ADRC Funds Alzheimer’s Research Across Multiple Disciplines

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The Alzheimer’s Disease and Dementia Research Center (ADRC) at Utah State has extended support totaling over $350,000 to multiple USU researchers studying Alzheimer’s disease and related dementia.

Researchers from the Emma Eccles Jones College of Education and Human Services and the College of Engineering are studying many facets of Alzheimer’s disease, from biological markers of Alzheimer’s to its prevalence in specific populations and impacts on caregivers.

“We’re thrilled to partner with so many researchers from different disciplines,” said Dr. Beth Fauth, ADRC director. “Supporting research like this is central to our mission and marks an important milestone for the center. In our first funding cycle, we focused on supporting research at USU; in the future, this program will expand to support researchers across the state.”

Research is the primary mission of the ADRC. These projects will advance the current understanding of Alzheimer’s disease and create opportunities for future research and the development of treatments and support for individuals living with dementia.

Learn about the researchers and their projects below.

Dr. Catalin Buhusi

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Dr. Catalin Buhusi, professor of Psychology, will study the disruptions in sleep cycles in people living with Alzheimer’s disease using mice that model Alzheimer’s and cognitive decline. Humans typically follow a diurnal sleep cycle, meaning we are awake during the day and sleep at night. However, aging and neuropsychiatric disorders can disrupt these cycles and can affect health in significant ways. Alteration of diurnal rhythms, which can increase cognitive and behavioral deficits, have been reported in individuals with Alzheimer’s disease and related dementia. In the long-term, this research aims to identify new options for improving cognitive function in individuals with Alzheimer’s disease and related dementia.

Dr. Catalin Buhusi is joined in this research by Psychology Associate Professor Dr. Mona Buhusi and Psychology Professor Dr. JoAnn Tschanz.

Dr. Mona Buhusi (left); Madison Treasure-Areno (right)

Dr. Mona Buhusi & Madison Treasure-Areno

Dr. Mona Buhusi, associate professor of Psychology, will provide a graduate student research assistantship to Madison Treasure-Areno, a current applicant for the Brain and Cognition PhD program at USU. Treasure-Areno will help study the brain pathology and cognitive impairments seen in human Alzheimer’s disease patients using mice that carry specific gene mutations. Buhusi’s lab is studying ways cells communicate in the brain and how this communication is altered in Alzheimer's disease and normal aging. By examining cognitive impairment in mice at different ages, the researchers hope to identify ways of slowing down Alzheimer's disease and preserving cognitive abilities for a longer period of time.

Buhusi will also receive support to purchase an Odyssey XF Dual-Mode Imaging system, which is essential equipment for quantifying changes in protein expression in neurodegeneration studies. The new system will help the researchers move past the use of X-ray film and developing chemicals, which are dangerous to the environment, and it will allow them to conduct their studies more quickly and effectively.

Dr. Kerry Jordan (left); Olivia Ewing (right)

Dr. Kerry Jordan & Olivia Ewing

Dr. Kerry Jordan, associate professor of Psychology, will extend a year-long research assistantship to neuroscience PhD student Olivia Ewing to work on a project entitled “Aging and Numerical Quantity Estimation.” Jordan’s lab studies numerical and mathematical abilities, which play a role in many aspects of life such as counting, measuring, remembering numbers, and using money. Ewing’s project will focus on general quantity estimation, an ability that begins to develop in childhood and changes throughout the lifespan.

Building on previous research at USU, the main question addressed in this study is whether a sample of aging individuals maintain the more precise numerical representation of numbers exhibited by young adults, or if they revert to a more approximate, child-like pattern in their quantity estimations. A previous study from Jordan's lab in collaboration with Dr. JoAnn Tschanz and USU undergraduate student Brett Campbell found that, overall, a sample population of older adults did maintain a young adult-like pattern of numerical representation; however, this study did not account for factors such as level of cognitive ability, age, and education. Ewing will be able to analyze these previous data, collect new data as needed, and draw conclusions that can be published and disseminated.

This study will help researchers understand which cognitive abilities, such as numerical estimations, are left

intact during the process of typical aging compared to dementia.

Dr. Maria Kleinstäuber

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Dr. Maria Kleinstaeuber, assistant professor in Psychology, is working to develop a program to help with pain management for individuals suffering from dementia. The program will involve dementia patients as well as their caregivers, and it will be especially tailored to needs of community-dwelling patients residing in rural areas. Along with Psychology professor Susan Crowley and Psychology assistant professor Sara Boghosian, Kleinstaeuber will first gather information about the needs of patients with dementia and chronic pain, as well as the needs of their caregivers. The team will then examine how feasible it is to implement a caregiver-assisted program over seven sessions.

Kleinstaeuber and her colleagues are interested in establishing a clinic at the USU Behavioral Health Clinic that offers psychological interventions for individuals with persistent somatic symptoms, including chronic pain. Kleinstaeuber and Crowley have clinical and research experience in working with individuals with persistent somatic symptoms and associated emotional distress over many years. Chronic pain in dementia has been neglected in previous research, and psychological support for this specific patient group is challenging to access, especially in rural areas.

The researchers hope to have a positive impact on patients' pain intensity and interference with quality of life, as well as on caregivers' self-efficacy, burden of care, and satisfaction.

Dr. Naveen Nagaraj

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Dr. Naveen Nagaraj, Assistant Professor in Communicative Disorders and Deaf Education, will study the effect of hearing aid use on cognition in older adults with hearing loss. Age-related hearing loss is associated with a higher incidence of dementia, social isolation, decreased cognitive functioning, poorer physical functioning, and reduced quality of life. Current evidence suggests that effective treatment of age-related hearing loss improves quality of life and is associated with a reduction in new dementia cases. While studies have suggested that hearing aids improve social engagement and, in turn, cognition, there is no neurophysiological evidence supporting these observations.

To assess the cognitive and neurophysiological benefits of hearing aids, Nagaraj and his team will conduct a study using functional near-infrared spectroscopy, which is a relatively low cost, non-invasive, and portable device for assessing brain activity. The team will assess changes in

neural connectivity between different parts of the brain as a function of wearing hearing aids. Age-related hearing loss is recognized as one of the major risk factors for dementia, so this project has high significance and a strong potential for guiding future research and practice in this area. The team's long-term plan is to understand the social, cognitive, and neural benefits of increased access to hearing aid interventions in rural areas.

Nagaraj is joined in this research by Dr. Ronald Gillam, Raymond and Eloise Lillywhite Endowed Chair of Speech-Language Pathology, Dr. Tiffany Shelton, Clinical Assistant Professor of Audiology, Allison Hancock, Neuroscience PhD student, and Mindee Anderson, Doctor of Audiology student.

Premium Hearing aids are provided by the Oticon and WS Audiology to use in the study.

Dr. JoAnn Tschanz

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Dr. JoAnn Tschanz, professor of Psychology, will collaborate with other researchers to increase the diversity of samples in the Cache County Study on Memory in Aging (CCSMA). The CCSMA is a longitudinal, population-based study of Alzheimer's disease and other dementias that has followed over 5,000 elderly residents of Cache Valley since 1995. The study has contributed to the research on genetic, psychosocial, and environmental risk factors for Alzheimer's disease, late life cognitive decline, and the progression of dementia after its onset.

Because the CCSMA is a population-based study, it is limited to the racial makeup of the area it came from. Tschanz is partnering with Dr. Perry Ridge (BYU), Dr. Lisa Cannon-Albright (UofU), and BYU PhD students Justina Tavana and Anika Wallace to build on their efforts to recruit a cohort of Native Hawaiians and Pacific Islanders to examine difference in Alzheimer's disease risk between the two cohorts. Native Hawaiians and Pacific Islanders are largely absent from existing studies on Alzheimer's disease and related dementias, but limited research suggests these populations have higher rates of dementia than Caucasians and exhibit different genetic biomarkers. By collecting and cataloging samples from these populations, researchers hope to increase understanding of the genetic makeup of dementia and increase opportunities for research moving forward.

In addition to this study, Tschanz will receive support to organize and catalogue existing biological samples from the CCSMA stored at Brigham Young University (BYU) in collaboration with Dr. Ridge. A central database with website access will be developed, facilitating collaborations for the study. Completion of the database will allow researchers to look up specific information on around 5,000 samples and explore the relationship between genetics and co-morbidities of Alzheimer's disease.

A similar effort to sort and catalog DNA and other biological samples from the CCSMA will also take place at USU. These projects may facilitate research to use blood-based biomarkers to identify risk for Alzheimer's, and the organized repositories will facilitate future biomarker and genetics investigations of Alzheimer's disease and related cognitive decline in older adults.

Tschanz has also received support for two PhD students to continue their research and studies at USU.

Dr. Elizabeth Vargis

Elizabeth Vargis

A major marker of Alzheimer's disease is the presence of plaques that form when protein pieces called beta-amyloid clump together. The connection between these clinical markers, neuronal death, and cognitive impairment has long been studied, but the link between Alzheimer's disease and abnormalities in organs other than the brain, such as the heart and eyes, is less studied. For example, beta-amyloid aggregations similar to those in Alzheimer's patients are found in patients with dilated cardiomyopathy, a condition that affects the ability of the heart muscle to pump blood through the body. Individuals diagnosed with Alzheimer's disease tend to experience an increase in severity of heart and retinal diseases, but mechanisms explaining how Alzheimer's and markers like beta-amyloid relate to these diseases remain unclear.

Along with her team, Dr. Elizabeth Vargis, associate professor of Biological Engineering, aims to prevent the effects of Alzheimer's disease in the heart and eye by investigating their impact on the heart muscle wall and outer retina using realistic models made of hagfish protein fibers. These tissue-engineered models will mimic the characteristics of real heart and eye tissue, allowing the researchers to evaluate the effect of beta-amyloid buildup on cardiac muscle and retinal cell health. Understanding the impact of beta-amyloid plaques on heart and eye health will have a positive impacton research surrounding Alzheimer's disease and related diseases.

Vargis is joined in this research by Dr. Justin Jones, assistant professor of biology, Biological Engineering master's student Emilee Rickabaugh, and Biological Engineering PhD student Dillon Weatherston.

Researchers

- Dr. Catalin Buhusi, PSY
- Dr. Mona Buhusi & Madison Treasure-Areno, PSY
- Dr. Kerry Jordan & Olivia Ewing, PSY
- Dr. Maria Kleinstäuber, PSY
- Dr. Naveen Nagaraj, COMDDE
- Dr. JoAnn Tschanz, PSY
- Dr. Elizabeth Vargis, BENG