

# Neural Activities

THE NEWSLETTER OF THE CENTER FOR VITAL LONGEVITY

## Brain Scientists Present Groundbreaking Work at Conference

Nearly 200 researchers met in Dallas recently to share important new findings and map strategies for identifying age-related dementias as early as possible.

The two-day Dallas Aging and Cognition Conference (ACC) was sponsored by the Center for Vital Longevity (CVL) and featured a fast-paced schedule of presentations by leading international investigators that focused on how the brain is affected by aging and age-related diseases such as Alzheimer's. Between sessions at the Four Seasons Resort & Club in Las Colinas, renowned researchers mingled with graduate students from a variety of institutions, who detailed their own findings in posters.

During his presentation, Dr. William Thies, chief medical scientific officer of the Alzheimer's Association, expressed optimism about the pace of investigation and discovery. He pointed to the major shift in the last decade toward development of disease-modifying treatments, instead of medicines aimed only at addressing symptoms of Alzheimer's disease.



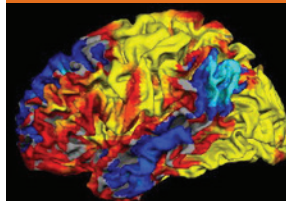
Researchers discussed recent findings.

Thies also lobbied for increased funding from government and private sources, along the lines of cancer and heart disease research support.

"Those big investments in other diseases are great," he said. "But we now have a public health problem, and we need to get Alzheimer's research to that level."

Dr. Adam Brickman of Columbia University offered an update on his work involving white matter and its connection to Alzheimer's disease. He said the conference provided a great opportunity to discuss **CONFERENCE** continued on page 5

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## On Our Minds *A message from the center directors* Collaboration in Science



Denise Park, PhD



Michael Rugg, PhD

In popular entertainment—think of Frankenstein or, more recently, Iron Man—scientists are often portrayed as eccentrics who single-handedly come up with revolutionary breakthroughs that immediately (and often adversely) impact the world around them. This stereotype is inaccurate in several ways. Most people would agree that, in reality, scientists are no more likely to be eccentric than are people in other walks of life. More importantly though, scientists infrequently work alone, and only rarely does a scientific field experience a breakthrough because of the efforts of a single individual.

There are good reasons why scientists work collaboratively, and these are well illustrated by research conducted at CVL. Not only is the research labor-intensive—any one individual would be hard-put to single-handedly conduct a modern aging study—but it is also interdisciplinary, depending crucially upon expertise in multiple scientific fields. For example, understanding how brain amyloid affects mental function—an important aspect of the Dallas Lifespan Brain Study—not only requires the psychological and neuroscience skills of researchers in CVL, but also the contribution of specialists in radiochemistry

and nuclear medicine. We are fortunate that expertise in these and other disciplines crucial to our research, such as magnetic resonance imaging, is found among the outstanding scientists at UT Dallas' sister institution, UT Southwestern Medical Center. Our collaborative projects with these scientists—several of which are funded by peer-reviewed federal grants—illustrate the promise of the interdisciplinary approach to such challenging problems as the causes of age-related cognitive decline.

A second kind of scientific collaboration is exemplified by our recent international conference (*see the article in this newsletter*). The conference brought together leading researchers to share and discuss their most recent findings. This happened not only in the forum of the conference room, but also in the innumerable conversations and discussions between scientists from different institutions (and continents) that took place outside of the formal proceedings. Such exchanges lead to insights and new ideas that would not have emerged otherwise, and are an important driver of innovative research. We are proud to serve cognitive aging research by making Dallas a destination where fellow-researchers can interact in this way. ☀



## RESEARCH UPDATE



A recent article in the *Journal of Neuroscience* by two Center for Vital Longevity (CVL) researchers furthers understanding of the brain regions involved in memory retrieval.

Dr. Kaia Vilberg, a postdoctoral fellow at CVL, and Dr. Michael Rugg, CVL co-director, conducted the research and wrote the November article, "The Neural Correlates of Recollection: Transient Versus Sustained fMRI Effects." It reported that most brain regions engaged when people remember events

also remain active during the maintenance of that information.

But the researchers also found that certain regions are only active at the time of memory retrieval and not during its maintenance. This is true of the hippocampus, a region critical for memory that is affected by Alzheimer's disease (see *this issue's Question About Cognition*).

"As the study of human memory using neuroimaging techniques develops, understanding how different brain regions contribute to support particular cognitive processes has grown more important," Vilberg said. "The results of this study are the first to dissociate activity in different brain regions in terms of their duration related to the demands of a memory-retrieval task."

For the study, 21 participants underwent a series of memory tests while images of changes in blood flow in their brains were obtained using functional magnetic resonance imaging (fMRI). The participants were young, healthy adults, with no neurological or memory problems.

Participants studied word-picture pairs and at test time were shown individual words and asked to try to remember the image that had been paired with that word during study time.

Vilberg said she is particularly interested in the



Kaia Vilberg, PhD

brain's left parietal cortex and its function in remembering. By understanding the conditions in which this region is engaged, as opposed to the situations when it is not engaged, scientists can begin to pinpoint the functions of the region, she said.

To determine what goes wrong or is different between populations of individuals with normal memory and impaired memory, scientists must first figure out which brain regions are involved in successful memory functioning in normal young adults. Vilberg's work is intended to increase understanding of how memory retrieval might occur in the brain before age- or disease-related impairments occur. This basic science research could potentially translate into future applications that improve memory function.

In their future work, Vilberg and Rugg will continue to address the question of how memories are reactivated in the brain. They will try to determine whether consciousness of a memory is a byproduct of reinstated activity in neurons that were active during the initial learning of that information – or, instead, requires engagement of another brain region tasked with binding the details of a memory into a coherent representation. ☀

## More Space Means More Research

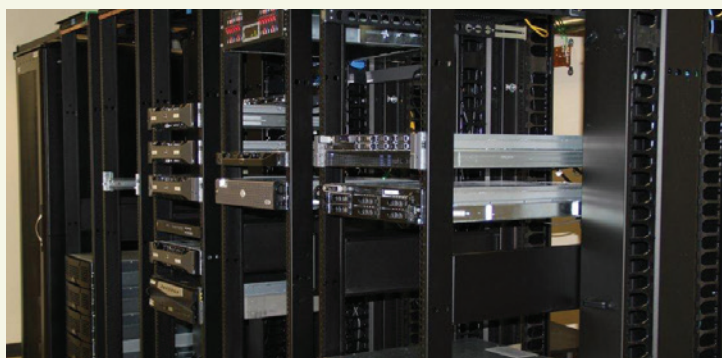
With the addition of more researchers and support staff, the Center for Vital Longevity has expanded its research and office space on the 7<sup>th</sup> floor of the Viceroy Building.

Renovations to the 7<sup>th</sup> floor started in early 2012, and faculty members and staff recently moved into the new offices, laboratories and conference room. About 2,400 square feet of existing space were refurbished for laboratories, and 1,800 square feet were added for offices.

CVL now encompasses about 30,000 square feet of space in the Viceroy building, an increase of nearly 3,500 square feet, said Blair Flicker, who was part of a team from the Provost's Office that helped manage the remodeling.

Each of the new faculty members received 600 square feet of space to configure into a laboratory. While the overall area is aesthetically similar to the center's 8<sup>th</sup> floor, all of the new scientists were able to develop lab arrangements that best suited their research needs.

Another 200 square feet were allocated for a new, state-of-the-art computer server room. Each of the center's research groups uses networks that connect researchers' desktop computers to servers capable of storing the large amounts of data that are amassed in neuroimaging studies. The new room hosts these servers and the associated networking equipment, with plenty



The expansion includes more room for servers.

of space for expansion. The center's computing capacity has also greatly benefited from a recent upgrade and expansion of its existing network.

Part of CVL's new 7<sup>th</sup> floor area is not yet customized. The center's directors expect to continue adding more faculty, staff and research projects, so this space will be finished out as new labs or offices are needed. ☀

# New CVL Faculty Members Focus on Aging and Memory

## Kristen Kennedy, PhD

**D**r. Kristen Kennedy is looking to the brain's white matter for clues about how the brain changes as we age and why some people are able to maintain good cognitive health while others are not.



Kristen Kennedy, PhD

Nearly half the human brain is white matter, which consists of millions of bundles of nerve fibers that connect neurons in different brain regions into functional circuits.

Kennedy joined the UT Dallas faculty this year as an assistant professor in the School of Behavioral and Brain Sciences (BBS) and UT Dallas' Center for Vital Longevity.

"White matter loses integrity as we age, but the brain is also really good at compensating for this," said Kennedy. "Structural losses don't necessarily translate to loss of brain function, which suggests that the aging brain is malleable and able to adapt in response to lost or weak neural connections."

Kennedy began her career with a clinical focus, earning a master's degree in clinical neuropsychology from Emporia State University in Kansas and her PhD in psychology from Wayne State University in Michigan. Her early studies used magnetic resonance imaging (MRI) as a tool to investigate age-related changes to the structure of the brain, and she quickly gravitated to the idea of using multimodal brain-imaging tools to examine the healthy brain structure's role in how brain function changes over the lifespan.

"By gaining a better understanding of the healthy aging brain, we can better understand what goes wrong in diseases like Alzheimer's and other dementias and gain insight into when and how we can best prevent or delay these devastating conditions," Kennedy said.

In 2010, Kennedy received a K99/R00 Pathway to Independence Award — a highly competitive career-development grant from the National Institutes of Health. The award provides two years of postdoctoral support and three years of faculty research support, which gave her a jump start on getting her new research program under way. She is particularly enthusiastic about fostering collaborations with other aging and imaging experts at UT Dallas and UT Southwestern Medical Center, who have a wealth of clinical and basic

## Karen Rodrigue, PhD

**D**r. Karen Rodrigue, a new assistant professor in the Center for Vital Longevity, wants to identify the key factors, both environmental and genetic, that impact the brain and cognition as we age.

"Understanding the mechanisms and modifiers of healthy brain aging can help inform us not only about how to maintain good cognitive health, but also about what goes awry in conditions like Alzheimer's disease and other age-related neurological disorders and the best options for treating them," said Rodrigue, who received her PhD in psychology from Wayne State University.



Karen Rodrigue, PhD

Rodrigue is particularly interested in knowing how health factors like hypertension and diabetes contribute to brain aging and cognitive decline, because these conditions are both prevalent in older adults, and amenable to prevention and treatment. In one line of research, she is examining how vascular health impacts the deposition of amyloid protein—a sticky protein whose buildup in the brain is a diagnostic marker of Alzheimer's disease.

In 2010, Rodrigue received a prestigious K99/R00 Pathway to Independence Award from the National Institutes of Health—a highly competitive career-development grant that provides two years of postdoctoral funding and three years of faculty research support.

"Neuroimaging studies are vital to my work, but they are expensive, so these funds are tremendously helpful in launching my new laboratory and research projects early," Rodrigue said.

Access to superb brain-imaging facilities, which are shared by faculty at UT Dallas, UT Southwestern Medical Center and UT Arlington, was an important factor in Rodrigue's decision to join the faculty at CVL and UT Dallas, as was the wealth of potential collaborators in the field of cognitive neuroscience and aging.

"UT Dallas has the caliber of faculty and resources of a large-scale, major university, but the intimate and more relaxed feel of a smaller school," said Rodrigue. "CVL is also unique in that everyone is focused on the problem of cognitive aging, but from different angles. I envision many opportunities for synergistic research projects that draw on our different strengths." 🌟

## Gagan Wig, PhD

**D**r. Gagan Wig recently joined the Center for Vital Longevity and is looking forward to collaborating with colleagues who share his interest in aging and memory loss.

Wig is an assistant professor in UT Dallas' School of Behavioral and Brain Sciences, and he will teach courses on the brain and cognition,



Gagan Wig, PhD

as well as connectivity and neuroimaging.

After earning a bachelor's degree from the University of British Columbia, a PhD at Dartmouth College and completing a postdoctoral fellowship at Harvard University, Wig

joined the Human Connectome Project at Washington University School of Medicine. He recently chose to come to CVL because he was "extremely encouraged and inspired" by the level of support UT Dallas has put toward building a world-class brain sciences program.

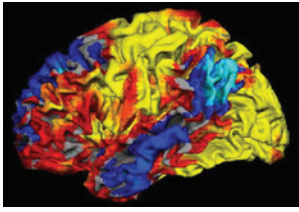
"The establishment of CVL is exemplary of this strong commitment and is unique in its clear and focused mission," Wig said.

Besides gaining an opportunity to work alongside a new group of internationally renowned experts in aging and cognition neuroscience, Wig said he is excited about the chance to develop his own research program directed toward studying how the brain changes with age.

Wig's research program uses a combination of structural and functional imaging tools (including structural and functional brain imaging and non-invasive cortical disruption) to understand the organization of large-scale human brain networks and how these networks change over the adult lifespan. He uses this information to guide studies related to memory and attention, with a particular focus on understanding the sources of individual differences in memory and attention, and how they may be affected by aging and disease.

His studies have largely focused on understanding and comparing the brain across snapshots at specific points in time, comparing young adults to older adults. Moving forward, he plans to study how the brain changes more dynamically over the lifespan, in an effort to identify the patterns of brain function and connectivity that may ultimately predict

## Questions About Cognition



### How does the brain store memories?

#### Dr. Michael Rugg:

The most widely accepted idea is that memories are stored in the networks of connections that allow nerve cells (neurons) to communicate with one another. Neuroscientists have discovered several processes that work at the synapse (the junction between two neurons) to alter the strength of the synaptic connection and make it easier for the neurons to communicate. These processes begin when two neurons connected by a synapse are active at the same time. In the same way, the synapses connecting a group of neurons will be strengthened if the neurons are jointly active, as would occur if they all responded to the same event. After the event is over, a "memory" for the event exists in the pattern of the strengthened connections.

Many brain regions contain synapses that show what is called "experience-dependent plasticity." But there is one region that is especially important for "episodic" memories, the complex, multifaceted memories central to our everyday lives. This is the hippocampus, located in the innermost (medial) parts of each temporal lobe of the brain. Damage to the hippocampus and nearby areas causes a severe, irreversible inability to store new memories or to recall memories formed up to a few years before the damage occurred. The hippocampus is one of the first brain regions to be affected by Alzheimer's disease, which explains why memory problems are one of its earliest symptoms. ☀

*Do you have a question about the aging mind and how it works?*

*To submit a question, please visit us online at:*

**[vitallongevity.utdallas.edu/newsletter](http://vitallongevity.utdallas.edu/newsletter)**

## Museum Serves as Setting for Supporters' Dinner

The Center for Vital Longevity brought together some of the world's most prominent scientists in cognitive aging with many of the area's leading philanthropists for a dinner and lecture at the Nasher Sculpture Center in late January.

The event took place during the weekend of CVL's Dallas Aging and Cognition Conference. The theme of the conference was "Predicting Successful and Unsuccessful Aging: Early Neural Markers of Decline and Disease," and the dinner's speaker also focused on that theme.

Richard Collins, chairman and CEO of Istation, along with center co-directors Dr. Michael Rugg and Dr. Denise Park, hosted the dinner to honor the visiting international researchers. Dr. Clifford Jack Jr. of the Mayo Clinic College of Medicine was the evening's keynote speaker. He described how Alzheimer's disease can now be detected before symptoms occur, and explained how this advance should help future efforts to treat the disease.

The dinner is part of the center's Directors' Research Circle series. The four annual events feature speakers who offer lectures and research updates to supporters of the center.



The dinner guests included (from left to right): Dr. David Daniel, UT Dallas president; Dr. Denise Park, Genevieve Collins, Sandra Thomas and Richard Collins.

The center's Advisory Council, led by Sandra Thomas and Bill Booziotis, launched the series. Among the members of the Director's Research Circle are: Linda Marcus, Mary Susan Barnhill, John Stilwell, Nancy O'Neil, Larry Warder and Dr. Kenneth and Ruth Altshuler.

"The dinner was a delightful experience, an opportunity for our center supporters to hear about the progress being made in research, directly from many of the individuals who are leading the way," Park said. ☀

## Support the Center

### Endowed Fellowships and Other Naming Opportunities

The high international profile of the Center for Vital Longevity, combined with its superb facilities, enables us to attract the best and brightest young scientists. Endowed fellowships increase our capacity to support the scientists of tomorrow as they undertake graduate or postdoctoral training, and also help boost the center's research productivity.

Additional naming opportunities are available that will permanently associate the name of a foundation, corporation or individual donor - or that of a family member, friend or colleague - with the center. We would especially welcome support for our scientific lecture series and the Dallas Aging and Cognition Conference (see feature story in this issue). Other opportunities include naming the center itself or one of our laboratories.

### Opportunity Funds

Opportunity funds give donors the chance to benefit any part of CVL. The funds provide the center with crucial unrestricted resources. They can be used to take advantage of timely opportunities, enhance programs, and upgrade research equipment and facilities.

### Planned Giving

Planned gifts give us the opportunity to plan for future growth. They can take the form of a bequest, charitable gift annuity, charitable remainder trust or life insurance. For more details, see **[utdallas.plannedgiving.org](http://utdallas.plannedgiving.org)**

To learn more about these and other opportunities for supporting our work, please contact the center at **972-883-3200**.

## CONFERENCE *continued from page 1*

new approaches to major issues with other presenters and young researchers.

"I think the intimacy of conferences like this make them very productive," he said. "Focusing on this specific topic of aging allowed greater exchange of ideas."

Dr. Denise Park, center co-director and Distinguished University Chair in the School of Behavioral and Brain Sciences, said great progress is being made in the field of aging research.

"This conference represents a special moment for Dallas, in our city's ambitious effort to become a leading center for research and scholarship," Park said. "Rarely are we able to bring together so many innovative thinkers to exchange ideas about research that will make a major difference in how we live our lives."

Speakers at the conference came from Europe, Canada and throughout the United States. Among the institutions represented were the Mayo Clinic, Harvard Medical School, the University of Zürich, the Rotman Research Institute in Ontario and the Max Planck Institute for Human Development in Berlin. Scientists from the Center for Vital Longevity and UT Southwestern Medical Center also presented their findings.

Dr. K. Warner Schaie of the University of Washington said ACC brought together many of the "world's top people" working in a highly specialized field.

"It's been terribly useful to hear the presentations and to interact with colleagues I've known and respected for a long time," he said.

Dr. Michael Rugg, co-director of CVL and Distinguished Chair, said the conference included experts from diverse areas of inquiry, all committed to improving older adults' quality of life by decreasing cognitive decline.

"ACC brought attendees up to date on the most important developments in a field that is progressing at a rapid pace, offering hope to everyone eager to maintain a sharp mind and an active lifestyle long past middle age," Rugg said.

Dr. Stephanie Dollinger, a professor at Southern Illinois University, said conferences are especially valuable for student researchers.

"This type of event gets them excited about their own research projects, and it helps them learn about how to teach and reach an audience," she said.

Dr. Trey Hedden of Massachusetts General Hospital said he gained a great deal of insight from his experience at the conference.

"It's important to hear from presenters who are working in fields similar to your own area and to hear about the progress they are making," he said.

"That type of cross-pollination is very beneficial."



Conference presenters shared their research and goals for the future.

Among the other featured topics and speakers at the January conference were:

- "Update on Hypothetical Model of Alzheimer's Disease Biomarkers" by Dr. Clifford R. Jack Jr. of the Mayo Clinic
- "Functional Phenotyping of Encoding Networks in Old Age" by Dr. Emrah Duzel of University Hospital Magdeburg and University College London
- "Effects of Age and Beta-Amyloid on Neurodegeneration in Clinically Normal Elderly Individuals" by Dr. Elizabeth Mormino of Harvard Medical School

CVL also hosted a dinner during the conference weekend for researchers and local supporters at the Nasher Sculpture Center. The dinner was part of CVL's annual Directors' Research Circle series, which allows supporters of the center to hear from experts on aging-related research and clinical care.

The Center for Vital Longevity is leading the way in research aimed at identifying risk factors for Alzheimer's disease and other forms of dementia. Using brain-imaging techniques, scientists are identifying a neural signature in middle-aged people that could help predict who may not age well cognitively. Researchers also are looking at memories, how they are formed and retrieved and how these processes change with age. Center scientists also are developing and testing interventions designed to improve cognitive performance in older adults, such as computer-based training programs.

The center received more than \$5 million in federal funding to support its age-related projects last year. The Dallas Lifespan Brain Study is among the broadest efforts, designed to track neural and cognitive aging across the entire adult lifespan from age 20 to 90. 🌞

## KENNEDY *continued from page 3*

research expertise.

Kennedy is also looking forward to teaching Functional Neuroanatomy, a course on the structure of the brain and how it is wired, during the spring 2013 semester. "It is fundamental knowledge you need to have in order to progress in any area of cognitive neuroscience," she said.

Kennedy is eager to bring her experience in structural and functional neuroimaging to the course. "By pairing knowledge gained from traditional gross anatomy studies with insights gleaned from MRI and other technologies, we can gain a more complete understanding of the functioning human brain," she said.

She ultimately hopes to make the class interactive by incorporating virtual dissections now available as YouTube videos, 3D computer modeling, and tutorials on the latest brain-imaging software. 🌞

## WIG *continued from page 3*

cognitive decline far in advance of noticeable behavioral changes.

Wig said he has always viewed the brain as complex and interesting.

"The brain is a network, and cognition is a product of how this network communicates," he said. "I am interested in this basic idea and its ultimate implications."

The brain functions in the same way that many other networks function, Wig said, but even well-functioning networks can be vulnerable to seemingly minor damage. An unfortunate negative consequence of aging can be the eventual loss of many of the core attributes and abilities that make people who they are.

Wig thinks age-related cognitive decline may be related to the susceptibility of brain networks to ongoing deterioration. He believes it's important to understand how and why age-related cognitive decline occurs, and try to prevent or forestall it when possible. 🌞

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THE SCIENCE OF THE AGING MIND

