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Appointment: I am a tenure track Assistant Professor/Research Scientist with a shared appointment in the Department of Psychology and the Gerontology Center (within the Schiefelbusch Life Span Institute) at the University of Kansas. As my primary research activity, I direct the Neuropsychology and Aging Laboratory. I am also Director of Neuropsychology at the KU Alzheimer's Disease Center, responsible for the clinical-cognitive assessment, analysis, and interpretation of our participants' test performance. I am a faculty member in the Clinical Psychology graduate training program, and have adjunct appointments in Quantitative Psychology, the Center for Research Methods and Data Analysis, and the Department of Neurology.

Focus: My research program is a confluence of my doctoral and postdoctoral specialty training in three areas: Clinical Gerontology, Neuropsychology, and Neurology. I investigate the biological bases of behavior that identify healthy aging and distinguish it from dementia. Biologic and behavioral markers of Alzheimer's disease (endophenotypes) will be crucial to the eventual development of efficacious treatments for Alzheimer's dementia (i.e., more than our current symptomatic treatments). My work describes the complexity of multiple, co-occurring changes in brain, metabolic function, and cognition, and their utility as early diagnostic indicators of disease and/or new neurocognitive markers of dissociable neuropathological processes.

Accomplishments: The Neuropsychology and Aging Laboratory has produced 16 published papers (9 first authored) in *Neurology, Archives of Neurology, Neuropsychology, Alzheimer's Disease and Related Disorders, Journal of Alzheimer's Disease, Movement Disorders, Journal of Gerontology,* and *Journal of the American Geriatrics Society*. I have instrumentally contributed to 12 grant applications of which 5 have been funded, including a National Institute on Aging (NIA) program project (P30AG035982; PI: Burns; Role: Neuropsychologist), two NIA Research-One awards (AG09009; PI: Burns; Role: Neuropsychologist & AG033673; PI: Burns; Role: Neuropsychologist), one award from the Michael J. Fox Foundation (NYU/KU subcontract; PI: Galvin; Role: Neuropsychologist), and one grant award from the US Department of Health and Human Services (DHHS; AoA-AP-0914; PI: Niedens; Role: Treatment outcome evaluator). The laboratory has also received considerable support from internal university grants. As PI I have submitted three exploratory and development research grant applications (R21) that are pending at NIH: *Neuroimaging of Prose Recall in Preclinical Alzheimer's Disease, Disease State Modeling of Alzheimer's Disease and Functional Ability in the ADNI, and Epidemiology and Development of Alzheimer's Disease in Costa Rica.*

Neuropsychological assessment of early cognitive decline: Enhancing the accuracy (sensitivity and specificity) of assessment tools to distinguish healthy aging from dementia is the organizing principle of my research program. My work has contributed to our knowledge about the earliest signs of Alzheimer's disease and related dementias and provided insight into possible component processes that fail in each disease.

Using prose comprehension and recall—well-known early indicators of Alzheimer's disease and predictors of future progression of healthy older adults to Alzheimer's disease—I created new scoring rules for the Logical Memory subtest grounded in psycholinguistic theory and enhanced its measurement properties. With these rules we correctly discriminated 86% of very mildly demented individuals from healthy control participants (*Neuropsychology*; Johnson, Storandt, & Balota, 2003).

Using factor analysis and advanced longitudinal models of disease state progression, I wrote first authored papers published in *Neurology* (2005 & 2008) and *Archives of Neurology* (2006 & 2009) that have convincingly demonstrated that a preclinical state of Alzheimer's disease exists for several years (2-6 yrs) before any overt functional cognitive decline is apparent to medical professionals or family.

Even in the earliest stages Alzheimer's disease, cognitive declines are witnessed across a range of verbal, visuospatial, and working memory cognitive domains. Further, among healthy older adults, cognition acts in concert across domains. As the disease process begins, that integrity is challenged and cognition fragments. Some or most of the immense variability that we witness in the cognitive ability of people with Alzheimer's disease is due to this fragmentation, and there may be subtypes of Alzheimer's disease associated with the unique patterns of decline through time. For instance, I found that visuospatial deficits actually preceded verbal memory deficits in a majority of autopsy-confirmed patients with Alzheimer's disease (N=115) which implicates a host of early diagnostic issues. This paper gained national and international attention in the media (Associated Press, BBC, CNN) and engaged a dialogue regarding the etiology of geriatric falls, disorientation or other visuospatial problems, suggesting an Alzheimer's disease process rather than some more general sensory deficit (Galvin & Johnson, 2010).

My research has also focused on people with Parkinson's disease (Johnson & Galvin, 2011) and with Lewy body dementia (Johnson, Morris, & Galvin, 2005). My colleagues and I show that visuospatial deficits are even more pronounced in these two dementias than in Alzheimer's disease, and that multiple concomitant diseases result in an additive effect. Two diseases result in significantly more problems than one disease; however, two diseases do not result in steeper declines through time (i.e., interact). This work is one of the first studies to demonstrate a preclinical Parkinson's disease dementia state that begins with acceleration of cognitive abilities three years prior to clinical detection of dementia associated with Parkinson's disease.

In my current Michael J. Fox award (PI: Galvin; Role: Neuropsychologist), my colleagues and I will characterize transition stages between Parkinson's disease and Parkinson's disease dementia to define the clinical and cognitive profile of Parkinson's disease-mild cognitive impairment (PD-MCI). This study uses archival data from well-characterized longitudinally followed individuals. In addition, we will prospectively evaluate structural, functional and neurophysiologic correlates of cognitive phenotypes of Parkinson's disease using fMRI and quantitative spectral EEG. Although dementia is a recognized sequela of Parkinson's disease (diagnostic criteria have been outlined), we do not yet know if there exists a clear cognitive phenotype associated with Lewy body neuropathology, particularly one that describes the transitional or prodromal phase of PD-MCI.

Finally, to become a nationally competitive and independent Alzheimer's disease researcher, I have worked hard to gain skills and expertise in functional magnetic resonance imaging (fMRI). I have recently finished my first fMRI experiment at the KU Hoglund Brain Imaging Center (N=37) and I am preparing this project's first manuscript. The project is a return to my graduate training in discourse comprehension. It refines a psycholinguistic fMRI paradigm used by others (e.g., Murray Grossman at UPenn) by reducing floor effects, thus creating a task that people with mild cognitive impairment can complete. Results from brain region analyses are encouraging. There is a very specific processing demand spillover of activation from left-to-right temporal lobe when a frontal lobe region associated with executive function (the anterior cingulate cortex) is less active. These preliminary data have supported an Exploratory/Development Research application to the NIH/NIA Biobehavioral and Behavioral Processes Integrated Review Group (IRG) as a complementary research project to the existing clinical trials in healthy aging and Alzheimer's disease. Using the prose comprehension task developed in the previous project, my colleagues and I will investigate whether cerebral amyloid deposition correlates with very early episodic memory deficits on this diagnostic instrument. We will validate that task using an existing KU ADC Florbetapir PET imaging protocol as a screening mechanism to identify asymptomatic individuals with (n=30) and without (n=30) global amyloid burden.

Body weight, exercise and Alzheimer's disease: In a series of papers examining biomarkers of preclinical and early stage Alzheimer's disease, my colleagues and I found that falling body weight is a strong predictor of future progression to Alzheimer's disease (*Archives of Neurology*; Johnson, Wilkins,

& Morris, 2006; *Alzheimer's Disease and Associated Disorders*; Cronc, Johnson, & Burns, 2010). This work was likewise reported in national and international media (e.g., NY Times, Science Section, September 19th, 2006; Voice of America; BBC; and CNN). We have also found that declining body weight is associated with atrophying brain (white and gray volumes), especially in the medial temporal lobe. These findings support the hypothesis that Alzheimer's disease and sarcopenia (age-related reduction in skeletal muscle mass) may share common underlying mechanisms. Healthy aging is marked by modest and constant weight loss of about ½ pound per year. Weight loss accelerated, however, about one year prior to the onset of very mild dementia symptoms. Dementing older adults lose a little more than one pound per year. Moreover, losing lean muscle mass leads to far worse outcomes than losing fat mass.

Based on our work together, my collaborator Jeffrey Burns, MD, and I have targeted known biologic processes associated with cognitive decline and are conducting exercise interventions to prevent cognitive decline in healthy aging (AG09009) and in people with dementia (AG033673). In these NIA-funded grants we will characterize the cognitive benefits of exercise conferred to an aging population, determine optimal dosing of fitness regimens, and determine the contraindications for exercise in the elderly (if any). Our hypothesis is that cognitive decrement in healthy aging is part of a metabolic syndrome that also affects muscle mass, body fat, and cardiovascular fitness. By intervening with physical exercise, we will at the very least improve mood and concentration of our participants or optimally slow neurodegenerative processes. Our preliminary data shows that irrespective of concomitant symptomology, exercise confers a clear and significant benefit for speed of processing and attention. Through this funding mechanism, my collaborator and I serve on an NIA/McKnight Foundation-sponsored committee to establish a large national clinical trial for cognitive interventions in healthy aging. I have also recently been invited to become an *Early Career Reviewer* at the NIH Center for Scientific Review. I begin training and participate in my first peer review in fall 2012.

These grants served an instrumental role in the successful application for the NIA-funded KU Alzheimer's Disease Center, a federally designated *Center of Excellence* for Alzheimer's disease treatment and research. I am honored to work, as Director of Neuropsychology, with many talented clinical investigators. In this role, I review clinical diagnoses of our research participants, initiate novel research, and participate in executive planning for the center. We enroll over 150 new research participants a year as well actively follow up another 200 participants annually. I am PI on an investigator-initiated research program examining the factor analytic structure of executive functioning and how it predicts functional decline and physical fitness. I serve as neuropsychologist on two other research initiatives examining (1) bioenergetics and brain metabolism (indices of mitochondrial health) and (2) sedentariness in our mild- and moderate-stage participants with dementia.

Clinical Gerontology: My graduate training included four years at the Alzheimer's Association in St Louis as a therapist for people with dementia and their caregivers, an experience that enriched my personal understanding of the catastrophic impact of Alzheimer's disease. I grew as a therapist and as a gerontologist. Currently, I serve as treatment outcome evaluator for the Heart of America Chapter in Kansas City's Alzheimer's Disease Demonstration Grant to the State of Kansas awarded by the US DHHS (AoA-AP-0914), the *Dementia Crisis Bridge Project*. The goal of this project was to provide pilot data on the effectiveness of a caregiver skills training intervention delivered by social workers at the time of dementia crisis (delivered in 9 Area Agencies on Aging across 4 Kansas counties). Results showed that the intervention was efficacious in preventing rehospitalization and nursing home eviction for the participants in dementia-related crisis. While we expected 100 referrals in 2010, we received over 300 referrals with a total of 180 families served. The success of the program led to the preparation of a white paper for Governor Brownback that promoted coordinated care for people with dementia-related neuropsychiatric symptoms. This white paper has been cited as the empirical support in the State of Kansas' KanCare Medicaid revision, legislating assessment and coordinated care to be

provided by new state Medicaid providers. The *Gerontologist* recently accepted the first paper from this project.

In addition to clinical research for the Alzheimer's Association, I am also conducting mental health and aging research that examines the social and genetic determinants of resilience in caregiving with colleagues Cynthia Teel (Dean of the School of Nursing) and Omri Gillath (Department of Psychology). This research stems from my position as clinical supervisor for an Alzheimer's disease caregiver support group. My colleagues and I constructed a battery of social and clinical tests to predict which caregivers benefited most from a psychotherapeutic intervention. Our first paper from this project was accepted by the *Clinical Gerontologist* (Gillath, Johnson, Selcuk, & Teel 2011). We hope that the continued success of this clinical opportunity will open up new avenues for advanced clinical research in grief and loss. I see this as a vital training resource for future clinical gerontologists.