>6</td>
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</tbody>
</table>
Application Summary

Competition Details

Competition Title: 2021 Vice President's Clinical and Translational (VPCAT) Research Scholars Program Application

Application Information

Submitted By: HEDIYEH BARADARAN
Application ID: 2659
Application Title: Imaging assessment of vascular aging and vulnerable plaque
Date Submitted: 9/25/2020 1:55 PM

Personal Details

uNID (U of U ID number/u0000000): u0574539
Applicant First Name: Hediye
Applicant Last Name: Baradaran
Applicant Alias (i.e., Name Applicant Prefers to Go By):
Applicant Degree(s): MD
Academic Rank (i.e., Primary Appointment Title): Assistant Professor
If selected "Other Title," please designate your Primary Appointment Title:
Secondary Appointment Title (i.e., clinic director, chair, chief, etc.):
Academic Track: Tenure Line
College or School:
Department: Radiology and Imaging Sciences
Division: Neuroradiology
Work Address: 30 N 1900 E
Email Address: hediyeh.baradaran@hsc.utah.edu
Work Phone Number:
Cell Phone Number:
Month of Birth:
Day of Birth:
Year of Birth:
Last 4 Digits of SS#: 
<table>
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<td>Country of Origin:</td>
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<td>Citizenship Status:</td>
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<td>eRA Commons UserID:</td>
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<tr>
<td>ORCID Identifier # (if applicant does not have an ORCID, please register for a unique ID via <a href="http://www.orcid.org">www.orcid.org</a>):</td>
<td>0000-0002-6251-5769</td>
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<td>Twitter Handle (if applicant does not have one, list &quot;none&quot;):</td>
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<td>Ethnicity:</td>
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<td>Race:</td>
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<tr>
<td>Do you have a disability? (NIH defines individuals with disabilities as those with a physical or mental impairment that substantially limits one or more major life activities.):</td>
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<td>Are you from a disadvantaged background? (see NIH NOT-OD-20-051 for definition):</td>
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<tr>
<td>Separating each with a semicolon, list up to 5 key SCIENTIFIC TERMS aligned to your research interests that we could use to search for funding opportunities via online systems (i.e., Grants.gov, NIH, Pivot, etc.).:</td>
<td>cerebrovascular disease; stroke; carotid atherosclerosis; dementia</td>
</tr>
<tr>
<td>Separating each with a semicolon, list up to 5 FUNDING AGENCIES you are interested in submitting an application for funding considerations. NOTE: if you are interested in the National Institute of Health (NIH), provide the name of the specific institute.:</td>
<td>NIA; NINDS</td>
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<tr>
<td>Administrative Assistant Last Name:</td>
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<td></td>
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<td>Administrative Assistant Phone #:</td>
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Proposal Title
Imaging assessment of vascular aging and vulnerable plaque

Scientific Mentor Unid (U of U ID number/u0000000. If none, list "Not Applicable")
u0033765

Scientific Mentor First Name
Dennis

Scientific Mentor Last Name
Parker

Scientific Mentor Alias (i.e., Name Mentor Prefers to Go By)

Scientific Mentor Degree(s)
PhD

Scientific Mentor Academic Rank (i.e., Primary Appointment Title)
Professor

If selected "Other Title," please designate Mentor's Primary Appointment Title

Scientific Mentor Secondary Appointment Title (i.e., clinic director, chair, chief, etc.)

Scientific Mentor College or School

Pre-Award Support Staff
First Name (This person should be the individual in your division/department that supports you with the submission of grants. If unknown, state 'Unknown'):
Amy

Pre-Award Support Staff Last Name:
Sikalis

Pre-Award Support Staff Email:
amy.sikalis@hsc.utah.edu

Post-Award Support Staff
First Name (This person should be the individual in your division/department that supports you with accounting/payroll. If unknown, state 'Unknown'):
Carla

Post-Award Support Staff Last Name:
Ortiz

Post-Award Support Staff Email:
carla.ortiz@hsc.utah.edu
Scientific Mentor Department
Radiology and Imaging Sciences

Scientific Mentor Division

Scientific Mentor Email Address
dennis.parker@hsc.utah.edu

Scientific Mentor Work Phone Number

Scientific Mentor eRA Commons UserID

Scientific Mentor ORCID Identifier # (if mentor does not have an ORCID, please register for a unique ID via www.orcid.org)
0000-0003-2557-8952

Comments to Competition Coordinators

Acknowledgment

Applicant Acknowledgement Statement
[Acknowledged] As an applicant to the Vice President's Clinical and Translational (VPCAT) Research Scholar Program, I acknowledge that everything I have written and included within my application is a true and accurate representation of the work that I have done and aim to do if chosen to be a part of the program. I acknowledge that my application will be reviewed by VPCAT senior mentors and members of the VPCAT Alumni Advisory Committee. I understand that upon submission, I will not be allowed to make any further changes to my application.
Dear Dr. Rubin,

I’m Hediyeh Baradaran, a tenure-track assistant professor in the neuroradiology section of the Department of Radiology and Imaging Sciences. My ultimate career goal is to become a leader and independent clinical investigator in academic neuroradiology, specifically in maximizing the contribution of imaging in the detection and treatment decision-making of cerebrovascular disease and dementia. I am applying for the VPCAT program because I believe it will help me realize my goals of becoming an independently funded researcher.

After graduating from Weill Cornell Medical College and completing my internship in Internal Medicine at the University of Utah, I began my radiology residency at NewYork Presbyterian Hospital-Weill Cornell Medicine. I found a mentor early in my residency who instilled the love of research and working towards answering tough clinical questions. It was with my initial mentor, Dr. Ajay Gupta, that I began studying how carotid atherosclerosis, specifically, certain carotid plaque features, can lead to stroke and other subclinical manifestations of cerebral ischemia. I continued my fellowship training at NewYork Presbyterian Hospital-Weill Cornell in neuroradiology where I was able to continue my cerebrovascular disease research. In residency and fellowship, I co-authored dozens of papers on this topic and quickly learned how to organize research questions, perform hypothesis-oriented research, and efficiently author research papers. In addition to working hard on performing meaningful research, I learned the importance of a dedicated mentor who helped me hone these skills and taught me critical lessons in performing effective research through working collaboratively.

After completing training, I soon began my first job as assistant professor of Radiology at Boston University. While at Boston University, I began collaborating with researchers at the Framingham Heart Study and applied for and was awarded the Scholar Award in Neuroradiology from the Foundation of the American Society of Neuroradiology (ASNR). This project involved evaluating changes to carotid intima media thickness, a marker of subclinical atherosclerosis, to markers of subclinical ischemia and aging on imaging and resulted in multiple presentations and publications.

After leaving Boston only after 1 academic year due to my husband’s job search, I quickly transitioned to the University of Utah where I started in 2018 and was able to carry out my first award from the ASNR. While here, I applied for and received the prestigious General Electric Radiology Research Academic Fellowship (GERRAF) from the Association of University Radiologists with the full support of my department. This career development award has been critical to my growth as a researcher and as part of it, I have started taking classes to earn a Masters of Science in Clinical Investigation (MSCI) at the University of Utah. The project for this two-year award involves creating a standardized reporting system for carotid artery plaque reporting which I hope will be implemented nationally eventually.

The University of Utah has been an ideal place for me to pursue my research interests because I have quickly become acquainted with multiple strong researchers with overlapping interests including Dr. Dennis Parker, a very successful medical physicist in the Department of Radiology and Imaging Sciences who will serve as my primary mentor. With the help of Dr. Parker and the rest of our research team (which includes some former and current VPCAT scholars), I feel equipped to continue my research in imaging of carotid atherosclerosis.

I feel extremely lucky to be working within the renowned neuroradiology section at the University of Utah and to have the extremely supportive, Dr. Satoshi Minoshima, as my chair. Because of his generous support and the support of my GERRAF award, I currently have 50% of my efforts dedicated to investigation and education pursuits and 50% of my efforts dedicated to clinical work. When my current grant funding expires in July 2021 and if I do not have any other funding at that time, I will still be on the tenure track which allows for 30% dedicated academic time. My department has generously offered to allow me to have 40% academic time after
my current funding expires, in order to focus my attention on obtaining NIH funding, as outlined in my plan for transition to independence.

<table>
<thead>
<tr>
<th>Responsibility</th>
<th>Percent effort</th>
<th>Description</th>
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<tbody>
<tr>
<td>Clinical</td>
<td>50%</td>
<td>I spend 2.5 clinical days per week interpreting neuroimaging studies and teaching radiology residents and neuroradiology fellows at the University and VA.</td>
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<tr>
<td>Investigation</td>
<td>25%</td>
<td>I have a total of 2.5 academic days per week for investigation which includes research group meetings.</td>
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<tr>
<td>Education</td>
<td>25%</td>
<td>I use some of my academic time to take graduate coursework as part of the MSCI program at the University of Utah.</td>
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</table>

I have dedicated my research career thus far to evaluating the interplay between imaging of carotid atherosclerosis to findings of subclinical vascular ischemia, stroke, and cognitive dysfunction. I believe my continued research in this realm can bridge a large gap in our understanding of how imaging carotid artery disease can lead to reduction in stroke and dementia. In the next academic year, I plan to continue to submit for foundation grants from the ASNR, local seed grants including the research incentive seed grant from the School of Medicine, and to apply for an R01 with projects that all directly relate to imaging of carotid atherosclerosis. Specifically, I plan to submit for a Comparative Effectiveness Award from the ASNR this winter (January 2021) and also an R01 in February or June 2021. Both projects are directly related to carotid plaque imaging and using this imaging to mitigate cerebrovascular ischemia. Since I am relatively new to the University of Utah system, I am sincerely interested in becoming acquainted with other dedicated clinician-scientists in order to utilize the resources available to me, learn from successful mentors, and take advantage of the wealth of opportunities offered by the University of Utah. I believe the VPCAT scholar program will provide an avenue for me to first learn from the successful clinician scientists here and then become a strong member of the research community at the University of Utah. I have learned the importance of strong mentorship and know that I will benefit immensely from developing relationships with people around the institution. I’m also interested in learning stronger leadership skills so that, in the future, I can hold leadership positions within and outside of my department.

I am fully committed to a career in academic neuroradiology with the ultimate goal of becoming an independently funded clinician-researcher. I believe that with the help, guidance, and mentorship offered through the University of Utah VPCAT program, I will be provided with a strong foundation to continue my research pursuits. Becoming a more integrated part of the research community at the University of Utah Health is of paramount importance to me and I believe the VPCAT program will be the springboard that allows me become more successful in my career. I hope that I will be chosen to participate in the VPCAT program because I am committed to making the most out of the opportunities within the University of Utah Health system to become a successful independently funded researcher.

Sincerely,

Hediyeh Baradaran, MD
Assistant Professor, Department of Radiology & Imaging Sciences
University of Utah Health
PERSONAL DATA
Name: Hediyeh Baradaran

EDUCATION

<table>
<thead>
<tr>
<th>Years</th>
<th>Degree</th>
<th>Institution (Area of Study)</th>
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<tbody>
<tr>
<td>2003 - 2007</td>
<td>B.A.</td>
<td>Brigham Young University (Philosophy)</td>
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<tr>
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<td></td>
<td>Provo, UT</td>
</tr>
<tr>
<td>2007 - 2011</td>
<td>M.D.</td>
<td>Weill Medical College of Cornell University (Medicine)</td>
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<tr>
<td></td>
<td></td>
<td>New York, NY</td>
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<tr>
<td>2011 - 2012</td>
<td>Intern</td>
<td>University of Utah School of Medicine (Internal Medicine)</td>
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<tr>
<td></td>
<td></td>
<td>Salt Lake City, UT</td>
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<tr>
<td>2012 - 2015</td>
<td>Resident</td>
<td>NewYork–Presbyterian Hospital/Weill Cornell Medical Center</td>
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<td>(Diagnostic Radiology)</td>
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<tr>
<td>2015 - 2016</td>
<td>Chief Resident</td>
<td>NewYork–Presbyterian Hospital/Weill Cornell Medical Center</td>
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<td>2016 - 2017</td>
<td>Fellow</td>
<td>NewYork–Presbyterian Hospital/Weill Cornell Medical Center</td>
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BOARD CERTIFICATIONS

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<tr>
<td>10/25/2018</td>
<td>Certificate of Added Qualification, Neuroradiology</td>
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CURRENT LICENSES/CERTIFICATIONS

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<td>2018 - 2022</td>
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ACADEMIC HISTORY

PROFESSIONAL EXPERIENCE

Full-Time Positions

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<td>2017 - 2018</td>
<td>Attending, Department of Radiology, Boston Medical Center, Boston, MA</td>
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<tr>
<td>2017 – 2018</td>
<td>Assistant Professor of Radiology, Boston University, Boston, MA</td>
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<tr>
<td>2018- present</td>
<td>Assistant Professor of Radiology, University of Utah, Salt Lake City, UT</td>
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Reviewer Experience

Ad Hoc Reviewer for Cerebrovascular Diseases
Ad Hoc Reviewer for Stroke
Reviewer for American Journal of Neuroradiology
Reviewer for Clinical Imaging
Associate Editor for Current Problems in Diagnostic Radiology

SCHOLASTIC HONORS
2007         Magna Cum Laude, B.A., Brigham Young University, Provo, UT
2013         Cornelius G. Dyke Memorial Award (First author on abstract for Best Original Paper submitted to the 2013 American Society of Neuroradiology Annual Meeting), American Society of Neuroradiology
2014         Stephen A. Kieffer Award (First author on abstract for Best Scientific Paper at the 2014 Eastern Neuroradiological Society Meeting), Eastern Neuroradiological Society
2015         Alexander Margulis Leadership Award (Sole recipient of award given to resident exhibiting exemplary leadership qualities), Weill Cornell Radiology
2016         Research Scholar, American College of Radiology-Association of University Radiologists
2016         Roentgen Resident Research Award, Radiological Society of North America
2018         Foundation of the American Society of Neuroradiology Scholar award in Neuroradiology Research
2019         GE-Radiology Research Academic Fellowship Award
2019         American Journal of Neuroradiology Editorial Fellow
2020         Council of Early Career Investigators in Imaging Awardee, Academy for Radiology and Biomedical Imaging Research Academic Council

SERVICE AT PREVIOUS INSTITUTIONS
2015 – 2016   Member, NewYork-Presbyterian Hospital, Weill Cornell Medical Center, Radiology Resident Selection Committee

ADMINISTRATIVE EXPERIENCE
Professional Organization & Scientific Activities
2018         Moderator, RAHSR session, Association of University Radiologists
2019-present Abstract Reviewer, International Stroke Conference
2019         Moderator, Evidence Based Medicine Programming: Speed Journal club. American Society of Neuroradiology
2019         Radiographies Panel, Neuroradiology Section
2020         Moderator, Brain Vascular Scientific Session, American Society of Neuroradiology

Symposium/Meeting Chair/Coordinator
2019-present Co-Chair, Radiology & Imaging Sciences Seminar

UNIVERSITY COMMUNITY ACTIVITIES
Department Level
2019-present Member, Neuroradiology Section Workflow Committee
2019-present Member, University of Utah Neuroradiology Fellow Selection Committee
2020-present Resident Education Liaison, Neuroradiology Section
2020-present  Member, Program Evaluation Committee (PEC) for Diagnostic Radiology Residency

University Level
2020-present  Member, University of Utah Center on Aging

CURRENT MEMBERSHIPS IN PROFESSIONAL SOCIETIES
American College of Radiology
American Society of Neuroradiology
Association of University Radiologists
Radiological Society of North America
American Heart Association

FUNDING
Active Grants
07/01/2019-06/30/2021  General Electric Radiology Research Academic Fellowship Award
$140,000
General Electric – Association of University Radiologists
Principal Investigator

Past Grants
09/01/2018-08/21/2019  Scholar Award of Neuroradiology
$60,000
American Society of Neuroradiology
Principal Investigator

TEACHING RESPONSIBILITIES/ASSIGNMENTS

Educational Lectures
Didactic Lectures
2015 - 2016  Baradaran H. Various radiology topics. NewYork–Presbyterian Hospital/Weill Cornell Medical Center
2016-2018  Baradaran H. Various radiology topics. Resident Lecture Series, Boston Medical Center
2018-present  Baradaran H. Various radiology topics. University of Utah

Trainee Supervision
Fellow
2020  Research Mentor, Kelly Dahlstrom, University of Utah

Resident
2018  Research Mentor, Eda Dou, Weill Cornell Medical College
2018  Research Mentor, Hersh Patel, Weill Cornell Medical College

Medical Student
2019  Research Mentor, Tyrel Foster, University of Utah
2019  Research Mentor, Paul Harrie, University of Utah
PEER-REVIEWED JOURNAL ARTICLES


37. **Baradaran H** and Gupta A. Carotid Vessel Wall Imaging on CTA. *AJNR Am J Neuroradiol* 2-2- Fev 6 (Epub)


**BOOK CHAPTERS**


**OTHER (Commentary/Letters/Editorials/Case Reports/Video/Film)**

**Case Reports**


Letters

PENDING PUBLICATIONS

Manuscripts
1. Baradaran H, Majersik J, McNally S, Parker D, de Havenon A. Carotid Stiffness and Parahippocampal and Hippocampal volume over a 20-year period: A pre-clinical marker for dementia. (Submitted to AJNR)

Book Chapters

ORAL PRESENTATIONS

Meeting Presentations (Not Published Abstracts and Not Unpublished Posters)

International
Baradaran, Hediyeh - #2659


**Invited/Visiting Professor Presentations**

**International**


2017 **Baradaran H**. Carotid Vessel Wall Findings on Routine CT Angiography. Eastern Neuroradiological Society, Toronto, Ontario, Canada

2019 **Baradaran H**. Imaging of CIMT progression and subclinical markers of ischemia. American Society of Neuroradiology Annual Meeting, Boston, MA

2020 **Baradaran H**. Cross Sectional Imaging of Extracranial Vessels. Utah Head and Neck Imaging Conference, Salt Lake City, Utah

**Regional:**

2020 **Baradaran H**. NeuroImaging in COVID-19. Radiology and Imaging Sciences Seminar at the University of Utah, Salt Lake City, Utah
APPLICATION NARRATIVE

CAREER PLAN

Career Statement: My goal is to be an expert in imaging carotid atherosclerosis and evaluating its relationship to downstream effects, including cerebrovascular ischemia, cognitive dysfunction, and dementia. As a neuroradiologist, I will evaluate how certain imaging characteristics of carotid artery disease can potentially predict poor outcomes and wish to make this information useful and actionable in everyday clinical practice.

CAREER GOALS AND OBJECTIVES:

Goal 1: Obtain formal education in performing research. I will continue to work towards formal education in clinical investigation through the MSCI program at the University of Utah. I will take specific courses tailored to gaining the skills and education necessary to become a successful independent researcher. After completing Fall 2020 semester where I am enrolled in MDCRC 6450: Grant Writing, MSCRC 6110: Intermediate Epidemiology; MDCRC 6200: Systematic Review and Meta-analysis; and MDCRC 6430: Clinical Research Ethics, I will also take coursework in the spring semester and throughout the 2021-2022 academic year (Table 1). This coursework is being funded through my career development award (GERRAF). In addition to these classes, I hope through the VPCAT program, I will take advantage of the structured curriculum to learn practical skills for a clinical researcher including study design.

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<td>Intermediate Epidemiology</td>
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<tr>
<td>Systematic Review and Meta-analysis</td>
<td>MDCRC 6200</td>
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<td>Clinical Research Ethics</td>
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<tr>
<td>Methods in Comparative Effectiveness Research</td>
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<td>Regression Models</td>
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<td>Design and Implementation of Clinical Trials</td>
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<tr>
<td>Cost-Effectiveness Analysis</td>
<td>MDCRC 6120</td>
<td>2</td>
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Goal 2: Improve grant writing skills. I will work with my mentor and other research collaborators during the two-year scholar award period to hone and improve my grant-writing skills. Throughout the 2020-2021, I will be attending the RSNA Advanced Grant Writing Course which is an intensive 8-day course on grant writing which is divided into two-day sessions throughout the academic year. This course will help me focus on preparing a successful NIH-style proposal. In addition, I will continue my Grant Writing course (MDCRC 6450) from the University of Utah, taught by Dr. Maureen Murtaugh. Through both of these courses, I will hone my writing skills to ensure my research ideas are presented clearly to have the highest chance of funding success. I also hope that with formal training and mentorship through the VPCAT program, I will improve my grant writing skills, learn about other grant writing resources present at the University, and have senior researchers critically revise and make suggestions on my NIH grant proposal.

Goal 3: Lead specific research projects in support of my aims for my future R01 proposal. Since my ultimate goal is to become an independently funded clinician-scientist, one of my main goals during the two-year award period is to lead research projects which will serve as preliminary data for my future R01 proposal. In addition to the proposed project in which we propose to use MR as a technique to evaluate carotid compliance, I have either started or drafted grant proposals on other projects evaluating the association between specific carotid plaque characteristics on imaging to other markers of subclinical vascular disease, brain aging, and cognitive dysfunction. These projects all support the central hypothesis that carotid atherosclerosis 1) can be accurately and efficiently imaged and characterized and that 2) specific imaging findings of carotid atherosclerosis are associated with future cerebrovascular ischemia, cognitive dysfunction, and dementia. I hope to complete at least 3 of these projects in the next two-years (some funded already) so I
can publish them as first-author papers. I hope that my formal coursework in clinical investigation will guide additional research projects and ensure my methodology is appropriate for my proposals. I also hope that through the VPCAT program, I can gain more formal training in successful leadership, specifically in leading research projects. I would like to eventually expand my research “lab” to include more trainees and medical students so would like to have more formal and informal training in leading a research group.

**Goal 4: Become a leader among academic radiologists and meet more clinical researchers at the U.** In order to achieve this goal, I will present at multiple national and international meetings, serve on committees at a society level, and continue working with mentors provided by the GERRAF career development grant. First, I will submit abstracts from my research projects to both national and international meetings including the annual meetings of the International Stroke Conference, American Society of Neuroradiology, and Radiological Society of North America. I will also continue to accept requests for moderating and speaking at conferences including my two invited presentations at RSNA in 2020 and an invited presentation at ASNR in 2021. I will also continue to serve on committees at the ASNR, including the Research committee and evidenced-based medicine committee. I believe a critical part of my being able to increase visibility and gain credibility as a clinician scientist is learn more from local researchers. I hope that through the VPCAT scholar program, I will be able to meet more successful academic researchers and develop research relationships with scientists in other, complementary fields.

**SCIENTIFIC MENTORING PLAN**

**Dr. Dennis Parker, PhD** is a medical physicist with 40 years of experience and expertise in neurovascular imaging using novel magnetic resonance imaging techniques. He is the Mark H. Huntsman endowed Professor in the Department of Radiology & Imaging Sciences with a strong record of successful funding with multiple current and prior R01s, including a current R01 in neurovascular imaging. He has mentored numerous post-doctoral trainees and many junior faculty and currently serves as my primary mentor for the MSCI research project. I have been working with Dr. Parker since I started working at the University of Utah in 2018 and he has been invaluable as I have submitted grant proposals. His technical and physics expertise in imaging complements my clinical experience and knowledge so he is well-suited to serve as my mentor for this project and additional future planned projects. He has always been very encouraging and supportive of my research, has provided helpful feedback on manuscript and grant drafts, and is committed to helping me succeed. He has served as a mentor for former VPCAT scholars so is very aware of the responsibilities associated with mentorship.

**Mentoring plan:**
- I will continue to meet weekly with Dr. Parker on Friday afternoons as part of a research team
- In addition to the weekly research meetings, I will also have separate individual research meetings with Dr. Parker twice/month to discuss upcoming grant submissions and current research projects
- Dr. Parker will be my primary mentor for conducting the research proposal and will guide in assessment of imaging protocols

With Dr. Parker’s mentorship, I expect to publish at least five first-author papers in leading journals in my field over the course of the two-year VPCAT scholar program. In addition, I expect to submit at least 2 grant proposals per year, including an R01 from the NIH. Over this time period, results from my studies will be presented at multiple national and international conferences in my field, specifically the annual conferences of the International Stroke Conference, the American Society of Neuroradiology, and the Radiological Society of North America.
Dementia is an epidemic affecting over 35 million people worldwide, costing over $600 billion annually, without available prevention or treatment. Cardiovascular risk factors, specifically carotid artery atherosclerosis, may play an important role in the development of cognitive decline and dementia. Vascular compliance decreases with age, with decreased compliance leading to downstream effects, importantly contributing to cognitive impairment and stroke risk. Decreased compliance, or carotid stiffness, is an independent risk factor for cerebrovascular disease, cognitive impairment, and mortality. Decreased carotid compliance may 1) impair blood flow to the brain from increased arterial stiffness resulting in cerebral hypoperfusion and 2) impair amyloid clearance from the brain leading to increased amyloid deposition, both of which may be associated with cognitive decline.

While compliance and other measures of vascular stiffness can be quantified with B-mode and Doppler ultrasound (US), these techniques are highly operator dependent and are limited to large vessels such as the common carotid artery. Also, atherosclerotic plaque components differentially affect compliance, and US can be limited in evaluating partially calcified plaques or those inaccessible due to anatomy. Furthermore, US has limited evaluation of vulnerable plaque features such as carotid intraplaque hemorrhage (IPH), lipid rich/necrotic core (LRNC) and intraplaque inflammation (IPI). These vulnerable plaque components are best detected with vessel wall MRI (vwMRI) and are strongly associated with future risk of stroke. There is a crucial need to elucidate the relationships between vulnerable plaque measurement, full neurovascular compliance mapping, and downstream effects on the brain.

To bridge these gaps, our team has developed full head/neck cine-vessel wall MRI (c-vwMRI) as an efficient method allowing real-time measurement of vulnerable plaque alongside vessel wall motion and compliance throughout the neurovasculature. We propose to carry out a clinical study to validate c-vwMRI compliance measures and explore the interplay between compliance, vulnerable carotid plaque, and downstream effects on imaging markers of brain aging and subclinical vascular disease. To accomplish this study, we will recruit 30 subjects with known carotid atherosclerosis defined as carotid stenosis of at least 50%. These recruited patients will undergo carotid US, head/neck c-vwMRI to simultaneously measure carotid compliance and assess other vulnerable plaque features, in addition to standard MR brain sequences. To this end, the specific aims are:

**Specific Aim 1. Validate c-vwMRI measurement of carotid compliance.** We will compare the primary outcome measure, common carotid artery compliance, between c-vwMRI and US in each subject. We will validate additional measures of arterial stiffness, including strain, distensibility, stiffness index, and pressure-strain elastic modulus. We hypothesize that c-vwMRI accurately measures vascular compliance and other measures of arterial stiffness as compared to standard US measures, without the inherent limitations of US.

**Specific Aim 2. Determine the relation between vulnerable plaque components and vascular compliance.** Specific markers of vulnerable plaque on vwMRI, including IPH, LRNC, and IPI, will be correlated with vascular compliance. We hypothesize that these vulnerable plaque markers will be associated with diminished vascular compliance compared to normal vessel segments.

**Specific Aim 3. Determine the correlation between vascular compliance and downstream imaging markers of brain aging and subclinical vascular disease.** We will relate vascular compliance to traditional MR measures of brain aging, including total cortical and hippocampal volumes, and MR measures of subclinical vascular disease, including white matter T2/FLAIR hyperintensities, silent brain infarctions, and cerebral microbleeds. We hypothesize that patients with decreased vascular compliance will have lower cortical and hippocampal volumes, and have increased burden of white matter T2/FLAIR hyperintensities, silent brain infarctions, and cerebral microbleeds, particularly in deep regions.

**Impact:** Our project will provide an efficient imaging method to evaluate carotid compliance and vulnerable carotid plaque features using a single imaging examination. On successful completion, we will elucidate the link between c-vwMRI-detected carotid compliance and plaque features and downstream brain aging and subclinical vascular disease. Once validated, c-vwMRI could be immediately translated into clinical practice with full head/neck vascular mapping, and will aid in future prospective studies aimed at slowing the progression of carotid atherosclerosis leading to cognitive decline.
SIGNIFICANCE

Given the increasing prevalence and economic impact of cognitive decline and dementia, there have been intensified efforts in recognizing targets for prevention and treatment.\textsuperscript{1} Traditionally thought to only contribute to vascular dementia, carotid artery atherosclerosis has been increasingly associated with all-cause dementia and Alzheimer’s disease\textsuperscript{2,20} with mechanisms including increased arterial stiffness, cerebral hypoperfusion, and impaired amyloid clearance from the brain leading to increased amyloid deposition.\textsuperscript{9-12} Vascular compliance is a marker of vascular health and is known to decrease as we age.\textsuperscript{3-5} Having decreased vascular compliance is associated with cardiovascular disease including stroke and myocardial infarction, cognitive impairment, and dementia\textsuperscript{6-8,21} It is traditionally measured using ultrasound (US) techniques, however, US is limited by operator-dependence, anatomic limitations, and inability to comprehensively evaluate carotid plaque.\textsuperscript{13-16} Because of the limitations of US, there are no ideal imaging studies that can evaluate both vascular compliance and high-risk plaque features. We have developed a cine-vessel wall MR (c-vwMRI) which can provide dynamic, cardiac phase-correlated measurements of vessel walls in order to calculate carotid compliance. This imaging method can be performed as part of a standard vwMRI acquisition in order to streamline assessment of vascular contributions to future stroke and dementia risk.

Vulnerable carotid plaque features. Vulnerable carotid plaque components are strongly associated with future stroke and cerebrovascular disease.\textsuperscript{17-19} Such plaque components, including IPH and LRNC are most accurately assessed using dedicated MR imaging.\textsuperscript{22-24} The relation between these high-risk plaque components and vascular compliance is less understood, though, they are likely pathophysiologically related with evidence of increased plaque in regions with arterial stiffness\textsuperscript{25} and evidence that arterial stiffness is associated with higher-risk plaque features on ultrasound.\textsuperscript{26,27} There is less direct evidence of the MR association between plaque and vascular compliance.

Carotid atherosclerosis and brain aging. MR markers of brain aging, specifically lower total brain cortical and hippocampal volumes, are also associated with dementia and cognitive decline.\textsuperscript{28-32} Decreased hippocampal and parahippocampal volumes are validated early biomarkers of Alzheimer’s disease.\textsuperscript{33-35} In population-based cohorts, we have shown that carotid artery atherosclerosis defined by progression of carotid intima-media thickness and also sonographically measured carotid compliance, is associated with lower hippocampal volumes.\textsuperscript{36,37} Prior studies have also shown that carotid endarterectomy improves cognition scores in patients with carotid artery disease, further supporting a link between carotid artery disease and brain cognition.\textsuperscript{38-40} We propose evaluating the relation between c-vwMRI measured carotid compliance and brain and hippocampal volumes in our cohort as it will further support the link between vascular compliance and cognitive decline.

Carotid atherosclerosis and subclinical markers of vascular injury. Subclinical markers of vascular injury including silent brain infarctions (SBIs), T2/FLAIR white matter hyperintensities (WMH), and cerebral microbleeds (CMBs) detected on routine brain MR are independently associated with increased risk of dementia, cognitive dysfunction, future stroke, and increased overall mortality.\textsuperscript{41-52} These imaging markers have also been shown to be associated with carotid atherosclerosis to varying degrees.\textsuperscript{53-57} Determining the relation between carotid compliance and these downstream imaging markers would be helpful in clarifying the interplay between vascular disease and cognition.

The proposed research is significant because it would validate a newly developed MR method for measuring vascular compliance. This technique would streamline our ability to assess risk for future cognitive dysfunction, stroke, or dementia by evaluating both carotid compliance and vulnerable plaque features simultaneously. The proposal would also advance our understanding of how vascular compliance relates to vulnerable plaque components, an important step in understanding the pathophysiology of plaque formation and for the identification of potential targets for prevention and treatment. Lastly, our proposal would allow for correlation of MR measures of carotid compliance to imaging findings known to be associated with brain aging and subclinical vascular injury. Since we know vascular compliance can improve with preventative techniques including diet modification, exercise, and blood pressure reduction,\textsuperscript{58-60} by easily identifying those with worse carotid compliance, we could potentially focus on stringent adherence to cardiovascular risk factor reduction as a primary prevention strategy.
PRELIMINARY DATA AND PRIOR RESEARCH EFFORTS

My research thus far has focused on the relationship of imaging of the internal carotid artery to cerebrovascular ischemia with over 30 publications in this specific research area. In support of Aim 1, we have preliminary unpublished data which has demonstrated the ability to measure changes in vessel diameter and volume throughout the cardiac cycle. Using this imaging reconstruction method, we are able to measure changes in vessel diameter to calculate carotid compliance, along with other measures of carotid stiffness.

In support of Aim 2, we have found extensive support that vulnerable plaque features on imaging are associated with downstream cerebrovascular ischemia and future stroke. Among other features, we have demonstrated that imaging features of IPH and LRNC on MR are associated with cerebrovascular ischemia and stroke. In addition to MR-based plaque features, I have also studied plaque features on other imaging modalities. The association between carotid compliance and these more established vulnerable plaque features is less clear.

In support of Aim 3, we have found imaging evidence of brain aging downstream to carotid artery disease. Using funding from the Foundation of the ASNR, we studied two population-based cohorts and found that having higher carotid compliance measured on ultrasound is associated with higher hippocampal and parahippocampal volumes when measured 20 years later and that progression of carotid intima media thickness, a measure of carotid atherosclerosis, was associated with decreased hippocampal volumes. In further support of Aim 3, we have found evidence of subclinical vascular injury on imaging secondary to carotid atherosclerosis. We have found that asymptomatic patients with carotid artery disease are more likely to have cortical rather than subcortical subtypes of SBIs. Furthermore, we have also found qualitatively increased WMH as measured by visual rating scales, downstream from carotid artery disease, compared to downstream from a normal carotid artery. We have also found that in asymptomatic subjects with carotid artery disease, we found differences in the neuronal integrity, with lower FA and higher MD values downstream from carotid artery disease compared to downstream from a normal carotid artery.

FUTURE RESEARCH PLAN

With the completion of the proposed research projects and future planned research projects, I believe I will have sufficient preliminary data to apply for larger NIH-funded grants. After the successful completion of this project, we are planning to submit a proposal using dedicated carotid imaging in the Framingham Heart Study cohort and to evaluate the association of high-risk carotid plaque features and measures of carotid compliance to incident dementia and cognitive dysfunction. This proposal evaluating carotid plaque features in a large epidemiologic cohort will be the primary content in my planned R01 proposal, specifically from the NIA. That proposal is a direct extension of my previously published work in cerebrovascular imaging research, specifically in using imaging to determine risk factors for stroke and dementia.

While I am actively applying for NIH-funding, there are a number of other specific research projects I am trying to complete in order to provide supporting evidence for my proposal while at the same time developing other research avenues for future funding. I plan on applying to the ASNR Comparative effectiveness award this winter and also the School of Medicine Research Incentive grant with proposals that also evaluate the role of cerebrovascular imaging in the prediction of future stroke and cognitive decline.

In summary, I have a strong track record of success thus far as an early career academic neuroradiologist with both quality publications and securing extramural funding for my research projects. With continued focus on research coupled with formal education and mentoring, I hope to have a robust research group maximizing the contribution of imaging to the prevention of ischemic stroke and cognitive dysfunction. The VPCAT program is a critical component of my career development as it will help in providing more specific mentorship from successful researchers throughout the University system, training in conducting research effectively, and providing introduction to the extensive resources available to me as a clinician-scientist.


PLAN FOR TRANSITION TO INDEPENDENCE

At this stage of my career, I have a strong start as an early investigator. I have obtained two prestigious early career awards from top Radiology research foundations, the American Society of Neuroradiology and the Association of University Radiologists, for a total of 3 years of funding. The next few years are critical to my development to becoming an independent researcher. At this critical juncture, I am lucky to have the support of my department to focus on research efforts. Initially, I had plans to submit for a 5-year K23 career development award from the NIH, but after many talks with mentors both within and outside of my department, I decided that with only a little more time, I would be prepared to submit an R01. In order to prepare to submit an R01, I will be supported more than the 30% guaranteed by being a tenure track assistant professor.

Current status until June 30, 2021:
- 50% protected academic time to pursue research and educational endeavors, including coursework for the MSCI program
- 50% clinical and teaching time (about 2.5 days/week) in which I interpret neuroimaging studies and teach radiology residents and neuroradiology fellows at the University and VA

Plan starting July 1, 2021:
- 40% protected academic time to pursue research and educational endeavors, specifically to continue submission and resubmission of R01 proposals and to develop research team for additional grants
- 60% clinical and teaching time (2.5-3 days/week) for interpreting neuroimaging studies and teaching radiology trainees

I have worked with Dr. Satoshi Minoshima (Chair) and Dr. Karen Salzman (Neuroradiology section chief) to increase protected academic time after current grant funding expires in order to dedicate sufficient time to grant writing and submission. Dr. Salzman, who manages the day-to-day scheduling, has also agreed to adjust the schedule to ensure that I have 40% protected academic time during these critical years. No additional administrative duties will be assigned to me during this time in order to focus my time on pursuing research. In addition to the extra academic time, I have scheduled individual meetings with my Chair in which he will help review and critically evaluate my grant proposal.

Hediyeh Baradaran, MD
Assistant Professor, Radiology and Imaging Sciences

I agree with the above stated plan.

Satoshi Minoshima, MD, PhD
Professor and Anne G. Osborn Chair
Department of Radiology and Imaging Sciences
University of Utah
Michael A. Rubin, MD, PhD, MS
Director, VPCAT Program
University of Utah Health, SVPHS Education Office
EHSEB 5515

Dear Dr. Rubin,

I am delighted to provide my highest level of support for Dr. Hediyeh Baradaran’s application for the Vice President’s Clinical and Translational (VPCAT) Research Scholars Program. I have had the privilege of working with Dr. Baradaran since she began working at the University of Utah in 2018 and have seen first-hand her dedication to a career as an independently funded academic researcher. I am committed to providing the mentorship and support for her to take part in the VPCAT program for the next two-years. She is currently on the tenure track but is lucky to have the additional support from a career development award from the Association of University Radiologists- General Electric Radiology Research Academic Fellowship (GERRAF) which currently protects 50% of her time.

Initially, I was very impressed with Hediyeh’s inquisitive mind, strong desire to pursue a career in academic medicine, and her impressive publication record. In many of our subsequent research meetings, I have been struck by her insightful comments and clarity of thought. She has shown her dedication to neurovascular research by seeking my help and joining our neuroimaging research group when she arrived at the University of Utah and then continuing to work with our group on novel imaging of the extracranial vasculature. She has a very strong background in cerebrovascular research, so this coupled with her clinical expertise makes her well-suited for a productive career as an independent researcher. Hediyeh has a deep understanding of what is required to succeed as an independent investigator and is firmly committed to that goal. She understands that the next step for independence requires continued mentorship and identification of strong research collaborators within the institution. She is wisely using her current protected academic time to actively pursue research projects and obtain formal education in clinical investigation.

It will be my privilege to mentor Hediyeh during this process and I feel well qualified to provide her the necessary guidance and support. I have a funded research program, including R01 funding to develop novel MR imaging techniques. As a medical physicist with over 40 years of experience, I have particular interest in technology development in neuroradiology. I have supervised 34 Ph.D students, 14 Masters students, and several post-doctoral students, most of whom have successfully transitioned to independent research careers. In addition, I have served as a mentor for prior VPCAT scholars so am aware of the expectations and requirements with this excellent program. I have read, understand, and can meet the required responsibilities outlined in the “Scientific Mentor Requirements and Expectations.” As mentioned, Dr. Baradaran currently has 50% protected academic time, but even after her current grant funding expires, she will have 30% protected academic time to devote to this career development and research program. She has the strong support of her research-oriented Chair who will work closely with her section chief in Neuroradiology to ensure that she has the necessary time to devote to the VPCAT program. I have
read and also agree with and commit to implementing Dr. Baradaran’s Transition to Independence Plan.

Dr. Baradaran and I have a mentoring plan throughout the two-year VPCAT program including the following:
- Meeting weekly as part of a neurovascular research group (Friday afternoons)
- We will meet individually twice per month throughout the two-year VPCAT program to discuss current projects, manuscript drafts, and grant submissions
- I will continue to mentor her as she completes the research aims detailed in her research proposal. We will discuss specific issues that may arise in implementing her research plan and will continue to brainstorm additional ideas.
- I will continue to critically edit and help with revisions of the papers that result from her current research efforts
- We will spend dedicated time on honing grant-writing skills as she prepares to submit her first major NIH grant

My mentoring philosophy thus far has been to foster an environment where ideas can grow and develop. Through our weekly research meetings, we discuss many ideas, some of which develop into grant proposals and other research projects. I hope to continue to support Dr. Baradaran to the point where she has enough autonomy to become an independent researcher. It is through these research meetings that Dr. Baradaran developed her current grant proposal on using cine-MR to evaluate carotid compliance. Dr. Baradaran’s transition plan builds on her current work thus far and I am well-suited to mentor her as she applies for NIH funding related to carotid imaging research.

In summary, I am wholly confident Dr. Baradaran will excel in her educational and research pursuits while part of the VPCAT program. Given the strong support of our department, including an extremely supportive chair, current funding from the GERRAF which allows for adequate academic time and future protected academic time as a tenure-track assistant professor, she is well-equipped to successfully participate in the VPCAT scholar program. I wholeheartedly support Dr. Baradaran’s VPCAT scholar application without reservation.

Yours sincerely,

Dennis L. Parker, Ph.D.,
Mark H. Huntsman, Professor of Radiology and Imaging Sciences
The Utah Center for Advanced Imaging Research
University of Utah
September 1, 2020

Dear Dr. Rubin,

I would like to enthusiastically support Dr. Hediyeh Baradaran’s Vice President’s Clinical and Translational (VPCAT) Research Scholars Program application. We recruited Dr. Hediyeh Baradaran to our faculty because of her exceptional academic record, outstanding performance throughout her training, and her remarkable endorsement from her prior institutions. We were confident that Dr. Baradaran would excel both academically and clinically, and in her time as Assistant Professor of Radiology, she has exceeded expectations. She is not only well-respected and well-liked among her colleagues and referring clinicians, but has already forged strong research relationships with many investigators at the University of Utah. Dr. Baradaran’s research endeavors thus far are a very welcome addition to our department’s research activities. Through the VPCAT program, she will continue to build on her expertise in vessel wall imaging and learn how to take full advantage of the vast resources at University of Utah Health.

When Dr. Baradaran began working with us, she had already been awarded the one-year Scholar Award in Neuroradiology from the ASNR. Despite transitioning to our department after already having received the award, we were delighted to be able to fully support all of the resources and academic time necessary for that award because we highly prioritize supporting our young investigators. Shortly after starting her position at the University of Utah, she applied for and was awarded the very prestigious two-year career development General Electric Radiology Research Fellowship (GERRAF) award. The Department has been thrilled to support her with 50% academic time in order to complete her research proposal and the educational activities included in that fellowship award, including pursuing a Masters of Science in Clinical Investigation (MSCI). As such, she will have sufficient time (50% academic time) to attend the workshops, classes, and mentorship meetings required to successfully complete the VPCAT program. When her current grant funding ends in July 2021, she will have at least 30% academic time (0.30 FTE) as a tenure track assistant professor. I am working with Dr. Baradaran’s section chief to provide Dr. Baradaran 40% (0.40 FTE) academic time starting in July 2021 to protect her academic time while she is actively applying for grants. As Chair, I am personally extremely invested in Dr. Baradaran’s retention, development, and academic advancement and as such am very supportive of her active research and educational pursuits. In fact, I strongly encouraged Dr. Baradaran to apply for the VPCAT program because prior junior faculty have found the program very helpful. In coordination with Dr. Karen Salzman, the neuroradiology section chief, I will ensure that Dr. Baradaran has adequate protected time to comply with the attendance requirements for the VPCAT program. I will personally ensure that her clinical responsibilities do not interfere with her research, training, or mentoring meetings, including the 1 ½ day VPCAT Program Colloquium in December, the twice-monthly 1/2 day curricular sessions on the 2nd and 4th Wednesdays at 12:30pm, the 3-day Leadership Seminar Series, the 1-hour VPCAT initial mentoring team meeting with her scientific mentor, and at least 3 VPCAT
mentor meetings over the two-year VPCAT scholar program period. She will have protected time to pursue all of the mandatory activities required as part of the two-year VPCAT program and also additional supplemental career development opportunities, including her attending the RSNA advanced grant writing workshop which she will be attending this academic year as she prepares to write her first R01 grant. There is sufficient staffing within the neuroradiology section to ensure that Dr. Baradaran will have no clinical duties interfering with her attendance of the required components of the VPCAT program. As Chair, I am personally very invested in Dr. Baradaran’s retention, development, and academic advancement during and beyond the award period.

With such a stellar background and already having started meaningful research activity, we have envisioned a productive long-term career advancement plan for Dr. Baradaran in our department. With the addition of the strong mentorship involved with the VPCAT program in addition to her current career development grant, Dr. Baradaran will be poised to apply for a federally funded research grant, including her first R01 during the VPCAT award period. Given Dr. Baradaran’s enormous potential, we will continue to support Dr. Baradaran as a tenure-track assistant professor which guarantees at least 0.30 FTE academic time and hopefully 0.40 FTE for the duration of the VPCAT scholar period, in order to ensure she has the adequate academic time to pursue her scholarly and research activities.

Emphasizing research activity is one of my top priorities as chair and supporting junior faculty, such as Dr. Baradaran, is extremely important to achieving this goal. Dr. Baradaran has extensive resources available to her at University of Utah Health including a research office, physicist and statistical support, a research-oriented library, a strong neurovascular research group, and the opportunity to take formal Clinical Investigation courses. With the help of the VPCAT program, she will continue to take full advantage of the valuable resources at her home institution.

In addition to utilizing the rich resources available, Dr. Baradaran has also chosen a strong research mentor, Dr. Dennis Parker, who has the expertise and strong research track record to be an excellent mentor. With a strong mentor within her department whose expertise complements Dr. Baradaran’s clinical research knowledge, she is poised to excel in neurovascular imaging research.

I wish to provide my highest level of support to Dr. Baradaran’s application for the VPCAT program. She has proven a high level of commitment and dedication to patient-oriented research through her strong academic record and I am confident she will develop the necessary skills and knowledge to become a successful independent investigator, especially if selected to participate in the VPCAT program. I will personally ensure that Dr. Baradaran will be able to attend all of the required sessions as part of the VPCAT program. Without reservation, the Department of Radiology is fully committed to providing the protected time, mentorship, and resources for Dr. Baradaran to complete her proposed research and training.

Sincerely,

Satoshi Minoshima, MD, PhD
Professor and Anne G. Osborn Chair
Department of Radiology and Imaging Sciences
University of Utah
NAME: Dennis L. Parker, Ph.D.

eRA COMMONS USER NAME (credential, e.g., agency login): DennisParker

POSITION TITLE: Professor of Radiology, Biomedical Informatics. Director, Utah Center for Advanced Imaging Research

EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)

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A. Personal Statement

The goal of this project is to use high performance MR imaging methods to explore the interplay between compliance, vulnerable carotid plaque, and downstream effects on imaging markers of brain aging and subclinical vascular disease. This goal is made possible by our development of high-performance neck-shape-specific RF coils that can operate simultaneously with the OEM head coils and novel MRI pulse sequences that can efficiently capture the motion of the carotid wall. For this project we have advanced carotid imaging hardware, including the newly installed Siemens Prisma 3T MRI with improved SNR and 80 mT/m gradients with improved stability and increased duty cycle. Our modular neck-shape-specific intercchangeable RF coils operate simultaneously with the scanner head coil allowing simultaneous examination of the complete vascular bed. And we have developed efficient black blood MRI sequences using the 3D Stack of Stars (3D SoS) acquisition method (hybrid 2D radial / 1D Cartesian) which can efficiently be correlated with the patient’s cardiac cycle to yield images showing motion of the carotid wall. Further, we will use 3D SoS methods with improved flow suppression and reduced motion sensitivity to implement MRI methods to detect and characterize intraplaque hemorrhage (3D SOS MPRAGE), inflammation (3D SOS DCE-MRI), and lipid-rich necrotic core (3D SOS DWI). The increased SNR and higher spatial and temporal resolution coupled with methods to detect and eliminate motion-corruption will achieve a marked increase in in-vivo spatial resolution and clarity of plaque components.

I am a medical physicist with 40 years of experience in research in physics applied to medical imaging with the great majority of my efforts being in MRI. This project will utilize carotid MRI and MRA techniques that have been developed by our group primarily in the past 5 years. I began studying vascular imaging using x-ray angiography in 1982 and have been studying MR angiography techniques since about 1987. My group and I have been involved in developing some novel MRI vascular imaging techniques and novel MRI RF coils to improve the quality of vascular lumen and plaque morphology. Over the years, I have been involved in training several individuals who have gone out to become imaging scientists in their own rights. With a strong background in research, I will be able to successfully serve as primary mentor for Dr. Baradaran on this project.

Relevant Peer-Reviewed Publications


B. Positions and Honors

Positions and Employment
Adjunct Inst., Asst. Prof., Physics Sect., Radiation Oncology, Univ. of Calif., San Francisco 1977-1985
Assistant Professor, Medical Biophysics & Computing, LDS Hospital/University of Utah 1982-1986
Associate Professor, Medical Informatics & Radiology, LDS Hospital/University of Utah 1987-1997
Professor, Medical Informatics and Radiology, Univ. of Utah, Salt Lake City, Utah 1997-present
Board of Directors, ISMRM 2011-2014
Director, Utah Center for Advanced Imaging Research, University of Utah 2003-present

Honors
Memberships in Sigma Pi Sigma, Sigma Xi, American Association of Physicists in Medicine (AAPM), Society for Magnetic Resonance in Medicine (SMRM), President and Chair of International Conference, Magnetic Resonance Angiography Club, 1998, The University of Utah Distinguished Research Award, 2000
The University of Utah School of Medicine Mentoring Award, 2015
Education Committee Chairman, ISMRM 2015-2016
Fellow, ISMRM, 2015, Fellow AIMBE

C. Contributions to Science

1) Multiple overlapping thin slab acquisition (MOTSA): At the University of Utah, I studied using MRI to image blood vessels. When 3D acquisition methods became available, I found that the extent of the blood vessels caused signal saturation as the blood spent too much time in the imaging volume. 2D acquisition methods did not have this saturation problem, but the large slice thickness caused signal loss from within-voxel dephasing. We developed MOTSA as an intermediate method that had the best attributes of 2D and 3D acquisition. The method is still used clinically on all MRI scanners. In 1999 we published the sliding interleaved projection reconstruction (SLIPR) method that eliminates the slab boundary artifact. Now that 3D radial methods have been refined, we believe it is time to re-evaluate the SLIPR method.

2) MR Angiography: We have spent considerable time developing improvements to MRA methods, both with better RF coils and improved pulse sequences:
3) **vessel wall MRI (Stroke):** Much of our focus in the last 20 years has been in the development of improved methods of imaging vascular disease in the vessel wall:


4) **Dynamic measurements:** We have developed novel methods of tracking contrast dynamics:


5) **Zero-filled interpolation:** In early MR angiography (MRA) images, the vessel displays were blocky because of the resolution acquired. Acquiring at higher resolution could improve the vessel smoothness, but caused a huge loss in image quality (signal to noise ratio). We found that we could eliminate this problem by band limited (zero-filled) interpolation. ZFI is now used for all MRA studies and is available as a option for MRI in general on most if not all systems. Most recently, we found that ZFI was very important to avoid temperature measurement errors in MRI temperature imaging.


6) **Limited angle CT image reconstruction:** While developing a CT scanner for radiation therapy treatment planning, I published several papers on CT scanner design, image reconstruction, errors and artifacts. Our CT scanner needed to reconstruct CT images from projection measurements over less than 360°. Although data from 180° was sufficient for parallel geometries and 180° + the fan angle was sufficient for fan beam geometries, no one had published an analytic formula for the reconstruction. Another scientist published several methods that had not worked. I was able to find the solution and published it just before leaving the field of CT. Because nearly all reconstructions are of limited angle, to improve temporal resolution, this paper forms the basis of how CT reconstruction is performed. It now has over 500 citations:


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**R01 EB028316 (Parker, PI, Rieke Co-PI) 09/1/2019 – 07/31/2023 3.0 calendar months**

NIH/NIBIB $407,929

Toward the next generation in transcranial MR-guided focused ultrasound: Innovations in thermal and acoustic model-based planning and monitoring for improved safety, efficacy and efficiency

Fully develop and disseminate critically needed capabilities for next-generation transcranial MR-guided focused ultrasound (tcMRgFUS), to provide next generation treatment modeling, planning, monitoring, assessment and control. This will include robust volumetric MRTI monitoring methods for entire brain and skull and patient-specific, dynamic modeling of transcranial ultrasound propagation that adapts to measured temperature changes in the skull, dynamically predicting focusing phases and power needed for accurate treatment completion. We will incorporate and evaluate these tools in a tcMRgFUS visualization tool.

**R01CA224141 (Payne, PI, Parker Co-I) 02/01/2018 – 01/31/2023 0.6 calendar months**

NIH/NCI $370,826

Validation and translation of a non-invasive, MR-guided breast cancer therapy

This proposal will validate and translate a breast MRgFUS system. Treatment planning, monitoring and assessment protocols will be evaluated in a first-in-human, Phase I, treat and resect clinical trial.
PENDING
VA Merit Award (Department of Veteran Affairs) Treiman (PI), Parker (Co-I) 08/01/2020-07/31/2024
Development of a practical quantitative non-contrast approach for cerebrovascular MRI
Will implement and compare two methods of imaging disease in the cervical carotids.
Will form a collaboration between 5 University sites with VA connections and consolidate their different quantitative carotid MRI sequences and protocols into two different methods of measuring quantitative parameters of plaque components. We will then compare these two methods against each other and against the conventional multi-sequence contrast enhanced carotid MRI method in a study of 100 veterans with carotid disease at our 5 VAMC’s.

COMPLETED
NeoTherma (Parker, PI) 09/01/2018-02/28/2019 3.00 calendar months
Contract #10051555 $168,199
System Optimization of the Neothermia Oncology (NTO) Hyperthermia system, with assessment of Heating, imaging and temperature measurement performance

R43 CA233401-01 (Floriano, PI) 08/01/18 - 02/28/19 0.30 calendar month
(NIH/NCI-SBIR)/NeoTherma Oncology $64,927
System Optimization of the Neothermia Oncology (NTO) Hyperthermia system, with assessment of Heating, imaging and temperature measurement performance
Develop novel MRTI methodologies that significantly improve the state-of-the-art by accurately measuring temperature over HT treatment time scales (30-60 minutes) in an abdominal environment compensating for interfering processes including field drift and motion-induced field variations.
Role: Subcontract, Co-PI

VA Merit Award (Department of Veteran Affairs) Treiman (PI), Parker (Co-I) 04/01/2015-03/31/2018
High-Resolution, Motion-corrected 3D Cine MRI of Carotid Plaque
Acquire high-resolution motion-corrected 3D MRI of carotid plaque and compare against histology.

F32HD085685 (NIH/NICHD) Dillon (PI), Parker (Sponsor) 08/01/2015 – 01/31/2018
The role of T2 and blood flow properties in MRgFUS treatments of uterine fibroids
This proposal is evaluating the role of patient specific tissue properties in the MRgFUS treatment of uterine fibroids. Tissue characterization is being done with both ex vivo and in vivo uterine fibroid tissues.

R03 EB023712 (Parker, PI) $50,000 Direct/year 04/1/2017 – 03/31/2019
NIH/NIBIB
Project Title: Multi-point MR-ARFI for time-efficient volumetric tissue stiffness imaging
Develop a novel method to measure changes in tissue elasticity with multiple-point (volumetric) acoustic radiation force impulse imaging (ARFI) with MRI guided focused ultrasound (MRgFUS). The method builds on 3D MR-ARFI methods that we have developed and a recent proof-of-concept multiple-point modification. If successful, this method will provide a procedure endpoint assessment that is complementary to thermal dose.

R01 CA172787-01 (Parker, PI) 08/21/2013 – 05/31/2019 (NCE)
NIH/NCI
Non-Invasive MRI-Guided HIFU for Breast Cancer Therapy
Validate the breast-specific MRgHIFU system developed in our academic/industrial partnership for rapid, efficacious, and safe non-invasive treatment of localized breast lesions. Develop patient-specific methods of ultrasound beam aberration correction and temperature measurement in the adipose and aqueous tissues of the heterogeneous breast, demonstrate safety and efficacy of tumor and treatment margin ablation in an animal model, and evaluate the FUS aberration correction and temperature measurement in vivo in humans.

Intramural Seed Grant (McNally) 01/01/2015- 01/01/2016 Primary mentor
This project is designed to identify the potential of carotid intraplaque hemorrhage treatment targets, including the local and systemic angiotensin pathway, local carotid oxidases and oxidative stress.

Incentive Seed Grant Parker (PI) 01/01/2016-06/30/2017
University of Utah Vice President for Research Office  $34,475

TITLE: Elastography imaging with magnetic resonance imaging guided focused ultrasound
This proposal develops and evaluates a novel MRI method to obtain elastic displacement measurements at a plurality of points in the image volume effectively acquiring a low resolution image of tissue elasticity in the same time conventional MR-ARFI requires to measure displacement at a single point.

Focused Ultrasound Foundation  Parker (PI)  10/01/2015-9/30/2016
FUS Foundation  $150,000

TITLE: Method for fully 3D volumetric thermometry, with application to transcranial MRgFVS of the brain
This project will improve the monitoring of temperature in focused ultrasound treatments by 1) developing improved models of ultrasound transport through the skull; 2) Implementing and evaluating volume temperature measurements on the InSightec ExAblate Brain system, and 3) perform some invesgitation of RF coil design options for the InSightec ExAblate Brain system.

R01 EB013433 (Parker, PI)  08/01/11-07/31/15

Improved MRI temperature imaging using a subject-specific biophysical model
The goal of this project is to develop highly efficient, fully 3D MRI temperature imaging of the fully insonified brain for MRI guided HIFU treatment of the brain.