Annual Report

2017

Ronald M. Lazar, PhD, FAHA, FAAN
Professor
Evelyn F. McKnight Endowed Chair for Learning and Memory in Aging
Director, McKnight Brain Research Institute
Director, Division of Neuropsychology
Department of Neurology

Erik D. Roberson, MD, PhD
Associate Professor of Neurology and Neurobiology
Patsy W. and Charles A. Collat Professor of Neuroscience
Director, Alzheimer’s Disease Center
Co-Director, Evelyn F. McKnight Brain Research Institute
Co-Director, Center for Neurodegeneration and Experimental Therapeutics

The University of Alabama at Birmingham
Sparks Center
1720 7th Avenue South
Birmingham, Alabama 35294
Table of Contents

Institute Director’s Overall Report.................................................................04
Finance...........................................................................................................12
Investment Report..........................................................................................27
McKnight Chair’s Report..............................................................................51
Listing of Investigators and Individual Faculty Reports .........................58
Appendices.................................................................................................93
# DETAILED TABLE OF CONTENTS

Annual Report  
McKnight Brain Research Foundation  
Report Period: 2017  
Institution: The Evelyn F. McKnight Brain Institute at The University of Alabama at Birmingham

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Overview</td>
<td>8</td>
</tr>
<tr>
<td>2. Summary of Scientific Achievements Since Last Report</td>
<td>8</td>
</tr>
<tr>
<td>3. Publication in Peer Reviewed Journals</td>
<td>8</td>
</tr>
<tr>
<td>4. Publications (Other)</td>
<td>8</td>
</tr>
<tr>
<td>5. Presentations at Scientific Meetings</td>
<td>8</td>
</tr>
<tr>
<td>6. Presentations at Public (Non-Scientific) Meetings or Events</td>
<td>8</td>
</tr>
<tr>
<td>7. Awards</td>
<td>9</td>
</tr>
<tr>
<td>8. Faculty</td>
<td>9</td>
</tr>
<tr>
<td>9. Trainees, Post-Doctoral, Pre-Doctoral, Other</td>
<td>9</td>
</tr>
<tr>
<td>10. Clinical/Translational Programs</td>
<td>8</td>
</tr>
<tr>
<td>11. Technology Transfer</td>
<td>9</td>
</tr>
<tr>
<td>12. Budget Update</td>
<td>9</td>
</tr>
<tr>
<td>13. Educational Programs Focusing on Age Related Memory Loss</td>
<td>10</td>
</tr>
<tr>
<td>14. Collaborative Programs with other McKnight Institutes, Institutions and Research Programs</td>
<td>10</td>
</tr>
<tr>
<td>15. Collaborative Programs with non-McKnight Institutes, Institutions and Research Programs</td>
<td>10</td>
</tr>
<tr>
<td>16. Future Research and/or Clinical Initiatives</td>
<td>10</td>
</tr>
<tr>
<td>17. Endowment Investment Results</td>
<td>10</td>
</tr>
<tr>
<td>18. Funds Used for a Prohibited Purpose</td>
<td>10</td>
</tr>
<tr>
<td>19. Modifications to the Purpose</td>
<td>10</td>
</tr>
<tr>
<td>20. Furthering the Purpose</td>
<td>10</td>
</tr>
<tr>
<td>21. Negative Events</td>
<td>10</td>
</tr>
<tr>
<td>22. General Comments</td>
<td>10</td>
</tr>
<tr>
<td>23. Important Scientific Achievement</td>
<td>11</td>
</tr>
<tr>
<td>24. Signature(s)</td>
<td>11</td>
</tr>
<tr>
<td>25. Finance</td>
<td>12</td>
</tr>
<tr>
<td>26. Investment Report</td>
<td>26</td>
</tr>
<tr>
<td>27. McKnight Chair's Report</td>
<td>51</td>
</tr>
<tr>
<td>28. Listing of Investigators and Individual Faculty Reports</td>
<td>58</td>
</tr>
<tr>
<td>29. Appendices</td>
<td>93</td>
</tr>
</tbody>
</table>
INSTITUTE DIRECTOR’S OVERALL REPORT
The University of Alabama at Birmingham (UAB) McKnight Brain Institute (MBI) began a significant transition in 2017. In a strategic effort to come into greater alignment with principles regarding clinical application as stated in the agreement with the McKnight Brain Research Foundation and UAB, a national search culminated on June 1, 2017, with the appointment of Ronald M. Lazar, PhD, as the new Director of the UAB McKnight Brain Institute and the holder of Evelyn F. McKnight Endowed Chair in Learning and Memory in Aging. He came to UAB from the Department of Neurology at the Columbia University Medical Center in New York with more than 20 years of experience and 19 past and present NIH grants as a clinical neuroscientist, focused on cognitive resilience and recovery in aging.

Within UAB, Dr. Lazar’s vision is to build upon the already-existing strengths in basic and translational neuroscience by establishing new relationships with clinical departments, working toward the establishment of a vertically-integrated enterprise encompassing molecular science to clinical trials. To facilitate this larger focus, the UAB-MBI was moved to the Department of Neurology in the School of Medicine. Over June-August, Dr. Lazar met with each UAB McKnight faculty member to gain insights into past practices and future goals. The UAB McKnight faculty was expanded by 50%, mainly by outreach to clinical departments, such as geriatric medicine, exercise medicine, cardiovascular medicine, pulmonology, clinical psychiatry, nuclear medicine, among others. Moreover, he added a biostatistician to bolster the ability to generate federal grant applications to meet new requirements for robust and reproducible data. In addition, he initiated a pilot grant program in which basic and applied scientists will collaborate to execute small, innovative studies whose preliminary data would lead to federal applications. To help foster McKnight MBI inter-institutional relationships, Dr. Lazar had important conversations over the summer period with each member of the leadership at the Univ of Arizona, the Univ of Florida and the Univ of Miami. Discussions included plans for the 10th Annual Inter-Institutional Meeting to be held in Birmingham in April 2018, including a more focused “pre-meeting” with topics reflecting to some extent the recent position papers by the National Academies and the American Heart Association/American Stroke Association. In addition, inter-institutional collaborations to be pursued between UAB and the other Institutes involve age-related neuroinflammation, the role of exercise in mitigating the effects of aging, and age-related changes in cerebral blood flow.

The scientific productivity of UAB faculty continued to flourish, with more than 200 peer-reviewed publications in high-impact journals, many of which are listed below. Among the highlights, Dr. Herskovitz and his lab showed in post-mortem analysis that despite the presence of Alzheimer’s disease (AD) pathology, those who were cognitively intact had dendritic spine density no different than controls, but those with AD pathology and dementia had significantly reduced spine density. These findings provide new support for a mechanism underlying cognitive resilience. Dr. Lazar and his colleagues at Columbia reported that alterations in cerebral blood flow in otherwise asymptomatic individuals with carotid artery disease was associated with cortical thinning in the vascular territory supplied by the affected vessel. His recently funded NIH grant will determine whether carotid revascularization will improve cognition among those with baseline cognitive decline. Drs. Gerstenecker, Triebel and Martin studied financial capacity among older adults who represented the cognitive spectrum from normal cognitive aging to mild cognitive
impairment. They were able to extract four skill-based factors, which can serve as clinical metrics for potential financial changes during aging and targets for intervention. Dr. Austad and colleagues published on the development of a specific pathogen free marmoset colony, which will present a unique opportunity to examine aging in one of the smallest and shortest-lived primates. Dr. Visscher and her human visual group showed that increased use of peripheral vision is associated with functional connectivity in brain imaging between peripheral primary visual cortex and functionally specialized areas of visual processing, with potential clinical application among those with age-related vision changes. Dr. Visscher’s group has also enrolled 17 participants in the MBAR registry.

Additional Highlights:

- Dr. Erik Roberson continues in his role as Co-Director of the UAB MBI. Dr. Roberson is the Patsy W. and Charles A. Collat Endowed Professor of Neuroscience, Director of the Alzheimer’s Disease Center and Co-Director, Center for Neurodegeneration and Experimental Therapeutics.

The Roberson lab studies the neurobiology of age-related cognitive changes, especially Alzheimer’s disease and frontotemporal dementia (FTD), using mouse models to understand the cellular and molecular mechanisms of these disorders and identify new therapeutic strategies. Dr. Roberson is active in clinical research, patient care, leading clinical trials, and caring for patients with memory disorders and dementia. As a physician-scientist working at the interface between basic science animal model studies and human clinical research, Dr. Roberson helps focus the translational research of the MBI.

- The Annals of Neurology published Dr. Jeremy Herskowitz’s work, “Dendritic spines provide cognitive resilience against Alzheimer’s disease.” Neuroimaging and other biomarker assays suggest that the pathological processes of Alzheimer’s disease (AD) begin years prior to clinical dementia onset. Observations provide cellular evidence to support the hypothesis that dendritic spine plasticity is a mechanism of cognitive resilience that protects older individuals with AD pathology from developing dementia. Appendix G.

- An American Heart Association panel, including two experts from UAB, says the same healthy habits that can help ward off heart disease or stroke can also help prevent cognitive decline. Drs. Ronald Lazar and Virginia Howard believe a healthy lifestyle benefits the brain as much as the rest of the body. Appendix A.

- Addressing UAB’s strengths in both research and clinical medicine, UAB Magazine published “Missing Memories: Healing patients and caregivers in the present; investigating prevention strategies for the future.” Building new relationships between basic scientists and clinical scientists to study age-related memory decline and cognitive decline is a top priority. Appendix B.

- Linda Overstreet-Wadiche, PhD, and Jacques Wadiche, PhD, are working on neural networking and are learning how synapses change when new neurons are formed. The goal is to understand how the flow of electrical signals through brain circuits gives rise to perception, action, thought, learning and memories. Appendix C

- The first McKnight Scientific Dialogues symposium was held on December 7, 2017, with eight McKnight Brain faculty members representing four collaborations between basic and clinical neurosocience. Terrific feedback has been received, not only about the content, but also about the
nature of and excitement generated by the synergism between bench and clinical investigators. Research and clinical collaborations hold one of the keys to the future of the UAB McKnight Brain Institute. Appendix D

- Vladimir Parpura, MD, PhD, has been honored with his election as a 2017 Fellow of the American Association for the Advancement of Science. Recipients are selected to honor their scientifically or socially distinguished efforts to advance science or its applications. Parpura’s election notes his “distinguished contributions to the field of neuroscience, particularly for discovery of gliotransmission.”


- The McKnight Brain Aging Registry (MBAR) study is well underway. Recruitment and the data acquisition are in progress. The tremendous investment in organization across sites to harmonize data acquisition of neuropsychological data, computerized behavioral data of several types, tissue of several types from blood draws, and seven different kinds of MRI data have uniquely been able to harmonize data from four different sites, which have undergone quality control and are similar enough to be compared across sites. The protocol involves two visits at which behavioral testing (neuropsychological testing and other behavioral tests including the NIH toolbox) is performed. During one of these visits, blood is acquired from the participants. On the third visit, the participants undergo an extensive MRI battery. The study has created an interdisciplinary infrastructure, including organizing neurologists to be available on time for participants, blood draws, recruiting potential participants, running MRI scans, and quality checking all the data. This machinery, which took great care to build, is running smoothly and recruiting at UAB is robust. We have 17 participants who have fully completed the extensive battery. To facilitate enrollment, along with other standard recruitment methods, we regularly visit local senior centers and have a second large-scale postcard recruitment campaign scheduled after the holidays. The four sites continue to have weekly telephone calls during which we discuss ongoing quality assurance issues to ensure compatibility across sites. The first outcome analyses looking at aggregate data across sites is scheduled for early 2018.

The MBAR study will provide tremendous opportunities for learning more about cognitive aging, and UAB MBI investigators have already begun planning ways to leverage the study. Dr. Erik Roberson is exploring partnerships with the UAB Alzheimer’s Disease Center program that would allow for longitudinal follow-up of MBAR participants, as well as neuropathological examination of their brains at death. The four sites are planning an across-site NIH grant submission for 2018. We’re excited to be a part of understanding the healthy aging brain.

- The Civitan International Neuroimaging Laboratory (CINL), located on the first floor of UAB Highlands Hospital, houses a Siemens Prisma 3T whole body scanner for structural and functional, brain and body imaging. It is operated as a University core facility, and is of great value to McKnight investigators. It provides a state-of-the-art imaging facility to study human brain function and its relationship to memory and aging.

- The CIRC Neurodevelopmental Bioinformatics Initiative has established the dedicated expertise
and infrastructure necessary for the application of genomic/epigenomic techniques to studies related to neurodevelopmental disorders, cognitive impairment and aging. This support is now available for the MBI faculty, postdocs and students.

1. **Summary of Scientific Achievements since Last Report**
   Individual McKnight Investigators’ scientific accomplishments are noted in a separate section. The next few paragraphs highlight a few of the principal discoveries from the Institute this year.

   - One of the highlights includes Dr. Jeremy Herskowitz’s work which was published in the *Annals of Neurology*, “Dendritic spines provide cognitive resilience against Alzheimer’s disease,” which suggests that the pathological processes of Alzheimer’s disease (AD) begin years prior to clinical dementia onset. Observations provide cellular evidence to support the hypothesis that dendritic spine plasticity is a mechanism of cognitive resilience that protects older individuals with AD pathology from developing dementia. Appendix G.

   - Dr. Lazar and his former colleagues at Columbia showed that a reduction in cerebral blood flow in either the left or right internal carotid artery is associated with cortical thinning in the brain region supplied by that vessel, even in the absence of frank stroke. In this publication in PLoSOne, carotid thickness was measured with an innovative method using arterial spin labeling, and cerebral hemodynamics was assessed with transcranial Doppler ultrasonography. The implications for cognition will take place at the end of patient follow-up in 2018.

   - Dr. Visscher’s lab observed plasticity in participants who have age-related macular degeneration that is different from plasticity in participants with juvenile forms of the disease. They see robust increases in cortical thickness associated with increased use of peripheral vision in AMD subjects – but not JMD subjects. Both groups have similar visual experience and behaviors, suggesting that each group adopts different mechanisms for plasticity. These findings provide intriguing evidence that different forms of plasticity are available to younger vs. older adults, but more work is needed.

2. **Publications in Peer Reviewed Journals**
   The publication rate from the UAB McKnight Brain Institute was very successful with investigators publishing a total of 203 research papers, reviews, and commentaries in peer-reviewed journals during 2017.

3. **Publications (Other)**
   Successful research was documented in two books and four book chapters.

4. **Presentations at Scientific Meetings (Also Includes Invited Research Seminars)**
   Investigators presented their research at various institutions and also at national meetings. Over 78 presentations were given by key faculty representing the UAB McKnight Brain Institute.

   New Scientific Dialogues program was a huge success with various speakers sharing their research with others. Appendix D

   Seminar series continues with presentations by various speakers. Appendix E

5. **Presentations at Public (Non-Scientific) Meetings or Events**
Community service continues with McKnight key representatives speaking at over 27 meetings.

6. Awards and Honors
   - Neurobiologist Vladimir Parpura, MD, PhD, selected as a 2017 Fellow of the American Association for the Advancement of Science
   - Gwendalyn King, PhD, awarded the Graduate Biomedical Sciences Outstanding Service Award
   - Dr. Vladimir Parpura, selected as the 2017 McNulty Civitan Scientist
   - Dr. Virginia Bradley, UAB Department of Medicine Research Excellence Award
   - Dr. Cristin Gavin, Honors College Faculty Fellow
   - Dr. David Knight, UAB Dean’s Award for Excellence in Mentorship
   - Dr. Kristina Visscher, Graduate School Dean’s Award for Excellence in Mentorship
   - Dr. Kristina Visscher, Kavli, National Academy of Sciences Frontiers in Science Fellow
   - Dr. Linda Wadiche, appointed to Neurodevelopment Faculty of 1000

7. Faculty
   For faculty bios, see Appendix F.

8. Trainees
   A. Post-doctoral, residents, 9
   B. Pre-doctoral students – 21
   C. Other students - 11

9. Clinical/Translational Programs
   A. New Programs
      Dr. Virginia Bradley is working with the UAB Alzheimer’s Disease Center in the Outreach and Recruitment Core, which develops partnership with community and patient populations for engagement in the aims and research of the Alzheimer’s Disease Center.
      Additional new programs are noted in the Chair Report below.
   B. Update on Existing Clinical Studies
      Dr. Bradley continues her work with the Center for Translational Research on Aging and Mobility, as well as her collaboration with CARDIA, which is a multisite study in which cognitive testing and brain MRIs were measured.
      Additional clinical studies are noted in the Chair Report.

10. Technology transfer
    A. Patent Applications
        None.
    B. Revenue Generated from Technology
        Not applicable

11. Budget Update
    A full financial report is included in the Finance Section.
12. Educational Programs Focusing on Age-Related Memory Loss
   A. Scientific
      • “New Scientific Dialogues” December 7, 2017– Appendix D
      • Seminar Series – Appendix E

   B. Public
      Throughout the year, faculty members represented the McKnight Brain Institute by participating in speaking engagements to various civic groups at NeuroScience Café events and Civitan Club meetings.

13. Collaborative Programs with other McKnight Institutes, Institutions and Research Programs
In addition to the Collaborative Programs mentioned in the Chair Report below, Drs. Virginia Bradley and Kristina Visscher continue their work with the McKnight Brain Aging Registry. Dr. Jeremy Day is working with the University of Arizona and the University of Florida.

14. Collaborative Programs with Non McKnight Institutes, Institutions and Research Programs
Investigators have identified inter and intra institutional collaborations locally, nationally, and internally. Additional programs are noted in the Chair Report Below.

15. Briefly describe plans for future research and/or clinical initiatives.
   (See Chair Report Below)

16. If applicable, please provide endowment investments results for the report period.
   See Finance report.

17. Were any funds used for a Prohibited Purpose during the report period?
   No

18. Do you recommend any modification to the Purpose or mandates in the Gift Agreement?
   No

19. Did all activities during the report period further the Purpose?
   Yes

20. Please describe any negative events (loss of personnel, space, budget, etc.) that occurred during the report period and the possible impact on carrying out the Gift Agreement.
   No negative events to report.

21. Please provide any general comments or thoughts not covered elsewhere – a response is not required. Please respond only if you would like to add something not covered elsewhere.
22. What do you consider your most important scientific achievement this year?

Dr. Jeremy Herskowitz’s research which was published in the *Annals of Neurology*, “Dendritic spines provide cognitive resilience against Alzheimer’s disease” is outstanding. Neuroimaging and other biomarker assays suggest that the pathological processes of Alzheimer’s disease (AD) begin years prior to clinical dementia onset. See Appendix G.

23. Signature, date, and title of person submitting report

Ronald M. Lazar, PhD, FAHA, FAAN  
Professor  
Evelyn F. McKnight Endowed Chair for Learning and Memory in Aging  
Director, McKnight Brain Research Institute  
Director, Division of Neuropsychology  
Department of Neurology  
Date: 1/11/2018

Erik D. Roberson, MD, PhD  
Associate Professor  
Charles M. Collat Professor of Neurology  
Co-Director, Evelyn F. McKnight Brain Institute  
UAB School of Medicine  
Date: 1/11/2018
FINANCE

For Internal Use Only
INVESTMENT REPORT

For Internal Use Only
MCKNIGHT CHAIR’S REPORT
McKINNIGHT CHAIR’S REPORT

1. Summary of scientific achievements since last report

Dr. Lazar and his former colleagues at Columbia showed that a reduction in cerebral blood flow in either the left or right internal carotid artery is associated with cortical thinning in the brain region supplied by that vessel, even in the absence of frank stroke. In this publication in PLoSOne, carotid thickness was measured with an innovative method using arterial spin labeling, and cerebral hemodynamics was assessed with transcranial Doppler ultrasonography. The implications for cognition will take place at the end of patient follow-up in 2018.

2. Publications in peer reviewed journals

**Lazar Publications (2017 Peer-Review only)**


3. Publications (other)


4. Presentations at scientific meetings


5. Presentations at public (non-scientific) meetings or events
Due to relocating to Birmingham, public speaking engagements have been limited, however, invitations to future events are anticipated.

6. Awards (other)
On June 1, 2017, joined UAB as director of the Evelyn F. McKnight Brain Institute in the School of Medicine and holds the Evelyn F. McKnight Endowed Chair for Learning and Memory in Aging in the Department of Neurology.

7. CV
See Appendix F

8. Trainees
   a. Post doctoral - 2 (UAB) 1 (Columbia)
   b. Pre-doctoral - 1 (UAB)
   c. Other

9. Clinical/translational programs
   a. New programs
   - Pilot study to determine the extent to which aerobic exercise in otherwise healthy, elderly individuals improves cerebral vasodilatory capacity.
   - New study to evaluate cerebral vasodilatory capacity and cerebral oxygen utilization in elderly patients who have NYHA Stage 2 vs Stage 3 heart failure.
   - Pilot studies to compare intracerebral inflammation in patients discharged following admission for myocardial infarction vs those evaluated with stable angina.

   b. Update on existing clinical studies
   - 1 R01 NS076277-01A1 (Lazar/Marshall)
     NIH/NIND. Blood Flow and Cognition in Asymptomatic Carotid Artery Disease. This project studies the relationship of four measures of cerebral hemodynamics and cognitive function in patients with asymptomatic carotid artery disease. We completed enrollment for both patients and controls. We published an important paper (Marshall et al, PLoS One. 2017 Dec 14;12(12):e0189727), showing that asymptomatic carotid stenosis produces loss of cortical thickness in the regions supplied by the affected arterial circulation, and that this effect is affected by measures of cerebral hemodynamics. Collaboration is between UAB and Columbia.

   - 1 U01 NS080168-01A1 (PI: Brott; Cognitive Core PI: Lazar)
     NIH/NINDS CREST-2 Clinical Coordinating Center. The goal of this project is to assess if contemporary medical therapy is not inferior to contemporary revascularization (carotid endarterectomy or carotid angioplasty/stenting) plus best medical therapy in patients with ≥ 70% asymptomatic carotid stenosis. The cognitive substudy is to assess whether medical therapy alone is non-inferior to revascularization to maintain the level of cognitive function at 4 years of follow-up. We submitted an abstract to the
American Academic of Neurology describing the cognitive profile of the first 200 randomized patients, demonstrating cognitive decline in the absence of stroke. Collaboration is among UAB, Columbia, Mayo Clinic and UMaryland.

- **1R21NS096972-01A1 (Lazar/Kodali)**
  NIH/NINDS/NIA Cerebral Hemodynamics and Neurocognition in Aortic Valve Disease. The goal of this project is to determine whether severe aortic stenosis is associated with impaired cerebral hemodynamics and, in turn, impaired cognition, and whether valve replacement is associated with improved cerebral hemodynamics and improved cognition. This grant was successfully transferred to UAB, and enrollment was resumed in September 2017. We have enrolled 12 new patients. Collaboration is between UAB and Columbia.

- **R01NS097876 (Lazar, Marshall, Liebeskind, Connolly)**
  NIH/NINDS Carotid Revascularization and Medical Management for Asymptomatic Carotid Stenosis Trial - Hemodynamics
  The purpose of this project is to determine whether there is a subset of patients with carotid stenosis who have MRI-detected cerebral hemodynamic compromise and associated cognitive decline, and whether revascularization will be associated with improved hemodynamics and improved cognition. This new grant was funded just as Dr. Lazar arrived at UAB, and clinical site training has taken place for 150 investigators and coordinators across the US. The first enrollment will take place in January 20178. (Collaboration is among UAB, Columbia and UCLA).

---

10. Technology transfer
   a. Patents applications - None
   b. Revenue generated from technology – N/A

11. Budget update
   A full financial report is included in the Finance Section.

12. Educational programs focusing on age related memory loss
   a. Scientific – “New Science Dialogues” Appendix D
   b. Public - None

13. Collaborative programs with other McKnight Institutes, institutions and research programs
   Dr. Lazar is a neuropsychologist with broad interests in aging and vascular disease with emphases on reversible causes of cognitive decline, risk-factor modifications to promote cognitive resiliency. Collaborations with the other McKnight Institutes is anticipated with enthusiasm.

14. Collaborative program with non McKnight Institutes, institutions and research programs

  **Grants/Contracts (2017-present)**
  **Present Support**
  1 R01 NS097876-01A1 (Lazar, Marshall, Liebeskind, Connolly) 4/1/2017 – 3/31/2022
  NIH/NINDS Carotid Revascularization and Medical Management for Asymptomatic Carotid Stenosis Trial - Hemodynamics (CREST-H) The goal of this study is to determine whether patients with asymptomatic carotid stenosis who have cerebral hemodynamic compromise and cognitive impairment will improve after revascularization.
CREST-2 Clinical Coordinating Center.
This goal of this project is to assess if contemporary medical therapy is not inferior to contemporary revascularization (carotid endarterectomy or carotid angioplasty/stenting) plus best medical therapy in patients with $\geq 70\%$ asymptomatic carotid stenosis. The cognitive aim is to assess whether medical therapy alone is non-inferior to revascularization to maintain the level of cognitive function at 4 years of follow-up.
Role: Co-I and Cognitive Core PI.

1R21NS096972-01A1 (Lazar/Kodali)  8/1/2016 – 7/31/2018
NIH/NINDS/NIA
Cerebral Hemodynamics and Neurocognition in Severe Aortic Valve Disease.
The goal of this project is to determine whether severe aortic stenosis is associated with impaired cerebral hemodynamics and, in turn, impaired cognition, and whether valve replacement is associated with improved cerebral hemodynamics and improved cognition.

1 R21 DK104105-01A1 (Walker)  7/1/2015 – 6/30/2018
NIH/NIDDK
Primary Hyperparathyroidism: Neurocognitive Features.
The goal of this project is to determine whether primary hyperparathyroidism results in reduced cerebral vasomotor reactivity (VMR) that contributes to cognitive dysfunction, and whether reduced VMR can be reversed with surgical intervention.
Role: Co-I

Past Support

5 U54 NS081765-02 (Ogedegbe/Williams)  10/1/2012 – 9/30/2017
NIH/NINDS
The goal of this grant is to establish a Center for Stroke Disparities Solutions as a consortium between 3 academic institutions (NYU School of Medicine; Columbia University Medical Center; and SUNY Downstate Medical School); 5 stroke centers and a practice-based research network of primary care practices within New York City’s (NYC) Health and Hospital Corporation; the Research Division of the Hebrew Home at Riverdale and the Visiting Nurse Service of NY. The target communities are Black and Hispanic residents of NYC.
Role: Co-I

New York Stroke Trials Network of Columbia and Cornell (NYCCSTN)
The goal of this program is to establish an infrastructure that would maximize stroke clinical trial enrollment in studies targeted to acute treatment, primary and secondary stroke prevention and stroke recovery.
Role: Co-I and Rehabilitation Core Leader
The goal of the StrokeBelt StrokeNet is to establish a Regional Coordinating Center to facilitate Stroke research in the Southeastern States of Alabama and Mississippi. This infrastructure will provide research opportunities in acute stroke treatment, primary and secondary prevention, and post-stroke rehabilitation for an underserved, high-risk stroke population.

15. Briefly describe plans for future research and/or clinical initiatives
The future of the UAB McKnight Brain Institute is bright as new focus has begun with new research and clinical initiatives. There’s a pilot study to determine the extent to which aerobic exercise in otherwise healthy, elderly individuals improves cerebral vasodilatory capacity. A new study has begun to evaluate cerebral vasodilatory capacity and cerebral oxygen utilization in elderly patients who have NYHA Stage 2 vs Stage 3 heart failure. Pilot studies are anticipated to compare intracerebral inflammation in patients discharged following admission for myocardial infarction vs those evaluated with stable angina.
LISTING OF INVESTIGATORS
AND
INDIVIDUAL FACULTY REPORTS
LISTING OF INVESTIGATORS

Professors

Ronald M. Lazar, PhD, FAHA, FAAN
Professor
Evelyn F. McKnight Endowed Chair for Learning and Memory in Aging
Director, McKnight Brain Research Institute
Director, Division of Neuropsychology
Department of Neurology
Area of Interest: Cognitive Resilience and Recovery in Aging, Cerebral hemodynamics, Neurovascular Disease.

Steve Austad, PhD
Professor and Chair, Department of Biology
Area of Interest: Molecular and organismal biology of aging

Karlene Ball, PhD
Professor and Chair, Department of Psychology
Area of Interest: Aging-related cognitive function

Etty (Tika) Benveniste, PhD
Senior Associate Dean for Research Administration, SOM
Associate Vice President for Medicine and Basic Sciences
Charlene A. Jones Endowed Chair in Neuroimmunology
Professor, Department of Cell, Developmental and Integrative Biology
Co-Director, UAB Multiple Sclerosis Center
Associate Director, Basic Science Research • Comprehensive Cancer Center

Michael Brenner, PhD
Professor Emeritus, Department of Neurobiology
Area of Interest: Glial cell biology, Alexander Disease

Cynthia J. Brown, MD, MSPH
Professor
Director, Division of Gerontology,Geriatrics and Palliative Care
Comprehensive Center for Healthy Aging
Area of Interest: quality of life for the aging through research, education and clinical care

Lynn Dobrunz, PhD
Professor, Department of Neurobiology
Area of Interest: Regulation of short-term synaptic plasticity in the hippocampus

Lloyd J. Edwards, PhD
Professor and Chair
Department of Biostatistics
Area of Interest: Conducting statistical research in linear and generalized linear mixed model methodology, longitudinal data analysis, health disparities, cardiovascular disease, neuroscience, and clinical trials design and analysis
Paul Gamlin, PhD  
Professor, Department of Ophthalmology  
**Area of Interest:** Cell biology and systems neuroscience of vision and visual disorders

David Geldmacher, MD  
Professor, Collat Scholar, Department of Neurology  
**Area of Interest:** Aging-related memory disorders and visual cognition in AD.

John Hablitz, PhD  
Professor  
Interim Chair, Department of Neurobiology  
**Area of Interest:** Modulation of excitability in neocortial circuits

Adrianne Lahti, MD  
Patrick H. Linton Professor  
Director, Division of Behavioral Neurobiology  
Co-director, Alabama Advanced Imaging Consortium  
**Area of Interest:** Neuroimaging

Seth Landefeld, MD  
Professor and Chair  
Department of Medicine  
**Area of Interest:** Geriatrics and Health Care Research

Robin Lester, PhD  
Professor, Department of Neurobiology  
**Area of Interest:** Nicotinic receptors in CNS function

Lori McMahon, PhD  
Professor and Dean, Graduate School  
Professor, Department of Physiology/Biophysics  
Director, UAB Comprehensive Neuroscience Center  
**Area of Interest:** Hormonal control of synaptic plasticity in aging

James H. Meador-Woodruff, MD  
Professor and Chair, Department of Psychiatry and Behavioral Neurobiology  
**Area of Interest:** Cellular alterations of neural circuitry and molecular expression in psychiatric illnesses

Vlad Parpura, MD, PhD  
Professor, Department of Neurobiology  
**Area of Interest:** Imaging approaches to investigating synaptic and glial cell function

Lucas Pozzo-Miller, PhD  
Professor, Department of Neurobiology  
**Area of Interest:** Mechanisms controlling dendritic spine morphology

Sumanth D. Prabhu, MD  
Mary G. Waters Chair of Cardiovascular Medicine
Professor of Medicine and Cell, Developmental, and Integrative Biology  
**Area of Interest:** cardiovascular disease

Michael Sagg, MD  
Division of Infectious Diseases  
Director, The William C. Gorgas Center for Geographic Medicine  
Director, Center for AIDS Research  
**Areas of Interest:** Infectious Diseases, HIV/AIDS, Blood Equality, Hepatitis, Antiretroviral Therapy

David Standaert, MD, PhD  
John N. Whitaker Professor and Chair of Neurology  
Interim Director, McKnight Brain Institute  
Director, Division of Movement Disorders  
**Area of Interest:** Aging, Neurodegeneration, and Translational Neuroscience

Anne Theibert, PhD  
Professor, Department of Neurobiology  
Director, UAB Undergraduate Neuroscience B.S. Program  
**Area of Interest:** PI-3-Kinase signal transduction in neuronal cell biology

Erobo Ubogu, PhD  
Professor, Department of Neurology  
Director of the Neuromuscular Division of Neurology  
**Area of Interest:** Inflammatory neuropathies

**Associate Professors**

Virginia Wadley Bradley, PhD  
Associate Professor, Division of Gerontology, Geriatrics, and Palliative Care  
Director, Dementia Care Research Program  
Associate Director, Edward R. Roybal Center for Translational Research on Aging and Mobility  
**Area of Interest:** Mild Cognitive Impairment, Alzheimer’s disease, comorbid cerebrovascular disease

Matt Goldberg, PhD (Recruited from UT Southwestern)  
Associate Professor, Neurology  
**Area of Interest:** Mechanisms of neurodegeneration

Alecia Gross, PhD  
Associate Professor, Department of Vision Sciences  
**Area of Interest:** Signal transduction mechanisms in the CNS

David Knight, PhD  
Associate Professor, Department of Psychology  
**Area of Interest:** Human imaging approached to investigating memory

Farah Lubin, PhD  
Associate Professor, Department of Neurobiology  
**Area of Interest:** Signal transduction mechanisms in memory and memory disorders

Roy C. Martin, PhD  
Associate Professor, Department of Neurology
Area of Interest: Neuropsychology

Kazu Nakazawa, PhD  
Associate Professor, Department of Psychiatry  
Area of Interest: Epigenetics and cognition

Linda Overstreet-Wadiche, PhD  
Associate Professor, Department of Neurobiology  
Area of Interest: Adult neurogenesis in the dentate gyrus

Erik Roberson, MD, PhD  
Associate Professor, Department of Neurology  
Patsy W. and Charles A. collat Professor of Neuroscience  
Director, Alzheimer’s Disease Center  
Co-Director, UAB Center for Neurodegeneration and Experimental Therapeutics  
Co-Director, McKnight Brain Institute  
Area of Interest: Aging-related memory disorders

Kristina Visscher, PhD  
Assistant Professor, Department of Neurobiology  
Co-director, Civitan International Neuroimaging Laboratory  
Area of Interest: Human imaging approaches to investigating memory.

Jacques Wadiche, PhD  
Associate Professor, Department of Neurobiology  
Area of Interest: Synaptic plasticity and function in the cerebellum

Scott Wilson, PhD  
Associate Professor, Department of Neurobiology  
Area of Interest: The ubiquitin/proteasome system in neuronal function

Assistant Professors

Mark Bolding, PhD  
Assistant Professor, Division of Advanced Medical Imaging Research  
Area of Interest: Visual cognition, MRI, and neuroimaging

Jeremy Day, PhD  
Assistant Professor, Department of Neurobiology  
Area of Interest: Epigenetic mechanisms in memory formation.

Cristin Gavin, PhD  
Assistant Professor, Department of Neurobiology  
Co-director, Undergraduate Neuroscience Program  
Co-director, Post baccalaureate Research Education Program  
Area of Interest: Cellular and molecular mechanisms of structural and functional plasticity

Adam Gerstenecker, PhD  
Assistant Professor, Department of Neurology  
Area of Interest: Functional activity, decisional capacity, and cognition in persons with cognitive impairment and dementia.
Michelle Gray, PhD  
Assistant Professor, Dixon Scholar, Department of Neurology  
**Area of Interest:** Neurogenetics, glial function, and Huntington’s disease  

Jeremy Herskowitz, PhD  
Assistant Professor, Department of Neurology  
**Area of Interest:** Amyloid beta effects on neurons.

Gwen King, PhD  
Assistant Professor, Department of Neurobiology  
**Area of Interest:** Memory and aging, Klotho proteins in aging and cognition

Scott Phillips, PhD  
Assistant Professor, Department of Neurobiology  
**Area of Interest:** Neurogenetics, neurobiochemistry

Kristen Triebel, PsyD  
Assistant Professor, Department of Neurology  
**Area of Interest:** Neuropsychology
### Individual Investigators’ Reports

#### 1. Summary of Scientific Achievements

**Austad, Steve**

1. This year we verified that the lysate from muscle of the bivalve mollusc, Arctica islandica, contained some molecule or molecules (not a heat shock protein) that made human Aβ resistant to aggregation. Will be applying for NIH funds to follow up to try to identify the molecule(s).

2. This year we also finally published on the development specific-pathogen-free marmoset colony, which should be excellent for numerous neurological aging studies. Marmosets are one of the smallest primates and the shortest-lived, meaning that individual animals can be followed from maturity to old age in the course of a single 5 year grant period.

**Day, Jeremy**

1. Published manuscript detailing gene expression changes in hippocampus following contextual fear memory using genome-wide sequencing approaches (Duke, et al., 2017).

2. Discovered molecular function for non-coding RNAs called enhancer RNAs in activity-dependent gene regulation.

3. Discovered dopamine-regulated gene that controls learned behavioral responses to drugs of abuse.

**Gamlin, Paul**

Significant progress has been made in the following research areas over the past 12 months.

1. Study of the neural control of the near triad of vergence, accommodation, and pupil constriction in non-human primates (NHPs);

2. Study of the role of ipRGCs in pupillary responses and circadian rhythms in NHPs;

3. Development of AAV-based gene delivery techniques in NHPs to introduce genes into the brain and retina for basic research and therapeutic purposes.

**Gavin, Cristin**

The NIH R25 PREP Program identifies, recruits, and prepares up to 8 scholars a year from groups underrepresented in STEM research fields. The year-long program provides intensive research training and a series of academic experiences to prepare them for entry into high quality doctoral graduate programs in the U.S. UAB’s success rate is currently higher than the average of PREP programs nationwide (~70%, ~63%, respectively). We are currently receiving bridge funding for the 2017-2018 class and received a score of 25 on our most recent resubmission. Our program officer believes this is a competitive number for renewal, though we won’t know until December if there is NIH funding available for this initiative.

**Geldmacher, David**

1. Continued study of distance-accessible personalized coaching for dementia caregivers to reduce caregiver burden and improve quality of life

2. Began systematic assessment of clock drawing tests in clinical tauopathy populations

**Gerstenecker, Adam**

Served as coinvestigator on two funded projects and a coinvestigator on four submitted grants that are awaiting scoring. Published in peer-review journals.
Goldberg, Matthew
1. Role of alpha-synuclein in neurodegeneration linked to mitochondrial autophagy: Analyzed cohorts of wild-type and PINK1 knockout rats 4 weeks after stereotaxic injection of monomeric alpha synuclein or pre-formed fibrils. Determined that PINK1 deficiency increases susceptibility to formation of protein inclusions similar to Lewy bodies associated with cognitive decline (manuscript in preparation).
2. Mechanisms of PINK1 knockout rat neurodegeneration and locomotor dysfunction. We have significantly advanced our understanding of PINK1 knockout rat phenotypes and obtained data for multiple additional grants. We identified significant neuroinflammation and are seeking to determine if the neuroinflammation is a cause or a consequence of PINK1 knockout rat neurodegeneration (or repair).
3. Analysis of Parkin activity in vivo: We have obtained knockin mice bearing a Parkin activating mutation. We have developed DNA constructs, assays and other tools to measure PINK1 and Parkin activity in cultured primary neurons and cell lines.

Gray, Michelle
1. The Gray Laboratory is focused on generating and characterizing mouse models of neurodegenerative diseases and movement disorders. Huntington’s Disease (HD) is characterized by psychiatric, cognitive and movement deficits. In studies of Huntington’s Disease (HD), they have shown a significant contribution of astrocytes expressing the mutated protein to HD pathogenesis.
2. They have also undertaken the challenge of generating a mouse model for the rare X-Linked Dystonia and Parkinsonism/ Dystonia 3 (XDP/DYT3) movement disorder. The Gray Lab has generated two models for use in studying this disease.

Gross, Alecia
1. The Gross Lab has discovered key ciliary proteins and mechanisms that are involved in protein trafficking and disk formation in the sensory cilium of photoreceptors. Using transgenic tadpoles, conditional and congenital knock-in and knock-out mice and polarized tissue culture cells as the model systems to carry out the studies.
2. Three manuscripts are out under review (two submitted- PLOS ONE and IOVS, one re-submitted after review- Experimental Eye Research).

King, Gwendolyn
1. Developed a klotho conditional knockout, and this year brought the first progeny with brain specific loss of klotho protein. Found the first evidence that a single protein secreted from the choroid plexus can influence hippocampal function. These data were described as “holy grail” level by a collaborator and leader in the field.
2. A manuscript characterizing the effect of klotho on adult neurogenesis is under revision with a conditional acceptance after a very long 1.5 year struggle at several journals. This publication is seminal, showing a klotho specific effect upon both up and downregulation of the protein.
3. The lab’s first graduate student defended her thesis and is moving to a postdoc at a renowned lab in stem cell biology at the University of Michigan. A second graduate student is seeking permission to write his thesis at the next committee meeting. Work from these two students is anticipated to result in 4 additional publications this year.
Knight, David
The Knight Lab at UAB has been productive with 5 peer-reviewed publications and 8 poster presentations at scientific meetings. In addition, Dr. Knight received the Dean’s Award for Excellence in Mentorship.

Martin, Roy
1. NSF EPSCoR grant (UAB Site PI: Szafalarski) RII Track-2 FEC: Probing and Understanding the Brain: Micro and Macro Dynamics of Seizure and Memory Networks,” submitted by Louisiana Tech University to the National Science Foundation EPSCoR’s Research Infrastructure Improvement Track-2 solicitation.
2. NIH grant “noninvasive biomarkers to advance emerging DBS electrode technologies in Parkinson’s disease” (PI: Walker)

Nakazawa, Kazu
A current version of the dopamine hypothesis of schizophrenia posits that striatal hyperdopaminergia contributes to positive symptoms, and frontal cortical hypodopaminergia contributes to negative symptoms and cognitive dysfunctions. The Nakazawa Lab hypothesized that dopamine malfunction could be secondary to altered glutamatergic function, particularly N-methyl-D-aspartate receptor (NMDAR) hypofunction. To the end, they found abnormal dopamine release phenotypes in several mutant strains.

1. In line with the prevailing view that dopamine in anterior cingulate cortex (ACC) plays a role in evaluating effort-cost for engaging in actions, the Lab found that tail-suspension triggered dopamine release in ACC of wild-type mice (measured by in vivo microdialysis); it was severely attenuated in the conditional Gad1 (encoding ghad67) mutant mice, in which cortical GABA level is reduced.

2. The Lab also found amphetamine-stimulated dopamine release deficits in mPFC in a mouse strain in which NMDAR essential subunit Grin1 is deleted in a subset of GABA neurons. Notably, the same mutants showed exacerbated amphetamine-induced dopamine release in nucleus accumbens shell.

Pozzo-Miller, Lucas
1. Demonstration that homeostatic synaptic plasticity is impaired in MeCP2 knockout neurons due to lower levels of EEA1, an endosomal protein involved in synaptic AMPAR recycling. Increasing EEA1 levels in MeCP2 KO neurons restores homeostatic synaptic plasticity. Published in Journal of Physiology (London), with an accompanying Perspective commentary.

2. Demonstration that a BDNF mimetic with partial agonist activity at TrkB receptors improves hippocampal-dependent spatial memory by rebalancing network activity and promoting synaptic plasticity at excitatory hippocampal synapses. Published in Disease Models & Mechanisms, with an accompanying press release.

3. Demonstration that hippocampal dysfunction in MeCP2 knockout mice spreads to the medial prefrontal cortex via a direct monosynaptic projection, altering network activity and social behaviors. In preparation.
Standaert, David
1. Several important studies linking neuroinflammation to Parkinson disease were published. These includes the paper by Harms et al., showing that in a mouse model there is entry of peripheral monocytes into the brain in response to abnormal alpha-synuclein, and the Gendelman et al. study which explored the use of GMCSF to modify the phenotype of T cells in patients with Parkinson disease.
2. An important new mechanism was discovered that regulates the activity of cholinergic neurons in brain, involving the interaction of dopamine D2 receptors with beta-arresting signaling (Scarduzio et al.)

Ubogu, Eroboghene
1. Deduction of the adult human blood-nerve barrier transcriptome
2. Completion of project elucidating role of GDNF in blood-nerve barrier recovery in vitro and in vivo
3. Development of an in vitro hydraulic conductivity model to study blood-nerve barrier transendothelial fluid flux
4. Significant progress in elucidating molecular determinants of HIV+ leukocyte trafficking across the blood-nerve barrier
5. Significant progress in developing a conditional MHC Class II knockout mouse
6. Collaborative work deducing the neuromuscular phenotype seen in PINK 1 knockout rats (animal model of Parkinson’s disease)
7. Completion of clinical trials in chronic inflammatory demyelinating polyradiculoneuropathy, Lambert Eaton myasthenic syndrome and myasthenia gravis

Visscher, Kristina
1. Developed and maintained UAB’s McKnight Brain Aging Registry – 17 participants over the age of 85 have completed so far, with extensive MRI, behavioral data including neuropsychological data and the NIH toolbox, and blood based biomarkers.
2. Plasticity observed in participants who have age-related macular degeneration is different from plasticity in participants with juvenile forms of the disease. Robust increases are seen in cortical thickness associated with increased use of peripheral vision in AMD subjects – but not JMD subjects. Because both groups have similar visual experience and behaviors, this suggests that each group adopts different mechanisms for plasticity. This is intriguing evidence that different forms of plasticity are available to younger vs. older adults, but more work is needed. (Defenderfer, in progress)
3. Increased use of peripheral vision for everyday tasks is associated with increased functional connectivity between peripheral V1 and functionally specialized visual areas
   High visual acuity in central vision is vital for everyday tasks such as recognizing faces and reading words; with central vision loss, such as in macular degeneration, individuals must rely more heavily on peripheral vision to do things like recognizing faces and reading words. Previous work from our lab demonstrates that increased reliance on peripheral vision is associated with increased cortical thickness in areas of primary visual cortex (V1) that process peripheral vision. Because macular degeneration patients rely heavily on peripheral vision, we hypothesized that areas of V1 involved in peripheral vision would possess enhanced functional connectivity to visual areas that are important for tasks that are typically performed with central vision. For example, Fusiform Face Area (FFA) is specialized for face processing, while Visual Word Form Area (VWFA) is specialized for processing written language. To test this hypothesis, we used fMRI in 10 macular degeneration patients and matched controls in order to measure resting-state functional connectivity between peripheral V1 and functionally specialized visual areas. These
functionally specialized areas were defined based on meta-analyses. Consistent with our hypothesis, macular degeneration patients showed stronger connectivity from peripheral V1 to functionally specialized visual regions, compared to healthy controls. This association likely reflects increased use of peripheral vision for everyday visual tasks. Overall, these results suggest that connectivity between visual cortex and higher order brain regions is influenced by the degree to which certain parts of the visual field are used. Together, these findings demonstrate a stable form of network plasticity that is observable at rest, even when no faces or words are present. Furthermore, these findings help provide insight into the nature of visual cortical plasticity in the adult brain, a stage well beyond the “critical period” for visual development. (Fleming, in progress)

2. Publications in Peer Reviewed Journals

Austad, Steve


Benveniste, Tika


Manuscripts in preparation


Bradley, Virginia Wadley


Brown, Cynthia

Manuscripts in preparation
Kennedy RE, Williams CP, Sawyer P, Lo AX, Connelly K, Nassel A, Brown CJ. Life-space Predicts Healthcare Utilization in Community-Dwelling Older Adults (Journal of Aging and Health)

Day, Jeremy

Edwards, Lloyd
during peanut oral immunotherapy. *Journal of Allergy and Clinical Immunology*, 139(3): 882–888.e5.

Gamlin, Paul


Gavin, Cristin


Geldmacher, David

Gerstenecker, Adam


Manuscripts in press:

Manuscripts submitted but not yet accepted:

Goldberg, Matthew
3. Creed, RB and Goldberg MS, New Developments in Rat Models of Parkinson’s Disease, Movement Disorders, in press.

Hablitz, John
**Herskowitz, Jeremy**


**King, Gwendalyn**


**Knight, David**


**Lahti, Adrienne**


**Landefeld, Seth**

Turnipseed EG, Landefeld CS. A triumph for the Agency for Healthcare Research and Quality Safety Program for Long-term Care: Moving beyond “Round up the usual suspects” [published online May
Lubin, Farah

Martin, Roy

Meador-Woodruff, James
3. Pre-clinical Medical Students as the Primary Longitudinal Provider of Psychiatric Care in the Outpatient Setting: A Novel Training Model. Martinez JTC Jr, Fargason RE, Meador-Woodruff
Nakazawa, Kazu

Parpura, Vladimír

Pozzo-Miller, Lucas


**Prabhu, Sumanth**


*Selected for F1000 Prime.


Roberson, Erik

Standaert, David
Publications in peer reviewed journals
Synuclein induced inflammation and neurodegeneration in a model of Parkinson disease. Exp Neurol 300, 179-187


Triebel, Kristen


Manuscripts in press:


Ubogu, Eroboghene

Visscher, Kristina

Wadiche, Jacques

Wadiche, Linda
3. Publications (Other)

Austad, Steve


Gerstenecker, Adam


Knight, David
Book
Anticipation and Medicine
Harnett NG, Wood KH, Wheelock MD, Knight AJ, Knight DC
Nadin M, editor. Cham, Switzerland: Springer International Publishing; 2017. Anticipation and the Neural Response to Threat; p219-228

Nakazawa, Kazu


Triebel, Kristen
Book chapters in press:

4. Presentations at scientific meetings

Austad, Steve
1. Keynote Address. 2nd Scripps Florida Symposium on the Biology of Aging. The Scripps Research Institute, Jupiter, FL.
2. Invited speaker. 8th Aquatic Animal Models of Human Disease Conference. Birmingham, AL
3. Plenary speaker. Annual Women’s Health Initiative Annual Meeting. Columbus, OH
4. Invited speaker. MIXiii Biomed. 16th National Life Science & Technology Week. Tel Aviv, Israel
5. Invited speaker and moderator. American Aging Association Annual Pre-meeting Conference. New York City, NY
7. Course Faculty. 25th Annual Summer Training Course in Experimental Aging Research. University of Washington, Seattle, WA
8. Course Faculty. National Institute on Aging’s Butler-Williams Scholarship Program. Bethesda, MD
9. Session Chair and Speaker. A Cross-Species and Cross-National Examination of Sex Differences in Healthy Aging. 21st IAGG World Congress of Gerontology and Geriatrics. San Francisco, CA
10. Invited speaker. National Institute on Aging/McKnight Brain Institute-sponsored Cognitive Aging Summit III. Bethesda, MD.

Benveniste, Tika
1. Invited Speaker, Gordon Research Conference, Neuroimmune Communication in Health and Disease, Ventura, California, January 15-20, 2017
3. Invited Speaker, Council for Faculty and Academic Societies (CFAS) Annual Meeting “Faculty of Tomorrow’s Academic Health Center”, “Discovery Science in the Biomedical Research Center”, Orlando, Florida, March 9-11, 2017
4. Organizer, UAB Multiple Sclerosis Symposium, Birmingham, Alabama, June 1-2, 2017
5. Invited Speaker, Synthetic Immunity Conference, Sante Fe, New Mexico, July 10-17, 2017
6. Invited Speaker, Johns Hopkins University, School of Medicine, Baltimore, Maryland, December 5, 2017

Bradley, Virginia Wadley

Day, Jeremy
1. Symposium Speaker, 25th World Congress of Psychiatric Genetics (Orlando, FL)
2. Seminar speaker, Emory University, Department of Human Genetics
3. Seminar speaker, University of California at Irvine, Department of Anatomy and Neurobiology
4. Discussion Leader, Gordon Research Conference on Catecholamines
5. Seminar speaker, University of Minnesota, Department of Neuroscience
6. Symposium Speaker, 19th annual Genes, Brain, and Behavior Conference (Madrid, Spain)
7. Symposium Speaker, UAB Department of Psychiatry Annual Research Symposium
8. Seminar Speaker, University of Pennsylvania, Mahoney Institute for Neurosciences
9. Seminar Speaker, Tulane University, Department of Cell and Molecular Biology
10. Seminar Speaker, Purdue University, Department of Biochemistry

Gamlin, Paul
1. Immunotoxin-induced ablation of ipRGCs. 32nd International Pupil Colloquium, Morges, Switzerland – September 2017
2. “Intrinsically-photosensitive Ganglion cells: Anatomy, physiology and behavioral roles”, University of Pisa, Pisa, Italy – September 2017

Gavin, Cristin
NIH Training and Workforce Development Program Directors Meeting, June 2017
Baltimore, MD; Title: The Postbaccalaureate Research Education Program at the University of Alabama at Birmingham

Geldmacher, David

Gerstenecker, Adam
Poster to be presented at the Annual Meeting of the International Neuropsychological Society, Washington, D.C.


Goldberg, Matthew
1. Creed, RB and Goldberg MS, Analysis of neuropathology in Pink1 knockout rats induced by Alpha-synuclein preformed fibrils, Society for Neuroscience Annual meeting.


Gray, Michelle

2. Huntington’s Disease research update. Huntington’s Disease Research Symposium, Huntington’s Disease Society of America, Annual Meeting, Schaumburg, IL, June 2017.


Gross, Alecia
Paper presentation at Association for Research in Vision and Ophthalmology (ARVO) 2017 Annual meeting, Baltimore, MD

Herskowitz, Jeremy


King, Gwen

3. Nathan Shock Center Symposium on the Basic Biology of Aging. “Klotho regulates postnatal neurogenesis and protects against age-related loss of dentate gyrus function.” UAB Hill Center, Birmingham, AL March 15th, 2017

Knight, David


Nakazawa, Kazu

1. “Dysfunction of GABAergic interneurons and neuropsychiatric illnesses”, at MIT Colloquium on the Brain and Cognition in Department of Brain and Cognitive Sciences at MIT, Cambridge, MA, October 12, 2017.

2. “Cortical hypodopaminergia vs striatal hyperdopaminergia revisited in an NMDAR hypofunction model of schizophrenia”, at Symposium: “Alterations in NRG/ErbB and NMDA signaling may contribute to brain region-specific dopamine dysbalance in schizophrenia” at International Congress on Schizophrenia Research (ICOSR) 2017, San Diego.
Pozzo-Miller, Lucas
1. Speaker at the Gordon Research Conference on “Excitatory Synapses and Brain Function”. Les Diablerets, Switzerland.
2. Distinguished institute-wide speaker, Instituto Ferreyra, CONICET, Córdoba, Argentina.
3. Speaker in the Translational Science session at the 14th Meeting of RettSyndrome.org, Chicago, IL.

Standaert, David
3. MDS-PAS Congress, chair for Plenary Session 1103: Update on Parkinson's Disease Therapeutics
4. MDS-PAS Congress “Controversies: Immunotherapies”
5. MDS-PAS Congress “Parallel Session 3203; Inflammation, Infections and Immunity in Movement Disorders”
6. American Society for Experimental Neurotherapeutics (ASENT), Washington, DC, featured speaker, “Parkinson Disease.”
7. 5th Annual Shaping the Management of Parkinson’s Disease: Debating the Most Controversial Diagnostic and Therapeutic Issues, ST. Petersburg, FL – speaker, “Biomarkers”
8. Parkinson’s disease and alpha-synuclein: preparing for neuroprotection, University of Barcelona, Speaker
9. 6th Biennial meeting on Dystonia, Rome, Italy – speaker
10. MDS Course for Neurology Residents, “Parkinson Disease: Etiology and Pathogenesis” (speaker, course co-organizer)

Ubogu, Eroboghene

5. Presentations at public (non-scientific) meetings or events

Austad, Steve
1. Invited speaker. Stanford Center on Longevity 10th Anniversary Celebration. Palo Alto, CA.
2. Invited speaker. National Institute on Aging Taskforce on Minority Aging and Health Disparities. Bethesda, MD
3. Invited Seminar. Reynolds Oklahoma Center on Aging, University of Oklahoma HealthSciences Center, Oklahoma City, OK.
4. Invited Seminar. University of Oklahoma, Department of Biology. Norman, OK.
5. Invited speaker. Investment for Cures 2017. New York City, NY
6. Course Faculty. 25th Annual Summer Training Course in Experimental Aging Research. University of Washington, Seattle, WA
7. Course Faculty. National Institute on Aging’s Butler-Williams Scholarship Program. Bethesda, MD
Gavin, Cristin  
2017 Summer Science Institute (CORD) – student recruiting; presented twice to high school students about student and faculty research in the Undergraduate Neuroscience Program  
UAB Undergraduate Student Recruitment for UAB Admissions, UAB Night, Keynote speaker at Huntsville and Nashville events

Geldmacher, David  
1. Identifying Non-Alzheimer causes of Memory Loss. Huntsville Hospital Annual Neuroscience Conference, Huntsville, AL, April 2017  
3. Alzheimer’s Update. Caregiver Conference, Alzheimer’s Association (Huntsville Office), Anniston, AL, August 2017  
4. Alzheimer’s and dementia. Osher Lifelong Learning Institute, Birmingham Chapter, Birmingham AL, March 2017

Goldberg, Matthew  
“Mitochondrial Dysfunction and Parkinson’s” presentation at the 2017 Mitochondrial Medicine Southeast Regional Symposium

Gray, Michelle  
2. Advancing your career in Biomedical Sciences. Society for the Advancement of Chicanos and Native Americans in Science, University of Alabama at Birmingham Chapter. Birmingham, AL, March 2017

Gross, Alecia  
Emory University, Emory Eye Center Vision Science Seminar Distinguished Speaker, Atlanta, GA

King, Gwendalyn  

Pozzo-Miller, Lucas  
1. Neuroscience Café, UAB Comprehensive Neuroscience Center, Hoover Public Library, Hoover, AL.  
2. Civitan International Annual Convention, 100th year celebration, Sheraton Hotel, Birmingham, AL.

Standaert, David G.  
1. Canterbury Beeson Forum on Aging  
2. ANA/NINDS Career Development Symposium  
3. NINDS 2017 workshop for R25 residents and fellows

Triebel, Kristen  
Cancer Support Group
Visscher, Kristina
2. Neuroscience Café Seminar Series March 20, 2017 “Making the best of what we have: How patients with vision loss due to macular degeneration learn to use their spared vision and how that changes their brains” with Dawn DeCarlo and Kristina Visscher
3. Abroms-Engel Institute for the Visual Arts. Panel discussion April 12, 2017 “From Eye to Mind: a panel discussion examining the neuroscience of vision as applied to Jessica Angel’s installation Facing the Hyperstructure With Marshall Abroms and Jessica Angel and Kristina Visscher

6. Awards
Bradley, Virginia Wadley
UAB Department of Medicine Research Excellence Award

Gavin, Cristin
Honors College Faculty Fellow – dean nominated based on excellence in research, teaching, and service, selected by committee to provide outstanding extracurricular programming for honors students and to increase collaboration between faculty and staff across campus. Second year in this appointment.

Knight, David
UAB Dean’s Award for Excellence in Mentorship

Visscher, Kristina
1. Graduate School Dean’s Award for Excellence in Mentorship
2. Kavli/National Academy of Sciences Frontiers in Science Fellow

Wadiche, Linda
Appointed to Neurodevelopment Faculty of 1000

7. Faculty.
Please include abbreviated CV with publications for previous 12 months. See Appendix F

8. Trainees
Benveniste, Tika
   A. Post doctoral
      Wei Yang
      Luke Parkitny
   B. Pre-doctoral
      Sara Gibson
      Zhaoqi Yan
      Nathalia Melo
   C. Other
      Briania Smith

Bradley, Virginia Wadley
   A. Post doctoral
   B. Pre doctoral
Dissertation Committee Chair and Primary Mentor

Caroline Lassen-Greene, MA, Medical Psychology doctoral program.  


Dissertation Committee Member

Samantha Henry, M.A., Medical Psychology doctoral program

C. Other

Faculty Mentor

Noha Sharafeldin, MD, NIH K12 Award application, UAB Institute for Cancer Outcomes and Survivorship

Jessica Mirman, PhD, Assistant Professor, UAB Department of Psychology; Center for Clinical and Translational Science (CCTS) R01 grant review panel

Goldberg, Matthew
A. Post doctoral
   Sandeep Kumar Barodia  
   Laura McMeekin
B. Pre-doctoral
   Rose Creed
C. Other
   Affan Rizwan
   Mitchel King
   Nimrit Mokha

Gray, Michelle
A. Post doctoral 0
B. Pre-doctoral
   Annesha king, GBS Neuroscience Theme
C. Other
   Undergraduate
   Isaac Rhoades
   Amayrani Garcia
   Lawela Rose Enfinger

Gross, Alecia
A. Post doctoral 0
B. Pre doctoral
   Stefanie M. Percival
C. Other
Nakazawa, Kazu
A. Kazuhito Nakao
B. Vivek Jeevakumar

Triebel, Kristen
A. Post doctoral – none
B. Pre doctoral
1. Caitlyn Padek
2. Brittney Otruba
3. Victor DelBene
C. Other
1. Mackenzie Fowler
2. Lauren Bolden

Visscher, Kristina
A. Post doctoral
B. Pre doctoral
(a) Leland Fleming
(b) Mandy Biles
(c) Matt Defenderfer
(d) Sara Nolin
C. Other

9. Clinical/translational programs
Bradley, Virginia Wadley
A. New Programs
1R01 MH106366-01A1 (Vance, PI) 07/01/2016 – 02/28/2021 (NEW)
NIH/NIMH Wadley Bradley, Co-I
An RCT of Speed of Processing Training in Middle-aged and Older Adults with HIV
The purpose of this trial is to examine the impact of computer based training on adults with and without HIV-associated Neurocognitive Disorder (HAND) and to determine the optimal duration of the intervention sessions.

UAB Alzheimer’s Disease Center (Roberson, PI) 07/01/2017 – 06/30/2019 (NEW)
Internal funding/ philanthropy Wadley, Core Leader
The Outreach and Recruitment Core develops partnerships with community and patient populations for engagement in the aims and research of the Alzheimer’s Disease Center, with a focus on African Americans.

B. Update on existing clinical studies
- Determinants of Midlife & Longitudinal Change in Cognitive Function: CARDIA Study
CARDIA is a multisite prospective study that recently completed its Y25 follow-up in which cognitive testing and brain MRIs were measured. This ancillary study will repeat/augment cognitive testing for the Y30 visit (2015-16) on an estimated 3100 participants.

- **Reasons for Geographic and Racial Differences in Stroke**
  The REGARDS project is focused on advancing the understanding of factors contributing to disparities in stroke risk factors and disparities in cognitive impairment by conducting a second in-person evaluation 9 years after the baseline visit and continuing to provide national data on stroke incidence, case fatality, prevalence of cerebrovascular risk factors and lifestyle choices and assess geographic and racial variations in these factors.

- **Memory and Cognition IN Decreased Hypertension Substudy (SPRINT MIND)**
  Systolic Blood Pressure Intervention Trial (SPRINT) Clinical Center Networks. This project is investigating the impact of intensively lowering blood pressure on cardiovascular, kidney, and brain outcomes including cognitive function.

- **Childhood SES Factors: Impact on Age-Related Cognitive and Vascular Health**
  The general aim of this study is to identify childhood and family socioeconomic (SES) factors that shape disparities in vascular and cognitive health.

- **Carotid Revascularization Endarterectomy vs. Stenting Trial (CREST-2)**
  CREST-2 Statistical and Data Coordinating Center
  The goal of this multicenter clinical trial is to compare carotid revascularization and intensive medical management vs. intensive medical management alone in the prevention of stroke or death within 30 days of enrollment or ipsilateral stroke up to 4-years thereafter in patients with asymptomatic carotid artery stenosis. Cognitive change outcomes within the study arms also will be compared.

- **Processing Speed Training to Preserve Driving and Functional Competencies in MCI**
  The goal of this randomized clinical trial is to test the effectiveness of an enriched version of Speed of Processing training in supporting functional abilities in persons with MCI, and to identify genetic, neuroimaging, and cognitive biomarkers predicting who can and cannot benefit from this training.

- **Center for Translational Research on Aging and Mobility**
  The purpose of this grant is to develop and pilot new and innovative ideas for early and late stages of the translation of basic behavioral and social research findings at the individual or population level into programs and practices that will improve the lives of older people and the capacity of institutions to adapt to societal aging.

**Gray, Michelle**
Understanding cardiac abnormalities in Huntington’s Disease patients. HDRhythm observational study designed (patient enrollment in March 2018).

**Visscher, Kristina**
- A. New Programs
- B. Update on existing clinical studies
  - MBAR project is ongoing, at all four sites.

10. **Technology transfer**
- A. Patent applications
- B. Revenue generated from technology
11. **Educational programs focusing on age-related memory loss**
   A. **Scientific**
      New Scientific Dialogues symposium held on December 7, 2017. See Appendix D
   B. **Public**
      **Visscher, Kristina**
      Along with colleagues at the McWane Science Center, and through our Research Civitan Club, I run a monthly science outreach event called Sci Café at John’s City Diner downtown. We have speakers about various topics, and have recently had speakers focusing on aging.

12. **Collaborative programs with other McKnight Institutes, institutions and research programs**

   **Bradley, Virginia Wadley**
   McKnight Brain Aging Registry Cognitive Assessment Core (See Above)
   McKnight Foundation Cognitive Intervention Core

   **Day, Jeremy**
   - University of Arizona (Carol Barnes, Matt Heuntelman)
   - University of Florida (Tom Foster) on effort to understand age-related gene expression changes in the hippocampus.

   **King, Gwendalyn**
   - Lynn Dobrunz
   - Linda Wadiche
   - Jeremy Herskowitz

   **Visscher, Kristina**
   McKnight Brain Aging Registry

13. **Collaborative programs with non-McKnight institutes, institutions and research programs**

   **Bradley, Virginia Wadley**
   Multi-site collaborations—REGARDS, SPRINT, SPRINT ASK, CREST-2, CARDIA

   **Day, Jeremy**
   - Collaboration with Charles Gersbach (Duke University) to apply CRISPR tools to study genetic and epigenetic mechanisms in the brain.

   **King, Gwendalyn**
   - Stefanie Krick – lung function and klotho
   - Daryl Quarles – renal function and klotho
   - Christian Faul – FGF23 and klotho
   - Yabing Chen – calcification in aging models

   **Pozzo-Miller, Lucas**
   A. Within the UAB system
      - Sandipan Pati (Neurology)
      - Alan Percy (Pediatrics)
      - Manimaran Ramani (Pediatrics)
      - Victor Mark (Physical Medicine and Rehabilitation)
      - Ed Taub (Psychology)
      - Gitendra Uswatte (Psychology)
B. Outside the UAB system

- Frank Longo Stanford University, San Francisco, CA
- Tien-Le Xu, Jiao-Tong University, Shanghai, China
- James Eubanks, Toronto Western Hospital, Canada
- Alan Kozikowski, University of Illinois
- Steve Gray, University of North Carolina at Chapel Hill
- Suzanne Oberholster, Sanford University, Birmingham, AL
- Takafumi Inoue, Easeda University, Tokyo, Japan
- Arturo Romano, University of Buenos Aires, Argentina

Visscher, Kristina
Several collaborations, including with Dr. Aaron Seitz at University of California, Riverside, examining adult cortical plasticity in the context of cognitive training. The results of this work will be very relevant for our aging studies, as we are interested in identifying the mechanisms of adult cortical plasticity. Keeping the adult brain plastic is essential for maintaining healthy cognition throughout aging.
APPENDICES
An American Heart Association panel, including two experts from UAB, says the same healthy habits that can help ward off heart disease or stroke can also help prevent cognitive decline. (See Appendix Below)

Both the heart and brain need adequate blood flow; but in many people, blood vessels slowly become narrowed or blocked over the course of their lives, a disease process known as atherosclerosis, the cause of many heart attacks and strokes. Many risk factors for atherosclerosis can be modified by following a healthy diet, getting enough physical activity, avoiding tobacco products and other strategies.

“Research summarized in the advisory convincingly demonstrates that the same risk factors that cause atherosclerosis are also major contributors to late-life cognitive impairment and Alzheimer’s disease,” said vascular neurologist Philip Gorelick, M.D., the chair of the advisory’s writing group and executive medical director of Mercy Health Hauenstein Neurosciences in Grand Rapids, Michigan. “By following seven simple steps — Life’s Simple 7 — not only can we prevent heart attack and stroke, we may also be able to prevent cognitive impairment.”

Life’s Simple 7 outlines a set of health factors developed by the American Heart Association to define and promote cardiovascular wellness. Studies show these seven factors may also help foster ideal brain health in adults.

The Life’s Simple 7 program urges individuals to:

- Manage blood pressure
- Control cholesterol
- Keep blood sugar normal

Virginia J. Howard, PhD, professor in the Department of Epidemiology, UAB School of Public Health.
- Get physically active
- Eat a healthy diet
- Lose extra weight
- Don’t start smoking, or quit

“We can gauge brain health by observing how well we function within our normal environment,” said Ronald M. Lazar, PhD, Evelyn F. McKnight Endowed Chair for Learning and Memory in Aging in the Department of Neurology and one of the UAB faculty on the writing group. “A healthy brain allows us to think, communicate, remember, problem solve, have mobility and regulate emotions. Cognitive impairment can affect any or all of those functions.”

Ronald M. Lazar, PhD, Evelyn F. McKnight Endowed Chair for Learning and Memory in Aging in the Department of Neurology, School of Medicine. Lazar and Virginia J. Howard, PhD, a stroke epidemiologist and the other UAB co-author, say the advisory provides a foundation on which to build a broader definition of brain health that includes other influential factors such as the presence of atrial fibrillation, a type of irregular heartbeat that has been linked to cognitive problems; education and literacy; social and economic status; the geographic region where a person lives; and other brain diseases and head injuries.

Howard, professor in the Department of Epidemiology in the UAB School of Public Health, is the co-principal investigator of UAB’s long-running REGARDS study, a national effort to learn more about the factors that increase an individual’s risk for stroke and cognitive decline.

“Findings from REGARDS were important components in the deliberations that led to the advisory’s recommendations,” she said. “Equally important, our investigations while preparing the advisory showed areas where the body of knowledge is incomplete or where hypotheses have not been conclusively proved or disproved. This advisory should stimulate new avenues of collaborative research that can fill in the gaps of our understanding.”

The advisory, which is published in the American Heart Association’s journal Stroke, stresses the importance of taking steps to keep your brain healthy as early as possible, because atherosclerosis — the narrowing of the arteries that causes many heart attacks, heart failure and strokes — can begin in childhood.

“We cannot wait until we are seniors, in retirement or approaching retirement age, to begin focusing on brain health,” said Lazar, who is the director of the Evelyn F. McKnight Brain Institute in the UAB School of Medicine. “Some of the effects of cognitive decline are irreversible. Prevention is the key.”

The action items from Life’s Simple 7, which are based on findings from multiple scientific studies, meet three practical rules the panel developed in pinpointing ways to improve brain health — that they could be measured, modified and monitored.

“Life’s Simple 7 are easy concepts for the public to understand and follow, and easy for health care providers to monitor,” Howard said. “Blood pressure, for example, can be easily measured, and there are proven ways to positively affect blood pressure. And then, improvement can be measured over time.”
The advisory also recognizes that it is important to follow previously published guidance from the American Heart Association, Institute of Medicine and Alzheimer’s Association, which include controlling cardiovascular risks and suggest social engagement and other related strategies for maintaining brain health.

Dementia is costly to treat. Direct care expenses are higher than for cancer and about the same for heart disease, estimates from the AHA show. Plus, the value of unpaid caregiving for dementia patients may exceed $200 billion a year. As lives stretch longer in the United States and elsewhere, about 75 million people worldwide could have dementia by 2030, according to the advisory.

“Policymakers will need to allocate health care resources for this,” Gorelick said. “Monitoring rates of dementia in places where public health efforts are improving heart health could provide important information about the success of such an approach and the future need for health care resources for the elderly.”

The authors of the advisory reviewed 182 published scientific studies to formulate their conclusions that following Life’s Simple 7 has the potential to help people maintain a healthy brain throughout life.
Missing Memories: Helping patients and caregivers in the present; investigating prevention strategies for the future

The number of people coping with a memory disorder or caring for a loved one with a memory disorder is rising. Shortly after being diagnosed with Alzheimer’s disease in 2011, singer Glen Campbell recorded a song called “Ghost on the Canvas.” The song begins with the line, “I know a place between life and death for you and me.”

An existence in limbo is a daily reality for many of the 5.5 million people in the U.S. currently living with Alzheimer’s disease or another form of dementia. It also often accurately describes the agonizing circumstances facing the more than 15 million Americans who provide care for family members and loved ones suffering from memory disorders.

“It just takes over your life,” Kim Campbell, Glen Campbell’s wife of 34 years, said in an interview with The Tennessean a few months before Campbell’s death from Alzheimer’s this past August. “They are losing their identity because they can’t remember who they are, but as a caregiver you are losing your identity. You have to give up everything you are doing to take care of them.”

UAB researchers are actively working to find treatments and hopefully even a cure for Alzheimer’s and other memory disorders. Until those breakthroughs occur, UAB’s School of Medicine and School of Nursing are teaming up to try to help current patients and especially caregivers deal with this fatal disease that has been referred to as “the long goodbye.”

David Geldmacher from the School of Medicine is co-leading efforts to help people with memory disorders and their families cope and preserve quality of life. “Our focus is to try to promote the quality of life in the family as a whole,” says David Geldmacher, MD, holder of the Warren Family Endowed Chair in Neurology and director of the UAB Division of Memory
Disorders and Behavioral Neurology. “There are things we can do for the affected person—prescribe medicines and so forth—but there are also things we can do for the family members and caregivers. Since most people with dementia are cared for in the home environment, our goal is to try to optimize that family’s functioning and quality of life to the greatest extent possible.”

Though Alzheimer’s is the memory disorder that receives the most attention, Geldmacher says there are a number of other diseases and conditions that can cause neurological issues that result in changes to personality and behavior similar to Alzheimer’s. These include Parkinson’s disease, frontotemporal dementia, head injuries, strokes, and even sleep disorders.

“When we use the term dementia, we mean a change in cognition or behavior attributable to brain disease that’s severe enough to interfere with a person’s everyday activities,” Geldmacher says. “So saying ‘dementia’ is like saying ‘headache.’ It’s a generic, overall description of what we observe. But there are many causes of dementia, just like there are many causes for headaches. Dementia is the umbrella term, and specific illnesses like Alzheimer’s disease are the individual spokes.”

A Gathering Storm

Regardless of how the various illnesses are categorized, the overall issue of people in this country suffering from memory disorders is a rapidly growing problem. According to a report released earlier this year by the Centers for Disease Control and Prevention, death rates from Alzheimer’s rose 55 percent from 1999 to 2014 and nearly 14 million people are expected to be afflicted with the disease in the next 20 to 25 years.

“Meanwhile, we have a smaller cohort of people being left behind to take care of these older adults as they move into dementia,” Geldmacher says. “We also have difficulty attracting doctors and nurses to this field, so we have a growing shortage of specialists with an expertise in this area. Unless we come up with treatments that significantly interrupt the progression of the disease or even prevent its emergence, the public health burden on Medicaid and Medicare and the like will be overwhelming by mid-century.”

Rita Jablonski from the School of Nursing is also co-leading efforts to help patients with memory disorders and their families cope. Rita Jablonski, PhD, CRNP, FAAN, FGSA, associate professor with the UAB School of Nursing, is even more emphatic about the problem’s severity. “The dementia crisis is here. It’s not coming; it’s here,” Jablonski says. “Almost $300 billion is expended annually because of this diagnosis, either directly through hospitalization and nursing home care costs or indirectly because family caregivers have to leave the workforce or accept lower-paying positions that enable them to offer care. And that number is only going to go up.”

Since the treatment options for patients with memory disorders remain limited, the focus is increasingly turning toward helping caregivers and other family members deal with the disease. Toward that end, Geldmacher says the UAB Memory Disorders Clinic is creating a new position that he calls “a nurse navigator.”

“Families often don’t know where to turn with their questions,” Geldmacher says. “We hope to provide a single focal point for families that we work with that allows them to call in and get referrals to community resources and other education as needed. We could
potentially even have group educational sessions, where we can help families understand what they’re facing and the best ways of managing it.”

UAB is also using a $500,000 grant from the U.S. Department of Defense (DoD) on a three-year study to see if family members can be taught caregiving strategies through online or phone instruction. The DoD is interested in studying dementia because a large number of aging and younger veterans are experiencing memory-related problems stemming from head injuries sustained during combat. Such telemedicine programs are important since many rural areas do not offer any assistance for these types of patients and their caregivers.

“We know that a head injury is a risk for developing dementia later in life,” Geldmacher says. “And we know that many of the symptoms of people who have experienced repeated brain trauma—such as changes in memory, thinking, and behavior—are very similar to the symptoms that patients with Alzheimer’s disease experience. That’s why the study for both caregivers of people with Alzheimer’s disease and brain injury aims to find out their similarities and their differences. It looks to see if we can create a telemedicine caregiver coaching program that caters to both.”

As part of the study, Jablonski says she spends an hour each week for a total of six weeks talking with an individual caregiver. They discuss the problems the caregiver is having with the patient, and Jablonski offers advice on how best to solve the issues. For example, patients with Alzheimer’s disease or dementia from traumatic brain injury may resist care efforts from family members, such as taking a bath, taking medicine, practicing routine mouth care, abstaining from alcohol, or going to a medical appointment. When Jablonski and the caregiver talk again a week later, the caregiver will describe what worked well and what didn’t and Jablonski will offer fresh advice based on this feedback.

“This type of interaction is mandatory for family members to become more adept at caregiving,” Jablonski says. “They know their loved one better than anybody. They can take our general strategies and then tailor them to that person’s specific behavior.

“We are logical beings, and logic doesn’t work with dementia. So the way you’ve interacted with them your whole life through logic and reasoning goes out the window with dementia. In fact, a lot of the ways you used to interact with them can now cause behavior triggers that make them upset.”

Jablonski says the most common behavior associated with people with memory disorders is repetition, where the person will ask the same question over and over. “Every five minutes they’ll ask what time it is,” Jablonski says. “Things like that can really wear down family caregivers.”

Jablonski teaches techniques that enable caregivers to try to preempt such repetitive behaviors. If a patient continually asks about the time, she says the caregiver should put a large digital clock in the room and then ask the patient what time it is. “Beating the person to the repetitive question can sometimes move the repetitive train of thought off the track,” Jablonski says. “You can bounce them out of the loop so maybe that behavior lessens.”

On the clinical side, UAB has a group of nurse practitioners who provide longitudinal ongoing care for patients and families facing dementia. Geldmacher points out UAB has the only board-certified cognitive neurologists and nurse practitioners who provide the only outpatient-focused expertise in dementia care in the state. Therefore, it makes sense the School of Medicine and the School of Nursing have formed this partnership to help caregivers navigate this strange and frightening situation.
“Our doctors do a lot of diagnosis, but so much of what happens in the care of the person with dementia is nursing-oriented care, and doctors aren’t really taught that in medical school,” Geldmacher says. “Many people come in wanting to see the doctor because the doctor is going to ‘fix’ the problem. Well, unfortunately for Alzheimer’s disease we know the doctor can’t fix the problem. It’s not going away. That person is going to live with that problem for the rest of their lives.

“How do you live with dementia? That’s what nursing is, the care of the person with the disease. The disease is irrelevant; it’s the person who’s the focus. A lot of people resist transitioning to the nurse practitioner when in fact that health care professional offers the right expertise. The nursing expertise in our group is every bit as important, if not more important, than the physician expertise.”

Prevention & Reduction

With nearly half a million new cases of Alzheimer’s disease diagnosed each year in the U.S.—and an aging baby boomer generation expected to push that figure even higher—it’s clear that efforts to combat the disease will have to do more than treat and support those who are already afflicted. For that reason, clinicians and researchers are increasingly turning their attention toward preventive efforts for Alzheimer’s.

“The lesson we’re drawing from is the history of cardiovascular disease,” says Geldmacher. “In the 1950s, we didn’t know that someone had heart disease until they had a heart attack. Then we realized there were reversible risk factors and that you can treat heart disease long before a heart attack. The day may come when we can do the same thing with Alzheimer’s by finding the illness before any symptoms appear and intervening to prevent brain disease.”

Geldmacher imagines a future where healthy adults undergo routine screenings as they age that look for the earliest signs of Alzheimer’s in the brain with routine scans or tests in the same way blood tests screen for predictors of heart disease. At UAB, clinical trials involving both healthy people and those with dementia, as well as basic research to uncover the molecular underpinnings of Alzheimer’s disease, are helping bring Geldmacher’s vision to life.

Personalized Advice

Today, screening for Alzheimer’s in healthy adults is, in most primary care settings, limited to a short questionnaire. But for those interested in a more detailed examination of their likelihood of developing Alzheimer’s, UAB runs a first-of-its-kind personalized risk clinic, a reflection of the growing influence of precision medicine. Helmed by Geldmacher, the Alzheimer’s Risk Assessment and Intervention Clinic will—for a fee—perform memory tests, collect family history, and carry out a patient’s baseline MRI scan to integrate into his or her personal dementia risk assessment. If the patient has a heightened risk of Alzheimer’s disease, Geldmacher advises the patient how to decrease that risk.

“There’s a lot of junk information on Alzheimer’s out there,” says Geldmacher. “People can’t always sort out what is valid and what is snake oil. We offer personalized attention. We let them know what they can do and inform them on how certain behaviors affect their risk.”
The Alzheimer’s Risk Clinic medical professionals’ advice is based on a few large studies’ results that followed healthy adults and tracked who developed Alzheimer’s disease. Studies are still needed to determine whether changing risk factors—like diet—actually alter the risk of Alzheimer’s. Additionally, research is needed to uncover new drugs that may prevent the onset of dementia in those most at risk.

**Strengthening Defenses**

Left to right: Erik Roberson and Jeremy Herskowitz are researching ways to better understand the neurological and neurobiological mechanisms behind the development of Alzheimer’s disease. Researchers at UAB and around the country are simultaneously trying to better understand what causes Alzheimer’s at a molecular level and how those underlying changes to the brain can be stopped or reversed. Over the past couple of decades, two proteins—amyloid-beta and tau—have been implicated in the disease’s development. Both proteins are known to accumulate in the brains of people with Alzheimer’s, forming clumps known as amyloid plaques and tau neurofibrillary tangles. But when researchers autopsy the brains of healthy people—who died without ever having memory problems—they also see a significant percentage of brains with amyloid plaques and tau tangles.

According to Jeremy Herskowitz, PhD, an assistant professor of neurology and neurobiology and the Patsy W. and Charles A. Collat Scholar of Neuroscience, “There are large numbers of individuals from between the ages of 60 and 100 who have Alzheimer’s pathology but no dementia.” Herskowitz is studying what differentiates people who have amyloid-beta and tau pathology in their brains but do not develop dementia from those who have dementia. His lab recently used cutting-edge microscopy techniques to examine brains of elderly individuals who had died with and without Alzheimer’s diagnoses. They found that the synapses (connections between nerve cells) in people who avoided Alzheimer’s looked completely different—they were longer and more extensive.

“No we understand how some individuals can withstand dementia despite harboring the pathology in their brains,” he says. “We will focus on drugs to remodel the synapses in patients prone to Alzheimer’s to slow down the development of dementia.” Herskowitz is now pursuing a class of drug that may boost synapses even when amyloid and tau accumulate.

“The research field is beginning to accept the idea that an Alzheimer’s therapy will attack the disease from all angles: reducing tau and amyloid, curbing neuroinflammation, and boosting synapses,” Herskowitz says.

Erik Roberson, MD, PhD, associate professor of neurology and neurobiology, the Patsy W. and Charles A. Collat Professor of Neuroscience, and director of the UAB Alzheimer’s Disease Center, is working on a new twist on of those approaches: attempting to disrupt the effects of tau on the brain. In healthy brain cells, tau proteins help form tracks that transport materials throughout the cells. But when tau proteins accumulate into tangles—as they do in the brains of people with Alzheimer’s—transportation goes awry, cells die, and areas of the brain become hyperexcitable.

“In mice, we can fix this hyperexcitability by knocking out their tau genes,” says Roberson. “But we can’t do that in people.” Instead, Roberson’s lab is working on developing drugs that keep tau from interacting with other proteins that, when they team up, cause
the hyperexcitability. Like Herskowitz’s plan to change synapses that could block the disease even in the face of amyloid plaques and tau tangles, Roberson is hoping that thwarting tau’s interactions may stop Alzheimer’s without changing amyloid or tau levels.

Clinical Questions

Through his role as chair of the UAB McKnight Brain Institute, Ronald Lazar is working with researchers like Herskowitz and Roberson to connect memory disorders research. Through his role at the Alzheimer’s Disease Center, Roberson is also zooming out from the molecular details of dementia to answer some broader questions about who gets Alzheimer’s and why. The center is about to start recruiting patients with and without Alzheimer’s to study how health disparities in Alabama contribute to rates of the disease. African-Americans are at a significant higher risk for Alzheimer’s, and many other risk factors for dementia—from cardiovascular disease to obesity—are present at higher than average rates in Alabama. “We really need to understand why some people have higher risks and what’s unique about them that should guide the way we approach treatment for them,” says Roberson.

It is a question that is also at the heart of research being conducted at the UAB Evelyn F. McKnight Brain Institute, which welcomed Ronald Lazar, PhD, the Evelyn F. McKnight Endowed Chair for Learning Memory in Aging in the Department of Neurology, as its new chair this summer.

“We want to take UAB’s strengths in both research and clinical medicine and build new relationships between basic scientists and clinical scientists to study age-related memory decline and cognitive decline, and discover how to create resiliency and recovery,” says Lazar. “There are a lot of principles that have emerged out of basic science, and there are wonderful cellular and animal models of Alzheimer’s. Our challenge is to bring this work forward into the humanspace.”

The institute—one of four McKnight Brain Institutes in the country—was launched at UAB in 2004, and Lazar is already planning new initiatives that include pilot grants to facilitate interdisciplinary work.

Through collaborations with the other McKnight sites, UAB associate professor of neurobiology Kristina Visscher, PhD, is involved in one such interdisciplinary project that aims to define the healthy aging brain.

Kristina Visscher works on imaging studies that seek to define and characterize a healthy aging brain. “There are theories out there that say Alzheimer’s is an acceleration of brain aging,” explains Visscher, co-director of the Civitan International Neuroimaging Laboratory. “But the problem is that we don’t actually understand what a healthy aging brain means.”

Visscher and researchers at the McKnight Institutes in Miami and Gainesville, Florida, and Tucson, Arizona, are currently recruiting 200 cognitively healthy people over age 85. The participants undergo tests and scans in three sessions that profile their cognition and...
brains. Tests range from timed obstacle courses to memorization challenges, and scans measure such things as the strength of connections between brain areas or the volumes of those areas.

Visscher says she hopes her research reveals what healthy aging brains look like and it teaches us something about how that goes awry in Alzheimer’s. Ultimately, she and everyone else studying Alzheimer’s want to unlock the secret to growing old without losing one’s memory.

“Memory is a function that everybody needs every day to have quality of life, to interact with other people, and to enjoy experiences.” says Lazar. “To study memory means we are not only trying to make the Golden Years as meaningful as possible, but we’re also trying to preserve this function that maintains civilization and society.”

*By Cary Estes and Sarah C.P. Williams*

Quicklinks

**School** of **UAB Medicine**

**Knowledge that will change your world**
Neural Networking: Neurobiological research shows how synapses change when new neurons are formed

Two UAB neurobiologists are learning how synapses change when new neurons are formed. One goal in neurobiology is to understand how the flow of electrical signals through brain circuits gives rise to perception, action, thought, learning, and memories. Linda Overstreet-Wadiche, PhD, and Jacques Wadiche, PhD, associate professors in the UAB Department of Neurobiology and a wife-and-husband team, have published their latest contribution in this effort, focused on a part of the brain that helps form memories: the dentate gyrus of the hippocampus.

The dentate gyrus is one of only two areas in the brain where new neurons are formed continuously in adults through a process called neurogenesis. When a new granule cell neuron is formed in the dentate gyrus, it must get “wired in” by forming synapses, or connections, in order to contribute to circuit function. Dentate granule cells are part of a circuit that receive electrical signals from the entorhinal cortex, a cortical brain region that processes sensory and spatial input from other areas of the brain. By combining this sensory and spatial information, the dentate gyrus can generate a unique memory of an experience.

With this in mind, Overstreet-Wadiche and UAB colleagues posed several research questions: Since the number of neurons in the dentate gyrus increases by neurogenesis while the number of neurons in the cortex remains the same, does the brain create additional synapses from the cortical neurons to the new granule cells? Or do some cortical neurons transfer their connections from mature granule cells to the new granule cells?

The answer was revealed through a series of electrophysiology, dendritic spine density, and immunohistochemistry experiments with mice that were genetically altered to produce either more new neurons or to kill off newborn neurons. Their findings support the second model—some of the cortical neurons transfer their connections from mature granule cells to the new granule cells.

This opens the door to look at how this redistribution of synapses between the old and new neurons helps the dentate gyrus function. And it raises tantalizing questions: Does this redistribution disrupt existing memories? How does this redistribution relate to the beneficial effects of exercise, which is a natural way to increase neurogenesis?

“Over the past 10 years there has been evidence supporting a redistribution of synapses between old and new neurons, possibly by a competitive process that the new cells tend to ‘win,’” Overstreet-Wadiche says. “Our findings are important because they directly demonstrate that, in order for new cells to win connections, the old cells lose connections. So, the process of adult neurogenesis not only adds new cells to the network, but it also promotes plasticity of the existing network.”
“It will be interesting to explore how neurogenesis-induced plasticity contributes to the function of this brain region,” she continues. “Neurogenesis is typically associated with improved acquisition of new information, but some studies have also suggested that neurogenesis promotes ‘forgetting’ of existing memories.”

The researchers also unexpectedly found that the Bax gene, known for its role in cell death (apoptosis), appears to play a role in synaptic pruning in the dentate gyrus. “There is mounting evidence that the cellular machinery that controls cell death also controls the strength and number of synaptic connections,” Overstreet-Wadiche says. “The appropriate balance of synapses strengthening and weakening, collectively termed synaptic plasticity, is critical for appropriate brain function. Therefore, understanding how synaptic pruning occurs may shed light on neurodevelopmental disorders and on neurodegenerative diseases in which a synaptic pruning gone awry may contribute to pathological synapse loss.”

By Jeff Hansen

https://www.uab.edu/medicine/magazine/195-neural-networking-neurobiological-research-shows-how-synapses-change-when-new-neurons-are-formed
HISTORY

On November 5, 2004, the University of Alabama Board of Trustees approved the establishment of the Evelyn F. McKnight Brain Institute at UAB. The Evelyn F. McKnight Brain Institute has the long-term goal of translating discoveries from basic biomedical research into processes and products to minimize the deleterious effects of aging on learning and memory in humans.

The purpose of the McKnight Brain Research Foundation is to promote research and investigation of the brain in the fundamental mechanisms that underlie the neurobiology of memory with clinical relevance to the problems of age-related memory loss.

NOTES:

Appendix D

Evelyn F. McKnight Brain Institute

New Scientific Dialogues

Matching basic science and applied neuroscience!

December 7, 2017
8:30 – 11:30 a.m.
Shelby 1015
8:30 Breakfast

9:00 Welcome

Ronald Lazar, PhD
Evelyn F. McKnight Endowed Chair for Learning and Memory in Aging
Department of Neurology

9:15 Reperfusion, Cognition & Neuroinflammation

Ronald Lazar, PhD
Evelyn F. McKnight Endowed Chair for Learning and Memory in Aging
Department of Neurology

Tika Benveniste, PhD
Senior Associate Dean for Research Admin, SOM
Charlene A. Jones Endowed Chair, Neuroimmunology Professor, Department of Cell, Developmental And Integrative Biology

9:45 Huntington’s Disease: From the Brain to the Heart

Michelle Gray, PhD
Assistant Professor
Department of Neurology

Sabine Huke, PhD
Associate Professor
Med-Cardiovascular

10:30 Hippocampal Architecture in Human Temporal Lobe Epilepsy: From MRI to Epigenetics

Farah Lubin, PhD
Associate Professor
Director, NINDS, Neuroscience Roadmap Pro
Department of Neurobiology

Lawrence Ver Hoef, MD
Associate Professor
Department of Neurology

11:00 The val66met BDNF Single-Nucleotide Polymorphism in Rett Syndrome: A Biostatistical Consultation

Lucas Pozzo-Miller, PhD
Professor
Interim Scientific Co-director, CIRC
Associate Director, CNC
Co-director, Neuroscience Graduate Theme, Graduate Biomedical Science
Department of Neurobiology

Lloyd J. Edwards, PhD
Professor and Chair
Department of Biostatistics
## List of Seminar Speakers sponsored by the Evelyn F. McKnight Brain Institute at UAB

Evelyn F. McKnight Brain Institute
Seminars
2017

<table>
<thead>
<tr>
<th>Date</th>
<th>Speaker</th>
<th>Institution</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/19/2017</td>
<td>Aurelio Galli, PhD</td>
<td>University of Vanderbilt</td>
<td>&quot;From the Gut to the Brain: Hormonal Regulation of Brain Dopamine Homeostasis and Cocaine Reward&quot;</td>
</tr>
<tr>
<td>02/09/2017</td>
<td>David Weinshenker, PhD</td>
<td>Emory University</td>
<td>&quot;Noradrenergic Control of Neurodegenerative Disease&quot;</td>
</tr>
<tr>
<td>02/16/2017</td>
<td>Mark Wheeler, PhD</td>
<td>Georgia Tech</td>
<td>&quot;Tracking evidence during perceptual decisions using fMRI&quot;</td>
</tr>
<tr>
<td>03/16/2017</td>
<td>Aaron Gitler, PhD</td>
<td>Stanford University</td>
<td>&quot;Expanding mechanisms and therapeutic targets for neurodegenerative disease&quot;</td>
</tr>
<tr>
<td>03/23/2017</td>
<td>Steven Mennerick, PhD</td>
<td>Washington University, St. Louis</td>
<td>“Adventures in Hippocampal Neurotransmission&quot;</td>
</tr>
<tr>
<td>04/03/2017</td>
<td>Ege Kavalali, PhD</td>
<td>UT Southwestern Medical Center</td>
<td>&quot;Mechanisms Underlying Quantal Neurotransmission in Central Synapses&quot;</td>
</tr>
<tr>
<td>04/11/2017</td>
<td>Jan-Marion Ramirez, PhD</td>
<td>University of Washington</td>
<td>&quot;Dissecting the Neuronal Mechanisms Controlling Breathing&quot;</td>
</tr>
<tr>
<td>09/07/2017</td>
<td>Fu-Ming Zhou, MD, PhD</td>
<td>University of Tennessee Health Science Center</td>
<td>&quot;Dopamine, Ion channels, Basal ganglia and Parkinson’s disease&quot;</td>
</tr>
<tr>
<td>10/03/2017</td>
<td>Karel Svoboda, PhD</td>
<td>Howard Hughes Medical Institute</td>
<td>&quot;The neural circuits underlying short-term memory&quot;</td>
</tr>
<tr>
<td>10/19/2017</td>
<td>Rita Cowell, PhD</td>
<td>Fellow/Chair of Neuroscience, Southern Research</td>
<td>“&quot;Southern Research and the Drug Discovery and Development Pipeline for Neurodegenerative Disorders&quot;</td>
</tr>
<tr>
<td>11/09/2017</td>
<td>Babette Fuss, PhD</td>
<td>Professor Virginia Commonwealth University</td>
<td>&quot;Extracellular cues as regulators of oligodendrocyte differentiation and (re) myelination&quot;</td>
</tr>
<tr>
<td>11/30/2017</td>
<td>Giorgio Ascoli, PhD</td>
<td>Krasnow Institute for Advanced Study</td>
<td>&quot;A periodic table of (hippocampal) neurons&quot;</td>
</tr>
<tr>
<td>Date</td>
<td>Faculty/Author Information</td>
<td>Title</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>-------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td></td>
</tr>
</tbody>
</table>
| 12/07/2017 | UAB Faculty: Ronald Lazar, PhD
Tika Benveniste, PhD
Michelle Gray, PhD
Sabine Huke, PhD
Farah Lubin, PhD
Lawrence Ver Hoef, MD
Lucas Pozzo-Miller, PhD
Lloyd J. Edwards, PhD | “New Scientific Dialogues – Matching basic science and applied neuroscience!” |
| 12/14/2017 | Nicholas Seyfried, PhD
Assistant Professor
Emory University | "Proteomics-driven Network Approaches for Biomarker Discovery in Alzheimer's Disease" |
Appendix F

BIOGRAPHICAL SKETCHES

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ronald M. Lazar, PhD, FAAN, FAHA</td>
<td>Evelyn K. McKnight Endowed Chair in Learning and Memory in Aging</td>
</tr>
</tbody>
</table>

**EDUCATION/TRAINING**

<table>
<thead>
<tr>
<th>Institution</th>
<th>Degree</th>
<th>Date</th>
<th>Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York University, New York, NY</td>
<td>BA</td>
<td>06/71</td>
<td>Psychology</td>
</tr>
<tr>
<td>Northeastern University, Boston, MA</td>
<td>MA</td>
<td>06/73</td>
<td>Psychology</td>
</tr>
<tr>
<td>Northeastern University, Boston, MA</td>
<td>PhD</td>
<td>05/77</td>
<td>Psychology</td>
</tr>
<tr>
<td>Memorial Sloan-Kettering Cancer Center</td>
<td>Fellow</td>
<td>06/83</td>
<td>Neuropsychology</td>
</tr>
</tbody>
</table>

**Positions**

1980-1984 Graduate Faculty, Neuropsychology and Learning Processes Programs, CUNY, NY
1980-1984 Assistant Professor of Psychology, Dept of Psychology, Queens College of CUNY, NY
1981-1983 Adjunct Attending Psychologist, Dept of Neurology, Memorial Sloan-Kettering Cancer Center, NY
1983-1984 Assistant Attending Psychologist, Dept of Psychiatry, New York Hospital, NY
1983-1984 Adj Assistant Professor of Psychology (Psychiatry), Cornell University Univ Medical College, NY
1983-1984 Assistant Attending Psychologist, Dept of Neurology, Memorial Sloan-Kettering Ctr, NY
1984-1993 Chief Psychologist and Director of Neuropsychological Services, Dept of Psychology, Kings County Hospital Center, Brooklyn, NY
1984-1993 Director, Neuropsychology Service, Dept of Neurology, State University Hospital of Brooklyn, NY
1984-1993 Assistant Professor of Neurology and Psychiatry, SUNY/Health Science Center at Brooklyn, NY
2003-2013 Professor of Clinical Neuropsychology, Depts of Neurology and Neurological Surgery (Tenured), College of Physicians & Surgeons, Columbia University, NY
1994-2017 Professional Neuropsychologist, Dept of Neurology, NY Presbyterian Hospital, NY
1994-2017 Director, Levine Cerebral Localization Laboratory, Stroke Division, Dept of Neurology, NY Neurological Institute, Columbia University Medical Center, New York, NY
2013-Pres Professor of Neuropsychology in Neurology and Neurological Surgery at the Columbia University Medical Center, NY
2017-Pres Evelyn F. McKnight Endowed Chair, Dept of Neurology, Univ of Alabama at Birmingham, Birmingham AL
2017-Pres Professor of Neurology (with Tenure), Dept of Neurology, Univ of Alabama at Birmingham, AL
2017-Pres Director, UAB McKnight Brain Institute, Dept of Neurology, Univ of Alabama at Birmingham, AL
2017-Pres Director, Neuropsychology Division, Dept of Neurology, Univ of Alabama at Birmingham
2017-Pres Senior Scientist, UAB Center for Exercise Medicine, Univ of Alabama at Birmingham
2017-Pres Senior Scientist, UAB Comprehensive Neuroscience Center, Univ of Alabama at Birmingham
2017-Pres Senior Scientist, Center for Neurodegeneration and Experimental Therapeutics at UAB

Honors, Awards, and Advisory Committees
Honors:
Psi Chi / Robert Formica Memorial Award, Department of Psychology, New York University, 1971
Andrew W Mellon Fellow, Dept of Neurology, Memorial Sloan-Kettering Cancer Ctr, 1982-1983
Sigma Xi, 1980
Fellow, American Psychological Association, 2000
Fellow, American Heart Association, 2005
Fellow, American Academy of Neurology, 2011
Fellow, American Neurological Association, 2012
Evelyn K. McKnight Endowed Chair in Learning and Memory in Aging, 2017

Federal Government Advisory Committees
2017 - Pres Fogarty Global Brain Disorders Study Section ZRG1 BDCN-N (55) R, CSR, NIH
2013 – 2015 Agency for Healthcare Quality and Research (AHRQ) US Dept of Health and Human Services, Evidence-based Practice Center Program, Evidence-based Practice Center Program
2009 – 2015 Chartered Member, Acute Neural Injury and Epilepsy (ANIE) Study Section, Center for Scientific Review (CSR), NIH
2002 – 2010 Permanent Member, Circulatory System Devices Advisory Panel, Medical Devices Advisory Committee, Center for Devices and Radiological Health, US FDA
2009 – 2010 ZRG1 BDCN-L (95) S Competitive Revisions; Clinical Neuroscience and Disease, NIH.

Other Advisory Committees
1995 – 2017 Division 40 (Society for Clinical Neuropsychology), American Psychological Assn
National Co-Chair, Hospital Staff Membership Task Force
Practice Advisory Committee
2014 – 2016 National Institutes of Neurological Disorders and Stroke, NIH
StrokeNet Recovery Working Group

Peer-Review Panels
2011 – Pres Editorial Review Board, Stroke
Publications (2017 Peer-Review only)


Grants/Contracts (2017-present)

Present Support
1 R01 NS097876-01A1 (Lazar, Marshall, Liebeskind, Connolly) 4/1/2017 – 3/31/2022
NIH/NINDS
Carotid Revascularization and Medical Management for Asymptomatic Carotid Stenosis Trial - Hemodynamics (CREST-H) The goal of this study is to determine whether patients with asymptomatic carotid stenosis who have cerebral hemodynamic compromise and cognitive impairment will improve after revascularization.

1 U01 NS080168-01A1 (Brott) 7/1/2013 – 6/30/2021
NIH/NINDS
CREST-2 Clinical Coordinating Center.
This goal of this project is to assess if contemporary medical therapy is not inferior to contemporary revascularization (carotid endarterectomy or carotid angioplasty/stenting) plus best medical therapy in patients with ≥ 70% asymptomatic carotid stenosis. The cognitive aim is to assess whether medical therapy alone is non-inferior to revascularization to maintain the level of cognitive function at 4 years of follow-up.
Role: Co-I and Cognitive Core PI.

1 R21NS096972-01A1 (Lazar/Kodali) 8/1/2016 – 7/31/2018
NIH/NINDS
Cerebral Hemodynamics and Neurocognition in Severe Aortic Valve Disease.
The goal of this project is to determine whether severe aortic stenosis is associated with impaired cerebral hemodynamics and, in turn, impaired cognition, and whether valve replacement is associated with improved cerebral hemodynamics and improved cognition.

1 R21 DK104105-01A1 (Walker) 7/1/2015 – 6/30/2018
NIH/NIDDK
Primary Hyperparathyroidism: Neurocognitive Features.
The goal of this project is to determine whether primary hyperparathyroidism results in reduced cerebral vasomotor reactivity (VMR) that contributes to cognitive dysfunction, and whether reduced VMR can be reversed with surgical intervention.
Role: Co-I

1 R01 NS076277-01A1 (Lazar/Marshall) 4/1/2012-3/31/2018
NIH/NINDS
This project studies the relationship of four measures of cerebral hemodynamics and cognitive function in patients with asymptomatic carotid artery disease.

Past Support
5 U54 NS081765-02 (Ogedegbe/Williams) 10/1/2012 – 9/30/2017
NIH/NINDS
The goal of this grant is to establish a Center for Stroke Disparities Solutions as a consortium between 3 academic institutions (NYU School of Medicine; Columbia University Medical Center; and SUNY Downstate Medical School); 5 stroke centers and a practice-based research network of primary care practices within New York City’s (NYC ) Health and Hospital Corporation; the Research Division of the Hebrew Home at Riverdale and the Visiting Nurse Service of NY. The target communities are Black and Hispanic residents of NYC.
Role: Co-I

1 U10NS086728-01 (Marshall) 9/30/2013 – 5/31/2017
NIH/NINDS
New York Stroke Trials Network of Columbia and Cornell (NYCCSTN)
The goal of this program is to establish an infrastructure that would maximize stroke clinical trial enrollment in studies targeted to acute treatment, primary and secondary stroke prevention and stroke recovery.
Role: Co-I and Rehabilitation Core Leader
BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steven N. Austad</td>
<td>Assistant Professor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INSTITUTION/LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uni of CA, Los Angeles</td>
<td>B.A.</td>
<td>1969</td>
<td>English Literature</td>
</tr>
<tr>
<td>CA State Uni, Northridge</td>
<td>B.A.</td>
<td>1976</td>
<td>Biology</td>
</tr>
<tr>
<td>Purdue University</td>
<td>PhD</td>
<td>1981</td>
<td>Biological Sciences</td>
</tr>
</tbody>
</table>

Positions
2014 – present: Distinguished Professor & Chair, Department of Biology, University of Alabama at Birmingham (UAB), Birmingham, AL

- Director. UAB Nathan Shock Center of Excellence in the Basic Biology of Aging.
- Associate Director. UAB Comprehensive Center for Healthy Aging.
- Senior Scientist. UAB Nutrition Obesity Research Center.
- Senior Scientist. UAB Center for Exercise Medicine.
- Senior Scientist. UAB Diabetes Research Center
- Member. UAB McKnight Brain Institute.
- Steering Committee Member. UAB Mentored Experiences in Research, Instruction, and Teaching (MERIT) Program.
- Scientist. UAB Alzheimer’s Disease Center.
- Executive Committee Member. UAB Comprehensive Neuroscience Center.
- Investigator, McKnight Brain Institute

2014 – present: **Scientific Director**, American Federation for Aging Research, New York City, NY
- **Co-Director**, Nathan Shock Centers Coordinating Center.

2004 – 2013: **Professor**, University of Texas Health Science Center at San Antonio, Dept. of Cellular & Structural Biology & Barshop Institute for Longevity & Aging Studies

- **Interim Director**, Barshop Institute for Longevity & Aging Studies (2012 – 2013)
- **Director**, Biology of Aging Training Grant (2007-2013)
- **Director**, Comparative Aging Core, Nathan Shock Center of Excellence in the Biology of Aging (2010 – 2013)
- **Co-leader**, Biology of Aging Graduate Track (2006-2011)

1993 - 2013: **Affiliate Professor**, University of Washington School of Medicine, Seattle, Washington. Department of Pathology.
1997 - 2004: **Professor**, University of Idaho. Department of Biological Sciences
1993 - 1997: **Associate Professor of Zoology**, University of Idaho. Department of Biological Sciences.
1990 - 1992: **Associate Professor**, Harvard University. Department of Organismic & Evolutionary Biology.
1986 - 1990: **Assistant Professor.** Harvard University. Department of Organismic & Evolutionary Biology.

1984 - 1986: **Visiting Research Assistant Professor.** University of New Mexico. Department of Biology.

1981 - 1983: **Research Associate & Visiting Instructor.** Purdue University. Department of Biological Sciences.


**HONORS AND AWARDS:**

2016: Elected Fellow, American Association for the Advancement of Science


2012: Huck Institutes of Life Sciences Distinguished Lecture. Pennsylvania State University, State College, PA


2008: Outstanding Alumnus Award, Purdue University, Dept. of Biological Sciences, West Lafayette, Indiana.

2008: Robert R. Kohn Memorial Lecture. Case Western Reserve University, Cleveland, OH

2008: Distinguished Lecturer/Visiting Scholar, Ithaca College, Institute of Gerontology, Ithaca, NY

- Hayflick Lecture. University of Alabama Birmingham, Department of Nutrition Sciences, Clinical Nutrition Research Center, Birmingham, AL


- William Darden Endowed Lecture. University of Alabama, Tuscaloosa, Alabama

2001: University of Idaho Interfraternity Council/Panhellenic Council Faculty Member of the Year.


1999: Ellison Medical Foundation Senior Scholar Award


1997: Phi Kappa Phi/University of Idaho Alumni Association Distinguished Faculty Award.

1994: Fifth Nathan A. Shock Award, Gerontological Research Center of the National Institute on Aging.

1994: Winner (with John P. Phelan) Geron Corporation - Samuel Goldstein Distinguished Publication Award, Journals of Gerontology: Biological Science

1993: Elected Member, New York Academy of Sciences, New York, NY
118

1993: Elected Fellow, Gerontological Society of America: Biological Sciences Section, Washington, DC

Publications 2017


BIOGRAPHICAL SKETCH

NAME
Etty (Tika) Benveniste

POSITION TITLE
Assistant Professor

EDUCATION/TRAINING

<table>
<thead>
<tr>
<th>INSTITUTION/LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA State Uni, Chico, CA</td>
<td>B.A.</td>
<td>1978</td>
<td>Biological Sciences</td>
</tr>
<tr>
<td>Uni of CA, Los Angeles, CA</td>
<td>PhD</td>
<td>1983</td>
<td>Immunology</td>
</tr>
<tr>
<td>Uni of CA, Los Angeles, CA</td>
<td>Post-doc</td>
<td>1986</td>
<td>Neurology</td>
</tr>
</tbody>
</table>

Positions

Academic Appointments
1978 – 1979 Research Biologist, National Institutes of Health, Bethesda, Maryland
1986 – 1988 Assistant Professor, Department of Neurology, University of Alabama at Birmingham
1987 – present Member, Graduate Faculty, Graduate Study in Cellular and Molecular Biology
   Graduate Study in Neuroscience, Graduate Study in Cell Biology, UAB
1988 – present Senior Scientist, Center for AIDS Research, University of Alabama at Birmingham
1988 – 1992 Assistant Professor, Departments of Neurology and Cell Biology, UAB
1992 – 1995 Associate Professor, Department of Cell Biology, UAB
1993 – present Senior Scientist, UAB Arthritis Center
1995 – present Professor, Departments of Cell Biology, Physiology and Biophysics, Neurology, and Neurobiology, UAB
1995 – 2000 Director, Graduate Program, Department of Cell Biology, UAB
1997 – 2000 Vice-Chairman, Department of Cell Biology, UAB
1999 – 2001 Founding Associate Dean for Postdoctoral Education, Graduate School, UAB
2000 – 2011 Chair, Department of Cell Biology, UAB
2006 – 2010 Co-Director, HHMI Med-Grad Fellowship Program, UAB
2006 – present Associate Director, Basic Sciences, Comprehensive Cancer Center, UAB
2007 – 2011 Co-Director, Cancer Cell Biology Program, Comprehensive Cancer Center, UAB
2008 – 2015 Alma B. Maxwell UAHSF Endowed Chair, UAB
2012 – 2015 Founding Chair, Department of Cell, Developmental and Integrative Biology, UAB
2014 – 2015 Interim Senior Associate Dean for Research Administration and Development, UAB
2015 – present Co-Director, UAB Multiple Sclerosis Center, UAB
2015 – present Senior Associate Dean for Research Administration, UAB
2016 – present Charlene A. Jones Endowed Chair in Neuroimmunology, UAB
2017 – present Associate Vice President for Medicine and Basic Sciences
2017 – present, Investigator, McKnight Brain Institute

Honors, Awards, and Advisory Committees
Chair: SOM Executive Risk Oversight Committee, 2015-
Chair: SOM Master Space Planning Committee, 2016-
Member: Science and Technology Honors Program Leadership Council, 2016-
Co-Chair: Search Committee, Director of the Comprehensive Cancer Center, 2016-2017
Member: Search Committee, Vice President for Research, 2016
Chair: Internal Advisory Board, UAB Women’s Reproductive Health Research (WRHR) Program, 2016-
Member: Search Committee, Chair of Neurobiology, 2017
Member: Internal Advisory Board, Institute for Cancer Outcomes and Survivorship, 2017

**Professional Societies**

Past-President, American Society of Neurochemistry, 2015-2017

Member: Council of Faculty and Academic Societies, Association of American Medical Colleges, 2013-

Member: Council of Faculty and Academic Societies, Administrative Council, 2013-

Member: AAMC Distinguished Research Award Selection Committee, 2014, 2015

Member: Americas Committee for Treatment and Research in Multiple Sclerosis (ACTRIMS) Program Committee Advisory Board, 2017-

**Publications 2017**


**Manuscripts in preparation**


BIOGRAPHICAL SKETCH

NAME | POSITION TITLE
---|---
Mark Bolding, PhD | Associate Professor

Current Position:
Associate Professor
Division of Advanced Medical Imaging
Department of Radiology
Director, Civitan International Neuroimaging Laboratory
mbolding@uabmc.edu
205-975-4060

Areas of interest:
Vision - visual behavior and visual cognition; psychiatry – schizophrenia; imaging - MRI and neuroimaging

CURRENT

R01MH102951 (Lahti) 04/01/14-01/31/19 2.4 calendar
NIMH/NIH $403,512

Glutamate, Brain Connectivity and Duration of Untreated Psychosis
The primary aim of the research is to better understand the relationship between duration of psychosis, metabolites measured using MRS, and measures of structural and functional connectivity.

90IF0104-01-00 (DeCarlo) 09/30/15-09/29/18 1.44 calendar
DHHS/ACL/NIDDLR $199,909

Prognostic Indicators for Reading in Pediatric Vision Impairment
This longitudinal study will young children with vision impairment to evaluate both top-down and bottom-up processes to determine factors contributing to reading readiness.

1U01EY025858-01A1 (Visscher) 05/01/16-04/30/20 1.2 calendar
NEI/NIH $417,330

Changes in Visual Cortical Connectivity Following Central Visual Field Loss
The goal of this project is to identify the neuroplastic mechanisms that allow patients with macular degeneration to use peripheral vision for tasks, such as reading and recognizing faces, for which people with healthy vision use the macula.

1R01NS094743-01A1 (Ver Hoef) 08/01/16-06/30/21 0.6 calendar
NINDS/NIH $417,378
Understanding Hippocampal Internal Architecture in Human Temporal Lobe Epilepsy - From MRI to Epigenetics
This project will assess the performance of a novel high-resolution MRI technique on a common
scanner compared with a special ultra high field research scanner to visualize the internal structure of parts of the brain involved in epilepsy.

1632881 RII Track-2 FEC (Foulger) 09/01/16 – 08/31/20 1.2 calendar
NSF $500,000

The Creation of Next-Generation Tools for Neuroscience - Noninvasive Radioluminescence Approaches to Optogenetics
This is a collaboration between Clemson University, the University of Alabama Birmingham, the University of New Mexico, and the University of South Carolina. The aim of the project is to extend the uses of the experimental method of optogenetics, which, since its introduction in 2005, has had a transformative impact on neurobiology. This method allows experimenters to activate individual neurons or groups of neurons, with high levels of spatial and temporal control, by flashing light on them.

UH3NS100553 (Walker) 09/01/16 – 06/30/21 1.2 calendar
NIH $980,858

Noninvasive Biomarkers to Advance Emerging DBS Electrode Technologies in Parkinson’s Disease
The goal of this research is to use minimally invasive, patient-specific cortical physiology elicited by DBS to guide the use of emerging segmented (“directional”) DBS electrode technology in patients with Parkinson’s disease.
Role: Co-Investigator

No Number (Visscher) 10/16/14 – 10/15/17 0.6 calendar
McKnight Brain Research Foundation $241,399

Evelyn F. McKnight Neuroimaging Core and Brain Aging Registry
This project will be to support the establishment of the neuroimaging core/brain aging registry

PENDING

R01CA209915 (Bolding) 07/01/16— 2.4 calendar
06/30/20
NCI/NIH $250,000

MRI-Guided Ultrasound Triggered Drug Delivery System for Breast Cancer Therapy
The primary aim of the research is to develop and test a novel drug delivery platform based on using MRI guided focused ultrasound to activate microencapsulated drugs.
12194920 (Bolding) 04/01/17–03/31/19 2.4 calendar
NEI/NIH $275,000

**High Field Tagged MR Imaging of Extraocular Muscles and Associated Tissues**
The primary aim of the research is to develop MR tagging techniques on a 7 Tesla scanner to directly visualize interactions between eye muscles and “pulleys” with very high spatial and temporal resolution.

12464627 (Kesterson) 10/01/18–09/30/21 0.6 calendar
Department of Defense $525,000

**Translational Animal Models of NF1 Patient Mutations**
The goal of this project is to create new genetically engineered mice that can be used to study Neurofibromatosis type 1 (NF1), a genetic disorder causing one of the most common tumor syndromes affecting the nervous system.

S10OD025217 (Bolding) 02/01/18–01/31/19 0.0 calendar
NIH $299,000

**UAB Bruker BioSpec 9.4T Upgrade**
The Magnetic Resonance Imaging (MRI) enabled by the Bruker BioSpec 9.4T MRI scanner provides cost-effective, non-invasive, real-time data in important and relevant animal models of human disease. The upgrade will allow the scanner to remain in operation so that important biological questions can be answered and new therapies can be quickly evaluated.

12502904 (Bolding) 07/01/18–06/30/22 2.4 calendar
NIH $299,000

**Noninvasive Localized Drug Delivery for Neuromodulation with High Spatial and Temporal Precision**
The goal of this project is to develop noninvasive methods for temporally and spatially specific alteration of brain function that can be used in the laboratory and clinic.

**OVERLAP:**
No overlap. If all pending applications are funded, the percent effort on funded projects will be adjusted to maintain NIH support at or below 12 calendar months.
BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virginia G. Wadley Bradley</td>
<td>Professor</td>
</tr>
</tbody>
</table>

EDUCATION/TRAINING

<table>
<thead>
<tr>
<th>INSTITUTION AND LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Alabama at Birmingham</td>
<td>B.S.</td>
<td>1991</td>
<td>Psychology and English Medical Psychology Clinical Psychology</td>
</tr>
<tr>
<td>University of Alabama at Birmingham</td>
<td>M.A., PhD</td>
<td>1994, 1997</td>
<td></td>
</tr>
<tr>
<td>Duke University Medical Center</td>
<td>Internship</td>
<td>1996-1997</td>
<td></td>
</tr>
</tbody>
</table>

Positions

Postdoctoral Training

1997 - 1998 Clinical Associate and Postdoctoral Fellow  Duke University Medical Center
Department of Psychiatry and Behavioral Sciences
Division of Behavioral Medicine
Supervisor: James Blumenthal, PhD

1998 - 1999 Instructor and Postdoctoral Fellow  University of Alabama at Birmingham
School of Medicine, Department of Neurology
Division of Neuropsychology
Supervisor: Daniel Marson, PhD

2002 - 2009 Scientist, UAB Alzheimer’s Disease Research Center

2000 - 2009 Senior Scientist (2015), UAB Comprehensive Center for Healthy Aging (formerly Center for Aging)

2000 - 2005 Research Assistant Professor, School of Social and Behavioral Sciences, Department of Psychology, University of Alabama at Birmingham, Birmingham, AL
1999 - 2007 Assistant Director, UAB Edward R. Roybal Center for Translational Research on Aging and Mobility (formerly Center for Research on Applied Gerontology), University of Alabama at Birmingham, Birmingham, AL

1998 - 1999 Instructor, School of Medicine, Department of Neurology, Division of Neuropsychology, University of Alabama at Birmingham, Birmingham, AL

2015 – present Investigator, McKnight Brain Institute

**Honors, Awards, and Advisory Committees**

1989 Harry S. Truman Scholar for state of Alabama
1990 Outstanding Student, UAB Department of Psychology
1990 Dean's Award, Outstanding Undergraduate in Social and Behavioral Sciences, UAB
1993 - 1994 National Institutes of Health Predoctoral Trainee, Spain Rehabilitation Center, UAB
1994 - 1995 Merit Fellow, UAB Department of Medical Psychology
1996 Outstanding Graduate Student, UAB Department of Medical Psychology
1996 Dean's Award, Outstanding Graduate Student in Social and Behavioral Sciences, UAB

2003 - 2007 Awardee, NIH Loan Repayment Program
2006 Winner, UAB Center for Aging Abstract Competition and Annual Meeting (one of four selected for oral presentation and cash prize)
2010 - 2011 Research Excellence Award, UAB Department of Medicine (cash award for professional development)
2011 - 2012 Research Excellence Award, UAB Department of Medicine (cash award for professional development)
2012 Invited participant, White House Roundtable, Federal Motor Carrier Safety Administration, U.S. Department of Transportation
2012 Winner, UAB Center for Aging Oral Abstract Competition and Annual Meeting (one of four selected for oral presentation and cash prize)
2013 American Psychological Association Nominee to National Heart, Lung and Blood Institute (NHLBI) advisory board
2013 Invited Speaker, Alzheimer’s Association Research Roundtable
2012 - 2013 Research Excellence Award, UAB Department of Medicine (cash award for professional development)
2013 - 2014 Research Excellence Award, UAB Department of Medicine (cash award for professional development)
2014 - 2015 Research Excellence Award, UAB Department of Medicine (cash award for professional development)

**Publications** (2017)


**Manuscripts submitted but not yet accepted**


BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michael Brenner</td>
<td>Emeritus Professor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EDUCATION/TRAINING</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvard College, Cambridge, MA</td>
<td>A.B.</td>
<td>1965</td>
<td>Biochemical Sciences</td>
</tr>
<tr>
<td>Churchill College, Cambridge, En</td>
<td>PhD</td>
<td>1966</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>Uni CA Berkeley, CA</td>
<td></td>
<td>1970</td>
<td></td>
</tr>
</tbody>
</table>

Positions
2015-present Emeritus Professor, Department of Neurobiology, UAB
2007-2015 Professor Department of Neurobiology, UAB
2006 – present Investigator, McKnight Brain Institute
1999-2007 Associate Professor, Department of Neurobiology, UAB
1992-1998 Research Scientist, National Institute of Neurological Disorders and (“Special Expert”) Stroke, NIH, Bethesda, MD, Laboratory of Dr. John Hallenbeck
1987-92 Research Scientist, National Institute of Neurological Disorders and (“Special Expert”) Stroke, NIH, Bethesda, MD., Laboratory of Dr. Ernst Freese
1985-87 Research Scientist, National Institute of Diabetes, Digestive and Kidney (“Expert”) Diseases, NIH, Bethesda, MD, Laboratory of Dr. Jun-ichi Tomizawa
1980-84 Associate Professor, Temple Univ. Medical School, Philadelphia, PA
1979-80 Visiting Assistant Professor, Boston College, Chestnut Hill, MA
1979-80 Research Associate, Harvard University, Cambridge, MA
1976-79 Associate Professor, Harvard University, Cambridge, MA
1972-76 Assistant Professor, Harvard University, Cambridge, MA, Department of Biology

Honors, Awards, and Advisory Committees
Graduated Harvard College Magna cum Laude (1965)
United States Churchill Foundation Fellowship for year at Cambridge University, England (1966)
United States Public Health Service Training Grant (1966-1970)
American Cancer Society Postdoctoral Fellowship (1970-71)
National Institutes of Health Award of Merit (1993)
Grupo Carso Award: biennial award by the Fundación Mexicana para la Salud (Mexican Foundation for Health) for research on organ and tissue transplantation (1999)
Moore Award for best paper on clinico-pathologic correlation, annual meeting of the American Academy of Neuropathology (2000)
Paper in Nature Genetics selected for commentary (publication #59, 2001)
Outstanding poster award (selected for an oral presentation), American Society of Neurochemistry annual meeting (2003)
Paper in Annals of Neurology selected for commentary (publication #74, 2005)
Paper in Glia featured as cover art (publication #79, 2006)
Paper in Movement Disorders featured as cover art (publication #82, 2008)
Graduate Dean’s Award for Excellence in Mentorship (2012)
Patent:
United States Patent Number 5,627,047, “Astrocyte-Specific Transcription of Human Genes.” granted 6 May 1997, covers the use of the human GFAP regulatory sequences for targeting expression of genes to astrocytes in culture or in transgenic animals. Licensing agreements have been executed with several biotechnology companies.

Publications 2017

Manuscripts in preparation

Manuscripts in preparation
2. Olsen, M., Messing, A., and Brenner, M. Role of AP-1 in the Injury Response of the GFAP Promoter

Books and Book Chapters
BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cynthia J. Brown</td>
<td>Professor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EDUCATION/TRAINING</th>
<th>INSTITUTION/LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>East Carolina Uni, Greenville, NC</td>
<td>B.S.</td>
<td>1982</td>
<td>Physical Therapy</td>
</tr>
<tr>
<td></td>
<td>North Carolina St, Raleigh, NC</td>
<td>MD</td>
<td>1991</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Uni ov North Carolina, Chapel Hill</td>
<td>M.S.</td>
<td>1996</td>
<td>Public Health</td>
</tr>
<tr>
<td></td>
<td>UAB</td>
<td></td>
<td>2006</td>
<td></td>
</tr>
</tbody>
</table>

Positions

- 2000 – 2003 Staff Physician, St. Mary’s Hospital Walk-in Clinic, Naugatuck, CT.
- 2003 – 2008 Geriatric Program Consultant, UAB Hospital, Birmingham, Alabama
- 2003 – present Investigator, Birmingham/Atlanta VA Geriatric Research, Education and Clinical Center (GRECC)
- 2003 – present Medical Director, Birmingham/Atlanta GRECC Fall Prevention and Mobility Clinic
- 2003 – present Staff Physician, UAB Hospital, UAB Highlands and the Veterans Affairs Medical Center, Birmingham, Alabama
- 2008 – 2013 Quality Improvement Director, Acute Care for Elders (ACE) Unit, UAB Highlands, Birmingham, Alabama
- 2017 – present Investigator, McKnight Brain Institute

Honors, Awards, and Advisory Committees

- 2007 – 2017 Listed in Best Doctors in America – Birmingham
- 2016 – 2017 Selected for the Hedwig van Ameringen Executive Leadership in Academic Medicine (ELAM) Program for Women
- 2016 Selected as Top Reviewer for the Annals of Internal Medicine
- 2017 Graduate School Dean’s Award for Excellence in Mentorship, UAB, Birmingham Alabama

Publications 2017


Manuscripts in preparation
Kennedy RE, Williams CP, Sawyer P, Lo AX, Connelly K, Nassel A, Brown CJ. Life-space Predicts Healthcare Utilization in Community-Dwelling Older Adults (Journal of Aging and Health)
BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jeremy J. Day</td>
<td>Assistant Professor</td>
</tr>
</tbody>
</table>

EDUCATION/TRAINING

<table>
<thead>
<tr>
<th>INSTITUTION AND LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auburn University</td>
<td>B.A.</td>
<td>2000-2003</td>
<td>Psychology</td>
</tr>
<tr>
<td>University of North Carolina at Chapel Hill</td>
<td>M.A.</td>
<td>2004-2006</td>
<td>Psychology</td>
</tr>
<tr>
<td>University of North Carolina at Chapel Hill</td>
<td>PhD</td>
<td>2006-2009</td>
<td>Psychology</td>
</tr>
<tr>
<td>University of Alabama at Birmingham</td>
<td></td>
<td>2009-2014</td>
<td>Neurobiology</td>
</tr>
</tbody>
</table>

Positions

2016-present Interim Associate Director, Civitan International Research Center UAB
2016-present Scientist, Alzheimer’s Disease Center UAB
2015-present Associate Scientist, Civitan International Research Center UAB
2014-present Graduate Faculty UAB
2014-present Assistant Professor, Dept. of Neurobiology (Primary) UAB
2014-present Assistant Professor, Dept. of Genetics (Secondary) UAB
2014-present Assistant Professor, Dept. of CDIB (Secondary) UAB
2014-present Assistant Professor, Dept. of Psychology (Secondary) UAB
2014-present Investigator, McKnight Brain Institute UAB

Honors, Awards, and Advisory Committees

Faculty
2016 Pittman Scholar, UAB School of Medicine
2015 Avenir Award, National Institute on Drug Abuse
2015 Early Career Travel Award, American College on Neuropsychopharmacology

Reviewer, grant proposals
2015 Parkinson’s Disease Society of the United Kingdom, ad hoc reviewer
2015 National Science Foundation CAREER Awards, ad hoc reviewer
2015 NIH/NIDA Scientific Review Group ZDA1 JXR-G (16) R
2016 NIH/NIDA Scientific Review Group ZDA1 SXM-M (13) S

Postdoctoral Training
2013-2014 NIH-NIDA Pathway to Independence Award
2010-2013 NIH-NIDA National Research Service Award
2012 Poster Award, Winter Conference on Brain Research
2011 Travel Award, NIDA Frontiers in Addiction Research Mini-convention
2011 1st place, UAB Dept. of Neurobiology Retreat Postdoctoral Oral Presentation
2010 Scholars Award, UAB Office of Postdoctoral Education
2010 Faculty of 1000 Associate Faculty Member

Graduate Education
2006-2009 NIDA National Research Service Award
2009 Travel Award, Gordon Research Conference on Catecholamines
2009 Travel Award, Gordon Research Conference: Graduate Research Seminar on Catecholamines
2009 Irwin J. Kopin “Young Investigator” Award, Honorable Mention
2008 Poster Award, 12th Conference on In Vivo Methods in Neuroscience
2008 Transportation Grant, University of North Carolina Graduate School
2007 Travel Award, Gordon Research Conference: Graduate Research Seminar on Catecholamines
2007 Teaching Fellowship, University of North Carolina Graduate School
2006 Poster Award, 11th Conference on In Vivo Methods in Neuroscience
2004-2006 NIH Pre-doctoral Training Fellowship (T32DA007244)

Undergraduate Education
2003 Summa Cum Laude, Auburn University
2003 Undergraduate Research Fellowship, Auburn University

Publications (2017)
   *Corresponding authors

Manuscripts in review/revision
BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lynn Dobrunz</td>
<td>Professor</td>
</tr>
</tbody>
</table>

EDUCATION/TRAINING

<table>
<thead>
<tr>
<th>INSTITUTION/LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvard University, Cambridge, MA</td>
<td>B.S.</td>
<td>1988</td>
<td>Engineering Science</td>
</tr>
<tr>
<td>Johns Hopkins, Baltimore, MD</td>
<td>PhD</td>
<td>1994</td>
<td>Biomedical Engineering</td>
</tr>
<tr>
<td>Salk Institute, La Jolla, CA</td>
<td>Postdoc</td>
<td>1999</td>
<td>Molecular Neurobiology</td>
</tr>
</tbody>
</table>

Positions

2014-present  Associate Director, UAB Comprehensive Neurosciences Center
2008-present  Associate Professor, Department of Neurobiology, University of Alabama at Birmingham, Birmingham, AL.
2012-present  Secondary appointment, UAB Department of Cell, Developmental and Integrative Biology
2006-present  Member, UAB Civitan International Research Center
2006-present  Member, UAB Comprehensive Neurosciences Center
2006-present  Investigator, McKnight Brain Institute
2005-present  Member, UAB Center for Aging
2002-2012     Secondary appointment, UAB Department of Physiology and Biophysics
1999-2008     Assistant Professor, Department of Neurobiology, University of Alabama at Birmingham

Honors, Awards, and Advisory Committees

1988          Magna Cum Laude, Harvard University
1988          Phi Beta Kappa
1988-1989     National Science Foundation Award for Creativity in Engineering
1988-1989     Able Wolman Fellowship, The Johns Hopkins School of Medicine
1999-2000     Howard Hughes Medical Institute Career Development Award
2010-2014     Member, NIH MNPS Study Section
2014          Member, NIH Committee of Visitors
2014-2017     Member, NIH BRAIN Initiative Review Panel
2015          Member, NIH Conte Center Review Panel
BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lloyd J. Edwards</td>
<td>Professor</td>
</tr>
</tbody>
</table>

EDUCATION/TRAINING

<table>
<thead>
<tr>
<th>INSTITUTION/LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morehouse College, Atlanta, GA</td>
<td>B.A.</td>
<td>1980</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Uni of Maryland, College Park, MA</td>
<td>M.A.</td>
<td>1982</td>
<td>Mathematical Statistics</td>
</tr>
<tr>
<td>Uni of NC, Chapel Hill, NC</td>
<td>PhD</td>
<td>1990</td>
<td>Biostatistics</td>
</tr>
</tbody>
</table>

Positions

August 2017 Present, Professor and Chair - Department of Biostatistics, UAB
2017-present Investigator, McKnight Brain Institute
2000 – 2017 Associate Professor - Department of Biostatistics University of North Carolina, Chapel Hill Chapel Hill, North Carolina
1998 - 2000 - Associate Professor - Department of Community and Family Medicine / Division of Biometry Head of Department of Medicine Biostatistics Unit Duke University Medical Center Durham, North Carolina
1998 Associate Professor, Dept Biostatistics, Uni of NC, Chapel Hill, NC
1991 – 1998 Assistant Professor - Department of Biostatistics, University of North Carolina - Chapel Hill Chapel Hill, North Carolina
1990 – 1991 Visiting Assistant Professor - Department of Biostatistics, University of North Carolina - Chapel Hill Chapel Hill, North Carolina
1986 – 1990 Graduate Research Assistant, University of North Carolina - Chapel Hill, Chapel Hill, North Carolina

Organizations/Honors

Member, UNC IRB Scientific Review Committee (August 2012 - May 2017)
Member of Clinical Research Committee of the Cystic Fibrosis Foundation (Oct 2011 - June 2017)

Publications 2017

BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gamlin, Paul Douglas Roger</td>
<td>Professor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INSTITUTION AND LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Cambridge, England</td>
<td>B.A.</td>
<td>1978</td>
<td>Zoology</td>
</tr>
<tr>
<td>State Uni of New York, Stony Brook, NY</td>
<td>PhD</td>
<td>1984</td>
<td>Neurobiology</td>
</tr>
</tbody>
</table>

**Positions**
2013 - present Professor, Department of Ophthalmology, University of Alabama at Birmingham
2013-present Investigator, McKnight Brain Institute
1997 – present Professor, Departments of Biomedical Engineering, Psychology, and Neurobiology, University of Alabama at Birmingham
1996 - 2013 Professor, Department of Vision Sciences, University of Alabama at Birmingham
2003 - 2013 Director, UAB Center for the Development of Functional Imaging
2004 - 2012 Chairman, Department of Vision Sciences
2001 - 2006 Director, UAB Neuroscience Graduate Program
2002 - 2003 Associate Director, UAB Center for the Development of Functional Imaging
1995 - 1999 Director, UAB Vision Science Research Center (Center designated as University-Wide in 1996)
1995 - 1996 Scientist, Neurobiology Research Center, University of Alabama at Birmingham
1992 - 1996 Associate Professor, Departments of Physiological Optics and Psychology; Scientist, Vision Science Research Center, University of Alabama at Birmingham
1989 - 1992 Assistant Professor, Departments of Physiological Optics and Psychology; Associate Scientist, Vision Science Research Center, UAB
1989 Research Assistant Professor, Department of Physiological Optics, School of Optometry, University of Alabama at Birmingham
1984 - 1986 Research Associate, Neurosciences Program, UAB

**Honors, Awards, and Advisory Committees**
1984 Sigma Xi Award for Achievement in Research
1993 American Optometric Student Asso Award for Excellence in Basic Science Teaching
1997 UAB President’s Award for Excellence in Teaching
2009 Irene E. Loewenfeld Lecturer
2014 RPB Walt and Lilly Disney Award for Amblyopia Research

**Publications (2017)**

**Abstracts**


Grant Support

**ACTIVE RESEARCH GRANTS:**

**Multi-PI: Gamlin, PD Corresponding PI: (Do, MT - Harvard, PI):** “Intrinsically photosensitive retinal ganglion cells and their central projections”. NIH/NEI Research Grant. 12/01/2015-11/31/2020. Total Costs: $3,298,460. This project proposes to study the intrinsically photosensitive retinal ganglion cells in non-human primates as well as their central targets, the suprachiasmatic nucleus and pretectal olivary nucleus.

**Multi-PI: Gamlin, PD (May PM UMMC Corresponding):** “Midbrain Circuitry for Neuronal Control of Gaze“. NIH/NEI Research Grant. 04/01/2015 - 03/31/2019. Total Costs: $1,011,103. This project proposes to investigate the specific roles of two separate populations of premotor neurons in controlling vergence and ocular accommodation in non-human primates.

**Multi-PI: Gamlin, PD (Kara P MUSC Corresponding):** “RII Track-2 FEC: Bridging Cognitive Science and Neuroscience Using Innovative Imaging Technologies” NSF Research Infrastructure Grant. 8/1/2015 - 7/31/2019. Total costs $1,600,966. This grant supports the purchase of a multiphoton microscope and 680-1300 nm ultrafast laser. In addition, it supports under-represented individuals at both the undergraduate and postgraduate level for the purpose of workforce development.

**PI: Gamlin, PD:** “Research to Prevent Blindness Disney Award for Amblyopia Research” Research to prevent Blindness Award. 6/1/2014 - 5/31/2019. Total costs: $100,000. This project is studying the role of the cerebellum in controlling binocular alignment.

**Co-PI: Gamlin, PD: (PI Pittler SJ) “UAB Vision Science Research Center”. NIH/NEI Core Grant. 8/1/2016 - 7/31/2021. Total costs: $2,940,000. This Core grant supports NEI-funded and other vision-related investigators at UAB.

**Co-Investigator: Gamlin, PD: (PI Boye SE, University of Florida) “Developing Efficient AAV Vectors For Photoreceptor Targeting Via The Vitreous” NIH/NEI Research Grant 6/01/2014-5/31/2019. Total subcontract costs: $415,000. This project is testing AAV vectors and delivery routes for targeting expression to non-human primate photoreceptors.

**Co-Investigator: Gamlin, PD: (PI Boye SE, University of Florida) “Developing a dual AAV vector gene therapy for the treatment of Usher Syndrome” Gund Harrington Scholar award. 6/01/2017-5/31/2020. Total subcontract costs: $200,000. This project is testing dual AAV vectors for targeting expression of the MYO7A gene to non-human primate photoreceptors.
Co-Investigator: Gamlin, PD: (PI Heldermon C, University of Florida) “Optimizing AAV Vectors For Central Nervous System Transduction” NIH/NINDS Research Grant 8/01/2017-5/31/2022. Total subcontract costs: $400,000. This project is testing AAV vectors and delivery routes for targeting gene expression to specific brain regions for the treatment of Mucopolysaccharidosis (MPS) IIIB.

BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>Cristin F. Gavin</th>
</tr>
</thead>
<tbody>
<tr>
<td>POSITION TITLE</td>
<td>Assistant Professor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EDUCATION/TRAINING</th>
</tr>
</thead>
<tbody>
<tr>
<td>INSTITUTION AND LOCATION</td>
</tr>
<tr>
<td>Birmingham-Southern College</td>
</tr>
<tr>
<td>Birmingham-Southern College</td>
</tr>
<tr>
<td>University of Alabama at Birmingham</td>
</tr>
</tbody>
</table>

Positions

- Assistant Professor, Primary, Department of Neurobiology, Secondary, Department of Psychology, University of Alabama at Birmingham
- Co-Director, Undergraduate Neuroscience Program
- Co-Director, Post-baccalaureate Research Education Program
- Investigator, McKnight Brain Institute

Honors, Awards, and Advisory Committees

Awards and Honors

2017-present Science and Technology Honors Program Leadership Council, Neuroscience representative
2017-present CLSS Process & Policy Advisory Group, Joint Health Sciences Programs Representative
2016 Blaze Leadership Academy 2016-17 class
2016 National Academy of Academic Advisors (NACADA) – Outstanding Faculty Advisor
2016 UAB Outstanding Academic Advisor, Faculty
2016-present Honors College Faculty Fellow

Advisory Committees and Activities

2016-present University Undergraduate Curriculum Committee
2016-present Honors Neuroscience Summer Research Academy Director
2016-present Graduate Biomedical Sciences Graduate Admissions Committee Member, Neuroscience Theme
2016-present Research Ethics Training for Undergraduates Focus Group, Neuroscience representative
2016-present New Interdisciplinary Science Majors Committee, Co-Founder, Co-Chair
2016-present Research Civitan Club, Charity Art Auction Organizer
2016-present Women in STEM Undergraduate Facilitator
2016-present Faculty Sponsor, PrePhD Society
2016 Review Committee, Provost's Award for Faculty Excellence in Undergraduate Research, Office of Undergraduate Research
2016 Responsible Conduct in Research Graduate Ethics Training Facilitator
2016 Goldwater Scholar Nominee Selection Committee
2016 Faculty Commencement Representative, School of Medicine and UAB Honors College (Spring and Winter)
2016 Application Review Committee, Presidential Summer Research Scholarship
2016 Beckman Scholars Grant, Research Mentor Selection and Review Committee
2016 UAB Neuroscience Recruitment and Outreach
James Clemens High School Brain Health Week, Keynote speaker;
CORD Summer Science Institute, Invited Speaker;
HOSA State Competition, Neuroscience Representative
2016 Judge (Poster/Oral)
Civitan International/Simpson-Ramsey Neurodevelopment Symposium
UAB EXPO
Graduate Student Research Day
OST Research Competition
NEURAL conference

**Manuscripts submitted but not yet accepted**
Genome-wide transcription and DNA methylation profiling in an APP mouse model of Alzheimer’s Disease

**Manuscripts in preparation**
*Actin-myosin dynamics regulate structural plasticity in single spines.*
Cristin F. Gavin, Maria Rubio, Erica Young, Courtney Miller and Gavin Rumbaugh. Department of Neuroscience, The Scripps Research Institute, Jupiter, FL

**BOOKS AND BOOK CHAPTERS**

**Book Chapters**
Synaptic Plasticity
BIOGRAPHICAL SKETCH

NAME: David S. Geldmacher
POSITION TITLE: Patsy and Charles Collat Endowed Professor

EDUCATION/TRAINING

INSTITUTION AND LOCATION | DEGREE | YEAR(S) | FIELD OF STUDY
--- | --- | --- | ---
University of Rochester | B.A. | 1978 | Health Science
State University of New York | | | Science Center at Syracuse, New York
Health Science Center at Syracuse | MD | 1986 | New York

Positions

1991 - 1992 Assistant Professor of Neurology Robert Wood Johnson School of Medicine, University of Medicine and Dentistry of New Jersey
1993 - 2001 Assistant Professor of Neurology 
2001 - 2002 Associate Professor of Neurology Case Western Reserve University
2002 - 2006 Associate Professor of Neurology (without term) Case Western Reserve University
2006 - 2011 Harrison Distinguished Teaching Associate Professor of Neurology University of Virginia School of Medicine
(without term)
2011 – 2014 Patsy and Charles Collat Endowed Scholar in Neuroscience UAB
2011 - present Professor of Neurology (tenured) University of Alabama at Birmingham
Professor of Neurobiology
2014 - present Patsy and Charles Collat Endowed Professor in Neuroscience University of Alabama at Birmingham
2014 - present Investigator, McKnight Brain Institute UAB

Awards/Honors

Honors
2015 Alpha Omega Alpha Medical Honors Society, Inductee
2014 Who’s Who in the World Selection
2014-current America’s Top Doctors Selection, Castle-Connolly, Inc.
2013 Appointment to Fellow, American Neurological Association
2011-current Best Doctors listing, Birmingham magazine
2008 Election to Fellow, American College of Physicians
2006 Election to membership, American Neurological Association
2006 Leading Health Professionals of the World, Selection
2005 Appointment to Academy of Distinguished Educators, Uni of VA, School of Medicine
2002-current The Best Doctors in America Selection
1998 The Best Doctors in America Selection, Woodward/White, Inc.
1998 Top Doctors Listing, Cleveland Magazine
<table>
<thead>
<tr>
<th>Year</th>
<th>Award</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982</td>
<td>Phi Beta Kappa, Inductee</td>
</tr>
<tr>
<td>1978-82</td>
<td>National Merit Scholar</td>
</tr>
<tr>
<td>1978-82</td>
<td>New York State Regents' Scholar</td>
</tr>
<tr>
<td>1978</td>
<td>Valedictorian, Southside HS, Elmira, NY</td>
</tr>
</tbody>
</table>

**Awards**

<table>
<thead>
<tr>
<th>Year</th>
<th>Award</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>Residency Teaching Award, Department of Neurology, University of Alabama-Birmingham</td>
</tr>
<tr>
<td>2003</td>
<td>Residency Teaching Award, Department of Neurology, University of Virginia</td>
</tr>
<tr>
<td>2001</td>
<td>Award for Achievement: Science and Technology Division</td>
</tr>
<tr>
<td></td>
<td>Northern Ohio Live Magazine Annual Awards</td>
</tr>
<tr>
<td>1995</td>
<td>Monitors’ Choice Award – Best Overall Clinical Trials Site</td>
</tr>
<tr>
<td></td>
<td>Trial E2020-A-01-301, Eisai America, Inc.</td>
</tr>
<tr>
<td>1985</td>
<td>Merck Medical Student Achievement Award, SUNY-HSC, Syracuse</td>
</tr>
</tbody>
</table>
BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adam Gerstenecke</td>
<td>Assistant Professor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INSTITUTION/LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>So Illinois Uni at Carbondale</td>
<td>B.A.</td>
<td>2001</td>
<td></td>
</tr>
<tr>
<td>University of Louisville</td>
<td>M.S.</td>
<td>2007</td>
<td></td>
</tr>
<tr>
<td>University of Louisville</td>
<td>PhD</td>
<td>2014</td>
<td></td>
</tr>
</tbody>
</table>

Positions

Internship Training:

<table>
<thead>
<tr>
<th>Year</th>
<th>Degree</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013-2014</td>
<td>Intern</td>
<td>University of Alabama at Birmingham, Birmingham, AL</td>
</tr>
</tbody>
</table>

Postdoctoral Training:

<table>
<thead>
<tr>
<th>Year</th>
<th>Degree</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014-2016</td>
<td>Neuropsychology Fellow</td>
<td>UAB, Department of Neurology</td>
</tr>
</tbody>
</table>

Academic appointments:

<table>
<thead>
<tr>
<th>Year</th>
<th>Rank/Title</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016 – present</td>
<td>Assistant Professor</td>
<td>UAB, Department of Neurology</td>
</tr>
</tbody>
</table>

Other Appointments/Administrative Positions at UAB:

<table>
<thead>
<tr>
<th>Year</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>03/16 – present</td>
<td>Faculty Member, UAB Multiple Sclerosis Center</td>
</tr>
<tr>
<td>09/16 – present</td>
<td>Faculty Research Member, UAB Alzheimer’s Disease Center</td>
</tr>
<tr>
<td>2017 – present</td>
<td>Investigator, McKnight Brain Institute</td>
</tr>
</tbody>
</table>

Honors, Awards, and Advisory Committees

2014 John Richard Binford Memorial Award presented to the graduate degree recipient at the University of Louisville who excels in both scholarship and leadership

2014 Graduate Dean’s Citation – University of Louisville

One of five finalists for the Association of Test Publishers (ATP) Award for Best Student Poster Focused on Assessment and Western Psychological Services’ Emerging Leaders in Assessment Travel Award presented at the 2008 APA Conference in Boston, MA.

Publications 2017

1. **Gerstenecker, A.** (epub ahead of print). The Neuropsychology (Broadly Conceived) of MSA, PSP, and CBD. *Archives of Clinical Neuropsychology*. DOI: 10.1093/arclin/acx093


Mild Cognitive Impairment Due to Alzheimer’s Disease. Clinical Gerontologist, 40(1), 14-23.

BIOGRAPHICAL SKETCH

NAME
Matthew S. Goldberg

POSITION TITLE
Associate Professor

EDUCATION/TRAINING

<table>
<thead>
<tr>
<th>INSTITUTION/LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Michigan</td>
<td>B.S.</td>
<td>1990</td>
<td>Physics</td>
</tr>
<tr>
<td>Yale University</td>
<td>PhD</td>
<td>1998</td>
<td>Mol Biophysics</td>
</tr>
<tr>
<td>Harvard Medical School</td>
<td>Postdoc</td>
<td>1997-2003</td>
<td></td>
</tr>
<tr>
<td>Brigham and Women’s Hospital</td>
<td>Postdoc</td>
<td>1997-2003</td>
<td></td>
</tr>
</tbody>
</table>

Positions

<table>
<thead>
<tr>
<th>Year</th>
<th>Rank/Title</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014-present</td>
<td>Associate Professor</td>
<td>University of Alabama Birmingham</td>
</tr>
<tr>
<td>2014-present</td>
<td>Investigator, McKnight Brain Institute UAB</td>
<td></td>
</tr>
<tr>
<td>2005-2014</td>
<td>Assistant Professor</td>
<td>UT Southwestern Medical Center</td>
</tr>
<tr>
<td>2003-2005</td>
<td>Instructor</td>
<td>Brigham and Women’s Hospital</td>
</tr>
<tr>
<td>2003-2005</td>
<td>Instructor in Neurology</td>
<td>Harvard Medical School</td>
</tr>
</tbody>
</table>

Honors, Awards, and Advisory Committees

Grant reviewer March 2017: French Federation for Brain Research (FRC)
Grant reviewer April 2017: Michael J. Fox Foundation for Parkinson’s Research
Ad-hoc reviewer Feb 5-7, 2017 Reston, VA: US Army Medical Research and Materiel Command CDMRP Parkinson’s Research Program

Publications 2017

3. Creed, RB and Goldberg MS*, New Developments in Rat Models of Parkinson’s Disease, Movement Disorders, in press. *corresponding author

Manuscripts submitted but not yet accepted

1. Ding X, Goldberg MS*, Phosphorylated alpha-synuclein increases LRRK2 abundance, inclusion formation and cell toxicity, submitted. *corresponding author

Manuscripts in preparation

BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michelle Gray</td>
<td>Assistant Professor</td>
</tr>
</tbody>
</table>

**EDUCATION/TRAINING**

<table>
<thead>
<tr>
<th>INSTITUTION/LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama State University, Montgomery, AL</td>
<td>B.S.</td>
<td>1997</td>
<td>Biology</td>
</tr>
<tr>
<td>Ohio State University, Columbus, OH</td>
<td>PhD</td>
<td>2003</td>
<td>Molecular, Cellular, and Developmental Biology</td>
</tr>
<tr>
<td>University of California, Los Angeles, Los Angeles, CA</td>
<td>Post doc</td>
<td>2008</td>
<td>Neurogenetics/mouse genetics</td>
</tr>
</tbody>
</table>

**Positions**

1997-1998 Graduate Teaching Assistant, Introduction to Biology, Introductory Biology Program, The Ohio State University, Columbus, OH

1998 Graduate Teaching Assistant, Human Biology, The Ohio State University, Columbus, OH

1998-2003 Graduate Research Associate, Molecular, Cellular and Developmental Biology Program, The Ohio State University, Columbus, OH

2003-2008 Postdoctoral fellow, Semel Institute for Neuroscience and Human Behavior, David Geffen School of Medicine, University of California, Los Angeles, Los Angeles, CA

2008-2010 Instructor, Dixon Scholar in Neuroscience, Department of Neurology, Center for Neurodegeneration and Experimental Therapeutics, University of Alabama at Birmingham

2010 Assistant Scientist, Center for Glial Biology in Medicine, University of Alabama at Birmingham

2010 Assistant Professor, Department of Neurobiology, Secondary Appointment, University of Alabama at Birmingham, Birmingham, AL

2010-present Assistant Professor, Dixon Scholar in Neuroscience, Department of Neurology, Center for Neurodegeneration and Experimental Therapeutics, University of Alabama at Birmingham

2010 – present Investigator, McKnight Brain Institute

**Honors, Awards, and Advisory Committees**

1995-1996 National Institutes of Health, Minority Biomedical Research Support Fellow, Alabama State University

1996-1997 National Institutes of Health, Minority Access to Research Careers Honors Fellow, Alabama State University

2000-2003 National Institutes of Health, Ruth L. Kirschstein National Research Service Award, predoctoral fellowship, Laboratory of Christine Beattie, The Ohio State University, Columbus, OH

2003-2005 National Institutes of Health, Post-doctoral fellowship, X. William Yang and Michael Levine, Mental Retardation Research Center, University of California, Los Angeles

2005-2006 National Institutes of Health, Post-doctoral fellowship, X. William Yang and Nelson Freimer, Neurobehavioral Genetics training program, University of California, Los Angeles
2006  Gordon Research Conferences Travel Award, CAG Triplet Repeat Disorders
2007  Session Chair: Society for Neuroscience Annual Meeting, Neuroinflammation: Animal Models and Human Studies, San Diego, CA
2008  Travel Award/Best Poster, CHDI Inc., 3rd Annual HD Therapeutics Conference: A Forum for Drug Discovery & Development, Palm Springs, CA
2008  Dixon Scholar in Neuroscience, Department of Neurology, University of Alabama at Birmingham
2009  Session Chair: CHDI Inc., 4th Annual HD Therapeutics Conference, Cannes, France
2010  National Institutes of Health, NINDS K01 Career Development Award to Promote Diversity in Neuroscience Research
2014  Insights of the Year, Most Influential Paper in the laboratory, Huntington’s Disease Study Group for, “Neuronal targets for reducing mutant huntingtin expression to ameliorate disease in a mouse model of Huntington’s disease”

Publications 2017 – None

Research support
1R01NS089750-01A1 Gray (PI) 7/1/2015-6/30/2020
Exploring the contribution of astrocytes to Huntington’s Disease
To study the contribution of astrocytes and SNARE-dependent glutamate release from astrocytes to Huntington’s Disease
Role: Principal Investigator

MGH Collaborative Center for X-linked Dystonia Parkinsonism (XDP) Gray (PI) 01/15-06/17
Modeling X-linked Dystonia Parkinsonism Using BAC Transgenesis
Role: Principal Investigator
BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>Position Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alecia K. Gross</td>
<td>Associate Professor</td>
</tr>
</tbody>
</table>

EDUCATION/TRAINING

<table>
<thead>
<tr>
<th>Institution/Location</th>
<th>Degree</th>
<th>Year(s)</th>
<th>Field of Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uni of New Hampshire</td>
<td>B.S.</td>
<td>1993</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>Brandeis University</td>
<td>PhD</td>
<td>2002</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>Baylor College of Medicine</td>
<td>Postdoc</td>
<td>2006</td>
<td></td>
</tr>
</tbody>
</table>

Positions

<table>
<thead>
<tr>
<th>Year</th>
<th>Rank/Title</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006 – 2011</td>
<td>Assistant Professor</td>
<td>UAB Department of Vision Sciences</td>
</tr>
<tr>
<td>2006 – present</td>
<td>Secondary Appointment</td>
<td>UAB Department of Cell, Developmental and Integrative Biology</td>
</tr>
<tr>
<td>2007 – present</td>
<td>Secondary Appointment</td>
<td>UAB Department of Neurobiology</td>
</tr>
<tr>
<td>2008 – present</td>
<td>Secondary Appointment</td>
<td>UAB Department of Biochemistry and Molecular Genetics</td>
</tr>
<tr>
<td>2006 – present</td>
<td>Scientist</td>
<td>UAB Comprehensive Neuroscience Center</td>
</tr>
<tr>
<td>2006 – present</td>
<td>Scientist</td>
<td>UAB Vision Science Research Center</td>
</tr>
<tr>
<td>2006 – present</td>
<td>Scientist</td>
<td>UAB Civitan International Research Center</td>
</tr>
<tr>
<td>2006 – present</td>
<td>Scientist</td>
<td>UAB Evelyn F. McKnight Brain Institute</td>
</tr>
<tr>
<td>2011 – present</td>
<td>Project Leader</td>
<td>UAB Intellectual and Developmental Disabilities Research Center</td>
</tr>
<tr>
<td>2011 – present</td>
<td>Associate Professor (with tenure)</td>
<td>UAB Department of Vision Sciences</td>
</tr>
</tbody>
</table>

Honors, Awards, and Advisory Committees

2003 The V.C. Joshi Memorial Award, First Place Postdoctoral Poster Presentation, Baylor College of Medicine
2004 The V.C Joshi Memorial Award, First Place Postdoctoral Oral Presentation, Baylor College of Medicine
2002 – 2004 Science Education Leadership Fellow (SELF), Howard Hughes Medical Institute and Baylor College of Medicine
2002 – 2004 NRSA Postdoctoral Fellowship, Endocrinology Training Program, Baylor College of Medicine
2004 National Eye Institute, NIH Fellowship to attend “Fundamental Issues in Vision Research: Molecular and Cell Biological Approaches” Marine Biological Laboratories, Woods Hole, MA
2004 Jackson Laboratory, Travel Grant to attend The Laboratory Mouse in Vision Research Conference, Jackson Laboratory, Bar Harbor, ME
2004 – 2005 AAAS/Science Program for Excellence in Science Sponsored Membership Award, American Association for the Advancement of Science
2005 The V.C Joshi Memorial Award for first place postdoctoral oral presentation, Annual Biochemistry Research Conference, Baylor College of Medicine
2005 – 2006 Elected Co-President of the Postdoc Association at Baylor College of Medicine
2008 International Society for Eye Research (ISER) Young Investigator Travel Award to travel to XVIII International Congress for Eye Research, Beijing China
2008 XIIIth International Symposium on Retinal Degeneration Young Investigator Travel Award to travel to Emeishan, China for RD2008 meeting
2010 – 2013  Elected Biochemistry (BI) Program Committee Member, Association for Research in Vision and Ophthalmology (ARVO) Annual Meeting Program

2012 – 2013  Nominated by School of Optometry Dean and awarded position in BLAZE leadership academy (development program for high potential faculty and staff to take on positions of senior leadership)

2014  UAB President’s Award for Excellence in Teaching

2014-2015  UAB Faculty Senate Chair-Elect

2015  American Optometric Student Association (AOSA) Excellence in Basic/Vision Science Instruction Award

2015-2016  UAB Faculty Senate Chair

2016-present  Director, Cell, Molecular and Developmental Biology Graduate Program

2016  UAB Inaugural Recipient for the President’s Award for Excellence in Support of UAB and Shared Governance

Publications 2017
None

Manuscripts in preparation
None
BIOGRAPHICAL SKETCH

NAME
John Hablitz

POSITION TITLE
Professor

EDUCATION/TRAINING

<table>
<thead>
<tr>
<th>INSTITUTION AND LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>State University of New York, Plattsburgh</td>
<td>B.A.</td>
<td>1968</td>
<td>Physiological</td>
</tr>
<tr>
<td>University of Houston, Houston, TX</td>
<td>M.A.</td>
<td>1970</td>
<td>Psychology</td>
</tr>
<tr>
<td>University of Houston, Houston, TX</td>
<td>PhD</td>
<td>1972</td>
<td>Physiological Psychology</td>
</tr>
</tbody>
</table>

Positions
Postdoctoral Fellow, Department of Physiology, Baylor College of Medicine, and Department of Neurophysiology, The Methodist Hospital, Houston, TX, 1972-73
Instructor, Department of Physiology, Baylor College of Medicine, 1973-74
Assistant, Neurophysiology Service, The Methodist Hospital, 1973-1988
Assistant Professor of Physiology, Baylor College of Medicine, 1974-77
Assistant Professor of Neurology, Baylor College of Medicine, 1977-83
Visiting Scientist, Institute of Neurophysiology, University of Oslo, Oslo Norway, 1978-79
Member, Program in Neurosciences, Baylor College of Medicine, 1978-1988
Associate Professor of Neurology, Baylor College of Medicine, 1983-1988
Visiting Scientist, Department of Neurophysiology, Max-Planck Institute for Psychiatry, Munich, Germany, 1984-85
Associate Professor of Physiology and Molecular Biophysics, Baylor College of Medicine, 1986-1988
Professor of Physiology and Biophysics, University of Alabama at Birmingham, 1989-present
Senior Scientist, Neurobiology Research Center, University of Alabama at Birmingham, 1989-1996
Professor of Psychology, University of Alabama at Birmingham, 1995-present
Professor of Neurobiology, University of Alabama at Birmingham, 1996-present
Chairman, UAB Committee on Graduate Study in Neuroscience, 1997-2001
Vice Chairman, Department of Neurobiology 2002-present
Interim Chair, Department of Neurobiology 2005-2006
Investigator, Evelyn F. McKnight Brain Research Institute 2006-present

Honors, Awards, and Advisory Committees
Javits Neuroscience Investigator Award, 1989
UAB Joint Health Science Department's Teaching Award, 1992
Kellaway Lectureship in Epilepsy, Baylor College of Medicine, 2005
UAB Graduate Dean’s Award for Excellence in Mentorship, 2008

Other Activities:
Member, Neurological Sciences 2 Study Section, NIH 1987-1991
Member, American Epilepsy Soc Investigators’ Workshop Committee, 1998-2001
Member, Veterans Administration Neurology A Merit Review Panel, 2000-2003
Member, American Epilepsy Society Scientific Program Committee, 2001-2003
Member, Neurobiology of Learning and Memory Study Section, NIH 2003-2007
Member, Developmental Brain Disorders Study Section, NIH 2008-2012.
Member, DOD, AIBS Peer Reviewed Medical Research Review Panel, 2010.


Publications (2017)

Abstracts (2017)

Invited Speaker (2017)
1. Invited Speaker, Basic EcoE Research Seminar Group, “Roles of specific cortical interneurons in GABAergic network synchronization”, September 12, Teleconference.
2. Grants (2017 – present)
UAB Neuroscience Core Center Principal Investigator: John J. Hablitz, PhD
NIH-NINDS P30 NS47466 07/01/2005-04/30/2020
This grant provides multiple cores for NINDS funded investigators.
3. Training Program in the Neurobiology of Cognition and Cognitive Disorders Principal Investigator: John J. Hablitz, PhD
NIH-NINDS T32061788 07/01/2008-06/30/2018
4. Acquired HCN Channelopathies in Cortical Dysplasia Principal Investigator: John J. Hablitz, PhD
NIH-NINDS R01 NS090041 12/01/2014-11/30/18.
This project examines the role of HCN channels in diverse cell groups in animal models of cortical dysplasia.
5. Cellular Mechanism of Synchrony Impairments in Schizophrenia PI: Kazutoshi Nakazawa,
NIH-NIMH R01 MH110681 07/01/2016-06/30/2021
Role on project: Co-Investigator
BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jeremy H. Herskowitz</td>
<td>Assistant Professor</td>
</tr>
</tbody>
</table>

EDUCATION/TRAINING

<table>
<thead>
<tr>
<th>INSTITUTION AND LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of North Carolina Chapel Hill, NC</td>
<td>B.S.</td>
<td>2001</td>
<td>Chemistry</td>
</tr>
<tr>
<td>Emory University Atlanta, GA</td>
<td>Ph.D.</td>
<td>2007</td>
<td>Microbiology and Molecular Genetics</td>
</tr>
</tbody>
</table>

Positions

2001-2007 Graduate Student with Professor Samuel Speck, Department of Microbiology, Emory University, Atlanta, GA.
2007-2012 Postdoctoral Research with Professors Allan Levey and James Lah Department of Neurology, Emory University, Atlanta, GA.
2012-2014 Instructor, Department of Neurology, Emory University, Atlanta, GA
2014- Assistant Professor, Departments of Neurology and Neurobiology, University of Alabama at Birmingham
2014 - Investigator, McKnight Brain Institute

Honors, Awards, and Advisory Committees

2001 David L. Stern Scholarship Academic Achievement in Chemistry, University of North Carolina at Chapel Hill
2012 Member of Emory University 1% Club
2014 Patsy W. and Charles A. Collat Scholar in Neuroscience Endowment, University of Alabama at Birmingham
2015 Outstanding Early Career Investigator in Alzheimer’s disease, Charleston Conference
2016 College of Arts and Science and School of Medicine Interdisciplinary Team Award, University of Alabama at Birmingham

Competitive Fellowships, Faculty Development Awards

2007-2009 NIH Ruth L. Kirschstein National Research Service Award, T32 Institutional Postdoctoral Training Grant, NINDS
2009-2010 Ellison Medical Foundation/American Federation for Aging Research, (AFAR) Postdoctoral Fellowship
2010-2012 BrightFocus/American Health Assistance Foundation (AHAF), Alzheimer’s Disease Research Postdoctoral Fellowship
2012-2014 NIH K99/R00 Pathway to Independence Award, NIA priority score = 10
2015-2017 Alzheimer’s Association New Investigator Research Grant
BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
<th>EDUCATION/TRAINING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gwendalyn D. King</td>
<td>Assistant Professor</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INSTITUTION/LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purdue University</td>
<td>B.S.</td>
<td>1999</td>
<td></td>
</tr>
<tr>
<td>University of Michigan</td>
<td>M.S.</td>
<td>2002</td>
<td></td>
</tr>
<tr>
<td>University of Michigan</td>
<td>PhD</td>
<td>2004</td>
<td></td>
</tr>
<tr>
<td>Cedars Sinai Medical Center</td>
<td>Post-doc</td>
<td>2008</td>
<td></td>
</tr>
<tr>
<td>Boston University School of Med</td>
<td>Post-doc</td>
<td>2011</td>
<td></td>
</tr>
</tbody>
</table>

Positions
2008 – present, Assistant Professor, Department of Neurobiology, UAB
2008 – present, Investigator, McKnight Brain Institute

Honors, Awards, and Advisory Committees
2017 UAB Graduate Program in Biomedical Sciences Outstanding Service Award - Faculty

Publications 2017

Manuscripts in preparation
2. Laszczyk AM, King GD. Shed Klotho regulates FOXO to modulate neuronal stem cells. Submission 2017.
### BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>David C. Knight</td>
<td>Associate Professor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INSTITUTION/LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truman State University, Kirksville MO</td>
<td>B.S.</td>
<td>1994</td>
<td>Psychology Clinical</td>
</tr>
<tr>
<td>University of Wisconsin, Milwaukee WI</td>
<td>M.S.</td>
<td>1999</td>
<td>Psychology</td>
</tr>
<tr>
<td>West Virginia Uni, Morgantown WV</td>
<td>Intern</td>
<td>2002</td>
<td>Neuropsychology</td>
</tr>
<tr>
<td>University of Wisconsin, Milwaukee WI</td>
<td>PhD</td>
<td>2002</td>
<td>Clinical Psychology</td>
</tr>
<tr>
<td>National Institute of Mental Health, Bethesda MD</td>
<td>Postdoc</td>
<td>2007</td>
<td>Cognitive Neuro</td>
</tr>
</tbody>
</table>

### Positions

**1995-2001** Graduate Research, NMR Research Center, Medical College of Wisconsin & Psychology Department, University of Wisconsin-Milwaukee.

**1998-2001** NRSA Predoctoral Fellow (NIMH), Department of Psychology, University of Wisconsin-Milwaukee.

**2001-2002** Clinical Neuropsychology Intern, Department of Behavioral Sciences, West Virginia University Medical School, Morgantown, WV.

**2002-2007** NIH Postdoctoral IRTA Fellow, Laboratory of Brain & Cognition, National Institute of Mental Health, Bethesda, MD.

**2007-2013** Assistant Professor, Departments of Psychology and Neurobiology, University of Alabama at Birmingham

**2011-2014** Director, Civitan Functional Neuroimaging Facility, University of Alabama at Birmingham

**2013-Present** Associate Professor, Department of Psychology and Neurobiology, University of Alabama at Birmingham

**2014-Present** Co-Director, Undergraduate Neuroscience Program, University of Alabama at Birmingham

**2014-present** Investigator, McKnight Brain Institute

### Honors and Awards

- **1992** All American Scholar
- **1992, 93, 94** Edward D. Blanchard Award
- **1998** Sigma Xi Grant in Aid of Research
- **2000** Fazio Research Award
- **1998-2001** NIMH (MH11722), Predoctoral National Research Service Award
- **2004-2006** NIMH Seymour S. Kety Memorial Fellowship
- **2017** UAB Graduate Dean’s Award for Excellence in Mentorship

### Other Experience and Professional Memberships

**1995-Present** Society for Neuroscience
1996-Present Organization for Human Brain Mapping
2004-Present Pavlovian Society
2016-Present Council on Undergraduate Research
2016-Present Faculty for Undergraduate Neuroscience
2007-Present Editorial Board: The Open Neuroimaging Journal
2016 Associate Editor: The Open Neuroimaging Journal
2017-Present Editor-in-Chief: The Open Neuroimaging Journal

Publications 2017

Book
Anticipation and Medicine
Harnett NG, Wood KH, Wheelock MD, Knight AJ, Knight DC.

Emotion socialization as a predictor of physiological and psychological responses to stress.
Guo J, Mrug S, Knight DC.
PMID: 28377196 PMCID: PMC5487265

Glutamate/glutamine concentrations in the dorsal anterior cingulate vary with Post-Traumatic Stress Disorder symptoms.
Harnett NG, Wood KH, Ference EW 3rd, Reid MA, Lahti AC, Knight AJ, Knight DC.

Factor structure of the Emotions as a Child Scale in late adolescence and emerging adulthood.
Guo J, Mrug S, Knight DC.

Manuscripts in preparation
Controllability Modulates the Neural Response to Predictable but not Unpredictable Threat in Humans Wood KH, Wheelock MD, Shumen JR, Bowen KH, Ver Hoef LW, Knight DC. NeuroImage. Forthcoming;

Differentiation of veteran patients with chronic Post Traumatic Stress Disorder from healthy subjects using objective and subjective sleep-related parameters
Neuroscience and biobehavioral reviews. 2018; 84:218-224, PubMed [journal] PMID: 29203422
BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adrienne C. Lahti</td>
<td>Professor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EDUCATION/TRAINING</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>INSTITUTION/LOCATION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Université de Liege, Liege, Belgium</td>
<td>MD</td>
<td>1978</td>
<td>MD</td>
</tr>
<tr>
<td>University de Liege, Liege, Belgium</td>
<td>Resident</td>
<td>1983</td>
<td>Residents in Psychiatry</td>
</tr>
<tr>
<td>University of Maryland, Baltimore, MD</td>
<td>Research Fellow</td>
<td>1989</td>
<td>Research Fellowship in Psychiatry</td>
</tr>
<tr>
<td>University of Michigan, Ann Arbor, MI</td>
<td>Resident</td>
<td>1992</td>
<td>Research Fellowship in Psychiatry</td>
</tr>
</tbody>
</table>

Positions

2017-Present
Investigator, McKnight Brain Institute
9/2014-Present
Patrick H. Linton Professor of Psychiatry
9/2012-Present
Professor with Tenure
1/2012-Present
Secondary Appointment
Department of Psychology
University of Alabama at Birmingham
Professor

2011-Present
Department of Biomedical Engineering
Secondary Appointment
University of Alabama at Birmingham
Professor

10/2010-Present
Department of Psychiatry and Behavioral Neurobiology
University of Alabama at Birmingham
Professor

1/2010-1/2012
Secondary Appointment
Department of Psychology
University of Alabama at Birmingham
Associate Professor

10/2006-10/2010
Department of Psychiatry and Behavioral Neurobiology
University of Alabama at Birmingham
Associate Professor

Department of Psychiatry,
University of Maryland at Baltimore, Baltimore, Maryland
Associate Professor in Psychiatry

Department of Psychiatry,
University of Maryland at Baltimore, Baltimore, Maryland
Research Assistant Professor

7/1983-1/1985
Department of Psychiatry, Université de Liège, Faculté de Médecine, Liège.
Assistant Professor

Honors

2017
Member, F1000Prime (Schizophrenia & Other Psychoses Section)

2017
Kempf Fund Award for Research Development in Psychobiological Psychiatry from the American Psychiatric Association (with mentee: Dr Kraguljac)
Publications
In Press
BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charles Seth Landefeld</td>
<td>Professor and Chair</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EDUCATION/TRAINING</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>INSTITUTION AND LOCATION</td>
<td>DEGREE</td>
</tr>
<tr>
<td>Harvard University</td>
<td>B.A.</td>
</tr>
<tr>
<td>Oxford University</td>
<td>B.A</td>
</tr>
<tr>
<td>Yale University</td>
<td>.</td>
</tr>
<tr>
<td>UCSF</td>
<td>MD</td>
</tr>
<tr>
<td>UCSF</td>
<td>Intern</td>
</tr>
<tr>
<td>Harvard University</td>
<td>Resident</td>
</tr>
<tr>
<td>Weatherhead, Case Western Uni</td>
<td>Fellow</td>
</tr>
<tr>
<td>Academic Alliance for Internal Medicine</td>
<td></td>
</tr>
</tbody>
</table>

Current Positions Held
University of Alabama at Birmingham
2012-present Professor and Chair, Department of Medicine, University of Alabama at Birmingham
2012-present Board of Directors, University of Alabama Health Services Foundation
2012-present Executive Committee, University of Alabama Health Services Foundation
2012-present Board of Directors, University of Alabama at Birmingham Health System (including Audit and Finance Committees)
2017-present Investigator, McKnight Brain Institute

Faculty Appointments
Case Western Reserve University
1985-1991 Assistant Professor of Medicine, Case Western Reserve University
1991-1995 Associate Professor of Medicine, Case Western Reserve University
1992-1997 Associate Professor of Epidemiology and Biostatistics
1995-1997 Professor of Medicine, Case Western Reserve University

University of California San Francisco
1997-2012 Professor of Medicine, and of Epidemiology and Biostatistics, University of California San Francisco

University of Alabama at Birmingham
2012-present Professor of Medicine, University of Alabama at Birmingham

Center for Advanced Study in the Behavioral Sciences at Stanford University
2008-2009 Fellow

Hospital Appointments
1985-1997 Visiting Staff, University Hospitals of Cleveland
1990-1997 Medical Co-Director, Unit for the Acute Care of Elders
1991-1997  Staff Physician, Cleveland VAMC
1997-2012  Staff Physician, San Francisco VAMC
1998-2012  Staff Physician, Moffit Long Hospital
2007-2012  Staff Physician, San Francisco General Hospital

Administrative Appointments
Case Western Reserve University
1987-1997  Director, Fellowship in General Internal Medicine
1987-1990  Director, Clinical Analysis Project
1988-1993  Director, Clinical Epidemiology Section, Division of General Internal Medicine
1991-1997  Director, Program in Health Care Research, Department of Medicine
1991-1993  Co-Chief, Division of General Internal Medicine
1993-1994  Acting Chief, Division of General Internal Medicine
1994-1997  Chief, Division of General Internal Medicine and Health Care Research

University of California San Francisco & San Francisco VAMC
1997-2012  Chief, Division of Geriatrics, Department of Medicine
1997-2012  Director, UCSF-Mt. Zion Center on Aging
1997-1998  Acting Director, Nursing Home Care Unit, SFVAMC
1998-2009  Associate Chief of Staff/Geriatrics and Extended Care, San Francisco VAMC
1998-1999  Director, Geriatrics Fellowship Program
1999-2004  Co-Director, Geriatrics Fellowship Program
1998-2012  Director, VA National Quality Scholars Fellowship Program
2010-2012  Associate Chairman for Strategic Planning and Implementation, Department of Medicine

University of Alabama at Birmingham
2012-present  Chair, Department of Medicine, University of Alabama at Birmingham

Ancillary Positions Held
1995-1997  Senior Faculty Associate, University Center on Aging and Health, Case Western Reserve University

Clinical Training and Experience
1979-1982  Medical Resident, PGY1-3, University of California San Francisco
1982-1983  Chief Medical Resident, University of California San Francisco
1983-1985  Henry J. Kaiser Family Foundation Fellow in General Internal Medicine, Harvard Medical School and Brigham and Women’s Hospital

Honors and Awards
1971-1974  Harvard University Scholarship
1973  History of Science Departmental Prize, Harvard University
1974  B.A. magna cum laude
1976-1978  Rhodes Scholarship
1985-1987  Keck Research Scholar
1990-1993  American College of Physicians George Morris Piersol Teaching and Research Scholar
1990  Fellow, American College of Physicians
1991-1992  President, Midwest Society of General Internal Medicine
1992  Henry Christian Award for Excellence in Research (American Federation for Clinical Research)
1992  Society of General Internal Medicine Workshop Letter of Recognition
1993-1997  Senior Research Associate, HSR&D Service, Department of Veterans Affairs
1997  Elected, American Society for Clinical Investigation
1999-2000  President, Society of General Internal Medicine
2003  Harry Weinstein Award, Program for Elders in the Central City
2005  Elected, Association of American Physicians
2008  Fellow, Center for Advanced Study in the Behavioral Sciences at Stanford University
2011  Robert J. Glaser Award, “For Exceptional Contributions to Education and Research,” Society of General Internal Medicine
2012  Spencer Chair in Medical Science Leadership, UAB School of Medicine
2015  Elected, American Clinical and Climatological Association
2016  Appointed Member, US Preventive Services Task Force
2016  Laureate, Alabama Chapter, American College of Physicians
2017  Appointed Member, Board of the American Board of Internal Medicine

**Publications (2017)**
BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robin Lester</td>
<td>Professor</td>
</tr>
</tbody>
</table>

EDUCATION/TRAINING

<table>
<thead>
<tr>
<th>INSTITUTION/LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Bristol, U.K.</td>
<td>B.Sc.</td>
<td>1984</td>
<td></td>
</tr>
<tr>
<td>University of Bristol, U.K.</td>
<td>PhD</td>
<td>1988</td>
<td></td>
</tr>
<tr>
<td>Vollum Institute, Portland, OR</td>
<td>Post-doc</td>
<td>1991</td>
<td></td>
</tr>
</tbody>
</table>

Positions

1992-1993  Research Assistant Professor / Baylor College of Medicine
1993-1995  Assistant Professor / Neuroscience / Baylor College of Medicine
1995-1996  Associate Scientist / NRC, University of Alabama at Birmingham
1996-2001  Assistant Professor / Neurobiology, University of Alabama at Birmingham
2006-present, Investigator, McKnight Brain Institute
2001-2011  Associate Professor / Neurobiology, University of Alabama at Birmingham
2011-present  Professor / Neurobiology, University of Alabama at Birmingham

Honors, Awards, and Advisory Committees

2017- Reviewer of UAB fellowship applications (GRiP)
2017- Reviewer preclinical curriculum – Fundamentals Module
2017- Reviewer Scholarly Activity
2017- Preclinical subcommittee: Step 1 Prep Time Task Force
2017  Diversity Fair participant

Publications 2017

None
BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>Farah Lubin</th>
</tr>
</thead>
<tbody>
<tr>
<td>POSITION TITLE</td>
<td>Associate Professor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EDUCATION/TRAINING</th>
<th>INSTITUTION/LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AL State Uni, Montgomery, AL</td>
<td>B.S.</td>
<td>1996</td>
<td>Cell/Molecular Biology</td>
</tr>
<tr>
<td></td>
<td>SUNY, Binghamton, NY</td>
<td>PhD</td>
<td>2001</td>
<td></td>
</tr>
</tbody>
</table>

Positions

2006-2008 Postdoctoral Fellow, Advisor: J. David Sweatt, PhD, Department of Neuroscience, Baylor College of Medicine, Houston, TX

Department of Neurobiology, University of Alabama-Birmingham, Birmingham, AL

2006-present Investigator, McKnight Brain Institute

2002-2005 Postdoctoral Fellow, Cain Foundation Labs/Texas Children’s Hospital, Advisor: Anne E. Anderson, M.D., Department of Pediatrics-Neurology, Baylor College of Medicine, Houston, TX

ACADEMIC APPOINTMENTS: (In reverse chronological order)

2015-Present Associate Professor with Tenure, Dept. of Neurobiology, Dept. of Cell, Developmental and Integrative Biology, and Genetics Dept., University of Alabama at Birmingham, Birmingham, AL

2015-Present Director, Comprehensive Neuroscience Center EEG core

2014-Present Director, NINDS Neuroscience Roadmap Scholar Program; Co-Director: Lori L. McMahon, PhDat University of Alabama at Birmingham, Birmingham, AL

2009-Present Investigator, McKnight Brain Institute, University of Alabama at Birmingham, Birmingham, AL

2009-2015 Assistant Professor, Department of Neurobiology, University of Alabama-Birmingham, Birmingham, AL

2011-2014 Principal Investigator, GS-13/1, Veteran Affairs at University of Alabama at Birmingham, AL

Academic Honors, Awards, and Advisory Committees

2017 UAB Dean’s Award for Excellence in Mentorship

2017 Nominated School of Medicine Dean’s Excellence Award in Diversity Enhancement

2013-2014 excellence in Editing/Reviewing

Publications 2017


Manuscripts in preparation


BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roy C. Martin</td>
<td>Associate Professor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EDUCATION/TRAINING</th>
<th>INSTITUTION/LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Louisiana State University</td>
<td>PhD</td>
<td>1990-1995</td>
<td>Clinical Psychology</td>
</tr>
<tr>
<td></td>
<td>West Virginia University</td>
<td>Postdoctoral Fellowship</td>
<td>1995</td>
<td>Neuropsychology</td>
</tr>
</tbody>
</table>

Positions
Associate Professor, Department of Neurology
Investigator, McKnight Brain Institute

Honors, Awards, and Advisory Committees

Publications 2017
BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lori McMahon</td>
<td>Professor</td>
</tr>
<tr>
<td></td>
<td>Dean, Graduate School</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EDUCATION/TRAINING</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Southern Illinois University, Edwardsville, IL</td>
<td>B.A.</td>
<td>1987</td>
<td>Biology/Chemistry</td>
</tr>
<tr>
<td>-St. Louis Health Science Ctr, St. Louis, MO</td>
<td>PhD</td>
<td>1993</td>
<td>Neuropharmacology</td>
</tr>
<tr>
<td>-Duke University, Durham, NC</td>
<td>Postdoc</td>
<td>1998</td>
<td>Neurophysiology</td>
</tr>
</tbody>
</table>

**Positions**

1998 Primary Appointment – Department of Physiology and Biophysics
Cell, Developmental & Integrative Biology
Secondary Appointments: Neurobiology
Other Appointments:
McKnight Brain Institute, Neurology, Civitan International Research Center, comprehensive Ctr for healthy Aging, General Clinical Research Center, Electrical & Computer Engineering, Medicine,

**B. Positions and Honors**

**Professional Experience**

1987-1993 Graduate Assistant, Saint Louis University
1993-1998 Research Associate, Duke University
1998-2006 Assistant Professor, UAB Department of Physiology and Biophysics
2002-2006 Assistant Scientist, UAB Alzheimer’s Disease Research Center
2006-2010 Associate Professor with tenure, UAB Department of Physiology and Biophysics
2006-2012 Director, Neuroscience Theme Graduate Program
2006-2012 Co-Director, Synaptic Plasticity Core Facility
2008-pres Scientist, UAB Comprehensive Center for Healthy Aging
2010-2012 Professor, UAB Department of Physiology and Biophysics
2012-pres Scientist, Center for Exercise is Medicine
2012-pres Professor, UAB Department of Cell, Developmental, and Integrative Biology
2012-pres Jarman F Lowder Endowed Professor of Neuroscience
2012-pres Director, Comprehensive Neuroscience Center
2012-pres Member, UAB SOM Dean’s Executive Committee
2012-2015 Associate Director, Comprehensive Center for Healthy Aging
2013-2016 Associate Director, UAB McKnight Brain Institute
2015-pres Dean, UAB Graduate School

**Honors**

1983-1987 Presidential Scholarship, Southern Illinois University
1987 Ella Ott Weissman Award in Biological Sciences
1987-1988 Saint Louis University Predoctoral Fellowship
1994-1995 NIH Institutional Postdoctoral Fellowship, Duke University
1999-2000 New Investigator Award, Epilepsy Foundation
2000-2002 Junior Investigator Award, American Heart Association
2002 Ad Hoc Reviewer, NIH Study Section, MDCN 3
2002-2009 American Physiological Society Awards Committee
2002-2010 Editorial Board, Journal of Neurophysiology
2004-2005 Ad hoc member of NIH Study Section, Molecular Neuropharmacology (MNPS)
2005-2008 Permanent Member, NIH Study Section, Molecular Neuropharmacology (MNPS)
2008-2010 NARSAD Independent Investigator Award
2008-pres Editorial Board, Neuropsychopharmacology
2008 President’s Excellence in Teaching Award, UAB
2009-2013 Permanent Member NIH Study Section, Learning and Memory (LAM)
2009 Reviewing Editor, Frontiers in Aging Neuroscience
2010 Editorial Review Board, Frontiers in Neurodegenerative Disease
2011 Outstanding Mentor Award UAB
2011 NIH NICHD Intramural Program Reviewer
2011-2013 Co-Chair Faculty Council, UAB Promotions and Tenure Committee
2011-2014 Program Committee, Society for Neuroscience
2011-pres President, Birmingham Chapter of the Society for Neuroscience
2012-2013 Chair, Theme G, Novel Methods and Technology Development, SfN
2013-2014 Chair, Theme B, Neural Excitability, Synapses, and Glia: Cellular Mechanisms, SfN
2016-pres Editorial Board, Journal of Neuroscience

Complete List of Published Work: https://www.ncbi.nlm.nih.gov/pubmed/?term=mcmahon+LL
BIOGRAPHICAL SKETCH

NAME  
James H. Meador-Woodruff, MD

POSITION TITLE  
Heman E. Drummond Professor and Chairman Department of Psychiatry

EDUCATION/TRAINING

EDUCATION
09/73-06/76 Manchester High School, Richmond, Virginia
09/76-05/80 University of Richmond, Richmond, Virginia; B.S. in Chemistry, minor subject Mathematics (*summa cum laude*)
08/80-05/84 Medical College of Virginia Commonwealth University, Richmond, Virginia; M.D.

POSTDOCTORAL TRAINING
06/84-06/85 Intern, Department of Psychiatry, University of Michigan
07/85-06/89 Resident, Department of Psychiatry, University of Michigan (*Graduation with Distinction*)
07/85-12/89 Postdoctoral Fellow, Mental Health Research Institute, University of Michigan (Laboratories of Huda Akil and Stanley J. Watson)

INSTITUTION AND LOCATION  
Department of Psychiatry and Behavioral Neurobiology
University of Alabama at Birmingham SC 560C

DEGREE  
M.D.

YEAR(S)  
1984

FIELD OF STUDY  
Psychiatry

Positions

ACADEMIC APPOINTMENTS
07/89-12/89 Research Fellow, Mental Health Research Institute, University of Michigan
07/89-12/89 Lecturer, Department of Psychiatry, University of Michigan
01/90-08/93 Research Investigator, Mental Health Research Institute, University of Michigan
01/90-08/95 Assistant Professor of Psychiatry, University of Michigan
01/90-08/95 Assistant Research Scientist, Mental Health Research Institute, University of Michigan
09/95-08/97 Associate Research Scientist, Mental Health Research Institute, University of Michigan
09/95-08/02 Associate Professor of Psychiatry, University of Michigan
09/97-08/02 Senior Associate Research Scientist, Mental Health Research Institute, University of Michigan
09/02-08/03 Senior Research Scientist, Mental Health Research Institute, University of Michigan
09/02-03/06 Professor of Psychiatry, University of Michigan
09/03-03/06 Research Professor, Molecular and Behavioral Neuroscience Institute (formally Mental Health Research Institute), University of Michigan
04/06-present Heman E. Drummond Professor, Department of Psychiatry and Behavioral Neurobiology, University of Alabama at Birmingham
04/06-present Professor of Neurobiology, University of Alabama at Birmingham
04/06-present Senior Scientist, Civitan International Research Center, University of Alabama at Birmingham
04/06-present Investigator, McKnight Brain Institute
08/06-present Senior Scientist, Center for Glial Biology in Medicine, University of Alabama at Birmingham
10/06-present Senior Scientist, Comprehensive Neuroscience Center, University of Alabama at Birmingham
07/07-present Senior Scientist, Center for Neurodegeneration and Experimental Therapeutics, University of Alabama at Birmingham
01/09-present Senior Scientist, Evelyn F. McKnight Brain Institute, University of Alabama at Birmingham
04/09-present Senior Scientist, Alzheimer’s Disease Research Center (ADRC), University of Alabama at Birmingham

ACADEMIC ADMINISTRATIVE APPOINTMENTS
07/95-03/99 Research Advisor, Department of Psychiatry, Ann Arbor Veterans Administration Medical Center
04/99-12/02 Director of Psychiatric Research, Department of Psychiatry, Ann Arbor Veterans Administration Medical Center
07/00-12/05 Director of Residency Research Track, Department of Psychiatry, University of Michigan
09/01-03/02 Interim Associate Chair for Research, Department of Psychiatry, University of Michigan
09/01-07/02 Associate Chair for Research Training and Faculty Development, Department of Psychiatry, University of Michigan
07/02-03/06 Associate Chair for Research, Department of Psychiatry, University of Michigan
07/03-12/05 Co-Director of Residency Clinical Scholars Track, Department of Psychiatry, University of Michigan
03/04-01/06 Vice Chair, Department of Psychiatry, University of Michigan
04/06-present Psychiatrist-in-Chief, University of Alabama at Birmingham Health System Hospitals and Clinics
04/06-present Chairman, Department of Psychiatry and Behavioral Neurobiology, University of Alabama at Birmingham

Honors, Awards, and Advisory Committees
1976 Virginia High School League, State Champion, Debate
1976 The Margaret Pharr Award (Mathematical Association of America) 1977 Phi Eta Sigma (national academic honor society)
1978 Gamma Sigma Epsilon (national chemistry honor society) 1979 Pi Mu Epsilon (national mathematics honor society)
1979 The J. Stanton Pierce Award (Department of Chemistry, University of Richmond) 1979 The Denoon Scholarship (University of Richmond)
1980 American Chemical Society Award for Outstanding Achievement in Chemistry 1980 The Garnett Ryland Award (Department of Chemistry, University of Richmond) 1980 Sigma Xi (national research honor society)
1980 Phi Beta Kappa
1983 The National Dean's List
1983 The Merck Scholarship (Medical College of Virginia Commonwealth University)
1984 The Sandoz Award in Recognition of Superior Academic Achievement and Contribution to Health Care (Department of Psychiatry, Medical College of Virginia Commonwealth University) 1986 American College of Neuropsychopharmacology/Mead Johnson Travel Fellowship
1987 American Psychiatric Association/Pennwalt Resident Research Award Competition, Honorable Mention
1988 Upjohn Pharmaceutical/University of Michigan Department of Psychiatry, The Psychiatry Resident Outstanding Writing Award
1988 Alpha Omega Alpha
1989 The Lilly Psychiatric Research Fellowship
1989 The American Psychiatric Association/Dista Products Resident Research Award
1989 Upjohn Pharmaceutical/University of Michigan Department of Psychiatry, The Psychiatry Resident Outstanding Writing Award
1989 Graduation with Distinction from the Residency Program, Department of Psychiatry, University of Michigan
1991 The A. E. Bennett Neuropsychiatric Research Foundation Award
1992 Collegium Internationale Neuro-Psychopharmacologicum (CINP) Rafaelsen Fellowship Award
1993 Young Investigator Award, International Congress on Schizophrenia Research
2002 Elected as a Fellow of the American College of Neuropsychopharmacology

Publications (2017)
BIOGRAPHICAL SKETCH

NAME
Kazutoshi (Kazu) Nakazawa

POSITION/TITLE
Associate Professor

EDUCATION/TRAINING

<table>
<thead>
<tr>
<th>INSTITUTION/LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keio University</td>
<td>MD</td>
<td>1981 – 1987</td>
<td>Medicine</td>
</tr>
<tr>
<td>School of Medicine</td>
<td>PhD</td>
<td>1987 – 1991</td>
<td>Biological Science</td>
</tr>
<tr>
<td>Tokyo</td>
<td>Post-doctoral</td>
<td>1991- 1995</td>
<td></td>
</tr>
<tr>
<td>Graduate School of</td>
<td>Post-doctoral</td>
<td>1995 - 2003</td>
<td></td>
</tr>
<tr>
<td>Medicine, Keio</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University, Tokyo,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biological Science</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frontier Science</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program, Riken</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Institute, Japan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Picower Center for</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning &amp; Memory,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIT</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Positions
2003- 2013 Principal investigator, Intramural Program, National Institute of Mental Health
2013 – present Associate Professor, Department of Psychiatry and Behavioral Neurobiology,
University of Alabama at Birmingham
2013 – present Investigator, McKnight Brain Institute

Honors, Awards, and Advisory Committees
1987-1991: Scholarship for graduate school from Japan Scholarship Foundation
1995-1997: Human Frontier Science Program (HFSP) Long-Term Fellowship
1997-1999: Howard Hughes Medical Institute, Postdoctoral fellow
2010: National Institute of Mental Health (NIMH) Director’s Merit Award

Publications 2017

Original Articles in Referred Journals:


Books and Reviews:


\2017 American Neurological Association

Conference/Invited Talk As Chair/Organizer

As Speaker:
1. Title: “Dysfunction of GABAergic interneurons and neuropsychiatric illnesses”, at MIT Colloquium on the Brain and Cognition in Department of Brain and Cognitive Sciences at MIT, Cambridge, MA, October 12, 2017.
2. Title: “Cortical hypodopaminergia vs striatal hyperdopaminergia revisited in an NMDAR hypofunction model of schizophrenia”, at Symposium: “Alterations in NRG/ErbB and NMDA signaling may contribute to brain region-specific dopamine dysbalance in schizophrenia” at International Congress on Schizophrenia Research (ICOSR) 2017, San Diego.

Abstracts for Meeting Presentation:
BIOGRAPHICAL SKETCH

NAME
Vladimir Parpura, MD, PhD

POSITION TITLE
Professor

EDUCATION/TRAINING

<table>
<thead>
<tr>
<th>INSTITUTION AND LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>School of Medicine in Split, University of Zagreb, Croatia</td>
<td>MD</td>
<td>1989</td>
<td>Biological role of gangliosides</td>
</tr>
<tr>
<td>Iowa State University, Ames, IA</td>
<td>PhD</td>
<td>1993</td>
<td>Glia-neuron signaling</td>
</tr>
</tbody>
</table>

MILITARY SERVICE

POSITIONS
MEDICAL EXPERIENCE
07/87 International Educational Exchange, Dept. of Haemodynamics, University Clinic Novi Sad, Yugoslavia
07/88 International Educational Exchange, Dept. of General Surgery, University General Hospital Cordoba, Spain
07/89 International Educational Exchange, University of Rome, Italy, declined
07/89-12/89 Rotating Internship in Medicine, Clinical Hospital Center, Split, University of Zagreb, Croatia

ACADEMIC APPOINTMENTS: (In reverse chronological order)
Year Rank/Title Institution
10/1/15- Professor (with tenure) Dept. of Neurobiology, UAB
Secondary appointments: Department of Cell Developmental and Integrative Biology (10/1/15-), Dept. of Biomedical Engineering (10/1/15-) and Dept. of Vision Science (10/1/15-)
7/1/07-9/30/15 Associate Professor (with tenure) Dept. of Neurobiology, UAB, AL
Secondary appointments: Dept. of Cell Biology (8/27/07-3/6/12), which became Department of Cell Developmental and Integrative Biology (3/7/12-9/30/15), Dept. of Vision Science (9/28/07-9/30/15) and Dept. of Biomedical Engineering (1/1/09-9/30/15)
2015-present Investigator, McKnight Brain Institute
4/16/13-5/26/15, Professor (with tenure) Dept. of Biotechnology, Univ. of Rijeka, Croatia
7/1/-9/15/07 Visiting Associate Researcher* Dept. of Cell Biology & Neuroscience
Univ. of California, Riverside, CA
7/06-6/07 Cooperative Faculty-Associate Professor* Dept. of Physics & Astronomy
Univ. of California, Riverside, CA
7/05-6/07 Associate Professor (with tenure)* Dept. of Cell Biology & Neuroscience
Sabbatical leave in residence (7/1/06-1/2/07)Univ. of California, Riverside, CA
7/00-6/05 Assistant Professor* Dept. of Cell Biology & Neuroscience
Univ. of California, Riverside, CA
12/96-7/00 Affiliate Assistant Professor Dept. of Zoology & Genetics
Iowa State University, Ames, IA

Graduate Faculty (unless inherently linked to the appointment; * see above):

V2017 American Neurological Association
05/98-7/00  Graduate Faculty, Dept. of Zoology & Genetics, Iowa State University, Ames, IA
10/98-7/00  Graduate Faculty, Program for Neuroscience, Iowa State University, Ames, IA
9/12/07-6/5/14 Graduate Faculty, Dept. of Neurobiology (consolidated to GBS; see below), Univ. of Alabama at Birmingham (UAB), Birmingham, AL
10/4/07-7/16/12 Graduate Faculty, Cellular and Molecular Biology Program (consolidated to GBS; see below), UAB, Birmingham, AL
7/17/12- Graduate Faculty, Graduate Biomedical Science (GBS), UAB, Birmingham, AL
3/21/13- Graduate Faculty, Medical Scientist Training Program (MSTP), UAB, Birmingham, AL

Honors, Awards, and Advisory Committees

AWARDS/HONORS
2017- Elected Corresponding Member, Section of Medical Sciences, The Slovenian Academy of Sciences and Arts
2017-2018 McNulty Civitan Scientist Award, The UAB Civitan International Research Center and The Chesapeake District of Civitan International
2017- Elected Fellow, The American Association for the Advancement of Science (AAAS)

COUNCILS AND COMMITTEES
8/8/12-Member-At-Large (2-year term, 2 terms; 2013-15, 2015-17), Central Nervous System Section Steering Committee, American Physiological Society; Reviewer for CNS Section Awards: 2016 Research Recognition Award, and 2016 & 2017 Van Harreveld Memorial Award
3/17/15-3/20/17 President-Elect (2-year term), American Society for Neurochemistry
3/15/15-3/23/16 Member, American Society for Neurochemistry, 2016 Scientific Program Committee for 47th Annual ASN Meeting, Denver, CO
3/21/17- President (2-year term), American Society for Neurochemistry
10/24/17- Member, Program Committee, Joint International Society for Neurochemistry-American Society for Neurochemistry Meeting, Montreal, Canada

TEACHING
Mentor, 2013, 2015 and 2017 Summer Science Institute (SSI) Research Internships for High School and Community College Students, Center for Community OutReach Development (CORD), UAB
7/28/17 CORD Summer Science Program Closing Ceremony:

1 High school student, 2 Undergraduate Student, 3 Graduate Student, 4 Post-Doc, and 5 Research associate in my laboratory

1/3-3/3/17 Course Director. OBHS121 System 1 Neuroscience /DENT1255 Neuroscience. 7 lectures, test questions, brain anatomy practicum, exams and grading. University of Alabama Birmingham; optometry and dental students, total of 115.
1/10/-4/21/17 Course Director. NBL433/PY433 Diseases of the Nervous System. Undergraduate Neuroscience Program, University of Alabama at Birmingham. 7 (of 12) 75-minute lectures, discussions, exams and grading; 26 undergraduate students.

2/15/2017 Taught in GBS 746 Cellular Neurophysiology (Director: J. Wadiche), University of Alabama Birmingham; 2 lectures and provided exam questions; 4 graduate students

1/19/-4/13/17 Course Director. NBL 703. Neurobiology Seminar Series. University of Alabama Birmingham. 31 graduate students

MANUSCRIPTS

Journal articles in press

Journal articles submitted but not yet accepted

Invited lectures, etc. at national/international postgraduate courses and meetings and at other universities
Fundamental Biological and Disease-Related Processes, University of Missouri-Saint Louis, Saint Louis, MO
5/3/17 “Vesicular glutamate release from astrocytes at the interface of signaling and metabolism”, Department of Neurosciences, Lerner Research Institute, Cleveland Clinic, Cleveland, OH
9/21/17 “Vesicular glutamate release from astrocytes at the interface of signaling and metabolism”, International Conference “Brain Extracellular Matrix and Glia in Health and Disease”, Voronezh, Russian federation
10/17/17 “Vesicular Glutamate Release from Astrocytes at the Interface of Signaling”, In Session 4: Astrocyte Function in Health and Disease (Organizer: Doug Feinstein, University of Illinois), 11th Great Lakes Glia Meeting, Traverse City, MI

Undergraduate students (BS Honors Thesis Project Committee)
Benjamin D. Boros (4/4/17-), Undergraduate Neuroscience Program and the Science and Technology Honors
Hailey Edwards (7/18/17-), Science and Technology Honors Program, UAB

GRANT SUPPORT: (CURRENT AND PAST)
Active
12/1/13-11/30/17* National Institutes of Health (R21HD078678) “The Role of Astroglia in the Enteric Nervous System and Gut Function” (PI) 275,000(Direct), $129,063 (indirect), $404,250 (Total).
*two consecutive 1 year no cost extensions approved (12/1/15-11/30/16 & 12/1/16-11/30/17)
7/1/16-6/30/20 COST (CA 15214), EU Framework Programme Horizon 2020 “An integrative action for multidisciplinary studies on cellular structural networks- EuroCellNet” (International partner; PI: Pavel Hozák)
8/15/16 – 6/30/18 National Institutes of Health (R21NS093971) Frequency-dependent Modulation of Synaptic Transmission and Plasticity by pH (Collaborator: 2.5% salary effort; PIs: Mark O. Bevensee PhD, Lynn E. Dobrunz)

Pending
03/23/18 - 03/28/18 National Institutes of Health, R13 “ASN 2018 Annual Meeting” (PI) 31,000 (Direct)
1/1/18-12/31/19 Department of Defense, Congressionally Directed Medical Research Programs, Idea Award with Special Focus, “Exocytosis release of glutamate from human glioblastomas” PI; $400,000 (direct)
1/1/18-12/31/21 Department of Defense, Congressionally Directed Medical Research Programs, Translational Team Science Award; “Use of icatibant for the treatment of high-grade gliomas, “PI; $400,000 (direct)
12/01/17- 11/30/22 NIH-R01 “Bradykinin-elicited Regulated Exocytosis in Gliomas” (PI): $1,250,000 (Direct), $587,500 (indirect), $1,837,500 (Total)
1/1/18-12/31/20 Harrington Discovery Institute, Harrington Scholar-Innovator Program “Small organic bradykinin 2 receptor blockers for use in glioblastoma” (PI); direct only: $99,070
1/1/18-12/31/19 Shire, Investigator Initiated Research Grant, “Re-purposing Firazyr® for the treatment of anaplastic gliomas” (PI); $312,296 (direct), $112,427 (indirect), $424,723 (total)
BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lucas Damian Pozzo-Miller</td>
<td>Professor</td>
</tr>
</tbody>
</table>

EDUCATION/TRAINING

<table>
<thead>
<tr>
<th>INSTITUTION/LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universidad nacional de Cordoba,</td>
<td>B.S.</td>
<td>1985</td>
<td>Physical/Natural Sci</td>
</tr>
<tr>
<td>Argentina</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Universidad Nacional de Cordoba</td>
<td>M.S.</td>
<td>1986</td>
<td>Physical/Natural Sci</td>
</tr>
<tr>
<td>Argentina</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Universidad Nacional de Cordoba</td>
<td>PhD</td>
<td>1989</td>
<td></td>
</tr>
<tr>
<td>Argentina</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case Western Reserve Uni</td>
<td>Postdoc</td>
<td>1992</td>
<td>Hippocampal synapse</td>
</tr>
<tr>
<td>Cleveland, OH</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roche Institute of Molecular Bio</td>
<td>Postdoc</td>
<td>1995</td>
<td>Hippocampal synapse</td>
</tr>
<tr>
<td>Nutley, NJ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Master Teacher Program</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UAB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthcare Leadership Academy</td>
<td></td>
<td>2006</td>
<td></td>
</tr>
</tbody>
</table>

Positions

1995-1998 Senior Staff Fellow (Research-track Assistant Professor). Laboratory of Neurobiology (Tom Reese, Lab Chief, member US National Academy of Sciences), National Institute of Neurological Disorders and Stroke (NINDS), National Institutes of Health (NIH), Bethesda, MD.

1998-2006 Assistant Professor (tenure-track), Department of Neurobiology, School of Medicine, UAB. Secondary appointments in the Departments of Cell Biology and Physiology & Biophysics (currently Cell, Developmental & Integrative Biology), School of Medicine, UAB.

2006-present Scientist, Civitan International Research Center; Investigator, Evelyn F. McKnight Brain Institute; Scientist, Center for Glial Biology in Medicine; Scientist, Vision Science Research Center; Member, Comprehensive Neuroscience Center, UAB.

2006-2009 Associate Professor (with tenure), Department of Neurobiology, School of Medicine, UAB.

2006-present Investigator, McKnight Brain Institute

2009-present Professor, Department of Neurobiology, School of Medicine, UAB.

2013-present Professor, Department of Neurobiology, College of Arts & Sciences, UAB.

2014-present Secondary appointment in the Department of Neurology, School of Medicine, UAB.

2014-present Associate Director, Comprehensive Neuroscience Center, UAB.

2016-present Interim Scientific Co-Director, Civitan International Research Center, UAB.

2017-present Co-Director, Neuroscience Theme, Graduate Biomedical Sciences (GBS), UAB.

Honors, Awards, and Advisory Committees

2017 Chair Nanosymposium at the Society for Neuroscience Annual Meeting, Washington, DC.

Publications 2017


BIOGRAPHICAL SKETCH

NAME
Sumanth D. Prabhu

POSITION TITLE
Professor

INSTITUTION/LOCATION
Pennsylvania State Uni, PA
Jefferson Medical Collge, PA
Uni of Pittsburgh, PA
University of Pittsburgh, PA
Univ of TX Health Science Ctr, San Antonio, TX

DEGREE
B.S.
MD
Intern & Resident Research Fellow

YEAR(S)
1983
1985
1988
1989
1992

FIELD OF STUDY
Science
Medicine

Positions

7/92-8/98 Assistant Professor Dept. of Medicine/Cardiology
Univ. of TX Health Science Ctr
San Antonio, Texas

9/95-8/98 Assistant Professor (Joint) Dept. of Physiology
Univ. of TX Health Science Ctr

9/98-11/99 Associate Professor Dept. of Medicine/Cardiology
Dept. of Physiology
Univ. of TX Health Science Ctr

12/99-6/05 Associate Professor Dept. of Medicine/Cardiology
University of Louisville
Louisville, KY

6/00-6/11 University Scholar University of Louisville
Louisville, KY

7/00-6/05 Associate Professor (Joint) Dept. of Physiology/Biophysics
University of Louisville

7/05-9/11 Professor Dept. of Medicine/
Division of Cardiovascular Medicine
Dept. of Physiology/Biophysics
University of Louisville

7/11-9/11 Distinguished University Scholar University of Louisville
Louisville, KY

10/11- Adjunct Professor (Gratis) Division of Cardiovascular Disease/

V2017 American Neurological Association
Department of Medicine
University of Louisville
Louisville, KY

10/11- Professor
Division of Cardiovascular Disease/
Department of Medicine
Dept. of Cell, Developmental, and
Integrative Biology (CDIB)
Univ. of Alabama at Birmingham

10/11- Director
Division of Cardiovascular Disease
Univ. of Alabama at Birmingham

02/12- Mary Gertrude Waters Endowed
Chair of Cardiovascular Medicine
Univ. of Alabama at Birmingham

02/12- Director
Comprehensive Cardiovascular Ctr.
Univ. of Alabama at Birmingham

C. OTHER POSITIONS AND EMPLOYMENT

7/92-11/99 Staff Cardiologist
University Hospital & VA Hospital
San Antonio, Texas

7/93-6/97 Associate Director
Non-Invasive Cardiology
University Hospital & VA Hospital
San Antonio, Texas

7/96-11/98 Director
Cardiology Fellowship Program
Univ. of TX Health Science Ctr
San Antonio, Texas

12/99-9/11 Staff Cardiologist
University of Louisville Hospital
Louisville VA Medical Center
University Medical Associates
Jewish Hospital
Norton Hospital
Louisville, KY

3/02-4/05 Director, Coronary Care Unit
University of Louisville Hospital

9/02-9/11 Director
Louisville VA Heart Failure Clinic
Louisville, KY

7/06-3/10 Director
Heart Failure Section
Division of Cardiovascular Medicine
University of Louisville
2008-9/11 Medical Director, Heart Failure University of Louisville Hospital Louisville, KY

3/10-9/11 Director Heart Failure/Transplant Research Division of Cardiovascular Medicine University of Louisville

7/09-9/11 Director Preventive Cardiology Clinic University of Louisville

9/10-9/11 Cardiology Section Chief University of Louisville Hospital Louisville, KY

10/11- Staff Cardiologist UAB Hospital/Clinics Birmingham VA Medical Center Birmingham, AL

10/11- Cardiologist-in-Chief UAB Hospital Birmingham, AL

1/12- Co-Chair Cardiovascular Leadership Cmte. UAB Hospital Birmingham, AL

1/12- Faculty Member Graduate Biomedical Science & MSTP Program, UAB

2017-present, Investigator, McKnight Brain Institute

Honors, Awards, and Advisory Committees
Association of University Cardiologists, 2017
American Clinical and Climatological Association, 2017
Member, NIH MPOR Study Section 7/2015-6/2019

Invited Lectures and Presentations 2017
9/29/17 Distinguished Guest Lecturer: “Immune Activation in Heart Failure”
19th Annual Molecular Cardiology Research Institute Retreat
Tufts Medical Center
Woods Hole, Massachusetts

9/21/17 Invited Speaker: “Immune Cell Remodeling in Heart Failure”
Center for Heart Failure Research
15th Annual Symposium on Heart Failure
University of Oslo
Oslo, Norway

9/15/17 Moderator: “Molecular Mechanisms of Arrhythmia”
6th Annual Symposium of the UAB Comprehensive Cardiovascular Center
Focus on Cardiovascular Electrophysiology
Birmingham, AL

7/14/17  “Immune Cell Alterations in Heart Failure”
International Academy of Cardiology
2017 Annual Scientific Sessions
22nd World Congress on Heart Disease
Vancouver, BC, Canada

5/31/17  “CCR2+ Infiltrating Macrophages and Pressure-Overload Heart Failure”
2017 International Society for Heart Research – North American Section Meeting
“Translation of Cardiovascular Therapeutics to the Clinic”
New Orleans, LA

5/4/17  “Heart Failure: An Inflammatory Response to Injury”
LSUHSC Cardiovascular Center of Excellence Seminar Series
Louisiana State University Health Sciences Center
New Orleans, LA

4/23/17  “Splenic Macrophages in Heart Failure”
SCVP Symposium: New Roles for Inflammation in the Heart
American Society for Investigative Pathology (ASIP) Annual Meeting
Experimental Biology 2017
Chicago, IL

4/12/17  “Immune Cell Remodeling in Heart Failure”
Research Seminar, Department of Cell Biology and Molecular Medicine
Rutgers, New Jersey Medical School
Newark, NJ

3/2/17  “Splenic Marginal Zone Macrophages and Cardiac Repair”
Cardiovascular Tissue Engineering Symposium
NIH NHLBI Progenitor Cell Biology Consortium (PCBC) Birmingham, AL

1/26/17  “Immune Cell Hypothesis of Heart Failure”
Comprehensive Cardiovascular Center Seminar Series
University of Alabama at Birmingham
Birmingham, AL

Publications 2017


Manuscripts in preparation


BIOGRAPHICAL SKETCH

NAME
Erik Roberson

POSITION TITLE
Associate Professor
Virginia B. Spencer Professor of Neuroscience

EDUCATION/TRAINING

<table>
<thead>
<tr>
<th>INSTITUTION AND LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Princeton University, Princeton, NJ</td>
<td>A.B.</td>
<td>1990</td>
<td>Molecular Biology</td>
</tr>
<tr>
<td>Baylor College of Medicine</td>
<td>PhD</td>
<td>1997</td>
<td>Neuroscience</td>
</tr>
<tr>
<td>Baylor College of Medicine</td>
<td>MD</td>
<td>1999</td>
<td></td>
</tr>
</tbody>
</table>

Positions

2005–08 Assistant Adjunct Professor of Neurology, UCSF
2006–08 Staff Scientist, Gladstone Institute of Neurological Disease
2008–12 Assistant Professor of Neurology, UAB
2012– Associate Professor of Neurology with tenure, UAB
2013–15 Associate Director, UAB Alzheimer’s Disease Center
2013– Co-Director, UAB Center for Neurodegeneration and Experimental Therapeutics
2015– Co-Director, Evelyn F. McKnight Brain Institute at UAB
2015– Director, UAB Alzheimer’s Disease Center

Concurrent Appointments

2008–12 Assistant Professor of Neurobiology, UAB (joint appointment)
2012– Associate Professor of Neurobiology, UAB (joint appointment)
2008– Investigator, UAB Center for Neurodegeneration and Experimental Therapeutics
2008– Investigator, McKnight Brain Institute, UAB
2008– Neurologist, UAB Division of Memory Disorders and Behavioral Neurology
2008– Faculty, UAB Graduate School
2008– Faculty, UAB Medical Scientist Training Program
2008– Scientist, UAB Comprehensive Center for Healthy Aging
2010– Scientist, UAB Center for Glial Biology in Medicine

Honors, Awards, and Advisory Committees

- Valedictorian, Washington High School, Cedar Rapids, IA, 1986
- Phi Beta Kappa, 1990
- NIH Medical Scientist Training Program fellowship, 1990–1999
- Baylor College of Medicine Presidential Scholar, 1990–1999
- Baylor College of Medicine Dean’s Award for Excellence, 1992–1997
- Life & Health Insurance Medical Research Fund Young Scientist Scholar, 1992–1997
- Alpha Omega Alpha, 1999
- S.D. Bechtel, Jr. Young Investigator Award, 2004
- Kathryn Grupe Award for Excellence in Alzheimer’s Disease Research, 2005
- Virginia B. Spencer Endowed Scholar in Neuroscience at UAB, 2008–2013
- Fellow, American Neurological Association, 2012
- McNulty Civitan Scientist Award, 2012
- Virginia B. Spencer Endowed Professor of Neuroscience at UAB, 2013–
- Derek Denny-Brown Neurological Scholar Award, American Neurological Association, 2015
Publications
BIOGRAPHICAL SKETCH

NAME
Michael Switow Saag

POSITION TITLE
Professor of Medicine
Associate Dean for Global Health
Director, UAB Center for AIDS Res

EDUCATION/TRAINING

<table>
<thead>
<tr>
<th>INSTITUTION/LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry, Tulane University</td>
<td>B.S.</td>
<td>1977</td>
<td>Chemistry</td>
</tr>
<tr>
<td>University of Louisville,</td>
<td></td>
<td>1981</td>
<td>Medicine</td>
</tr>
<tr>
<td>Louisville, Kentucky</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UAB</td>
<td>MD</td>
<td></td>
<td>Medicine</td>
</tr>
<tr>
<td>UAB</td>
<td></td>
<td>1982</td>
<td></td>
</tr>
<tr>
<td>UAB</td>
<td>Intern</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UAB</td>
<td>Resident</td>
<td>1984</td>
<td></td>
</tr>
<tr>
<td>UAB</td>
<td>Chief Resident</td>
<td>1985</td>
<td></td>
</tr>
<tr>
<td>UAB</td>
<td>Fellow</td>
<td>1987</td>
<td></td>
</tr>
<tr>
<td>UAB</td>
<td>Post Doc</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1987</td>
<td></td>
</tr>
</tbody>
</table>

Positions

1987 - 2010 Staff Physician, Medical Service Infectious Diseases, Department of Veterans Affairs Medical Center, Birmingham, Alabama
1987 - 2010 Consulting Physician, Cooper Green Hospital, Birmingham, Alabama
1987 - Present Attending Physician, Department of Medicine, University of Alabama at Birmingham, School of Medicine, Birmingham, Alabama
2009 - Present Secondary Appointment to Epidemiology, University of Alabama at Birmingham, School of Public Health, Birmingham Alabama
2017 – Present Investigator, McKnight Brain Institute

Honors, Awards, and Advisory Committees

2012 - Present Board Member, Infectious Diseases and Therapy
2012 - Present Member, WHO Antiretroviral Therapy Guidelines Committee
2013 - Member, CFAR Sub-Saharan Africa Working Group (CFAR-SSA)
2013 - Present Member, NIH R13 Grant Review Panel
2013 - Present Member, NIH NIAID/DIR Board of Scientific Counselors
2013 - Present Co-Chair, AASLD/IDSA/ IAS-USA Hepatitis C Guidelines Committee
2016-presents Member, United Health Council

Publications 2017
None.

Manuscripts in preparation

\2017 American Neurological Association
BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>David George Standaert</td>
<td>Professor and Chair</td>
</tr>
</tbody>
</table>

EDUCATION/TRAINING

<table>
<thead>
<tr>
<th>INSTITUTION/LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvard University</td>
<td>A.B.</td>
<td>1982</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>Washington University</td>
<td>MD/PhD</td>
<td>1988</td>
<td>Medicine, Pharmacology</td>
</tr>
<tr>
<td>School of Medicine</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Positions

July, 1995 – June, 2000 Assistant Neurologist, Massachusetts General Hospital, Boston, MA
July, 2000 – June, 2006 Associate Neurologist, Massachusetts General Hospital, Boston, MA
July, 2000 – June, 2006 Associate Neurologist, Brigham and Women's Hospital, Boston, MA
July, 2005 – June, 2006 Consultant in Neurology, Spaulding Rehabilitation Hos, Boston, MA
Jan., 2007 – Sept. 2010 Vice-Chair, UAB Department of Neurology
Oct., 2010 – Oct. 2011 Interim Chair, UAB Department of Neurology
Oct., 2013 – Sept. 2016 Chair, Health Services Foundation Advisory Board
July, 2007 – June, 2017 Director, UAB Division of Movement Disorders
Oct., 2014 – Sept, 2016 Board of Directors, UAB Health System
July, 2006 – present Neurologist, University of Alabama Hospital
2006 – present Investigator, McKnight Brain Institute
Nov., 2011 – present Chair, UAB Department of Neurology

Honors, Awards, and Advisory Committees

2007-2017 (inclusive) “Best Doctors in America”

Publications 2017


BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anne Theibert</td>
<td>Professor</td>
</tr>
</tbody>
</table>

EDUCATION/TRAINING

<table>
<thead>
<tr>
<th>INSTITUTION/LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goucher College, Baltimore, MD</td>
<td>B.A.</td>
<td>1979</td>
<td>Chemistry</td>
</tr>
<tr>
<td>Johns Hopkins Uni, Baltimore, MD</td>
<td>PhD</td>
<td>1985</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>Johns Hopkins Uni, Baltimore, MD</td>
<td>Postdoc</td>
<td>1987</td>
<td></td>
</tr>
<tr>
<td>Johns Hopkins Uni, Baltimore, MD</td>
<td>Postdoc</td>
<td>1991</td>
<td></td>
</tr>
</tbody>
</table>

Positions

<table>
<thead>
<tr>
<th>Year</th>
<th>Rank/Title</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009-present</td>
<td>Undergraduate Neuroscience Program Director</td>
<td>University of Alabama at Birmingham</td>
</tr>
<tr>
<td>2006-present</td>
<td>Investigator</td>
<td>McKnight Brain Institute</td>
</tr>
<tr>
<td>2000-present</td>
<td>Associate Professor (primary)</td>
<td>University of Alabama at Birmingham</td>
</tr>
<tr>
<td>2000-present</td>
<td>Department of Cell, Developmental and Integrative Biology</td>
<td>University of Alabama at Birmingham</td>
</tr>
<tr>
<td>2000-2012</td>
<td>Associate Professor (secondary)</td>
<td>University of Alabama at Department of Biology and Biophysics</td>
</tr>
<tr>
<td>1996-2000</td>
<td>Assistant Professor (primary)</td>
<td>University of Alabama at Department of Neurobiology</td>
</tr>
<tr>
<td>1991-1996</td>
<td>Assistant Professor (primary)</td>
<td>University of Alabama at Department of Cell Biology</td>
</tr>
</tbody>
</table>

Honors, Awards, and Advisory Committees
Undergraduate Neuroscience Program Director; Undergraduate Neuroscience Program Curriculum Committee; Neurobiology Department Graduate Program Director and Executive Committee Chair; Graduate Biomedical Science (GBS) Steering and Oversight Committee (SOC); GBS Curriculum Committee; GBS Neuroscience Curriculum Committee; Comprehensive Neuroscience Center (CNC) Executive Committee; Science and Technology Honors Program Admissions Committee

Publications 2017
None.

Manuscripts in preparation
None.
BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kristen L. Triebel</td>
<td>Associate Professor</td>
</tr>
</tbody>
</table>

EDUCATION/TRAINING

<table>
<thead>
<tr>
<th>INSTITUTION/LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pittsburg State University</td>
<td>B.A.</td>
<td>2002</td>
<td>Psychology</td>
</tr>
<tr>
<td>Psychology, Forest Institute</td>
<td>M.A.</td>
<td>2005</td>
<td>Psychology</td>
</tr>
<tr>
<td>Psychology, Forest Institute</td>
<td>PsyD</td>
<td>2006</td>
<td>Psychology</td>
</tr>
<tr>
<td>Coatesville VA Med Ctr, Coatesville, PA</td>
<td>Intern</td>
<td>2006</td>
<td></td>
</tr>
<tr>
<td>Dept of Neurology, UAB</td>
<td>Fellow</td>
<td>2008</td>
<td></td>
</tr>
</tbody>
</table>

Positions

<table>
<thead>
<tr>
<th>Year</th>
<th>Rank/Title</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/2017 -</td>
<td>Associate Professor/Neuropsychologist (Tenure-track)</td>
<td>UAB, Neurology</td>
</tr>
<tr>
<td>10/2011 – 9/2017</td>
<td>Assistant Professor/Neuropsychologist (Tenure-track)</td>
<td>UAB, Neurology</td>
</tr>
<tr>
<td>2008 - 2011</td>
<td>Instructor/Neuropsychologist</td>
<td>UAB, Neurology</td>
</tr>
<tr>
<td>2017-present</td>
<td>Investigator, McKnight Brain Institute</td>
<td></td>
</tr>
</tbody>
</table>

Other Appointments/Administrative Positions at UAB:

<table>
<thead>
<tr>
<th>Year</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>03/16 – present</td>
<td>Faculty Member, UAB Multiple Sclerosis Center</td>
</tr>
<tr>
<td>01/16 – present</td>
<td>Scientist, Alzheimer’s Disease Center, UAB</td>
</tr>
<tr>
<td>04/15 – present</td>
<td>Member, CNS Disease Working Group, Comprehensive Cancer Center, UAB</td>
</tr>
<tr>
<td>01/12 – present</td>
<td>Director, Clinical Neuropsychology Training Program, UAB</td>
</tr>
<tr>
<td>08/12 - present</td>
<td>Associate Scientist, Comprehensive Cancer Center, Cancer Control and Population Sciences Program, UAB</td>
</tr>
<tr>
<td>06/12 - present</td>
<td>Scientist, Center for Outcomes and Effectiveness Research and Education (COERE), UAB</td>
</tr>
<tr>
<td>08/09 - present</td>
<td>Scientist, UAB Comprehensive Neuroscience Center</td>
</tr>
<tr>
<td>01/09 - present</td>
<td>Psychology Graduate Faculty, UAB</td>
</tr>
</tbody>
</table>

Honors, Awards, and Advisory Committees

Professional societies:

American Academy of Clinical Neuropsychology (AACN)
International Neuropsychological Society (INS)
National Academy of Neuropsychology (NAN)

Councils and committees:

External service activities:
Chair, Membership Committee, National Academy of Neuropsychology (NAN) (Chair term: 2015-2017; Membership Committee term 2012-2017)
Professional Member Advisor, Student Committee, National Academy of Neuropsychology, 2014-2017
Member, International & Affiliation Task Force, NAN, 2015-2016
Leader, Student Task Force, NAN, 2014
Co-leader, Ambassador and Leadership Development Program Task Force, NAN, 2016 – present
Secretary-Elect, Member of the Board of Directors, NAN, 2018 - 2020

UAB service activities:
Member, UAB Faculty Policies and Procedures Committee (term: Sept. 2016 – Sept. 2018)  
Working Group Member – UAB Faculty Wellness Task Force (appointed December 2016 – 2017)  
UAB Deep Brain Stimulation Patient Selection Committee (member, recurring monthly, 2008 – present)

Publications 2017


Manuscripts in press:

Manuscripts submitted but not yet accepted:
BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eroboghene E. Ubogu</td>
<td>Professor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INSTITUTION/LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>King's College, Lagos, Nigeria</td>
<td></td>
<td>1991</td>
<td>Secondary School</td>
</tr>
<tr>
<td>University of Lagos, Lagos, Nigeria</td>
<td></td>
<td>1992</td>
<td>Pre-medical</td>
</tr>
<tr>
<td>Imperial College School of Medicine</td>
<td></td>
<td>1998</td>
<td>MBBS</td>
</tr>
<tr>
<td>(University of London), London, England, United Kingdom</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Positions**

Professor (tenured) September 2013-
Department of Neurology
The University of Alabama at Birmingham
Birmingham, Alabama

Director, Division of Neuromuscular Diseases September 2013-
Department of Neurology
The University of Alabama at Birmingham
Birmingham, Alabama

Director, Neuromuscular Immunopathology Research Laboratory September 2013-
Division of Neuromuscular Diseases
Department of Neurology
The University of Alabama at Birmingham
Birmingham, Alabama

Director, Shin J. Oh Muscle and Nerve Histopathology Laboratory, Division of Neuromuscular Diseases September 2013-
Department of Neurology
The University of Alabama at Birmingham
Birmingham, Alabama

Director, Electromyography and Clinical Neurophysiology Laboratory, Division of Neuromuscular Diseases September 2013-
Department of Neurology
The University of Alabama at Birmingham
Birmingham, Alabama
Director, Clinical Neurophysiology Residency Program  September 2013-
(Fellowship), Department of Neurology
The University of Alabama at Birmingham
Birmingham, Alabama

Director, Neuromuscular Medicine Fellowship Program,  March 2014-June 2015
Department of Neurology
The University of Alabama at Birmingham
Birmingham, Alabama

Professor  August 2015-
Department of Neurobiology
The University of Alabama at Birmingham
Birmingham, Alabama

Investigator  2015 - present
McKnight Brain Institute
The University of Alabama at Birmingham
Birmingham, Alabama

Presentations
2. Unravelling the Mysteries of the Human Blood-Nerve Barrier: Implications for Neuroinflammation. Multiple Sclerosis Collaborative Research Meeting. UAB Multiple Sclerosis Center (MSC), Department of Neurology, the University of Alabama at Birmingham, Birmingham, Alabama, May 26th, 2017

Publications 2017
BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kristina M. Visscher</td>
<td>Associate Professor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INSTITUTION/LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carleton College, Northfield MN</td>
<td>B.A.</td>
<td>1998</td>
<td>Physics</td>
</tr>
<tr>
<td>Washington Uni, St. Louis, MO</td>
<td>PhD</td>
<td>2004</td>
<td>Neuroscienc</td>
</tr>
</tbody>
</table>

**Positions**

2009-2017  Assistant Professor, Neurobiology, University of Alabama, Birmingham
Secondary appointments in Psychology, Vision Sciences/optometry, Biomedical Engineering, Ophthalmology, Vision Science Research Center, Comprehensive Center for Healthy Aging

2017-present  Associate Professor, Neurobiology, University of Alabama, Birmingham
Secondary appointments in Psychology, Vision Sciences/Optometry, Biomedical Engineering, Ophthalmology, Vision Science Research Center, Comprehensive Center for Healthy Aging

2009-present  Investigator, McKnight Brain Institute
The University of Alabama at Birmingham
Birmingham, Alabama

**Honors, Awards, and Advisory Committees**
Graduate School Dean’s Award for Excellence in Mentorship, UAB (2017)

**Publications 2017**
BIOGRAPHICAL SKETCH

NAME
Jacques I. Wadiche

POSITION TITLE
Associate Professor

EDUCATION/TRAINING

<table>
<thead>
<tr>
<th>INSTITUTION AND LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northwestern University; Evanston, IL</td>
<td>B.A.</td>
<td>1984-1988</td>
<td>Neurobio. &amp; Physiology</td>
</tr>
<tr>
<td>Vollum Institute, OHSU; Portland, OR</td>
<td>PhD</td>
<td>1992-1998</td>
<td>Neurosci. / Biophysics</td>
</tr>
<tr>
<td>Vollum Institute, OHSU; Portland, OR</td>
<td>Postdoctoral Student</td>
<td>1998-2006</td>
<td>Synaptic Transmission</td>
</tr>
<tr>
<td>CSHL Imaging Course; Co. Sp.Har., NY</td>
<td></td>
<td>2003</td>
<td>Neuroimaging</td>
</tr>
</tbody>
</table>

Positions
1987 - 1988 Undergraduate Thesis Fellow, Department of Neurobio. and Physiol., Northwestern University, Evanston, IL; Advisor: Fred Turek, PhD
1990 - 1992 Research Assistant, Department of Neuroscience, Baylor College of Medicine, Houston, TX; Advisor: James W. Patrick, PhD
1992 - 1998 Graduate Student, Vollum Institute, Oregon Health Sciences University, Portland, OR; Advisor: Michael P. Kavanaugh, PhD
1998 - 2006 Postdoctoral Fellow, Vollum Institute, Oregon Health Sciences University, Portland, OR; Advisor: Craig E. Jahr, PhD
2004 Teaching Assistant, Cold Spring Harbor Laboratories Imaging Course, Cold Spring Harbor, NY
2006 – 2013 Assistant Professor, Department of Neurobiology, University of Alabama at Birmingham; Birmingham, AL
2006-present Investigator, McKnight Brain Institute
2013 - Associate Professor, Department of Neurobiology, University of Alabama at Birmingham; Birmingham, AL

Honors, Awards, and Advisory Committees
1992 - 1994 Predoctoral Dean's Fellowship, Oregon Health Sciences University, Portland, OR
1994 Biophysical Society Student Travel Award
1994 - 1996 NIH - NIDA Predoctoral Training Fellowship, Vollum Institute, Oregon Health Sciences University, Portland, OR
1996 Medical Research Foundation Tartar Award, Oregon Health Sciences University, Portland, OR
1998 John Resko Award Outstanding Doctoral Thesis, Oregon Health Sciences University, Portland, OR (recognizes best doctoral thesis)
1999 NIH/NIDDK Training Grant fellowship, Vollum Institute, OHSU
2002 - 2004 NIH - NIMH National Research Postdoctoral Fellowship, Vollum Institute, Oregon Health Sciences University, Portland, OR
2003 Cold Spring Harbor Laboratories Imaging Course - student
2004 Cold Spring Harbor Laboratories Imaging Course - teaching fellowship
2007 - 2009 Editorial Member, Open Neuroscience Journal
2008 - Ad hoc reviewer: Netherlands Organization for Scientific Research, Agence Nationale de la Recherche (France), North Carolina Biotechnology Center
2009 - Ad hoc reviewer NSF Peer Review Committees (Biomolecular Systems, Cellular Systems)
2011 - Editorial Board, Frontiers in Behavioral and Psychiatric Genetics
2016 - Graduate Dean’s Excellence in Mentorship Award, UAB

Publications (2017)
BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linda Wadiche</td>
<td>Associate Professor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EDUCATION/TRAINING</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>INSTITUTION/LOCATION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North Park Uni, Chicago, IL</td>
<td>B.S.</td>
<td>1992</td>
<td>Biology</td>
</tr>
<tr>
<td>Northwestern Uni, Chicago, IL</td>
<td>PhD</td>
<td>1997</td>
<td></td>
</tr>
<tr>
<td>Vollum Institute, Oregon Health</td>
<td></td>
<td>2004</td>
<td></td>
</tr>
</tbody>
</table>

Positions
2011 – present Associate Professor, Department of Neurobiology, UAB
2006 - 2011 Assistant Professor (primary), Department of Neurobiology, UAB
2006-present Investigator, McKnight Brain Institute
2005 - 2006 Assistant Research Professor, Vollum Institute, Oregon Health & Sciences University, Portland, OR

Honors, Awards, and Advisory Committees
2018-19 Standing member, CURE grant review board

Publications 2017

PUBLICATIONS (Google scholar H-index 28)
BIOGRAPHICAL SKETCH

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scott Wilson</td>
<td>Associate Professor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INSTITUTION/LOCATION</th>
<th>DEGREE</th>
<th>YEAR(S)</th>
<th>FIELD OF STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of South Florida</td>
<td>B.S.</td>
<td>1986</td>
<td>Biology</td>
</tr>
<tr>
<td>University of South Florida</td>
<td>M.S.</td>
<td>1989</td>
<td>Microbiology</td>
</tr>
<tr>
<td>University of Florida</td>
<td>PhD</td>
<td>1996</td>
<td>Molecular Genetics</td>
</tr>
<tr>
<td>National Cancer Institute</td>
<td>Postdoc</td>
<td>2002</td>
<td>Genetics</td>
</tr>
</tbody>
</table>

Positions

1990-1991  Instructor, Introductory Biology, Hillsboro Community College, Tampa, Florida
1992-1996  Graduate student in the laboratory of Maurice Swanson, Department of Molecular Genetics and Microbiology, University of Florida College of Medicine, Gainesville, Florida
1997-2002  Postdoctoral Fellow in the laboratory of Drs. Neal Copeland and Nancy Jenkins, National Cancer Institute, Frederick, MD.
8-02 to present Assistant Professor, Department of Neurobiology, University of Alabama at Birmingham, Birmingham, AL,
11-03 to present Secondary Appointment in the Department of Biochemistry and Molecular Genetics
11-04 to present Secondary Appointment in the Department of Genetics
2006-present  Investigator, McKnight Brain Institute
6-06 to present Director of Summer Program in Neuroscience
10-06 to present Director of Molecular Recombineering Core. NIH Blueprint Core facility.
8-10 to present Associate Professor, Department of Neurobiology, University of Alabama at Birmingham, Birmingham, AL
2017 American Neurological Association
Dendritic Spines Provide Cognitive Resilience against Alzheimer’s Disease

Benjamin D. Boros,1,2 Kelsey M. Greathouse, BS,1,2 Erik G. Gentry, BS,1,2 Kendall A. Curtis,1,2 Elizabeth L. Birchall, BS,1,2 Marla Gearing, PhD,3 and Jeremy H. Herskowitz, PhD 1,2

Objective: Neuroimaging and other biomarker assays suggest that the pathological processes of Alzheimer’s disease (AD) begin years prior to clinical dementia onset. However, some 30 to 50% of older individuals who harbor AD pathology do not become symptomatic in their lifetime. It is hypothesized that such individuals exhibit cognitive resilience that protects against AD dementia. We hypothesized that in cases with AD pathology, structural changes in dendritic spines would distinguish individuals who had or did not have clinical dementia.

Methods: We compared dendritic spines within layer II and III pyramidal neuron dendrites in Brodmann area 46 dorsolateral prefrontal cortex using the Golgi–Cox technique in 12 age-matched pathology-free controls, 8 controls with AD pathology (CAD), and 21 AD cases. We used highly optimized methods to trace impregnated dendrites from bright-field microscopy images that enabled accurate 3-dimensional digital reconstruction of dendritic structure for morphologic analyses.

Results: Spine density was similar among control and CAD cases but was reduced significantly in AD. Thin and mushroom spines were reduced significantly in AD compared to CAD brains, whereas stubby spine density was decreased significantly in CAD and AD compared to controls. Increased spine extent distinguished CAD cases from controls and AD. Linear regression analysis of all cases indicated that spine density was not associated with neuritic plaque score but did display negative correlation with Braak staging.

Interpretation: These observations provide cellular evidence to support the hypothesis that dendritic spine plasticity is a mechanism of cognitive resilience that protects older individuals with AD pathology from developing dementia.

ANN NEUROLOGY 2017:00:000–000

Alzheimer’s disease (AD) is the most common cause of dementia in older individuals and a leading cause of death in the developed world. Recent advances in neuroimaging and other biomarker assays that provide the means to detect AD pathophysiology in vivo suggest that the pathological processes of AD begin years to decades prior to clinical dementia onset.1 However, some 30 to 50% of older individuals who harbor AD pathology do not become symptomatic in their lifetime.2

Large-scale epidemiological studies provide evidence for cognitive resilience to AD pathology, including the Religious Orders Study and the companion Rush Memory and Aging Project. These studies showed that one-third of individuals in their 80s are cognitively nor- mal despite levels of b-amyloid (Ab) plaques and neurofibrillary tangles (NFTs) that meet National Institute on Aging (NIA)-Reagan criteria for intermediate to high likelihood of AD.3 Additionally, the Baltimore Longitudinal Study of Aging, Honolulu-Asia Aging Study, 90 1 Study, and Medical Research Council Cognitive Function and Ageing Study reported similar disconnect among Ab plaques, NFTs, and cognition.4–7 Dating to the work of Ramon y Cajal, it is hypothesized that the brain is capable of protective structural plasticity in the
ANNALS of Neurology

face of aging and disease, a proposed mechanism contributing to cognitive resilience. However, studies providing neurobiological evidence of this in patients with AD pathology are limited.

Cognitively normal individuals with AD pathology are proposed to represent individuals who are resilient to dementia or in preclinical stages of AD. This cohort allows exploration of mechanisms that are critical for retaining cognitive function in the face of AD pathology (i.e., cognitive resilience) or involved in the transition from preclinical to symptomatic AD. Neuronal synapse loss correlates more strongly with cognitive impairment than classical pathologic markers of AD, yet whether synapse loss is progressive or synaptic remodeling contributes to cognitive resilience to protect individuals with AD pathophysiology is not known. Excitatory synapses occur on actin-rich dendritic protrusions called dendritic spines, and synapse strength and activity are inseparably linked to spine morphology. We hypothesized that in cases with AD pathology, structural changes in dendritic spines would distinguish individuals who had or did not have clinical dementia. To test this hypothesis, we used highly optimized 3-dimensional modeling of dendritic spines to analyze prefrontal cortex synapse populations from controls, cognitively normal individuals with high AD pathology (CAD), and AD dementia cases.

Subjects and Methods

Human Brain Tissue

Samples of frontal cortex derived from subjects exhibiting a range of AD pathology were examined. Tissue samples were collected at the Emory University Alzheimer's Disease Research Center. The case diagnosis is based on Mini-Mental State Examination (MMSE), Consortium to Establish a Registry for Alzheimer's disease (CERAD) criteria for the neuro-pathologic diagnosis of AD, and Braak staging of neurofibrillary pathology. Cases were categorized into 3 diagnostic groups, which included (1) 12 cognitively normal controls without AD pathology, (2) 8 cognitively normal control subjects showing moderate to severe AD pathology at autopsy, and (3) 21 definite AD cases with severe pathology. The 3 groups were matched as closely as possible for age, sex, and postmortem interval. It is important to note that the majority of these cases had no coexisting pathologies, such as stroke or Lewy body disease. Although multiple neuropsychological tests were employed in the cognitive testing of these subjects, the MMSE is the most commonly used test for complaints of memory problems or when a diagnosis of dementia is being considered, and those results are presented in Table 1. Severe to moderate AD patients have MMSE scores of 10 to 20 of total possible of 30; at the end stages of disease, impairment.
is so severe as to prevent testing. Clinical Dementia Rating (CDR) was conducted on 3 cases. CDR scores the severity of symptoms of dementia using a composite range of 0 to 3, where 0 indicates no symptoms of dementia and 3 marks severe impairment. Pathology data on cases is presented in Table 2. Neuritic and diffuse plaques were scored semiquantitatively according to CERAD methods. CERAD (0-3 or none, sparse, moderate, frequent) and Braak (0–6) scores are measures of the severity of neuritic plaque and NFT accumulation, respectively. The Amyloid Braak CERAD score was used as a global measure of AD pathology.  

**Tissue Processing and Golgi-Cox Staining**  
All tissue samples were fixed in 4% paraformaldehyde immediately following dissection and stored in preservative solution containing sodium azide at 4°C. Tissue blocks of approximately 20 3 20 3 5mm taken from the dorsolateral prefrontal cortex (Brodmann area 46 [BA46]) were sectioned into 250 mm slices (about 15 per block) using a Leica Vibratome (VT1000s, Leica Biosystems, Buffalo Grove, IL) and stored in preservation buffer (0.1% wt/vol sodium azide in phosphate-buffered saline) until Golgi-Cox impregnation. All tissues were stained using the FD Rapid Golgi Stain Kit (PK401, FD Neurotechnologies, Columbia, MD) and the manufacturer's instructions with the following modifications. Tissue slices were impregnated in chromate mixture of Solution A (potassium dichromate and mercuric chloride) and Solution B (potassium chromate). The chromate solution was replaced after the first 24 hours, and tissue was then left in chromate solution in the dark for 6 weeks. Next, tissue slices were immersed in Solution C for 48 hours, and this solution was replaced after 24 hours, according to manufacturer's instructions. Tissues were then plated on 75 3 25mm gelatin-coated slides (PO101, FD Neurotechnologies) using additional Solution C and allowed to dry in the dark for 2 hours. Next, tissues were submerged sequentially in mixtures of Solution D, Solution E, and distilled water according to the manufacturer's instructions. After rinsing with distilled water, tissues were dehydrated with graded alcohols (70%, 90%, 100% ethanol in deionized water) and cleared with xylenes (X3P-1GAL, Thermo Fisher Scientific, Waltham, MA). Slides were sealed with Permount Toulene Solution (SP15-100, Fisher Chemicals, Fair Lawn, NJ) and cover-slipped with spacers (Secure Seal Spacer, 20mm diameter 3 0.12mm depth, 70327-205, Electron Microscopy Sciences, Hartfield, PA) and 50 3 24mm glass (cover glass, rectangles, 24 3 50mm, thickness 5 0.13–0.17mm, 633153, Carolina Biological, Burlington, NC). Slides were stored in darkness.  

**Dendrite Imaging**  
Layers II and III pyramidal neuron dendrites in BA46 dorsolateral prefrontal cortex were imaged. For each case, many tissue slices were Golgi stained. From each tissue slice, 2 or more cells were imaged and analyzed. Ten to 20 Golgi-stained cells were sampled per case. From each cell, a single dendritic segment was imaged. The following criteria were used to select cells for imaging: (1) located centrally within the tissue sample depth,
<table>
<thead>
<tr>
<th>Cases</th>
<th>Race/Sex</th>
<th>PMI, h</th>
<th>Age at Onset, yr</th>
<th>Age at Death, yr</th>
<th>ApoE</th>
<th>MMSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control, n 5 12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>WF</td>
<td>3</td>
<td>52</td>
<td>E3/4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>AM</td>
<td>6</td>
<td>59</td>
<td>E2/3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>WM</td>
<td>5.5</td>
<td>94</td>
<td>E3/3 29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>WF</td>
<td>6</td>
<td>91</td>
<td>E3/3 29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>WM</td>
<td>12.5</td>
<td>56</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>AF</td>
<td>6</td>
<td>61</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>WF</td>
<td>6</td>
<td>75</td>
<td>E3/3 29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>AM</td>
<td>&lt;12</td>
<td>61</td>
<td>E3/4 CDR5 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>WF</td>
<td>11.5</td>
<td>78</td>
<td>E3/3 30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>WF</td>
<td>15.5</td>
<td>92</td>
<td>E3/3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>WF</td>
<td>14.5</td>
<td>88</td>
<td>E2/3 26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>AM</td>
<td>2.5</td>
<td>70</td>
<td>E3/3 29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAD, n 5 8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>WM</td>
<td>35.5</td>
<td>76</td>
<td>E2/4 29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>WM</td>
<td>20</td>
<td>81</td>
<td>E3/3 27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>WF</td>
<td>17</td>
<td>64</td>
<td>E4/4 30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>WF</td>
<td>38</td>
<td>82</td>
<td>E3/4 30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>WM</td>
<td>19</td>
<td>89</td>
<td>E3/3 27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>WM</td>
<td>5.5</td>
<td>80</td>
<td>E3/4 28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>WM</td>
<td>20.5</td>
<td>87</td>
<td>E3/4 27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>WF</td>
<td>5</td>
<td>87</td>
<td>E2/3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AD, n 5 21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>WM</td>
<td>9</td>
<td>78</td>
<td>84</td>
<td>E3/4 20</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>WF</td>
<td>15.5</td>
<td>93</td>
<td>E3/4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>WM</td>
<td>78</td>
<td>77</td>
<td>E3/4 25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>AF</td>
<td>6</td>
<td>79</td>
<td>86</td>
<td>E3/3 15</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>WF</td>
<td>4</td>
<td>76</td>
<td>94</td>
<td>E3/4 19</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>WM</td>
<td>28</td>
<td>63</td>
<td>77</td>
<td>E4/4 CDR5 3</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>WM</td>
<td>40</td>
<td>85</td>
<td>94</td>
<td>E3/4 18</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>WM</td>
<td>21</td>
<td>69</td>
<td>76</td>
<td>E3/3 15</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>WF</td>
<td>5</td>
<td>76</td>
<td>88</td>
<td>E3/4 CDR5 3</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>WM</td>
<td>4</td>
<td>72</td>
<td>80</td>
<td>E3/4 23</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>AM</td>
<td>7</td>
<td>70</td>
<td>86</td>
<td>E4/4 12</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>WM</td>
<td>5.5</td>
<td>76</td>
<td>83</td>
<td>E3/4 10</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>WM</td>
<td>9</td>
<td>56</td>
<td>64</td>
<td>E3/4</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>WF</td>
<td>7</td>
<td>59</td>
<td>72</td>
<td>E3/4 11</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>WF</td>
<td>5</td>
<td>93</td>
<td>E3/4 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>WM</td>
<td>4</td>
<td>74</td>
<td>85</td>
<td>E3/4 13</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>WM</td>
<td>12</td>
<td>70</td>
<td>77</td>
<td>E3/4 11</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>WM</td>
<td>2.5</td>
<td>60</td>
<td>74</td>
<td>E3/3 6</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>WF</td>
<td>2.5</td>
<td>70</td>
<td>91</td>
<td>E3/4</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>WF</td>
<td>9.5</td>
<td>85</td>
<td>E4/4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>WF</td>
<td>12</td>
<td>69</td>
<td>81</td>
<td>E3/4 0</td>
<td></td>
</tr>
</tbody>
</table>

Twelve cognitively normal, age-equivalent, pathology-free controls were compared to 8 cognitively normal controls with Alzheimers disease (AD) pathology and 21 sporadic AD cases. If values are blank, then information was not available. Age of onset is not applicable to controls or CAD cases. A5 African American; ApoE apolipoprotein E; CDR5 Clinical Dementia Rating; F5 female; M5 male; MMSE5 Mini-Mental State Examination; PMI5 postmortem interval; SI5 sight impairment; W5 white/Caucasian.
## TABLE 2. Pathology Data on Postmortem Human Brain Tissue Samples

<table>
<thead>
<tr>
<th>Cases</th>
<th>Frontal NP</th>
<th>Frontal DP</th>
<th>Frontal NFT</th>
<th>Braak Stage</th>
<th>CERAD Score</th>
<th>ABC Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control, n = 12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>None</td>
<td>Frequent</td>
<td>None</td>
<td>0</td>
<td>B</td>
<td>Low</td>
</tr>
<tr>
<td>2</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>I</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>3</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>II</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>4</td>
<td>Sparse</td>
<td>Frequent</td>
<td>None</td>
<td>III</td>
<td>A</td>
<td>Low</td>
</tr>
<tr>
<td>5</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>I</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>6</td>
<td>None</td>
<td>Sparse</td>
<td>None</td>
<td>II</td>
<td>0</td>
<td>Low</td>
</tr>
<tr>
<td>7</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>I</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>8</td>
<td>None</td>
<td>Moderate</td>
<td>None</td>
<td>II</td>
<td>0</td>
<td>Low</td>
</tr>
<tr>
<td>9</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>II</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>10</td>
<td>None</td>
<td>None</td>
<td>Sparse</td>
<td>III</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>11</td>
<td>None</td>
<td>Sparse</td>
<td>None</td>
<td>II</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>12</td>
<td>None</td>
<td>Moderate</td>
<td>None</td>
<td>I</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>CAD, n = 8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Frequent</td>
<td>Moderate</td>
<td>None</td>
<td>IV</td>
<td>C</td>
<td>Intermediate</td>
</tr>
<tr>
<td>2</td>
<td>Sparse</td>
<td>Moderate</td>
<td>None</td>
<td>II</td>
<td>B</td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
<td>Frequent</td>
<td>Frequent</td>
<td>Sparse</td>
<td>II</td>
<td>C</td>
<td>Low</td>
</tr>
<tr>
<td>4</td>
<td>Frequent</td>
<td>Frequent</td>
<td>None</td>
<td>III</td>
<td>C</td>
<td>Intermediate</td>
</tr>
<tr>
<td>5</td>
<td>Frequent</td>
<td>Frequent</td>
<td>None</td>
<td>IV</td>
<td>C</td>
<td>Intermediate</td>
</tr>
<tr>
<td>6</td>
<td>Frequent</td>
<td>Frequent</td>
<td>Sparse</td>
<td>IV</td>
<td>C</td>
<td>Intermediate</td>
</tr>
<tr>
<td>7</td>
<td>Moderate</td>
<td>None</td>
<td>Sparse</td>
<td>I</td>
<td>B</td>
<td>Intermediate</td>
</tr>
<tr>
<td>8</td>
<td>Frequent</td>
<td>Frequent</td>
<td>Sparse</td>
<td>III</td>
<td>C</td>
<td>Intermediate</td>
</tr>
<tr>
<td>AD, n = 21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Frequent</td>
<td>Frequent</td>
<td>Sparse</td>
<td>IV</td>
<td>C</td>
<td>Intermediate</td>
</tr>
<tr>
<td>2</td>
<td>Frequent</td>
<td>Frequent</td>
<td>None</td>
<td>III</td>
<td>C</td>
<td>Intermediate</td>
</tr>
<tr>
<td>3</td>
<td>Frequent</td>
<td>Frequent</td>
<td>None</td>
<td>III</td>
<td>C</td>
<td>Intermediate</td>
</tr>
<tr>
<td>4</td>
<td>Frequent</td>
<td>Moderate</td>
<td>None</td>
<td>II</td>
<td>C</td>
<td>Low</td>
</tr>
<tr>
<td>5</td>
<td>Moderate</td>
<td>Frequent</td>
<td>Sparse</td>
<td>IV</td>
<td>C</td>
<td>Intermediate</td>
</tr>
<tr>
<td>6</td>
<td>Frequent</td>
<td>Frequent</td>
<td>Frequent</td>
<td>VI</td>
<td>C</td>
<td>Intermediate</td>
</tr>
<tr>
<td>7</td>
<td>Frequent</td>
<td>Frequent</td>
<td>Sparse</td>
<td>I</td>
<td>C</td>
<td>Low</td>
</tr>
<tr>
<td>8</td>
<td>Frequent</td>
<td>Moderate</td>
<td>Sparse</td>
<td>IV</td>
<td>C</td>
<td>Intermediate</td>
</tr>
<tr>
<td>9</td>
<td>Frequent</td>
<td>Moderate</td>
<td>Sparse</td>
<td>IV</td>
<td>C</td>
<td>Intermediate</td>
</tr>
<tr>
<td>10</td>
<td>Frequent</td>
<td>Frequent</td>
<td>Sparse</td>
<td>IV</td>
<td>C</td>
<td>Intermediate</td>
</tr>
<tr>
<td>11</td>
<td>Sparse</td>
<td>Frequent</td>
<td>Sparse</td>
<td>IV</td>
<td>C</td>
<td>Intermediate</td>
</tr>
<tr>
<td>12</td>
<td>Frequent</td>
<td>Sparse</td>
<td>Frequent</td>
<td>V</td>
<td>C</td>
<td>High</td>
</tr>
<tr>
<td>13</td>
<td>Frequent</td>
<td>None</td>
<td>Frequent</td>
<td>V–VI</td>
<td>C</td>
<td>High</td>
</tr>
<tr>
<td>14</td>
<td>Frequent</td>
<td>Frequent</td>
<td>Moderate</td>
<td>VI</td>
<td>C</td>
<td>High</td>
</tr>
<tr>
<td>15</td>
<td>Frequent</td>
<td>Moderate</td>
<td>Frequent</td>
<td>VI</td>
<td>C</td>
<td>High</td>
</tr>
<tr>
<td>16</td>
<td>Frequent</td>
<td>Frequent</td>
<td>Frequent</td>
<td>VI</td>
<td>C</td>
<td>High</td>
</tr>
<tr>
<td>17</td>
<td>Frequent</td>
<td>Frequent</td>
<td>Frequent</td>
<td>VI</td>
<td>C</td>
<td>High</td>
</tr>
<tr>
<td>18</td>
<td>Frequent</td>
<td>Frequent</td>
<td>Moderate</td>
<td>VI</td>
<td>C</td>
<td>High</td>
</tr>
<tr>
<td>19</td>
<td>Frequent</td>
<td>Frequent</td>
<td>Frequent</td>
<td>VI</td>
<td>C</td>
<td>High</td>
</tr>
<tr>
<td>20</td>
<td>Frequent</td>
<td>Frequent</td>
<td>Moderate</td>
<td>VI</td>
<td>C</td>
<td>High</td>
</tr>
<tr>
<td>21</td>
<td>Frequent</td>
<td>None</td>
<td>Frequent</td>
<td>VI</td>
<td>C</td>
<td>High</td>
</tr>
</tbody>
</table>

Twelve cognitively normal, age-equivalent, pathology-free controls were compared to 8 cognitively normal controls with Alzheimer’s disease (AD) pathology (CAD) and 21 sporadic AD cases.  
ABC 5 amyloid Braak CERAD score; CERAD 5 Consortium to Establish a Registry for Alzheimer’s Disease; DP 5 diffuse b-amyloid plaque; NFT 5 neurofibrillary tangle; NP 5 neuritic b-amyloid plaque.
FIGURE 1: Highly optimized 3-dimensional modeling of dendritic spines in controls (CTL), cognitively normal individuals with high Alzheimer’s disease (AD) pathology (CAD), and AD cases. (A, C, E) Representative bright-field images of Golgi-impregnated dendrites. Scale bars represent 5 mm. (B, D, F) Three-dimensional digital reconstructions of the same dendrites generated in Neurolucida360. (G; left to right) Representative zoomed-in bright-field image of a single Golgi-impregnated spine in the XY plane; 3-dimensional digital reconstruction of the spine in the XY plane with a gray line representing the head diameter measurement; clockwise rotation in XYZ dimensions with a gray line representing the spine extent measurement; further rotation in XYZ with gray lines representing spine head diameter and extent.
(2) not obscured by large staining debris, and (3) fully impregnated. If the cell met the criteria, a single dendritic length was imaged. Dendrite selection criteria were: (1) unobstructed/iso-lated/not overlapping other dendrites, (2) length > 30 mm, and (3) diameter approximately 1 mm. If > 2 dendrites fulfilled the criteria from a single cell, the first dendrite clockwise was the only dendrite selected. If no dendrites from a single cell fulfilled the criteria, another cell was viewed and scrutinized.

All imaging was conducted by a single, blinded experimenter. Each tissue slice was initially viewed under low 34 magnification to establish the region of interest (layers II and III). Next, a pyramidal cell dendrite within the region of interest was viewed at 360 magnification to determine whether the dendrite fulfilled the above criteria. A maximum of 2 pyramidal cells were imaged per tissue slice. Z-stacks were captured with a z-step size of 0.1 mm. Each image was recorded using the following parameters: lamp, 100%; field stop, 1.5 mm; exposure, 60 milli-seconds; analog gain, 2.0–2.43; image size, 1,028 3 1,028 pixels (0.1619 3 0.1619 3 0.1 mm). Images were captured on a Nikon (Tokyo, Japan) Eclipse Ni upright microscope with

ANNALS of Neurology

![Graphs and images]

**FIGURE 2**: Comparison of dendritic spine density in controls, cognitively normal individuals with high Alzheimer’s disease (AD) pathology (CAD), and AD cases. (A) Mean spine density per 10 mm was reduced significantly in AD compared to controls and CAD (1-way analysis of variance [ANOVA]: F2,38 510.31, p 50.0003; Tukey: controls, **p 50.0032, CAD, **p 50.0013). Each case is expressed as an individual data point, and each data point is an average of 10 to 20 dendrites. (B) Distribution of spine density measured per 10 mm of dendrite. Each dot represents the average spine density per 10 mm for each dendrite that was imaged. (C) Aggregate distribution of spine density measured per surface area of dendrite in control, CAD, and AD cases. Each dot represents the average spine density per surface area of dendrite for each individual case. Spine density measured per dendrite surface area is reduced in AD cases compared to controls (1-way ANOVA: p50.0398, F2,38 53.515; Tukey: controls, p50.0725). Lines represent the mean±standard error of the mean. (D) Distribution of spine density measured per surface area of dendrite in control, CAD, and AD cases. Each dot represents the average spine density per surface area of dendrite for each individual dendrite that was imaged. Case numbers refer to patients described in Table 1. (E) Mean age was similar among controls, CAD, and AD. (F) Average spine density per 10 mm of dendrite for each individual was graphed based on disease state and sex. (G) Linear regression analysis of spine density measured per 10 mm of dendrite across all cases with post-mortem interval (PMI). Each dot represents the average spine density per 10 mm for each individual case. The density of spines per 10 mm of dendrite was plotted against the PMI for each individual. PMI is represented in hours. (H) Linear regression analysis of spine density measured per 10 mm of dendrite in control, CAD, and AD cases with age. Each dot represents the average spine density per 10 mm for each individual case. The density of spines per 10 mm of dendrite was plotted against the age of each individual. Age is represented in years. (I) Linear regression analysis of spine density measured per 10 mm of dendrite in all cases with age represented in years. Each dot represents the average spine density per 10 mm for each individual case. The density of spines per 10 mm of dendrite was plotted against the age of each individual. Age was inversely proportional to spine density (F1,38 5 6.570, R2 5 0.1442, p 5 0.0143). Dashed lines represent 95% confidence intervals.

Lumen 200 (Prior Scientific, Rockland, MA) light source, Nikon DS-43 Digital Sight for bright-field microscopy, and Nikon Elements 4.20.02. A 3 60 oil immersion objective (Nikon Plan Apo, N.A. 1.40) was used.
Three-Dimensional Digital Image Reconstruction

Dendrite and spine reconstructions were conducted by a single, blinded experimenter. Image stacks of neuronal dendrites were imported to Neurolucida 360 (2.70.1, MBF Biosciences, Williston, VT). Dendrites were traced using a semiautomated directional kernel algorithm. Spines were traced using voxel clustering. Initiation and termination points for dendrite reconstruction were established using the following criteria: must be 2’10 μm away from the distal tip of the dendrite, must contain consistent dendrite diameter, must have a level axis with limited movement in the z plane, and must be 2’30 μm in length. Next, the experimenter manually scrutinized each assigned point in the x, y, and z plane to verify that the point was located on the dendrite or spine and not artificially assigned. Points were scrutinized first by viewing the dendrite at individual x–z or y–z planes and by ensuring that points were correctly positioned at the midline of the dendrite. Afterward, points were verified in the x–y plane, and the diameter of each point was confirmed to match the dendrite diameter. Dendritic spine reconstruction utilized the following parameters for classification: outer range, 7.0 μm; minimum height, 0.3 μm; detector sensitivity, 90 to 125%; minimum count, 8 voxels. Dendritic spines were traced as the experimenter traversed the full dendrite z-plane and inspected the x–y plane at each individual z-step. The morphology of each reconstructed spine was carefully scrutinized by verifying that axial smear did not cause misrepresentation, and the merge and slice tools were used to correct inconsistencies. Spine backbone was used in recording spine extent and in spine classification. The positioning of each backbone point (including point of greatest breadth) was confirmed by the experimenter. To correct a misrepresentative backbone, the spine was viewed from the z-plane, and experimenter moved backbone points in the x–y plane. Any repositioning in the x–z or y–z plane was performed while the spine was being viewed from the lateral angle.

Morphometric analysis was conducted for each spine, and measurements categorized spines into thin, stubby, mushroom, and filopodia classes. Reconstructions were exported to Neurolucida Explorer (2.70.1, MBF Biosciences), where data were
FIGURE 3: Linear regression analysis of spine density and Alzheimer’s disease (AD) pathology. (A) Spine density does not correlate with neuritic plaque score. (B) Spine density does not correlate with diffuse plaque score. (C) There is negative correlation of spine density with neurofibrillary tangle (NFT) score ($F_{1,39} 5.495, R^2 0.1428, p 0.0149$). (D) There is negative correlation of spine density with Braak staging ($F_{1,37} 11.63, R^2 0.2392, p 0.0016$). (E) Spine density does not correlate with Braak staging among AD cases. Dashed lines represent 95% confidence intervals.
collected for quantitative analysis. The dendritic spine measurement parameters included spine extent and spine head diameter, among others. These parameters were exported and collected in Microsoft (Redmond, WA) Excel. Derived measurements, such as spine density per dendrite surface area, were calculated from raw measurement data. For spine classification, the following established parameters were used: head-to-neck ratio, 1.1; length-to-head ratio, 2.5; mushroom head size, 0.35 μm; filopodium length, 3.0 lm. Spines with a head-to-neck ratio > 1.1 and head diameter > 0.35 lm were classified as mushroom. Spines were classified as filopodia, or thin, if head-to-neck ratio was < 1.1, and either (1) length-to-head ratio was > 2.5 or (2) head size was < 0.35 lm. Of these, if the total length was >3.0 lm, the spine was classified as filopodia, and if <3.0 lm as thin. Spine density was calculated by determining the number of spines per micrometer of dendrite length or the number of spines per square micrometer of dendrite surface area. Spine extent was defined as the curvilinear backbone length from the insertion point to the most distal point of the spine head. Head diameter was defined as the breadth of the spine head at its widest cross-sectional point. Both morphological measurements and corresponding backbone reconstructions were verified.

Notably, our spine structure and density measurements are consistent with similar studies assessing dendritic spine density and morphology in human samples. Prior investigations using electron microscopy in aged neocortex exhibit strong similarities to our reported spine length and head diameter. Additional studies measuring spine structure characteristics in human and nonhuman primates using confocal and light microscopy report spine measurements that are highly consistent with our findings. In total, 5,569 μm of dendrite length and 4,297 spines were analyzed in this study. Approximately 118 spines per control case, 109 spines per CAD case, and 95 spines per AD case were analyzed.

Statistical Analysis
Statistical analyses were conducted with Prism 6.0 (GraphPad Software, La Jolla, CA). Data are presented as mean ± standard error of the mean.
FIGURE 4: Comparison of dendritic spine morphology classes in controls, cognitively normal individuals with high Alzheimer's disease (AD) pathology (CAD), and AD cases. (A) Mean number of thin, stubby, or mushroom spines and filopodia per 10 μm. Thin spines are reduced significantly in AD cases compared to CAD (2-way analysis of variance: \( p < 0.0003 \); Tukey: CAD, \( * p < 0.0004 \)). Stubby spines are reduced in CAD and AD cases compared to controls (Tukey: CAD, \( * p < 0.031 \); AD, \( ** p < 0.0054 \)). Mushroom spines are reduced significantly in AD cases compared to CAD (Tukey: CAD, \( * p < 0.041 \)). (B) Linear regression analysis of spine classification densities measured per 10 μm of dendrite in all cases with age. Each dot represents the average spine class density per 10 μm for each individual case. The density of spine class per 10 μm of dendrite was plotted against the age of each individual. Age is represented in years. (C) Average spine class density per 10 μm of dendrite for each individual was graphed based on sex. Lines represent the mean ± standard error of the mean (SEM), and all graph error bars represent SEM. All statistical tests were 2-tailed, with the threshold for statistical significance set at 0.05. To compare aggregate spine densities among conditions, the mean spine density per patient was calculated. These patient means were then averaged per condition and reported as a condition mean. Mean spine densities for each spine class were similarly accumulated. Statistical comparisons included unpaired \( t \) test, 1-way analysis of variance (ANOVA) with Tukey comparisons test, 2-way ANOVA with Tukey or Bonferroni multiple comparison test, linear regression analysis, and 2-sample Kolmogorov–Smirnov test. Possible covariants were assessed for spine densities and morphology. Sex, age, and postmortem interval were compared against the patient means for each parameter using 2-way ANOVA, linear regression, or \( t \) tests. For spine morphology, cumulative distributions of dendritic spine extent or head diameter are reported for each condition. The D’Agostino and Pearson omnibus normality test determined that these spine morphology parameters were not normally distributed, so nonparametric Kolmogorov–Smirnov tests were used. Two-sample Kolmogorov–Smirnov tests compared the frequency of spine morphology among spine populations between each pair of conditions.\(^{25,26}\) Additionally, 1-way ANOVA with Tukey post hoc test was performed to compare morphology among conditions.
Results

Using the Golgi–Cox technique, we compared the density of dendritic spines within layers II and III pyramidal neuron dendrites of BA46 dorsolateral prefrontal cortex (DLPFC) in controls, CAD, and AD cases (see Tables 1 and 2). BA46 was selected because it is a region tightly linked to cognitive performance, including working memory, and is highly vulnerable in AD. 27,28 We developed and optimized a method to trace impregnated dendrites from bright-field microscopic images that enabled accurate 3-dimensional digital reconstruction of dendritic structure (Fig 1). Spine density, measured per dendrite length or dendrite surface area, was similar among control and CAD cases but reduced in AD (Fig 2, Supplementary Tables 1 and 2). The mean ages of the control, CAD, and AD groups were not significantly different. Linear regression analysis indicated that spine density was independent of sex or postmortem interval and that spine density changes within disease states were not associated with age (Supplementary Tables 2 and 3). However, collective analysis of all cases revealed that age was inversely proportional to spine density ($F_{1,39} = 6.570, R^2 = 0.1442, p = 0.0143$), which supports past findings in aging mammals. 29,30

The amyloid hypothesis of AD posits that increased soluble and insoluble Ab levels induce a cascade of processes that manifest in NFT formation and synaptic loss, resulting in clinical dementia. 31 Linear regression analysis of all cases indicated that, irrespective of disease state, spine density was not associated with Ab plaque severity (neuritic or diffuse plaque scores) but did display negative correlation with the degree of NFT distribution ($F_{1,39} = 6.495, R^2 = 0.1428, p = 0.0149$) and Braak...
staging \( (F_{1,37} 5 \ 22.65, \ R^2 5 \ 0.4754, \ p < 0.0001; \ Fig \ 3A-D, \ Supplementary \ Table \ 3) \). Notably, among AD cases there was no correlation with spine density and Braak staging (see Fig 3E, Supplementary Table 3).
Despite high levels of Ab plaques and NFTs in CAD brains, the mean spine density measurements were not significantly different from controls (see Fig 2A–D, Supplementary Tables 1 and 2). This may contribute to the lack of cognitive impairment in CAD cases; however, we hypothesized that maintenance of cognitive function in an environment of AD pathology would involve structural remodeling of dendritic spines. To test this, we assessed spine morphology across control, CAD, and AD cases. Dendritic spine morphology influences excitatory neurotransmission and synaptic plasticity, and spines can be classified on the basis of their 3-dimensional structure as stubby, mushroom, or thin. Stubby spines are theorized to be transitional, mushroom spines represent more stable structures, and thin spines are more dynamic. Dendritic filopodia are actin-rich protrusions that are widely considered the precursors of spines. Thin spines were reduced significantly in AD compared to CAD cases (2-way ANOVA:  

\[ p < 0.0001; \text{Tukey: } p < 0.0001 \] 

), whereas stubby spine density was decreased significantly in CAD and AD compared to controls.

![Figure 5](image)

**FIGURE 5:** Comparison of dendritic spine extent in controls, cognitively normal individuals with high Alzheimer’s disease (AD) pathology (CAD), and AD cases. (A) Mean spine extent was increased significantly in CAD compared to controls or AD (analysis of variance [ANOVA]:  

\[ p < 0.0001; \text{Tukey: con-trols, } \ast \ast \ast p < 0.0001; \text{AD, } \ast \ast \ast \ast p < 0.0001 \] 

). (B) The cumulative frequency plots of individual spines indicate that CAD segregates based on spine extent (Kolmogorov–Smirnov: controls,  

\[ D = 5.1221, p < 0.0001; \text{AD, } D = 5.1455, p < 0.0001 \] 

). (C) Distribution of spine extent in control, CAD, and AD cases. Each dot represents the average spine extent per individual dendrite that was imaged. (D) Linear regression analysis of spine extent measured across all cases with age. Each dot represents the average spine extent for each individual case. The average spine extent was plotted against the age of each individual. Age is represented in years. (E) Average spine extent per individual was graphed based on sex. (F) Mean extent for thin spines was reduced in AD cases compared to CAD (ANOVA:  

\[ p = 0.0486; \text{Tukey: } AD, \ast p < 0.0748 \] 

). (G) The cumulative distribution of thin spine extent for each disease state was plotted. (H) Mean extent for stubby spines was increased significantly in CAD compared to controls or AD (ANOVA:  

\[ p < 0.0001; \text{Tukey: con-trols–CAD, } \ast \ast p < 0.0204; \text{controls–AD, } \ast \ast \ast p < 0.0001; \text{CAD–AD, } \ast \ast \ast \ast p < 0.0001 \] 

). (I) The cumulative distribution of stubby spine extent for each disease state was plotted. The cumulative frequency plots indicated that AD cases segregate from controls and CAD based on stubby spine extent (Kolmogorov–Smirnov: controls,  

\[ D = 5.1502, p < 0.0001; \text{CAD, } D = 5.2190, p < 0.0001 \] 

). (J) A trending increase in mean extent for mushroom spines was observed in CAD cases compared to controls and AD (ANOVA:  

\[ p = 0.1105; \text{Tukey: AD, } p = 0.0914 \] 

). (K) The cumulative distribution of mushroom spine extent for each disease stage was plotted. The cumulative frequency plots indicated that CAD cases segregate from AD based on mushroom spine extent (Kolmogorov–Smirnov: AD,  

\[ D = 5.1165, p = 0.0410 \] 

). Lines represent the mean ± standard error of the mean.

**Annals of Neurology**
(Tukey: CAD, \( p \approx 0.031 \); AD, \( p \approx 0.0054 \)). Numbers of mushroom spines were reduced significantly in AD compared to CAD (Tukey: \( p \approx 0.0405 \)), but filopodia did not differ significantly among disease states (Fig 4A,
Supplementary Tables 1 and 2). Linear regression analysis across all cases revealed that age and sex did not correlate with spine classification densities (see Fig 4B, C, Supplementary Table 3).

To further analyze spine structure, spine extent (length) was measured among control, CAD, and AD dendrites. Mean spine extent was increased significantly in CAD cases compared to controls or AD (ANOVA: F2,4548 = 36.17, p < 0.0001; Tukey: controls, p < 0.0001; AD, p < 0.0001; Fig 5, Supplementary Tables 1 and 2). To examine this change in length in more detail, the cumulative distribution of spine extents for each disease state was plotted. The cumulative frequency plots indicated that AD cases segregate from controls and CAD based on spine extent (Kolmogorov–Smirnov: controls, D = 0.1221, p < 0.0001; AD, D = 0.1455, p < 0.0001).

Notably, age and sex did not influence overall mean

FIGURE 6: Comparison of dendritic spine head diameter in controls, cognitively normal individuals with high Alzheimer’s disease (AD) pathology (CAD), and AD cases. (A) Mean spine head diameter was reduced significantly in AD compared to controls (analysis of variance [ANOVA]: p < 0.0032; Tukey: AD, **p < 0.0032), and CAD was reduced compared to controls (ANOVA: CAD, p < 0.0611). (B) The cumulative frequency plots indicate that CAD cases segregate from controls and AD based on spine head diameter (Kolmogorov–Smirnov: controls–CAD, D = 0.09061, p < 0.0002; controls–AD, D = 0.06866, p < 0.0005; CAD–AD, D = 0.06968, p < 0.0070). (C) Distribution of spine head diameter in control, CAD, and AD cases. Each dot represents the average spine head diameter per individual dendrite that was imaged. (D) Linear regression analysis of spine head diameter measured across all cases with age. Each dot represents the average spine head diameter for each individual case. The average spine head diameter was plotted against the age of each individual. Age is represented in years. (E) Average spine head diameter per individual was graphed based on sex. (F) Mean head diameter for thin spines was reduced in CAD cases compared to controls and AD (ANOVA: p = 0.0036; Tukey: controls, p = 0.057, AD, *p = 0.0024). (G) The cumulative distribution of thin spine head diameters for each disease state was plotted. The cumulative frequency plots indicated that CAD cases segregate from AD based on thin spine head diameter (Kolmogorov–Smirnov: AD, D = 0.1034, p = 0.0101). (H) Mean head diameter was reduced significantly for stubby spines in AD compared to CAD and controls (ANOVA: p = 0.0001; Tukey: CAD, **p = 0.0015; controls, ***p = 0.0003). (I) The cumulative distribution of stubby spine head diameters for each disease state was plotted. The cumulative frequency plots indicated that AD cases segregate from controls and CAD based on stubby spine head diameter (Kolmogorov–Smirnov: controls, D = 0.1421, p < 0.0001; CAD, D = 0.1512, p = 0.0010). (J) Mean head diameter for mushroom spines was similar among control, CAD, and AD cases. (K) The cumulative distribution of mushroom spine head diameters for each disease state was plotted. The cumulative frequency plots indicated overlap among controls, CAD, and AD cases based on mushroom spine head diameter. Lines represent the mean ± standard error of the mean.
FIGURE 7: Representative illustration of dendrites from control, cognitively normal individuals with high Alzheimer’s disease (AD) pathology, and AD cases (not to scale).
spine extent (see Supplementary Tables 2 and 3). Comparison among spine classes revealed that stubby spine extent was increased selectively and significantly in CAD cases compared to controls and AD (Kolmogorov–Smirnov: controls, D 5 0.1502, p < 0.0001; AD, D 5 0.2190, p < 0.0001; see Supplementary Tables 1 and 2). Thin spine extent was reduced in AD cases compared to CAD, and mushroom spine extent was increased in CAD cases compared to controls and AD. However, these results were not significant.

Next, spine head diameter was measured among control, CAD, and AD dendrites. Mean spine head diameter was reduced significantly in AD cases compared to controls (ANOVA: F2,1635 5 5.763, p 50.0032; Tukey: AD, p 5 0.0032; Fig 6, Supplementary Tables 1 and 2). To examine this change in size in more detail, the cumulative distribution of spine head diameters for each disease state was plotted. The cumulative frequency plots indicated that each group segregates based on spine head diameter (Kolmogorov–Smirnov: controls–CAD, D 5 0.09061, p 5 0.0002; controls–AD, D 5 0.06866, p 5 0.0005; CAD–AD, D 5 0.06968, p 5 0.0070).

Notably, controls segregate from CAD at 50.4 m head diameter, likely due to reduced thin spine head diameter in CAD cases. Notably, age and sex did not influence overall mean spine head diameter (see Supplementary Tables 2 and 3). Analysis of spine classes revealed that thin spine head diameter was reduced selectively in CAD cases compared to controls and AD (ANOVA: F2,1635 5 5.652, p 5 0.0036; Tukey: controls, p 5 0.057; AD, p 5 0.0024; see Supplementary Tables 1 and 2). Stubby spine head diameter was reduced significantly in AD compared to controls and CAD (ANOVA: F2,1483 5 10.33, p < 0.0001; Tukey: controls, p 5 0.0003; CAD, p 5 0.0015). Mushroom spine head diameter was similar among controls, CAD, and AD.

Discussion

In this study, we used optimized 3-dimensional modeling of dendritic spines to reveal that maintenance of thin and mushroom spine populations combined with cumulative increased spine extent distinguished CAD cases from AD. These observations provide cellular evidence to support the hypothesis that spine plasticity is a mechanism of cognitive resilience that protects older individuals with AD pathophysiology from developing dementia.35

Concomitant alternations in extent and head diameter among spine classes in CAD cases may reflect more rapid plasticity to maintain information storage.36 For instance, cumulative increases in spine extent through the DLPFC could sustain working memory in an environment of Ab plaques and NFTs by extending their reach to maintain degenerating connections or facilitating new synaptic inputs. Moreover, preservation of thin and mushroom spine density in CAD appears to be important for cognitive maintenance, whereas stubby spines may be less essential. These results support findings in rhesus monkeys, where selective loss of thin spines in BA46 is associated with age-related memory impairment.30 Maintenance of thin spines suggests preservation of dynamic synapses that are formed or remodeled during learning and memory in adulthood.37,38

Recently, positron emission tomography (PET) imaging of tau indicated that NFT distribution across cognitively normal older individuals and AD patients strongly correlated to Braak staging in postmortem tissue.39 Using the findings here, a comparison of PET tau imaging and its correlative Braak stage could be used to extrapolate a hypothetical representation of synaptic density and structure in the DLPFC. However, no correlation with spine density and Braak staging was observed among AD cases, suggesting that a clinical diagnosis of AD is associated with reduced spine density irrespective of Braak stage (see Fig 3E, Supplementary Table 3). However, the limited numbers of AD cases that display Braak stage I–III at autopsy hinder this analysis.

11C-Pittsburgh compound B imaging studies suggest that only 13% of cognitively normal individuals who are positive for Ab will transition to mild cognitive impairment or AD.40 Based on this, comparison of structural plasticity among controls, and CAD and AD cases may be interpreted in 2 ways. If the CAD individuals lived to develop dementia, then the observed phenotypes could reflect necessary synaptic structure changes during...
the transition from preclinical to symptomatic AD. Alter- natively, if the CAD individuals lived and remained immune to dementia, then the observed phenotypes could represent an inherent protective mechanism that prevents the onset of dementia (Fig 7). In either scenario, these findings emphasize spine plasticity as a mechanism of cognitive resilience and highlight structural plasticity as a substrate for therapeutic intervention during the pre- clinical phase of AD.

Acknowledgment

This work was supported by the NIH through NIA AG054719 to J.H.H. and NIA AG043552-05 to J.H.H., Emory Neuroscience National Institute of Neu- rological Disorders and Stroke Core Facilities grant P30NS055077, and the Emory University Alzheimer’s Disease Research Center grant AG025688. Additional support stemmed from New Investigator Research Grant 2015-NIRG-339422 to J.H.H. from the Alzheimer’s Association.

We thank Drs S. Swanger and L. Overstreet-Wadiche for critical reading of the manuscript and Dr. Y. Stern for constructive discussions.

Author Contributions

J.H., B.D.B., and M.G. conceived the experiments; all authors performed the experiments and analyzed the data; B.D.B. and J.H.H. wrote the article.

Potential Conflicts of Interest

Nothing to report.

References

8. Ramon y Cajal S. On a special ganglion of the sphen-occipital cortex. Madrid, Spain: Works of the Laboratory of Biological Research of the University of Madrid, 1901.
Defining Optimal Brain Health in Adults
A Presidential Advisory From the American Heart Association/ American Stroke Association

Philip B. Gorelick, MD, MPH, FAHA, Chair*; Karen L. Furie, MD, MPH, FAHA, Co-Chair†; Costantino Iadecola, MD, FAHA, Co-Chair‡; Eric E. Smith, MD, MPH, FAHA‡; Salina P. Waddy, MD§; Donald M. Lloyd-Jones, MD, ScM, FAHA¶; Hee-Joon Bae, MD, PhD, FAHA; Mary Ann Bauman, MD; Martin Dichgans, MD; Pamela W. Duncan, PhD, PT, FAHA; Meighan Gigrus; Virginia J. Howard, PhD, FAHA; Ronald M. Lazar, PhD, FAHA; Sudha Seshadri, MD, FAHA; Fernando D. Testai, MD, PhD, MS, FAHA; Stephen van Gaal, MD; Kristine Yaffe, MD, FAHA; Hank Wasiak, MBA; Charlotte Zerna, MD, MS; on behalf of the American Heart Association/ American Stroke Association

Abstract—Cognitive function is an important component of aging and predicts quality of life, functional independence, and risk of institutionalization. Advances in our understanding of the role of cardiovascular risks have shown them to be closely associated with cognitive impairment and dementia. Because many cardiovascular risks are modifiable, it may be possible to maintain brain health and to prevent dementia in later life. The purpose of this American Heart Association (AHA)/American Stroke Association presidential advisory is to provide an initial definition of optimal brain health in adults and guidance on how to maintain brain health. We identify metrics to define optimal brain health in adults based on inclusion of factors that could be measured, monitored, and modified. From these practical considerations, we identified 7 metrics to define optimal brain health in adults that originated from AHA’s Life’s Simple 7: 4 ideal health behaviors (nonsmoking, physical activity at goal levels, healthy diet consistent with current guideline levels, and body mass index <25 kg/m²) and 3 ideal health factors (untreated blood pressure <120/80 mm Hg, untreated total cholesterol <200 mg/dL, and fasting blood glucose <100 mg/dL). In addition, in relation to maintenance of cognitive health, we recommend following previously published guidance from the AHA/ American Stroke Association, Institute of Medicine, and Alzheimer’s Association that incorporates control of cardiovascular risks and suggest social engagement and other related strategies. We define optimal brain health but recognize that the truly ideal circumstance may be uncommon because there is a continuum of brain health as demonstrated by AHA’s Life’s Simple 7. Therefore, there is opportunity to improve brain health through primary prevention and other interventions. Furthermore, although cardiovascular risks align well with brain health, we acknowledge that other factors differing from those related to cardiovascular health may drive cognitive health. Defining optimal brain health in adults and its maintenance is consistent with the AHA’s Strategic Impact Goal to improve cardiovascular health of all Americans by 20% and to reduce deaths resulting from cardiovascular disease and stroke by 20% by the year 2020. This work in defining optimal brain health in adults serves to provide the AHA/American Stroke Association with a foundation for a new strategic direction going forward in cardiovascular health promotion and disease prevention. (Stroke. 2017;48:e00-e00. DOI: 10.1161/STR.0000000000000148.)

Key Words: AHA Scientific Statements □ aging □ brain □ cognitive dysfunction □ prevention and control □ risk factors □ stroke

*Also a member of Maintenance of Brain Health writing group section. †Also a member of Optimal Brain Health writing group section. ‡Lead of Maintenance of Brain Health writing group section. §Lead of Public Health Impact of Cognitive Impairment, Dementia, Stroke, and Cardiovascular and Stroke Risks writing group section. ¶Senior reviewer.

The views in this report are those of the authors and do not necessarily reflect those of the National Institute of Diabetes and Digestive and Kidney Diseases, the Department of Health and Human Services, or the government of the United States.

The American Heart Association makes every effort to avoid any actual or potential conflicts of interest that may arise as a result of an outside relationship or a personal, professional, or business interest of a member of the writing panel. Specifically, all members of the writing group are required to complete and submit a Disclosure Questionnaire showing all such relationships that might be perceived as real or potential conflicts of interest.

This advisory was approved by the American Heart Association Science Advisory and Coordinating Committee on July 28, 2017, and the American Heart Association Executive Committee on August 21, 2017. A copy of the document is available at http://professional.heart.org/statements by using either “Search for Guidelines & Statements” or the “Browse by Topic” area. To purchase additional reprints, call 843-216-2533 or e-mail kelle.ramsay@wolterskluwer.com.

The Data Supplement is available with this article at http://stroke.ahajournals.orglookup/suppl/doi:10.1161/STR.0000000000000148/-/DC1.