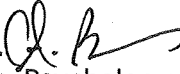


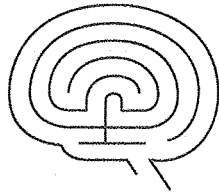
January 14, 2013

MEMORANDUM

TO: Trustees, The McKnight Brain Research Foundation  
J. L. Dockery, M.D.  
M.L. Dockery, M.D.  
N. Ellenbogen Raim, M.D., J.D.  
G. Ryerson, M.D.  
R.M. Wah, M.D.  
M.A. Cianciotto, Corporate Trustee

FROM: C.A. Barnes, Ph.D.   
Regents' Professor, Psychology and Neurology  
Evelyn F. McKnight Chair for Learning and Memory in Aging  
Director, Evelyn F. McKnight Brain Institute  
Director, ARL Division of Neural Systems, Memory and Aging  
Associate Director, BIO5

Please find enclosed six copies of the Annual Report for the University of Arizona Evelyn F. McKnight Brain Institute, which covers the financial reports for the period of July 1, 2011 through June 30, 2012 and scientific reports for the period of January 1, 2012 through December 31, 2012.



**Evelyn F. McKnight  
Brain Institute**

## **Annual Report**

**McKnight Brain Research Foundation  
Sponsored Institutes and Research Programs**

**Scientific Report Period: January 1, 2012 – December 31, 2012**

**Financial Report Period: July 1, 2011 – June 30, 2012**

**Institution: University of Arizona**

**Submitted January 14, 2013**

Table of Contents	Page
1. Summary of scientific achievements since last report .....	1
2. Publications in peer reviewed journals	
From Barnes.....	2
From Selected Affiliates .....	3
3. Publications (other)	
From Barnes.....	5
From Selected Affiliates .....	5
4. Presentations at scientific meetings	
From Barnes.....	5
From Selected Affiliates .....	7
5. Presentations at public (non-scientific) meetings or events	
From Barnes .....	9
From Selected Affiliates .....	9
6. Awards .....	10
7. Faculty (with abbreviated CV for previous 12 months) .....	10
8. Trainees	
Postdoctoral .....	21
Predoctoral .....	22
Undergraduate Students .....	23
Staff .....	24
9. Clinical/translational programs .....	24
10. Technology transfer .....	24
11. Budget update	
Last year's budget and actual results .....	25
(a) Status of matching funds .....	n/a
(b) Projected budget for coming year .....	25
(c) Extramural funding	
Grants Received – From Barnes .....	25
Grants Received – From Selected Affiliates .....	26
Grants Submitted – From Barnes .....	27
Grants Submitted – From Selected Affiliates .....	28
12. Educational programs focusing on age related memory loss	
Scientific .....	29
Public .....	29

13. Collaborative programs with McKnight Institutes, institutions and research programs.	29
14. Collaborative programs with non McKnight Institutes, institutions and research programs . . . . .	30
15. Plans for future research . . . . .	33
16. Endowment investment results . . . . .	33
17. Where any funds used for a Prohibited Purpose during the report period? . . . . .	34
18. Do you recommend any modification to the Purpose or mandates in the Gift Agreement? . . . . .	34
19. Did all activities during the report period further the Purpose? . . . . .	34
20. Negative Events . . . . .	34
21. Additional Comments. . . . .	34
22. Signature, date and title of person submitting the report . . . . .	35

## 1. Summary of scientific achievements since last report

The Evelyn F. McKnight Brain Institute at the University of Arizona (EMBI) has made significant progress towards our goal of understanding how aging impacts the circuits responsible for age-related memory decline. The Director has pioneered and developed two primary scientific tools that are used by her laboratory and in collaboration with others. The first involves the ability to monitor cognitive decline in aged rodents and nonhuman primates, in combination with live imaging methodologies, and state-of-the-art ensemble electrophysiological recording in behaving animals. The second is a molecular imaging technology (the catFISH method) that allows the examination of individual cells that participate in circuits critical for memory, and in combination with other methods, can detect transcriptional and epigenetic factors that are altered in these circuits by behavior and aging.

*A number of exciting papers were published during 2012, a few among these include:*

One prominent component of aging is a defect in memory stabilization. My McKnight affiliate faculty member Diano Marrone and I published two manuscripts this year using the catFISH method. Interestingly, there is a second “wave” of *Arc* transcription that occurs about 8 hours after a behavioral experience. In aged rats, granule cells in the dentate gyrus, a region of the hippocampus particularly vulnerable to aging (something that Scott Small and I showed a number of years ago), show reduced late phase *Arc* expression. This late phase expression is hypothesized to be required for effective consolidation and memory stabilization processes. Critically, this decreased *Arc* expression in old rats was correlated with impaired spatial memory (Marrone et al., *Neurobiology of Aging* 2012 33:979). Additionally, we studied the ability of adult-born granule cell neurons of old rats to survive and be integrated into the dentate gyrus. Even though neurogenesis is reduced in the old rats compared to adults, the adult born granule cells that survive in the aged brain remain equally responsive to spatial behavior, and can express *Arc* as do younger animals. This suggests that the cells born in the aged dentate gyrus do retain the capacity to participate in functional hippocampal networks (Marrone et al., *Hippocampus* 2012 22:737), which is a promising target for therapeutic intervention for altering memory in aged populations.

The Tucson McKnight Institute funded a collaboration with Leyla de Toledo-Morrell, and the data from this work is now published in two manuscripts. Investigations of rat models of aging have demonstrated that there are the same number of pyramidal cells in layer II of the entorhinal cortex, as well as in hippocampal CA3 and dentate gyrus regions. There are, however, indications of synapse loss from this input, and electrophysiological data suggest that there is a pruning of axon collaterals from the major input pathway from the entorhinal cortex to the hippocampus (the perforant path). If there is, indeed, a cross-species correspondence in the types of brain changes that occur during aging, then the rodent data predict that humans should also show reductions (pruning) in the region of the perforant pathway as a function of age. *In vivo* structural MRI methods were applied to healthy older individuals and young adults to examine the volume of the white matter that includes the perforant pathway. The results suggest that, indeed, there is a reduction in the white matter projections to the hippocampus in healthy older adults compared to younger persons – consistent with predictions from the animal studies (Stoub et al., *Neurobiology of Aging* 2012 33:1168.). Additionally, using diffusion tensor imaging, we also were able to show that the axons that run in the perforant pathway from the entorhinal

cortex to the hippocampus show reduced integrity of the remaining white matter fibers (Rogalski et al., *Neuropsychologia* 2012 50:1759).

We are also very excited about the project that I initiated with the McKnight Inter-institutional Cognitive Aging Test Battery working group. As a group we published a series of seven papers in the journal *Frontiers in Aging Neuroscience*, three of which I was directly involved in writing, including Roberson et al. (*Frontiers in Aging Neuroscience* 2012 4:6), Engle and Barnes (*Frontiers in Aging Neuroscience* 2012 4:10) and Burke et al. (*Frontiers in Aging Neuroscience* 2012 4:15.)

## 2. Publications in peer reviewed journals

### From Barnes

- Marrone, D.F., Satvat, E., Schaner, M.J., Worley, P.F. and Barnes C.A. (2012) Attenuated long-term Arc expression in the aged fascia dentata. *Neurobiology of Aging*, 33:979-990.
- Maurer, A.P., Burke, S.N., Lipa, P., Barnes, C.A. (2012) Greater running speeds result in increased hippocampal sequence compression. *Hippocampus*, 22:737-747.
- Marrone, D.F., Ramirez-Amaya, V., and Barnes, C.A. (2012) Neurons generated in senescence maintain capacity for functional integration. *Hippocampus*, 22:1134-1142.
- Rogalski, E.J., Stebbins, G.T., Barnes, C.A., Murphy, C.M., Stoub, T.R., George, S., Ferrari, C., Shah, R.C., and deToledo-Morrell, L. (2012) Age-related changes in parahippocampal white matter integrity: A diffusion tensor imaging study. *Neuropsychologia*, 50:1759-1764.
- Thome, A., Erickson, C.A., Lipa, P., and Barnes, C.A. (2012) Differential effects of experience on tuning properties of macaque MTL neurons in a passive viewing task. *Hippocampus*, 22:2000-2011.
- Burke, S.N., Maurer, A.P., Hartzell, A.L., Nematollahi, S., Uprety, A., Wallace, J.L., and Barnes, C.A. (2012) Representation of 3-dimensional objects by the rat perirhinal cortex. *Hippocampus*, 22:2032-2044.
- Burke, S.N., Hartzell, A.L., Lister, J.P., Hoang, L.T., and Barnes, C.A. (2012) Layer V perirhinal cortical ensemble activity during object exploration: A comparison between young aged rats. *Hippocampus*, 22:2080-2093.
- Insel, N., Patron, L.A., Hoang, L.T., Nematollahi, S., and Barnes C.A. (2012) Reduced gamma frequency in the medial frontal cortex of aged rats during behavior and rest: Implications for aged-related behavioral slowing. *Journal of Neuroscience*, 32:16331-16344.
- Stoub, T.R., Barnes, C.A., Shah, R.C., Stebbins, G.T., Ferrari, C., and deToledo-Morrell, L. (2012) Age-related changes in the mesial temporal lobe: The parahippocampal white matter region. *Neurobiology of Aging*, 33:1168-1176.
- Burke, S.N., Ryan, L., Barnes, C.A. (2012) Characterizing cognitive aging of recognition memory and related processes in animal models and in humans. *Frontiers in Aging Neuroscience*, 4:15.
- Engle, J.R. and Barnes, C.A. (2012) Characterizing cognitive aging of associative memory in animal models. *Frontiers in Aging Neuroscience*, 4:10
- Roberson, E.D., DeFazio, R.A., Barnes, C.A., Alexander, G.E., Bizon, J.L., Bowers, D., Foster, T.C., Glisky, E.L., Levin, B.E., Ryan, L., Wright, C.B., and Geldmacher, D.S. (2012)

Challenges and opportunities for characterizing cognitive aging across species. *Frontier in Aging Neuroscience*, 4:6.

- Hoang, L.T., Lister, J.P. and Barnes, C.A. (2012) The ageing hippocampus. In: *Clinical Neurobiology of the Hippocampus*. Bartsch, T. (ed.) Oxford University Press, pp. 152-173.
- Chawla, M.K., Penner, M.R., Olson, K.M., Sutherland, V.L., Mittleman-Smith, M.A., and Barnes, C.A. (2013) Spatial behavior and seizure-included changes in c-fos mRNA expression in young and old rats. *Neurobiology of Aging*, 34:1184-1198.
- Takehara-Nishiuchi, K., Insel, N., Hoang, L.T., Wagner, Z., Olson, K., Chawla, M.K., Burke, S.N., and Barnes, C.A. (2013) Activation patterns in superficial layers of neocortex change between experiences independent of behavior, environment, or the hippocampus. *Cerebral Cortex*, in press [epub ahead of publication doi: 10.1093/cercor/bhs209].
- Ramirez-Amaya, V., Angulo-Perkins, A., Chawla, M.K., Barnes, C.A., Rosi, S. (2013) Sustained transcription of the immediate early gene Arc in the dentate gyrus after spatial exploration. *Journal of Neuroscience*, in press.
- Schimanski, L.A., Lipa, P., Barnes, C.A. (2013) Tracking the course of hippocampal representations during learning: When is the map required? *Journal of Neuroscience*, in press.
- Hartzell, A.L., Burke, S.N., Hoang, L.T., Lister, J.P., Rodriguez, C.N., and Barnes, C.A. (2013) Transcription of the immediate-early gene Arc in CA1 of the hippocampus reveals activity differences along the proximodistal axis that are attenuated by advanced age. *Journal of Neuroscience*, in press.

#### From Selected Affiliates

- Alexander, G. E., Ryan, L., Bowers, D., Foster, T. C., Bizon, J. L., Geldmacher, D. S., and Glisky, E. L. (2012) Characterizing cognitive aging in humans with links to animal models. *Frontiers in Aging Neuroscience*, 4:21.
- Alexander, G.E., Bergfield, K.L., Chen, K., Reiman, E.M., Hanson, K.D., Lin, L., Bandy, D., Caselli, R.J., and Moeller, J.R. (2012) Gray matter network associated with genetic risk for Alzheimer's disease in young to early middle-aged adults, *Neurobiology of Aging*, 33:2723-32.
- Bizon, J. L., Foster, T. C., Alexander, G. E., and Glisky, E. L. (2012) Characterizing cognitive aging of working memory and executive function in animal models. *Frontiers in Aging Neuroscience*, 4:19. doi: 10.3389/fnagi.2012.00019.
- Burns, C.M., Chen, K., Kaszniak, A.W., Lee, W., Alexander, G., Bandy, D., Fleisher, A., Caselli, R.J., & Reiman, E.R. (in press). Higher serum glucose levels are associated with cerebral hypometabolism in Alzheimer's regions. *Neurology*, in press.
- Burke, S.N., Ryan, L., and Barnes, C.A. (2012) Characterizing cognitive aging of recognition memory and related processes in animal models and in humans. *Frontiers in Aging Neuroscience*, 4:15.
- Chen, K., Ayutyanont, N., Langbaum, J.B., Fleisher, A.S., Reschke, C., Lee, W., Liu, X., Alexander, G.E., Bandy, D., Caselli, R.J., and Reiman, E.M. (2012) Correlations between FDG PET glucose uptake-MRI gray matter volume scores and apolipoprotein E  $\epsilon 4$  gene dose in cognitively normal adults: A cross-validation study using voxel-based multi-modal partial least squares. *Neuroimage*, 60:2316-22.
- Doraiswamy, P.M., Sperling, R.A., Coleman, R.E., Johnson, K.A., Reiman, E.M., Davis, M.D., Grundman, M., Sabbagh, M.N., Sadowsky, C.H., Fleisher, A.S., Carpenter, A., Clark, C.M.,

- Joshi, A.D., Mintun, M.A., Skovronsky, D.M., and Pontecorvo, M.J., for the AV45-A11 Study Group (incl. Ahern GL). Amyloid- $\beta$  assessed by florbetapir F 18 PET and 18-month cognitive decline: A multicenter study. *Neurology*, 2012, 79 (16), 1636-1644.
- Edmonds, E. C., Glisky, E. L., Bartlett, J. C., and Rapcsak, S. Z. (2012) Cognitive mechanisms of false facial recognition in older adults. *Psychology and Aging*, 27:54-60.
- Ewers, M., Walsh, C., Trojanowski, J.Q., Shaw, L.M., Petersen, R.C., Jack, C.R., Jr., Feldman, H.H., Bokde, A.W.L., Alexander, G.E., Scheltens, P., Vellas, B., Dubois, B., Weiner, M., and Hampel, H., in collaboration with the North American Alzheimer's Disease Neuroimaging Initiative (ADNI) (2012) Prediction of Conversion from Mild Cognitive Impairment to Alzheimer's Disease Dementia Based upon Biomarkers and Neuropsychological Test Performance, *Neurobiology of Aging*, 33:1203-14.
- Forbes, C.E., Cox, C.L., Schmader, T., and Ryan, L. (2012) Negative stereotype activation alters interaction between neural correlates of arousal, inhibition and cognitive control. *Soc Cogn Affect Neurosci*, 7(7):771-81.
- Grilli, M.D., and Glisky, E.L. (2012) Imagining a better memory: Self-imagination in memory-impaired patients. *Clinical Psychological Science*, doi:10.1177/2167702612456464.
- Henry, M.L., Beeson, P.M., Alexander, G.E., and Rapcsak, S.Z. (2012) Written language impairments in primary progressive aphasia: A reflection of damage to central semantic and phonological processes, *Journal of Cognitive Neuroscience*, 24, 261-75.
- Kaszniak, A.W., and Menchola, M. (2012). Behavioral neuroscience of emotion in aging. *Current Topics in Behavioral Neuroscience*, 10:51-66.
- Levy, D.M., Wobbrock, J.O., Kaszniak, A.W., and Ostergren, M. (2012). The effects of mindfulness meditation training on multitasking in a high-stress information environment. *Proceedings of Graphics Interface* (pp. 45-52). Toronto, Ontario (May 28-30, 2012). Toronto, Ontario: Canadian Information Processing Society.
- McFarland, C., and Glisky, E. (2012) Implementation intentions and imagery: Individual and combined effects on prospective memory among young adults. *Memory & Cognition*, 40, 62-69.
- Mittelman-Smith, M.A., Williams, H., Krajewski-Hall, S.J., Lai, J., Ciofi, P., McMullen, N.T., and Rance, N.E. (2012) Arcuate kisspeptin/neurokinin B/dynorphin (KNDy) neurons mediate the estrogen suppression of gonadotropin secretion and body weight. *Endocrinology*, 153:2800-2012. PMID: PMC3359616
- Mittelman-Smith, M.A., Williams, H., Krajewski-Hall, S.J., McMullen, N.T., and Rance, N.E. (2012) A Role for Kisspeptin/Neurokinin B/Dynorphin (KNDy) Neurons in Cutaneous Vasodilatation and the Estrogen Modulation of Body Temperature. *Proceedings of the National Academy of Science, USA*, 109:19846-19851.
- Reiman, E.M., Quiroz, Y.T., Fleisher, A.S., Chen, K., Velez-Pardo, C., Jimenez-Del-Rio, M., Fagan, A.M., Shah, A.R., Alvarez, S., Arbelaez, A., Giraldo, M., Acosta-Baena, N., Sperling, R.A., Dickerson, B., Stern, C.E., Tirado, V., Munoz, C., Reiman, R.A., Huentelman, M.J., Alexander, G.E., Langbaum, J.B.S., Kosik, K.S., Tariot, P.N., and Lopera, F.. Brain abnormalities in young adults at genetic risk for autosomal dominant Alzheimer's disease. *The Lancet Neurology*, in press.
- Roberson, E. D., DeFazio, R. A., Barnes, C. A., Alexander, G. E., Bizon, J. L., Bowers, D., Foster, T. C., Glisky, E. L., Levin, B. E., Ryan, L., Wright, C. B., and Geldmacher, D. S. (2012) Challenges and opportunities for characterizing cognitive aging across species. *Frontiers in Aging Neuroscience*, 4:6.



Ryan, L., Cardoza, J.A., Barense, M.D., Kawa, K.H., Wallentin-Flores, J., Arnold, W.T., and Alexander, G.E. (2012). Age-related impairment in a complex object discrimination task that engages perirhinal cortex. *Hippocampus*. 22(10):1978-89.

### 3. Publications (other)

#### From Barnes

Hoang, L. and Barnes, C.A. (2012) The ageing hippocampus. In: *Clinical Neurobiology of the Hippocampus*. Bartsch, T. (ed.) Oxford University Press, in press.

#### From Selected Affiliates

Kaszniak, A.W. (in press). Contemplative pedagogy: Perspectives from cognitive and affective science. In O. Gunlaugson, E. Sarath, H. Bai, & C. Scott (Eds.), *Contemplative learning and inquiry across disciplines*. New York: State University of New York Press, in press.

Kihlstrom, J. F., and Glisky, E. L. (2012) Amnesia. In V. S. Ramachandran (Ed.), *Encyclopedia of human behavior* (2nd Ed). Oxford: Elsevier.

### 4. Presentations at scientific meetings

#### From Barnes

Barnes, C.A. (2012) Several recent findings, and several beginning projects on memory and brain aging, Kavli Institute, Norwegian University of Science and Technology, Trondheim, Norway, January 2012 (Invited)

Barnes, C.A. (2012) Keynote Speaker "Society for Neuroscience as a global force in brain science: What are SfN's actual constituencies?" Winter Conference on Brain Research, Snowbird, Utah, January 2012. (Invited)

Barnes, C.A. (2012) Effects of aging on behavior and temporal lobe circuits. Integrative Center for Learning and Memory Inaugural Symposium, University of California at Los Angeles, March 2012. (Invited)

Barnes, C.A. (2012) Impact of aging on neural circuits critical for memory. XXXIVth International Symposium of the GRSNC entitled *The Neurobiology of Aging and Alzheimer's Disease: Walking Down the Same Road?*, Montreal, Canada, May 2012. (Invited)

Barnes, C.A. (2012) Temporal lobe correlates of memory decline in normal aging. *The Rise and Fall of Memory Across the Lifespan*, University College London, May 2012. (Invited)

Barnes, C.A. (2012) The aging hippocampal formation in animal models. *Cold Spring Harbor Workshop on Cognitive Aging*, Cold Spring Harbor, NY, June 2012. (Invited)

Barnes, C.A. (2012) Surprising lessons from aging temporal lobe circuits. *Centre for the Biology of Memory Advisory Board Meeting*, Norwegian University of Science and Technology, Runde, Norway, June 2012. (Invited)

Hoang, L.T., Maurer, A.P., Burke, S.N., Hindley, T.R., Marsh, R.N., Richards, A.M., and Barnes, C.A. (2012) *Retro Rat: The Effects of Backward Movement on CA1 Place Fields*. 8th FENS Forum of Neuroscience, Barcelona, Spain, July 2012. (Abstract)

- Lister, J.P., Clasen, S.J., Hartzell, A.L., Burke, S.N., and Barnes, C.A. (2012) Identity of objects is insufficient to alter Arc expression in lateral entorhinal cortex of young and old rats. 8th FENS Forum of Neuroscience, Barcelona, Spain, July 2012. (Abstract)
- Engle, J.R., Machado, C.J., Maurer, A.P., Permenter, M., Vogt, J., and Barnes, C.A. (2012) Mapping the spatial navigation network: A positron emission tomography study of young and aged rhesus macaque monkeys. 8th FENS Forum of Neuroscience, Barcelona, Spain, July 2012. (Abstract)
- Fitzhugh, M.C., Totenhagen, J.W., Yoshimaru, E.S., Richards, A., Hoang, L.T., Allen, A.N., Turk, M., Kratochvil, J., Biwer, L.A., Hale, T.M., Chen, K., Moeller, J.R., Mitchell, K.D., Huentelman, M.J., Barnes, C.A., Trouard, T.P., and Alexander, G.E. (2012) Regional brain network of MRI gray matter with gradual induction of hypertension in the Cypla1-Ren2 transgenic rat. Abstract Viewer/Itinerary Planner. Washington, DC: Society for Neuroscience, October 2012. (Abstract)
- Smith, K.E., Barnes, C.A., Corenblum, M.J., and Madhavan, L. (2012) Changing characteristics of neural stem cells across the lifespan during aging. Abstract Viewer/Itinerary Planner. Washington, DC: Society for Neuroscience, October 2012. (Abstract)
- Liang, J., Lister, J.P., and Barnes, C.A. (2012) Aging does not affect the proportion of dorsal medial entorhinal cortex cells active during track running behavior. Abstract Viewer/Itinerary Planner. Washington, DC: Society for Neuroscience, October 2012. (Abstract)
- Lister, J.P., Clasen, S.J., Hartzell, A.L., Burke, S.N., and Barnes, C.A. (2012) Effect of aging on the activity pattern of Arc expression in the deep layers of lateral entorhinal cortex. Abstract Viewer/Itinerary Planner. Washington, DC: Society for Neuroscience, October 2012. (Abstract)
- Burke, S.N., Hartzell, A.L., Lister, J.P., Hoang, L.T., and Barnes, C.A. (2012) The effects of age and environmental change on Arc transcription in perirhinal cortical ensembles following object exploration. Abstract Viewer/Itinerary Planner. Washington, DC: Society for Neuroscience, October 2012. (Abstract)
- Friel, J., Ferng, J.J., Hartzell, A.L., Burke, S.N., and Barnes, C.A. (2012) The influence of advanced age on noradrenergic-dependent novelty detection. Abstract Viewer/Itinerary Planner. Washington, DC: Society for Neuroscience, October 2012. (Abstract)
- Hartzell, A.L., Barrientos, R.M., Hoang, L.T., Lister, J.P., Maier, S.F., and Barnes, C.A. (2012) The effect of peripheral E. coli infection on behaviorally-induced Arc expression patterns in hippocampal granule cells. Abstract Viewer/Itinerary Planner. Washington, DC: Society for Neuroscience, October 2012. (Abstract)
- Schimanski, L.A., Lipa, P., and Barnes, C.A. (2012) Diminished place field density and direction-dependent learning in the aged rat. Abstract Viewer/Itinerary Planner. Washington, DC: Society for Neuroscience, October 2012. (Abstract)
- Insel, N. and Barnes, C.A. (2012) Spiking of theta-firing neurons in medial prefrontal cortex precedes population activity during behavior and rest. Abstract Viewer/Itinerary Planner. Washington, DC: Society for Neuroscience, October 2012. (Abstract)
- Plange, K., Burke, S.N., Thome, A., Engle, J.R., Trouard, T.P., Gothard, K.M., and Barnes, C.A. (2012) Grey matter volume in the orbital prefrontal cortex correlates with reinforcer devaluation but not reversal learning performance in bonnet macaques. Abstract Viewer/Itinerary Planner. Washington, DC: Society for Neuroscience, October 2012. (Abstract)

- Thome, A., Lipa, P., Erickson, C.A., and Barnes, C.A. (2012) Senescence modifies the structure of information encoding in the medial temporal lobe. Abstract Viewer/Itinerary Planner. Washington, DC: Society for Neuroscience, October 2012. (Abstract)
- Engle, J.R., Machado, C.J., Maurer, A.P., Permenter, M., Vogt, J., and Barnes, C.A. (2012) Mapping the spatial navigation network of young and aged rhesus macaque monkeys: A positron emission tomography study. Abstract Viewer/Itinerary Planner. Washington, DC: Society for Neuroscience, October 2012. (Abstract)
- Lu, L., Leutgeb, J.K., Henriksen, E.J., Tsao, A., Leutgeb, S., Barnes, C.A., Witter, M.P., Moser, E.I., and Moser, M.-B. (2012) The lateral entorhinal cortex and rate coding in the hippocampus. Abstract Viewer/Itinerary Planner. Washington, DC: Society for Neuroscience, October 2012. (Abstract)
- Barnes, C.A. (2012) Impact of Aging on Circuit Critical for Memory. Epilepsy Grand Rounds, Case Western Reserve University, Cleveland, Ohio, November 2012. (Invited)

#### From Selected Affiliates

- Kaszniak, A.W. (2012) Emotion experience, expression and physiology in aging. Invited presentation, Neuroscience Data Blitz, University of Arizona, Tucson, AZ, February 2012.
- Grilli, M.D., and Glisky, E.L. (2012) Self-knowledge and the self-imagination effect (SIE) in free recall: Implications for cognitive rehabilitation and memory disorders. International Neuropsychological Society, Montreal, Canada, February 2012. (Abstract)
- Polsinelli, A.J., and Glisky, E.L. (2012). The use of perspective in older adult's emotional autobiographical memories. International Neuropsychological Society, Montreal, Canada February 2012. (Abstract)
- Wohltmann, J.J., and Glisky, E.L. (2012). A comparison of many-to-one mapping and one-to-one mapping of source and associative memory in older adults. International Neuropsychological Society, Montreal, Canada, February 2012. (Abstract)
- Varteresian, T., Langbaum, J.B., Reeder, S., Hamilton, E., Lalio, F., Dougherty, J., Rapcsak, S., Shi, J., Baxter, L., Ahern, G.L., Brand, H., Woodruff, B.K., Caselli, R.J., Sabbagh, M., Tariot, P.N., Reiman, E.M., and Yaari, Y. (2012) Evaluating depression in older Native Americans. Presented at the American Association for Geriatric Psychiatry, Washington, DC, March 2012. (Abstract)
- Baena E, and Ryan L. (2012) Functional compensation in response to increasing task difficulty: Comparing semantic and episodic memory tasks in young and older adults. Poster presented at the Cognitive Aging Conference, Atlanta, Georgia, April 2012. (Abstract)
- Bisbee, M.L., Rapcsak, S.Z., Wohltmann, J.J., and Glisky, E.L. (2012) APOE  $\epsilon$ 4 is associated with recollection deficit and increased reliance on familiarity in face recognition memory. Cognitive Aging Conference, Atlanta, GA, April 2012. (Abstract)
- Cardoza, J., Kawa, K., Cain, E., Powers, F., Barense, M., and Ryan, L. (2012) An fMRI Study of Age-Related Differences in Complex Object Discrimination. Poster presented at the Cognitive Aging Conference, Atlanta, Georgia, April 2012. (Abstract)
- Ashish, D., and Kaszniak, A.W. (2012) Loving-kindness meditation: A review and future directions. Poster presented at the International Symposia for Contemplative Studies, Denver, CO, April 2012.
- Burns, C.M., Ashish, D., McDonnell, D., Baena, E., and Kaszniak, A.W. (2012) Mental health and mindfulness from the inside: Developing an introductory mindfulness based meditation

- class for prison inmates. Poster presented at the International Symposia for Contemplative Studies, Denver, CO, April 2012.
- Kaszniak, A.W. (2012) Clinical science and contemplative practice. Master Lecture session moderator, International Symposia for Contemplative Studies, Denver, CO, April 2012.
- Kaszniak, A.W. (2012) Education, social science, and positive psychology. Master Lecture session moderator, International Symposia for Contemplative Studies, Denver, CO, April 2012.
- Wiley, A., and Kaszniak, A.W. (2012) Does mindfulness meditation buffer against self-control failure? Poster presented at the International Symposia for Contemplative Studies, Denver, CO, April 2012.
- Sbarra, D., and Kaszniak, A.W. (2012) Contemporary training in clinical psychology: The UA model. Invited presentation given to the Southern Arizona Psychological Association, Tucson, AZ, April 2012.
- Glisky, E.L. (2012) Executive function and working memory in humans. Fifth Evelyn F. McKnight Inter-Institutional Meeting, Tucson, AZ, April 2012. (Invited)
- Rance, N.E. (2012) Neuroscience Program Seminar Speaker, University of Wyoming, Spring 2012. (Invited)
- Polsinelli, A.J., and Glisky, E.L. (2012) Characteristics of emotional autobiographical memories in younger and older adults. Association for Psychological Science, Chicago, IL, May 2012. (Abstract)
- Hasenkamp, W., and Kaszniak, A.W. (2012) The Varela and 1440 research awards programs. Presentation given at the 2012 Mind and Life Summer Research Institute, Garrison, NY, June 2012.
- Rance, N.E. (2012) Role of hypothalamic NKB neurons in the physiology of postmenopausal women. Symposium entitled "Neuro-Modulatory Regulation of Gonadotropin Release: NKB, Annual Meeting of the Endocrine Society, Houston, Texas, June 2012. (Invited)
- Glisky, E.L., and Grilli, M.D. (2012) Self-imagination improves memory in individuals with memory disorders. Symposium on "Cognitive Remediation of Memory Disorders," Memory Disorders Research Society, Davis, CA, September 2012. (Invited)
- Rance, N.E. (2012) Seminar speaker, St. Joseph's Hospital and the Barrow Neurological Institute, Phoenix, AZ, Fall 2012. (Invited).
- Baena, E., and Ryan, L. (2012) Functional compensation in response to increasing task difficulty: Comparing semantic and episodic memory tasks in young and older adults. Poster presented at the annual conference of the Society for Neuroscience, New Orleans, Louisiana, October 2012. (Abstract).
- Cardoza, J., Wallentin-Flores, J., Powers, F.E., Arnold, W., Barense, M., and Ryan, L. (2012) An fMRI Study of Age-Related Differences in Complex Object Discrimination. Poster presented at the annual conference of the Society for Neuroscience, New Orleans, Louisiana, October 2012.
- Cholanian, M., Krajewski-Hall, S.J, Levine, R.B., McMullen, N.T., and Rance, N.E., Long-term estradiol treatment reduces firing rate of arcuate neurokinin B (NKB) neurons in ovariectomized Tac2-EGFP. Society for Neuroscience, New Orleans, LA, October 2012. (Abstract)
- Krajewski-Hall, S. J., Mittelman-Smith, M.A., Williams, H, LaFrance, K.J. McMullen N. T., and Rance N.E. A role for kisspeptin/neurokinin B/dynorphin (KNDy) neurons in the regulation

- of estrous cycles and the estrogen modulation of body temperature. Society for Neuroscience, New Orleans, LA, October 2012. (Abstract)
- Fellous, J-M, Jones, B., Vargas, I.M., Pest, S., and Glisky, E. (2012) Contextual reminders fail to trigger memory reconsolidation in aged humans and rats. Society for Neuroscience, New Orleans, LA, October 2012. (Abstract)
- Fitzhugh, M.C., Totenhagen, J.W., Yoshimaru, E.S., Richard, A., Hoang, L.T., Allen, A.N., Turk, M, Krate, J., Biwer, L.A., Hale, T.M., Chen, K., Moeller, J.R., Coleman, P.D., Mitchell, K.D., Huentelman, M.J., Barnes, C.A., Trouard, T.P., Alexander, G.E. Regional brain network of MRI gray matter with gradual induction of hypertension in the Cyp1a1-Ren2 transgenic rat. (2012) . Society for Neuroscience, New Orleans, LA, October 2012. (Abstract)
- Kaszniak, A.W. (2012) Why we are here. Invited opening presentation given at the Mind and Life XXV Dialogs with the Dalai Lama ("Contemplative Practice and Health: Laboratory Findings and Real World Challenges), Rockefeller University, New York, NY, October 2012.
- Kaszniak, A.W. (2012) Dementia and end-of-life-care. Invited presentation given at the Casa de la Luz Hospice annual meeting, Tucson, AZ, November 2012.

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

### From Barnes

Barnes, C.A. (2012) Aging of the Brain, Living Beyond 100 Lecture Series, University of Arizona, Tucson, AZ, February 2012. (Invited)

### From Selected Affiliates

Glisky, E.L. (2012) Optimizing lifelong learning. Osher Lifelong Learning Institute, Tucson, AZ, January 2012. (Invited)

Kaszniak, A.W. (2012) Emotions, equanimity and Zen practice. Invited public talk given at the Upaya Zen Center and Institute, Santa Fe, NM, January 2012.

Kaszniak, A.W., Halifax, J., Chrousos, G., Davidson, R., Thompson, E., Dunne, J., and Todd, R. (2012) Discussion panels at the "Zen Brain: Emotions, Equanimity, and the Embodied Mind" retreat/seminar (A.W. Kaszniak & J. Halifax, organizers) held at the Upaya Zen Center and Institute, Santa Fe, NM, January 2012.

Ahern, G.L. (2012) A Brief Overview of Dementia and Alzheimer's Disease. Senior Brain Matters. West Social Center, Green Valley, AZ, February 2012. (Invited)

Ahern, G.L. (2012) Practical Aspects of Diagnosis and Treatment of Alzheimer's Disease and Other Dementias. Current Clinical Practice; Psychopharmacology Review, University of Arizona Department of Psychiatry, Westin La Paloma, Tucson, AZ, February 2012. (Invited)

Kaszniak, A.W. (2012) Metamemory: How the brain predicts itself. Invited community presentation to the Osher Lifelong Learning Institute, Marana, AZ, March 2012.

Kaszniak, A.W. (2012) Meditation and emotion regulation. Invited presentation given to the Arizona Meditation Research Interest Group, Tucson, AZ, March 2012.

- Ahern, G.L. (2012) Alzheimer's Disease: What Women Need to Know. 11th Annual Women's Health Symposium, University of Arizona Department of Psychiatry, UA Student Union, Tucson, AZ, April 2012. (Invited)
- Kaszniak, A.W. (2012) Affective neuroscience of aging. Invited public lecture given to the Spirit of the Senses Salon, Phoenix, AZ, April 2012.
- Kaszniak, A.W. (2012) Dementia and end-of-life care. Invited presentation given to the staff and volunteers of Casa de la Luz Hospice, Tucson, AZ, May 2012.
- Ahern, G.L. (2012) Diagnosis of Dementia, Evaluation, and Assessment, Catalina Vista Center, Sun City Oro Valley, Oro Valley, AZ, August 2012. (Invited)
- Glisky, E.L. (2012). Memory changes with age: What to do about it? La Posada, Green Valley, AZ, November 2012. (Invited)
- Glisky, E. L. (2012). Memory changes with age: What to do about it? Sun City, Oro Valley, AZ, December 2012. (Invited)

## **6. Awards (from McKnight Affiliates)**

Paige Scalf, Ph.D.: Recipient of George H. Davis Travel Fellowship for travel to Donders Institute (Radboud University Nijmegen, The Netherlands) for a project involving use of an MRI programmed to permit very high temporal resolution. This allowed them to measure the speed with which attention is directed to visual information (Summer 2012).

## **7. Faculty**

There are two levels of faculty participation in the Evelyn F. McKnight Brain Institute at the University of Arizona: the Scientific Advisory Board (all of whom are Affiliate Faculty members), and Affiliate Faculty members. The Scientific Advisory Board consists of Dr. Geoff Ahern, Dr. Gene Alexander, Dr. Carol Barnes (Director), Dr. Betty Glisky, Dr. Al Kaszniak, Dr. Naomi Rance and Dr. Lee Ryan. The Advisory Board's one-year abbreviated curricula vitae are included in the following pages.

## BIOGRAPHICAL SKETCH

NAME  Carol A. Barnes, Ph.D.	POSITION TITLE  Regents' Professor		
EDUCATION/TRAINING			
INSTITUTION AND LOCATION	DEGREE	YEAR(s)	FIELD OF STUDY
University of California, Riverside, CA	B.A. (Honors)	1971	Psychology
Carleton University, Ottawa, Ontario, Canada	M.A.	1972	Psychology
Carleton University, Ottawa, Ontario, Canada	Ph.D. (Cum laude)	1977	Psychology

### Positions

- 1978            **Research Associate**, Dalhousie University, Dept. Psychology, Halifax, Canada
- 1979 - 1980   **NRSA Postdoctoral Fellow**, Institute of Neurophysiology, Oslo, Norway
- 1981            **NATO Postdoctoral Fellow**, Cerebral Functions Group, Univ College, London, England
- 1982 - 1985   **Assistant Professor**, Department of Psychology, University of Colorado, Boulder
- 1985 - 1989   **Associate Professor**, Department of Psychology, University of Colorado, Boulder
- 1989 - 1990   **Professor**, Department of Psychology, University of Colorado, Boulder
- 1990 - 1996   **Professor**, Psychology, Neurology, University of Arizona, Tucson
- 2006 -         **Regents' Professor**, Psychology, Neurology, Neuroscience, University of Arizona
- 2006 -         **Director**, Evelyn F. McKnight Brain Institute, University of Arizona, Tucson
- 2006 -         **Evelyn F. McKnight Endowed Chair for Learning and Memory in Aging**, University of Arizona, Tucson
- 2008 -         **Director**, ARL Division of Neural Systems, Memory and Aging, Univ of Arizona
- 2009 -         **Associate Director**, Bio5, University of Arizona, Tucson

### Honors, Awards and Advisory Committees

- 1969            NSF Summer Research Fellowship
- 1971            Phi Beta Kappa
- 1972 - 1974   Ontario Graduate Fellowship
- 1979 - 1981   NRSA Individual Postdoctoral Fellowship
- 1981 - 1982   NATO Fellowship in Science
- 1984 - 1989   Research Career Development Award, N.I.H.
- 1987 - 1991   Neuroscience, Behavior and Sociology of Aging Committee A, N.I.A.
- 1989 - 1994   Research Scientist Development Award, Level II, N.I.M.H.
- 1991 - 1997   Medical and Scientific Advisory Board, Alzheimer's Association
- 1994 - 1999   Research Scientist Award, N.I.M.H.
- 1994 - 1997   National Advisory Council on Aging, N.I.H.
- 1995 - 1999   National Science Advisory Council, American Federation for Aging Research
- 1996 - 2000   Councilor, Society for Neuroscience
- 1997 - 2000   Medical and Scientific Advisory Council, Alzheimer's Association
- 1999 - 2004   Board of Scientific Counselors, N.I.M.H.
- 2000 - 2002   Secretary, Society for Neuroscience
- 2003 - 2006   President-Elect (2003-04), President (2004-05), Past-President (2005-06), Society for Neuroscience
- 2004            MERIT Award, National Institute on Aging, NIH
- 2004            Elected Norwegian Royal Society of Sciences and Letters
- 2007            Elected Fellow, American Association for the Advancement of Science
- 2007            Elected Executive Committee, Dana Alliance for Brain Initiatives
- 2008            Chair, Society for Neuroscience International Affairs Committee - US National Committee (Incoming Chair 2007-2008)
- 2008            APA Division 6 D.B. Marquis Behavioral Neuroscience Award for Behavioral Neuroscience

- 2010           Mika Salpeter Lifetime Achievement Award  
 2010           Elected, Galileo Fellow, College of Science, University of Arizona  
 2010 – 2014   Elected: Chair, Gruber Foundation Neuroscience Prize Advisory Board

## 2012 Publications

- Marrone, D.F., Satvat, E., Schaner, M.J., Worley, P.F. and Barnes C.A. (2012) Attenuated long-term Arc expression in the aged fascia dentata. *Neurobiology of Aging*, 33:979-990.
- Maurer, A.P., Burke, S.N., Lipa, P., Barnes, C.A. (2012) Greater running speeds result in increased hippocampal sequence compression. *Hippocampus*, 22:737-747.
- Marrone, D.F., Ramirez-Amaya, V., and Barnes, C.A. (2012) Neurons generated in senescence maintain capacity for functional integration. *Hippocampus*, 22:1134-1142.
- Rogalski, E.J., Stebbins, G.T., Barnes, C.A., Murphy, C.M., Stoub, T.R., George, S., Ferrari, C., Shah, R.C., and deToledo-Morrell, L. (2012) Age-related changes in parahippocampal white matter integrity: A diffusion tensor imaging study. *Neuropsychologia*, 50:1759-1764.
- Thome, A., Erickson, C.A., Lipa, P., and Barnes, C.A. (2012) Differential effects of experience on tuning properties of macaque MTL neurons in a passive viewing task. *Hippocampus*, 22:2000-2011.
- Burke, S.N., Maurer, A.P., Hartzell, A.L., Nematollahi, S., Uprety, A., Wallace, J.L., Barnes, C.A. (2012) Representation of 3-dimensional objects by the rat perirhinal cortex. *Hippocampus*, 22:2032-2044.
- Burke, S.N., Hartzell, A.L., Lister, J.P., Hoang, L.T., and Barnes, C.A. (2012) Layer V perirhinal cortical ensemble activity during object exploration: A comparison between young aged rats. *Hippocampus*, 22:2080:2093.
- Insel, N., Patron, L.A., Hoang, L.T., Nematollahi, S., and Barnes C.A. (2012) Reduced gamma frequency in the medial frontal cortex of aged rats during behavior and rest: Implications for aged-related behavioral slowing. *Journal of Neuroscience*, 32:16331-16344.
- Stoub, T.R., Barnes, C.A., Shah, R.C., Stebbins, G.T., Ferrari, C., and deToledo-Morrell, L. (2012) Age-related changes in the mesial temporal lobe: The parahippocampal white matter region. *Neurobiology of Aging*, 33:1168-1176.
- Burke, S.N., Ryan, L., Barnes, C.A. (2012) Characterizing cognitive aging of recognition memory and related processes in animal models and in humans. *Frontiers in Aging Neuroscience*, 4:15.
- Engle, J.R. and Barnes, C.A. (2012) Characterizing cognitive aging of associative memory in animal models. *Frontiers in Aging Neuroscience*, 4:10
- Roberson, E.D., DeFazio, R.A., Barnes, C.A., Alexander, G.E., Bizon, J.L., Bowers, D., Foster, T.C., Glisky, E.L., Levin, B.E., Ryan, L., Wright, C.B., and Geldmacher, D.S. (2012) Challenges and opportunities for characterizing cognitive aging across species. *Frontier in Aging Neuroscience*, 4:6.
- Hoang, L.T., Lister, J.P. and Barnes, C.A. (2012) The ageing hippocampus. In: *Clinical Neurobiology of the Hippocampus*. Bartsch, T. (ed.) Oxford University Press, pp. 152-173.
- Takehara-Nishiuchi, K., Insel, N., Hoang, L.T., Wagner, Z., Olson, K., Chawla, M.K., Burke, S.N., and Barnes, C.A. (2012) Activation patterns in superficial layers of neocortex change between experiences independent of behavior, environment, or the hippocampus. *Cerebral Cortex*, in press [epub ahead of publication doi: 10.1093/cercor/bhs209].
- Chawla, M.K., Penner, M.R., Olson, K.M., Sutherland, V.L., Mittleman-Smith, M.A., and Barnes, C.A. (2012) Spatial behavior and seizure-included changes in c-fos mRNA expression in young and old rats. *Neurobiology of Aging*, in press.
- Ramirez-Amaya, V., Angulo-Perkins, A., Chawla, M.K., Barnes, C.A., Rosi, S. (2012) Sustained transcription of the immediate early gene Arc in the dentate gyrus after spatial exploration. *Journal of Neuroscience*, in press.
- Schimanski, L.A., Lipa, P., Barnes, C.A. (2012) Tracking the course of hippocampal representations during learning: When is the map required? *Journal of Neuroscience*, in press.
- Hartzell, A.L., Burke, S.N., Hoang, L.T., Lister, J.P., Rodriguez, C.N., and Barnes, C.A. Transcription of the immediate-early gene Arc in CA1 of the hippocampus reveals activity differences along the proximodistal axis that are attenuated by advanced age. *Journal of Neuroscience*, in press.



## BIOGRAPHICAL SKETCH

NAME Geoffrey Lawrence Ahern, M.D., Ph.D.	POSITION TITLE Professor																																
EDUCATION/TRAINING																																	
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 45%;">INSTITUTION AND LOCATION</th> <th style="width: 15%;">DEGREE</th> <th style="width: 15%;">YEAR(s)</th> <th style="width: 25%;">FIELD OF STUDY</th> </tr> </thead> <tbody> <tr> <td>SUNY, Purchase College</td> <td>B.A.</td> <td>1976</td> <td>Psychology</td> </tr> <tr> <td>Yale University, New Haven</td> <td>M.S.</td> <td>1978</td> <td>Psychology</td> </tr> <tr> <td>Yale University, New Haven</td> <td>Ph.D.</td> <td>1981</td> <td>Psychology</td> </tr> <tr> <td>Yale University, New Haven</td> <td>M.D.</td> <td>1984</td> <td>Medicine</td> </tr> <tr> <td>Waterbury Hospital, Waterbury</td> <td>Intern</td> <td>1984-1985</td> <td>Medicine</td> </tr> <tr> <td>Boston University, Boston</td> <td>Resident</td> <td>1985-1988</td> <td>Neurology</td> </tr> <tr> <td>Beth Israel Hospital, Boston</td> <td>Fellow</td> <td>1988-1990</td> <td>Behavioral Neurology</td> </tr> </tbody> </table>	INSTITUTION AND LOCATION	DEGREE	YEAR(s)	FIELD OF STUDY	SUNY, Purchase College	B.A.	1976	Psychology	Yale University, New Haven	M.S.	1978	Psychology	Yale University, New Haven	Ph.D.	1981	Psychology	Yale University, New Haven	M.D.	1984	Medicine	Waterbury Hospital, Waterbury	Intern	1984-1985	Medicine	Boston University, Boston	Resident	1985-1988	Neurology	Beth Israel Hospital, Boston	Fellow	1988-1990	Behavioral Neurology	
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SUNY, Purchase College	B.A.	1976	Psychology																														
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Yale University, New Haven	M.D.	1984	Medicine																														
Waterbury Hospital, Waterbury	Intern	1984-1985	Medicine																														
Boston University, Boston	Resident	1985-1988	Neurology																														
Beth Israel Hospital, Boston	Fellow	1988-1990	Behavioral Neurology																														

### Positions

1977 - 1980	<b>Lab Director</b> , Human Psychophysiology Laboratory, Yale University, New Haven
1985 - 1988	<b>Teaching Fellow</b> , Department of Neurology, Boston Univ School of Medicine, Boston
1988 - 1990	<b>Instructor</b> , Department of Neurology, Harvard Medical School, Boston
1988 - 1990	<b>Attending Neurologist</b> , Beth Israel Hospital, Boston
1990 - 1996	<b>Assistant Professor</b> , Neurology and Psychology, University of Arizona, Tucson
1990 -	<b>Attending Neurologist</b> , University Medical Center, Tucson, Arizona
1990 - 1996	<b>Medical Director</b> , Behavioral Neurology Unit, University of Arizona, Tucson
1990 -	<b>Director</b> , Neurobehavioral Laboratory, University of Arizona, Tucson
1990 -	<b>Member</b> , Committee on Neuroscience, University of Arizona, Tucson, Arizona
1996 - 1999	<b>Associate Professor</b> , Neurology and Psychology, University of Arizona, Tucson
1996 -	<b>Director</b> , Behavioral Neuroscience & Alzheimer's Clinic, Univ of Arizona, Tucson
1999 - 2002	<b>Associate Professor</b> , Neurology, Psychology, Psychiatry, Univ of Arizona, Tucson
2002 -	<b>Professor</b> , Neurology, Psychology, and Psychiatry, University of Arizona, Tucson
2007-	<b>Professor</b> , Evelyn F. McKnight Brain Institute, University of Arizona, Tucson
2007-	<b>Bruce and Lorraine Cumming Endowed Chair in Alzheimer's Research</b>

### Honors and Awards

1994-1995	Cited in S Naifeh & GW Smith(eds.), The Best Doctors in America, 2 <sup>nd</sup> Edition, Woodward/White
1996-1997	Cited in S Naifeh & GW Smith(eds.), The Best Doctors in America, Pacific Region, Woodward/White
1997	Elected, American Neurological Association
1998-1999	Cited in S Naifeh & GW Smith(eds.), The Best Doctors in America, 4th Edition, Woodward/White
2003	Cited in S Naifeh and GW Smith (eds.), The Best Doctors in America, 2003-2004
2005	Cited in S Naifeh and GW Smith (eds.), The Best Doctors in America, 2005-2006
2007	Cited in S Naifeh and GW Smith (eds.), The Best Doctors in America, 2007-2008
2007	Peer Review Circle of Honor Award, Journal of Clinical Psychiatry
2009	Cited in S Naifeh and GW Smith (eds.), The Best Doctors in America, 2009-2010
2010	Cited in S Naifeh and GW Smith (eds.), The Best Doctors in America, 2011-2012

### 2012 Publications

Doraiswamy PM, Sperling RA, Coleman RE, Johnson KA, Reiman EM, Davis MD, Grundman M, Sabbagh MN, Sadowsky CH, Fleisher AS, Carpenter A, Clark CM, Joshi AD, Mintun MA, Skovronsky DM, and Pontecorvo MJ, for the AV45-A11 Study Group (incl. Ahern GL). Amyloid- $\beta$  assessed by florbetapir F 18 PET and 18-month cognitive decline: A multicenter study. *Neurology*, 2012, 79 (16), 1636-1644.

## BIOGRAPHICAL SKETCH

NAME  Gene E. Alexander, Ph.D.	POSITION TITLE  Professor		
EDUCATION/TRAINING			
INSTITUTION AND LOCATION	DEGREE	YEAR(s)	FIELD OF STUDY
Pomona College, Claremont, CA	B.A.	1983	Psychology
Loyola University of Chicago, Chicago, IL	M.A.	1987	Clinical
Loyola University of Chicago, Chicago, IL	Ph.D.	1992	Clinical

### Positions

1988-1989	<b>Clinical Psychology Intern</b> , Dept. of Psychiatry & Behavioral Sciences, Univ. of Washington, Seattle, WA
1989-1992	<b>Research Fellow</b> , Dept. of Brain Imaging, NYSPI and Columbia University, NY, NY
1991-1993	<b>Research Scientist I</b> , Dept. of Brain Imaging, NYSPI and Columbia University, NY, NY
1993-1999	<b>Staff Fellow to Sr. Staff Fellow</b> , Lab. of Neurosciences, NIA, NIH, Bethesda, MD
1993-1999	<b>Chief Neuropsychology Unit</b> , Lab. of Neurosciences, NIA, NIH, Bethesda, MD
1999-2003	<b>Research Associate Professor</b> , Dept. of Psychology, Arizona State University, Tempe
1999- date	<b>Director</b> , MRI Morphology Core, Arizona Alzheimer's Disease Research Ctr, Phoenix
2001-2009	<b>Director</b> , Data Management Program/Core, NIA Az Alzheimer's Disease Core Center
2001- date	<b>Member</b> , Executive Committee, NIA Arizona Alzheimer's Disease Core Center, AZ
2003-2007	<b>Associate Professor to Professor</b> , Psychology Dept., Arizona State University, Tempe
2007-date	<b>Professor</b> , Psychology & Evelyn F. McKnight Brain Institute, Univ of Arizona, Tucson
2007-date	<b>Director</b> , Brain Imaging, Behavior, & Aging Lab, Univ of Arizona, Tucson, AZ

### Honors, Awards and Advisory Committees

1995- date	Ad Hoc Reviewer, 20 journals in Neuropsychology, Psychiatry, Neurology, & Neurosci.
1996-1999	Staff Recognition Awards (annual), Laboratory of Neurosciences, National Inst. on Aging
2000- date	Reviewer, Alzheimer's Association Research Grant Program
2003-2007	Member, Study Section, Clinical Neuroscience and Disease, IRG, CSR, NIH
2003	Member, SEP, Women's Health Initiative Memory Study, Review Branch, NHLBI, NIH
2004	Member, Special Emphasis Panel, Alzheimer's Disease Center Grant Review, NIA, NIH
2004- date	External Adv, Aging Brain: Vasculature, Ischemia & Behav. Prog Proj, USC, UCSF/Davis
2005-2007	Member, Specialist Peer Review Comm, Psychology: Exp/Clin, Fulbright Scholar Prog
2006	Chair, Special Emphasis Panel, Clin Neurosci & Disease, ZRG1 BDCN-E, IRG, CSR, NIH
2008	Member, SEP, Prog Proj Review Group, Recovery from Illness, ZAG1 ZIJ-8 O1, NIA, NIH
2008	Member, Study Section, Brain Injury & Neurovasc. Path., ZRB 1 BDCN-L (07), CSR, NIH
2008	Member, Special Emphasis Panel, SPRINT Ctr Review, ZHL1 CCT-B C2 1, NHLBI, NIH
2008-date	Member, Neuroimaging Workgroup, International Conf. on Alzheimer's Disease/ISTAART
2009	Reviewer, Special Emphasis Panel, Challenge Grant Panel 10, ZRG1 BDA-A 58 R, CSR, NIH
2009	Member, SEP, P30 Faculty Recruitment in Biomedical Research Core Centers, NIA, NIH
2009	Member, SEP, RC2 Grand Opportunity Grants in Genetics, Epigenetics & Genomics, NIA
2009	Member, SEP, Program Project Review Group, Brain Dopamine, ZAG1 ZIJ-8 J3, NIA, NIH
2009	Member, SEP, Program Project Review Group, Neuroimaging & Aging, ZAG1 ZIJ-5 JF, NIA
2009	Member, Faculty Annual Performance Comm, Psychology Dept., Univ. of Arizona
2010	Member, Neurological Sciences & Disorders K Review Committee, NSD-K, NINDS, NIH
2010	Member, Neuroscience of Aging Review Committee, NIA-N, NIA, NIH
2010	Member, SEP, Program Project Review Group, Exercise, Motor Deficits, & Aging, ZAG1-ZIJ-9, NIA, NIH
2010	Member, SEP, Program Project Review Group, Dopaminergic Dysfunction in Aging, ZAG1 ZiJ-6 J3, NIA, NIH

- 2010 Member, Executive Committee, Neuroscience GIDP, University of Arizona
- 2010 Member, Academic Program Review Faculty Committee, Psych. Dept., Univ of Arizona
- 2010 Member, Faculty Search Committee, Cognitive & Neural Systems, Psychology Dept., University of Arizona
- 2011 Chairperson, Member Special Emphasis Panel, ZAG1 ZIJ-7 (J1), NIA, NIH, 2011.
- 2011 Member, Neuroscience of Aging Review Committee, NIA-N, NIA, NIH, 2011.
- 2011 Advisory Editor, Neurobiology of Aging, Elsevier.
- 2011 Member, Evelyn F. McKnight Brain Institute, Cognitive Aging Working Group.
- 2011 Member, VA MHBB Merit Review Subcommittee, Veterans Administration, 2011.
- 2011 Member, SEP, Loan Repayment Program, ZNS1 SRB-M (76), NIA, NIH, 2011.
- 2011 Member, Special Emphasis Panel, Biobehavioral Research Awards for Innovative New Scientists (BRAINS), ZMH1 ERB-L-04, NIA, NIMH, NIH, 2011.
- 2011 Reviewer, Alzheimer's Disease Pilot Grant Program, Arizona Alzheimer's Disease Center
- 2012 Member, Neurological Sciences & Disorders K Review Committee, NSD-K, NINDS, NIH
- 2012 Member, Neuroscience of Aging Review Committee, ZAG1 ZIJ-4 (J1), NIA, NIH

### 2012 Publications

- Ewers, M., Walsh, C., Trojanowski, J.Q., Shaw, L.M., Petersen, R.C., Jack, C.R., Jr., Feldman, H.H., Bokde, A.W.L., Alexander, G.E., Scheltens, P., Vellas, B., Dubois, B., Weiner, M., and Hampel, H., in collaboration with the North American Alzheimer's Disease Neuroimaging Initiative (ADNI) (2012) Prediction of Conversion from Mild Cognitive Impairment to Alzheimer's Disease Dementia Based upon Biomarkers and Neuropsychological Test Performance, *Neurobiology of Aging*, 33:1203-14.
- Henry, M.L., Beeson, P.M., Alexander, G.E., and Rapcsak, S.Z. (2012) Written language impairments in primary progressive aphasia: A reflection of damage to central semantic and phonological processes, *Journal of Cognitive Neuroscience*, 24, 261-75.
- Alexander, G.E., Bergfield, K.L., Chen, K., Reiman, E.M., Hanson, K.D., Lin, L., Bandy, D., Caselli, R.J., and Moeller, J.R. (2012) Gray matter network associated with genetic risk for Alzheimer's disease in young to early middle-aged adults, *Neurobiology of Aging*, 33:2723-32.
- Alexander, G. E., Ryan, L., Bowers, D., Foster, T. C., Bizon, J. L., Geldmacher, D. S., and Glisky, E. L. (2012) Characterizing cognitive aging in humans with links to animal models. *Frontiers in Aging Neuroscience*, 4:21.
- Bizon, J. L., Foster, T. C., Alexander, G. E., and Glisky, E. L. (2012) Characterizing cognitive aging of working memory and executive function in animal models. *Frontiers in Aging Neuroscience*, 4:19. doi: 10.3389/fnagi.2012.00019.
- Chen, K., Ayutyanont, N., Langbaum, J.B., Fleisher, A.S., Reschke, C., Lee, W., Liu, X., Alexander, G.E., Bandy, D., Caselli, R.J., and Reiman, E.M. (2012) Correlations between FDG PET glucose uptake-MRI gray matter volume scores and apolipoprotein E  $\epsilon$ 4 gene dose in cognitively normal adults: A cross-validation study using voxel-based multi-modal partial least squares. *Neuroimage*, 60:2316-22.
- Roberson, E. D., DeFazio, R. A., Barnes, C. A., Alexander, G. E., Bizon, J. L., Bowers, D., Foster, T. C., Glisky, E. L., Levin, B. E., Ryan, L., Wright, C. B., and Geldmacher, D. S. (2012) Challenges and opportunities for characterizing cognitive aging across species. *Frontiers in Aging Neuroscience*, 4:6.
- Reiman, E.M., Quiroz, Y.T., Fleisher, A.S., Chen, K., Velez-Pardo, C., Jimenez-Del-Rio, M., Fagan, A.M., Shah, A.R., Alvarez, S., Arbelaez, A., Giraldo, M., Acosta-Baena, N., Sperling, R.A., Dickerson, B., Stern, C.E., Tirado, V., Munoz, C., Reiman, R.A., Huentelman, M.J., Alexander, G.E., Langbaum, J.B.S., Kosik, K.S., Tariot, P.N., and Lopera, F.. Brain abnormalities in young adults at genetic risk for autosomal dominant Alzheimer's disease. *The Lancet Neurology*, in press.

## BIOGRAPHICAL SKETCH

NAME <p style="text-align: center;">Elizabeth L. Glisky, Ph.D.</p>	POSITION TITLE <p style="text-align: center;">Professor</p>		
EDUCATION/TRAINING <i>(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)</i>			
INSTITUTION AND LOCATION	DEGREE	YEAR(s)	FIELD OF STUDY
University of Toronto, Ontario, Canada	B.A.	1958-1962	Psychology
University of Toronto, Ontario, Canada	Ph.D.	1978-1983	Psychology
University of Toronto, Ontario, Canada	Postdoc	1983-1987	Psychology

### Positions

1987 - 1989	<b>Visiting Assistant Professor</b> , Dept of Psychology, University of Arizona, Tucson
1989 - 1995	<b>Assistant Professor</b> , Department of Psychology, University of Arizona, Tucson
1995 - 1999	<b>Associate Professor</b> , Department of Psychology, University of Arizona, Tucson
2000 - 2002	<b>Head</b> , Interdisciplinary Program in Gerontology, University of Arizona, Tucson
1999 -	<b>Professor</b> , Department of Psychology, University of Arizona, Tucson
2004 - 2008	<b>Associate Head and Graduate Coordinator</b> , Department of Psychology, University of Arizona, Tucson
2007 -	<b>Professor</b> , Evelyn F. McKnight Brain Institute, University of Arizona, Tucson
2008 - 2009	<b>Acting Head</b> , Department of Psychology, University of Arizona, Tucson
2010 -	<b>Head</b> , Department of Psychology, University of Arizona, Tucson

### Honors, Awards and Advisory Committees

1980 - 1981	Natural Sciences and Engineering Research Council postgraduate scholarship
1981 - 1982	University of Toronto open fellowship
1982 - 1983	Ontario Government scholarship
1983 - 1986	University of Toronto postdoctoral award to research fellow
1989 - 1990	University of Arizona, Provost's Teaching Award
2003	Social and Behavioral Sciences Research Professorship
2007	Fellow of the Association for Psychological Science
2011	Elizabeth Hurlock Beckman Award

### 2012 Publications

- Edmonds, E.C., Glisky, E.L., Bartlett, J.C., and Rapcsak, S. Z. (2012) Cognitive mechanisms of false facial recognition in older adults. *Psychology and Aging*, 27:54-60.
- McFarland, C., and Glisky, E. (2012) Implementation intentions and imagery: Individual and combined effects on prospective memory among young adults. *Memory & Cognition*, 40:62-69.
- Kihlstrom, J.F., and Glisky, E.L. (2012) Amnesia. In V. S. Ramachandran (Ed.), *Encyclopedia of human behavior* (2<sup>nd</sup> Ed). Oxford: Elsevier.
- Roberson, E.D., DeFazio, R.A., Barnes, C.A., Alexander, G.E., Bizon, J.L., Bowers, D., Foster, T. C., Glisky, E.L., Levin, B.E., Ryan, L., Wright, C.B., and Geldmacher, D. S. (2012) Challenges and opportunities for characterizing cognitive aging across species. *Frontiers in Aging Neuroscience*, 4:6.
- Bizon, J.L., Foster, T.C., Alexander, G.E., and Glisky, E.L. (2012) Characterizing cognitive aging of working memory and executive function in animal models. *Frontiers in Aging Neuroscience*, 4:19.
- Alexander, G.E., Ryan, L., Bowers, D., Foster, T.C., Bizon, J.L., Geldmacher, D.S., and Glisky, E.L. (2012) Characterizing cognitive aging in humans with links to animal models. *Frontiers in Aging Neuroscience*, 4:21.
- Grilli, M.D., and Glisky, E.L. (2012) Imagining a better memory: Self-imagination in memory-impaired patients. *Clinical Psychological Science*, doi:10.1177/2167702612456464.

## BIOGRAPHICAL SKETCH

NAME		POSITION TITLE	
Alfred W. Kaszniak, Ph.D.		Professor of Psychology, Neurology & Psychiatry	
EDUCATION/			
INSTITUTION AND LOCATION	DEGREE	YEAR(s)	FIELD OF STUDY
University of Illinois, Chicago	B.S.	1970	Psychology
University of Illinois, Chicago	M.A.	1973	Clinical Psychology
University of Illinois, Chicago	Ph.D.	1976	Clinical Psychology
Rush Medical College, Chicago	Postdoc	1973-1974	Clinical

### Positions

- 1976 - 1979 **Assistant Professor**, Department of Psychology, Rush College of Medicine, Chicago
- 1979 - 1985 **Assistant to Associate Professor**, Department of Psychiatry, University of Arizona, Tucson
- 1985 - 1987 **Associate Professor**, Departments of Psychology and Psychiatry, University of Arizona, Tucson
- 1987 - present **Professor**, Departments of Psychology, Psychiatry and, Neurology, University of Arizona, Tucson
- 2002 - 2010 **Head**, Department of Psychology, University of Arizona, Tucson
- 2007 - present **Professor**, Evelyn F. McKnight Brain Institute, University of Arizona, Tucson

### Fellowships, Honors and Awards

- 1978 Distinguished Contribution Award (for dissertation research), Division 20 (Adult Development and Aging), American Psychological Association
- 1989 Commendation for special contributions as a member of the Veterans Administration Geriatrics and Gerontology Advisory Board, Washington, DC
- 1989 Fellow, American Psychological Assoc; 1988 Fellow, Amer Psychological Society
- 1995 President, Section on Clinical Geropsychology, Div 12, Amer Psychological Assoc
- 2004 Koffler Prize for Outstanding Accomplishments in Public Service/Outreach
- 2006 University of Arizona Alumni Association Extraordinary Faculty Award
- 2007 Distinguished Contribution to the Science of Psychology Award, Arizona Psychological Association
- 2008 Contemplative Practice Fellow, Center for Contemplative Mind in Society

### 2012 Publications

- Kaszniak, A.W., and Menchola, M. (2012) Behavioral neuroscience of emotion in aging. *Current Topics in Behavioral Neuroscience*, 10, 51-66.
- Levy, D.M., Wobbrock, J.O., Kaszniak, A.W., and Ostergren, M. (2012) The effects of mindfulness meditation training on multitasking in a high-stress information environment. *Proceedings of Graphics Interface* (pp. 45-52). Toronto, Ontario (May 28-30, 2012). Toronto, Ontario: Canadian Information Processing Society.
- Kaszniak, A.W. Contemplative pedagogy: Perspectives from cognitive and affective science. In O. Gunnlaugson, E. Sarath, H. Bai, & C. Scott (Eds.), *Contemplative learning and inquiry across disciplines*. New York: State University of New York Press, in press.
- Burns, C.M., Chen, K., Kaszniak, A.W., Lee, W., Alexander, G., Bandy, D., Fleisher, A., Caselli, R.J., & Reiman, E.R. Higher serum glucose levels are associated with cerebral hypometabolism in Alzheimer's regions. *Neurology*, in press.

## BIOGRAPHICAL SKETCH

NAME Naomi E. Rance, M.D., Ph.D.	POSITION TITLE Professor of Pathology		
EDUCATION/TRAINING			
INSTITUTION AND LOCATION	DEGREE	YEAR(s)	FIELD OF STUDY
University of Maryland, College Park	B.S.	1973	Psychology
University of Maryland, Baltimore	Ph.D.	1981	Physiology
University of Maryland, Baltimore	M.D.	1983	Medicine
The Johns Hopkins Hospital	Fellowship	1989	Neuropathology

### Positions

- 1976 -1981 **Predoctoral Fellow**, Department of Physiology, University of Maryland, Baltimore, MD
- 1983 -1986 **Resident**, Anatomic Pathology, The Johns Hopkins Hospital, Baltimore, MD
- 1986 -1987 **Chief Resident**, Anatomic Pathology, The Johns Hopkins Hospital, Baltimore, MD
- 1987 -1989 **Clinical and Research Fellow**, Neuropathology Lab, Johns Hopkins Hospital, Baltimore
- 1989 -1995 **Assistant Professor**, Dept of Pathology College of Medicine, Univ of Arizona, Tucson, AZ
- 1989 - **Chief**, Division of Neuropathology, University Medical Center, Tucson, AZ
- 1989 - **Neuropathology Consultant**, Forensic Science Center, Pima County, Tucson, AZ
- 1995 - **Associate Professor**, Dept of Pathology College of Medicine, Univ of Arizona, Tucson, AZ
- 1996 - **Associate Chairperson**, Dept of Pathology College of Medicine, Univ of Arizona, Tucson
- 2000 - **Professor**, Department of Pathology, Univ of Arizona College of Medicine, Tucson, AZ
- 2007 - **Professor**, Evelyn F. McKnight Brain Institute, University of Arizona, Tucson, AZ

### Honors, Awards and Advisory Committees

- 1973 Phi Beta Kappa
- 1983 Rudolph Virchow Prize for Research in Pathology, University of Maryland
- 1993 Advisory Group, Workshop on Menopause, NIH, Bethesda
- 1994, 1997 Ad Hoc member, Biochemical Endocrinology Study Section, NIH, Bethesda
- 1995 John Davis Outstanding Residency Teaching Award, Dept. of Pathology, Univ of Arizona
- 1995, 1997 Ad Hoc Reviewer, National Science Foundation
- 1998 - 2004 Site Visit Review Committees, NIH, NIA Program Project Grants
- 1999, 2000, 2001 Basic Science Educator of the Year, University of Arizona College of Medicine
- 2001 Advisory Group, NIA Workshop on Primate Models of Menopause, NIH, Bethesda
- 2002 Basic Science Educator of the Year Lifetime Award, Univ of Arizona College of Medicine
- 2007 Vernon and Virginia Furrow Award for Excellence in Innovation in Teaching, Univ Arizona
- 2009 Ad Hoc Reviewer, ICER Study Section, NIH Bethesda
- 2010 Ad Hoc Reviewer, Burroughs Welcome Trust
- 2011 Ad Hoc Reviewer, ICER Study Section, Chicago Illinois

### 2012 Publications

- Mittelman-Smith, M.A., Williams, H., Krajewski-Hall, S.J., Lai, J., Ciofi, P., McMullen, N.T., and Rance, N.E. (2012) Arcuate kisspeptin/neurokinin B/dynorphin (KNDy) neurons mediate the estrogen suppression of gonadotropin secretion and body weight. *Endocrinology*, 153:2800-2012. PMID: PMC3359616
- Mittelman-Smith, M.A., Williams, H., Krajewski-Hall, S.J., McMullen, N.T., and Rance, N.E. (2012) A Role for Kisspeptin/Neurokinin B/Dynorphin (KNDy) Neurons in Cutaneous Vasodilatation and the Estrogen Modulation of Body Temperature. *Proceedings of the National Academy of Science, USA*, 109:19846-19851.

## BIOGRAPHICAL SKETCH

<b>NAME</b>  <p style="text-align: center;">Lee Ryan, Ph.D.</p>	<b>POSITION TITLE</b> Associate Professor, Psychology, Neurology, and Neurosciences Program		
<b>EDUCATION/TRAINING</b>			
<b>INSTITUTION AND LOCATION</b>	<b>DEGREE</b>	<b>YEAR(s)</b>	<b>FIELD OF STUDY</b>
University of Toronto, Toronto, Canada	BMus	1979	Music
University of Toronto, Toronto, Canada	MA	1981	Music
University of Toronto, Toronto, Canada	BS	1988	Psychology/Neuroscience
University of British Columbia, Vancouver, Canada	Ph.D.	1992	Clinical/Cognitive Psychology
University of California, San Diego, CA	Postdoctoral	93-95	Neuropsychology

### Positions

- 1992 - 1993     **Clinical Internship**, Department of in Neuropsychology, VA Medical Center, La Jolla, and University of California at San Diego, San Diego, CA
- 1993 - 1996     **Research Scientist**, Department of Psychiatry, University of California, San Diego, CA
- 1998             **Participant**, Summer Institute on Aging Research, National Institute on Aging
- 1996 - 2003     **Assistant Professor**, Departments of Psychology and Neurology, University of Arizona, Tucson, AZ
- 1996 - present   **Director**, Cognition & Neuroimaging Laboratories, University of Arizona, Tucson, AZ
- 2003 - present   **Associate Professor**, Departments of Psychology and Neurology, University of Arizona, Tucson, AZ
- 2007 - present   **Associate Professor**, Evelyn F. McKnight Brain Institute, University of Arizona, Tucson, AZ
- 2008 - present   **Associate Head**, Department of Psychology, University of Arizona, Tucson, AZ

### Honors

- 1988 - 1992     National Science & Engineering Research Council of Canada Graduate Fellowships
- 1993 - 1995     National Science & Engineering Research Council of Canada Postdoctoral Fellowships
- 2000             Member, Memory Disorders Society

### 2012 Publications

- Alexander, G.E., Ryan, L., Bowers, D., Foster, T.C., Bizon, J.L., Geldmacher, D.S., and Glisky, E.L. (2012). Characterizing Cognitive Aging in Humans with Links to Animal Models. *Frontiers in Aging Neuroscience*, 4:21.
- Burke, S.N., Ryan, L., and Barnes, C.A. (2012). Characterizing cognitive aging of recognition memory and related processes in animal models and in humans. *Frontiers in Aging Neuroscience*, 4:15.
- Roberson, E.D., Defazio, R.A., Barnes, C.A., Alexander, G.E., Bizon, J.L., Bowers, D., Foster, T.C., Glisky, E.L., Levin, B.E., Ryan, L., Wright, C.B., and Geldmacher, D.S. (2012). Challenges and opportunities for characterizing cognitive aging across species. *Frontiers in Aging Neuroscience*, 4:6.
- Ryan, L., Cardoza, J.A., Barense, M.D., Kawa, K.H., Wallentin-Flores, J., Arnold, W.T., and Alexander, G.E. (2012). Age-related impairment in a complex object discrimination task that engages perirhinal cortex. *Hippocampus*. 22(10):1978-89.
- Forbes, C.E., Cox, C.L., Schmader, T., Ryan, L. (2012). Negative stereotype activation alters interaction between neural correlates of arousal, inhibition and cognitive control. *Soc Cogn Affect Neurosci*, 7(7):771-81.

## 7. Faculty (continued)

The full Affiliate faculty list is given below:

- Geoffrey L. Ahern, M.D., Ph.D., Professor, Neurology, Psychology and Psychiatry; Medical Director, Behavioral Neuroscience and Alzheimer's Clinic, Bruce and Lorraine Cumming Endowed Chair in Alzheimer's Research, University of Arizona
- Gene E. Alexander, Ph.D., Professor of Psychology, University of Arizona
- E. Fiona Bailey, Ph.D., Assistant Professor of Physiology, University of Arizona
- Carol A. Barnes, Ph.D., Regents' Professor, Psychology and Neurology; Director, Evelyn F. McKnight Brain Institute; Evelyn F. McKnight Chair for Learning and Memory in Aging; Director, ARL Division of Neural Systems, Memory and Aging, Associate Director, Bio5, University of Arizona
- Heather Bimonte-Nelson, Ph.D., Associate Professor, Honors Disciplinary Faculty. Behavioral Neuroscience Program Director, Arizona State University
- Richard R. Bootzin, Ph.D., Professor of Psychology and Psychiatry; Director, Insomnia Clinic and Sleep Research Laboratory, University of Arizona
- Paul Coleman, Ph.D., UA Associate: Research Scientist, Evelyn F. McKnight Brain Institute, University of Arizona; Co-Director and Senior Scientist, J. Roberts Center for Alzheimer's Research; Professor of Neurobiology and Anatomy, University of Rochester Medical Center
- Stephen Cowen, Ph.D. Assistant Professor, Department of Psychology, University of Arizona
- Ralph F. Fregosi, Ph.D., Professor of Physiology, University of Arizona
- Andrew J. Fuglevand, Ph.D., Associate Professor of Physiology, University of Arizona
- Elizabeth Glisky, Ph.D., Professor, Department of Psychology, University of Arizona
- Katalin M. Gothard, M.D., Ph.D., Associate Professor of Physiology, University of Arizona
- Marco Herrera-Valdez, Ph.D., UA Associate: Assistant Research Scientist, Evelyn F. McKnight Brain Institute, University of Arizona; Assistant Research Professor, Mathematical, Computational and Modeling Sciences Center, Arizona State University
- Matthew J. Huentelman, Ph.D., UA Associate: Assistant Research Scientist, Evelyn F. McKnight Brain Institute, University of Arizona; Investigator, Neurobehavioral Research Unit, Translational Genomics Research Institute
- Alfred W. Kaszniak, Ph.D., Head, Department of Psychology; Director, Coordinated Clinical Neuropsychology Program, University of Arizona
- Lalitha Madhavan, MBBS, Ph.D., Assistant Professor, Department of Neurology, University of Arizona
- Diano Marrone, Ph.D., UA Associate: Assistant Research Scientist, Evelyn F. McKnight Brain Institute; Assistant Professor, Psychology, Wilfrid Laurier University
- Matthias R. Mehl, Ph.D., Associate Professor, Department of Psychology, University of Arizona
- Lynn Nadel, Ph.D., Regents' Professor of Psychology, University of Arizona
- Janko Nikolich-Zugich, M.D., Ph.D., Professor and Chairman, Department of Immunobiology; Co-Director, Arizona Center on Aging, University of Arizona
- Mary Peterson, Ph.D., Professor of Psychology, University of Arizona



- Naomi E. Rance, M.D., Ph.D., Professor, Neurology, Cell Biology and Anatomy, and Pathology; Associate Head, Department of Pathology, University of Arizona
- Steve Rapcsak, M.D., Professor of Neurology, Psychology, and Speech, Hearing and Language Pathology, University of Arizona; Chief, Neurology Section, VA Medical Center
- Eric M. Reiman, M.D., Ph.D., Professor of Psychiatry; Associate Head for Research and Development (Phoenix Campus), University of Arizona; Director, Arizona Alzheimer's Disease Consortium; Executive Director, Banner Alzheimer's Institute; Clinical Director, Neurogenomics Program, Translational Genomics Research Institute (TGen)
- Linda L. Restifo, M.D., Ph.D., Professor, Neuroscience, Cell Biology & Anatomy, and BIO5 Institute, University of Arizona
- Lee Ryan, Ph.D., Associate Professor, Psychology; Director, Cognition and Neuroimaging Labs, University of Arizona
- David A. Sbarra, Ph.D., Associate Professor and Director of Clinical Training, Department of Psychology, University of Arizona
- Paige E. Scalf, Ph.D., Assistant Professor, Department of Psychology
- Robert S. Sloviter, Ph.D., Professor of Pharmacology and Neurology, University of Arizona
- Ted P. Trouard, Ph.D., Associate Professor, Biomedical Engineering

We added one new affiliate member to the Evelyn F. McKnight Institute at the University of Arizona in the past year:

A major effort in the past year was the recruitment of Dr. Stephen Cowen to the University of Arizona Evelyn F. McKnight Institute. This was the long-awaited "McNaughton Replacement" position. The Trustees met him at the Inter-institutional meeting in April. He is setting up his laboratory, getting his teaching in order, and already has one graduate student, one post-doctoral fellow, and a technician to help with his research program that is directed towards understanding large scale brain circuits that form the basis for memories and decision making.

Additionally, the search for a person to fill the position within the Clinical and Translational Science Institute (BIO5) that is targeted at an M.D./Ph.D. clinician/scientist (that Dr. Dubal unexpectedly declined last summer), has been re-opened, we interviewed 3 candidates in 2012. Our top choice (Dr. Keith Vossel, from UCSF) is coming back for his second interview in March 2013. We are very hopeful that this search will be successful, as he also has interests in memory and aging that would fit very well within the Tucson Institute.

## 8. Trainees (advisor in brackets)

### *Postdoctoral*

Sara Burke, Ph.D. (Barnes)

Area of Interest: Ensemble recording approaches to determine age-related changes in perirhinal cortical function.

Monica Chawla, Ph.D. (Barnes)

Area of Interest: Immediate early gene expression in aging in the rat.

James Engall, Ph.D. (Barnes)

Area of Interest: Interactions between peripheral sensory systems and cortical association areas as contributors to age-related memory declines in primates.

James Lister, Ph.D. (Barnes)

Area of Interest: Large-scale genetic imaging. (Accepted Faculty Position at UCLA 9/12)

Andrew Maurer, Ph.D. (Barnes)

Area of Interest: Temporal lobe circuits involved in memory.

Rachel Samson, Ph.D. (Barnes)

Area of Interest: Age-related changes in the amygdala and emotional perception in the rat.

Lesley Schimanski, Ph.D. (Barnes)

Area of Interest: Ensemble recording of aged rat hippocampus: evaluation of map dynamics. (Accepted Faculty Position at Glendale Community College 1/12)

John Totenhagen, Ph.D. (Alexander)

Area of Interest: Development and implementation of MRI methods for small animal models and human studies of aging.

### ***Predoctoral***

Dev Ashish (Kaszniak)

Area of Interest: Aging, mindfulness, attention, and memory.

Elsa Baena (Ryan)

Area of Interest: fMRI studies of memory function in normal older adults.

Kaitlin Bergfield (Alexander)

Area of Interest: Imaging and cognitive functioning associated with pathological and healthy aging in humans.

Molly Bisbee (Glisky)

Area of Interest: Executive function, associative memory, and APOE status in normal aging.

Christine Burns (Kaszniak)

Area of Interest: Ethnicity, metabolic syndrome, and AD genetic risk as predictors of PET regional glucose metabolism in middle-aged and older adults.

Andrew Busch (Barnes)

Area of Interest: How ensembles of hippocampal neuron activity predict memory decline in aged rats.

Joe Cardoza (Ryan)

Area of Interest: fMRI studies of memory and aging.

Marina Cholanian (Rance)

Area of Interest: Interest in the morphology and electrophysiology of Neurokinin B neurons.

Matt Grilli (Glisky)

Area of Interest: Self-referential processing, self-imagination, prospective memory, and memory rehabilitation (in normal aging and patient populations).

Megan Fitzhugh (Alexander)

Area of Interest: Translation of human neuroimaging methods to animal models of aging.

Kari Haws (Alexander)

Area of Interest: Cognition and neuroimaging in cognitive aging.

Kevin Kawa (Ryan)

Area of Interest: Brain imaging, genetics, and cognitive changes in normal older adults.

Adam Lester (Barnes)

Area of Interest: Spatial computations made by the entorhinal cortex and how this changes in aging rats.

Suzanne Moseley (Glisky)

Area of Interest: Self-referential processing and metamemory in normal aging.

Laura Nguyen (Alexander)

Area of Interest: Relation of cognitive complaints in relation to cognition and aging in the elderly.

Rose Marie O'Donnell (Kaszniak)

Area of Interest: Developing stress resiliency in middle-aged and older adult caregivers of persons with neurodegenerative disorders.

Angelina Polsinelli (Glisky)

Area of Interest: Emotion and autobiographical memory in normal aging.

Brooke Reid (Alexander)

Area of Interest: Effects of sleep on cognition.

Ruth Robbins (Glisky)

Area of Interest: Social interaction and cognitive function in normal aging.

Ariana Stickel (Ryan)

Area of Interest: Brain imaging, genetics, and cognitive changes in normal older adults.

Melinda Smith (Rance)

Area of Interest: Role of neurokinin B in menopausal flushes and the hypothalamic regulation of gonadotropin.

Alex Thome (Barnes)

Area of Interest: Age-related changes in alpha and gamma oscillations in primate neocortex.

Autumn Wiley (Kaszniak)

Area of Interest: Mindfulness and attention in younger and older adults.

Janelle Wohltmann (Glisky)

Area of Interest: Social networking in normal aging; memory and executive function; source memory.

***Undergraduate Students*** (from Barnes' lab with graduate student, postdoctoral or staff mentor in brackets)

Sandra Arnautovic (Thome/Plange)

Nichole Burkett (Thome)

Comrie, Alison (Lister)

Espinosa, Arturo (Uprety)

Jonathan Ferng (Burke)  
Jacqueline Friel (Burke)  
Tricia Hindley (Thome)  
Sabhya Kumar (Lister)  
Juliana Liang (Lister)  
Amanda Richards (Lister)  
Ingriue Salt (Thome)  
Daniel Sweeney (Thome)  
Erin Trageser (Plange)  
Anu Venkatesh (Samson)  
Toby Weinstein (Samson)  
Monica Xiong (Lister)

*Staff*

Caroline Garcia, Assistant to the Vice President for Research  
Kojo Plange, Research Specialist, Non-human Primates  
Luann Snyder, Department Administrator

**9. Clinical/translational programs**

- 2010-2012 A Phase 3 Extension, Multicenter, Double-Blind, Long Term Safety and Tolerability Treatment Trial of Bapineuzumab (AAB-001, ELN115727) in Subjects with Alzheimer's Disease who Participated in Study ELN115727-301 or in Study ELN115727-302. Protocol # ELN115727-351. Elan Pharmaceuticals, Inc. Total grant: \$ 43,491 / patient. 2% salary support, 2% effort.
- 2010-2012 A Long-Term Follow-Up Study of Oral ELND005 (AZD-103) in Subjects with Alzheimer's Disease. Protocol # ELND005-AD251. Elan Pharmaceuticals, Inc. Total grant: \$ 11,901 / patient. 2% salary support, 2% effort.
- 2011- A Phase 2, Randomized, Double-Blind, Placebo-Controlled, Parallel Group, Multi-Center, Biomarker, Safety, and Pharmacokinetic Study of Bapineuzumab (AAB-001) Administered Subcutaneously at Monthly Intervals in Subjects with Mild to Moderate Alzheimer's Disease. Protocol # AAB-001-SC-ALZ-2003. Janssen Alzheimer Immunotherapy. Total grant: \$62,791 / patient. 2% salary support, 2% effort.
- 2011- A Phase 2, Multicenter, 24-Month, Randomized, Third-Party Unblinded, Placebo-Controlled, Parallel-Group Amyloid Imaging Positron Emission Tomography (PET) and Safety Trial of AAC-001 and QS-21 Adjuvant in Subjects with Early Alzheimer's Disease. Protocol # B2571010. Pfizer. Total grant: \$56,031 / patient. 2% salary support, 2% effort.
- 2012- A Phase 2 Clinical Trial to Evaluate the Efficacy and Safety of [18F]AZD4694 PET in the Detection of Beta Amyloid in Subjects with Probable Alzheimer's Disease, Older Healthy Volunteers and Young Healthy Volunteers. Protocol # NAV4-01. Navidea Biopharmaceuticals. 2% salary support, 2% effort.

**10. Technology transfer**

None

**11. Budget update**

**Last year's budget and actual results - July 1, 2011 to June 30, 2012**

	<b>Budget</b>	<b>Expenditures</b>
Personnel	\$ 675,000	\$ 676,059
Operations	\$ 200,000	\$ 354,275
Recruitment	<u>\$ 280,329</u>	<u>\$ 6,920</u>
Total	\$1,155,329	\$1,037,254

**(a) Status of matching funds**

Not Applicable.

**(b) Projected budget for coming year (FY 12/13)**

Personnel	\$ 675,000
Operations	\$ 275,000
Recruitment	<u>\$ 273,409</u>
Total	\$1,223,409

**(c) Extramural funding (covering period July 1, 2011 to June 30, 2012)**

Grants Received – from Barnes

5 RO1 AG003376-28 (P.I.: Barnes)

Title: Neurobehavioral Relations in Senescent Hippocampus

Dates: 05/01/12 – 4/30/13 (5/10 – 4/15 project period)

Amount: \$735,153/year (\$653,479 direct costs)

5 R37 AG012609-18 (P.I.: Barnes)

Title: Cell Assemblies, Pattern Completion and the Aging Brain

Dates: 07/01/11 – 06/30/12 (7/09 – 6/14 project period)

Amount: \$292,967/year (\$195,076 direct)

1 R44 AG035446-02 (P.I.: LaComb; co-PI: Barnes)

Title: Whole-brain fluorescence and brightfield imaging at single-cell level

Dates: 09/01/11 – 07/31/12 (9/10 – 7/15 project period)

Amount: \$47,130/year (\$31,109 direct)

1 P30 AG019610-11 (PI: Reiman – Barnes, Director, Ad Hoc Review Program)

Title: Arizona Alzheimer's Disease Core Center Ad Hoc Review

Dates: 08/01/11 – 06/30/12 (7/01 – 6/16 project period)

Amount: \$20,502/year (\$13,533 direct)

State of Arizona, DHS Grant

Title: Arizona Alzheimer's Consortium - UA Evelyn F. McKnight Brain Institute

Date: 07/01/11 – 06/30/12

Amount: \$22,500/year (direct costs)

4 F32 AG033460-03 (Sponsor: Barnes; NRSA to J. Lister)

Title: Age effects on grid cell and scene recognition systems of entorhinal cortex

Date: 09/01/11 – 08/31/12 (9/09 – 8/12 project period)

Amount: \$54,734 (direct costs)

1 F32 NS070464-01 (Sponsor: Barnes; NRSA to A. Maurer)

Title: Hippocampal ensemble dynamics during active ambulation, passive movement  
& rest

Date: 07/01/11 – 06/30/12 (07/11 – 06/14 project period)

Amount: \$51,326 (direct costs)

#### Grants Received - From Selected Affiliates

State of Arizona, DHS Grant (Ryan)

Title: Arizona Alzheimer's Consortium - Risk factors for brain aging and cognitive health

Date: 07/01/11 – 06/30/12

Amount: \$108,052/year (direct costs)

State of Arizona, DHS Grant (Alexander)

Title: Arizona Alzheimer's Consortium - Risk factors for brain aging and cognitive health

Date: 07/01/11 – 06/30/12

Amount: \$138,839/year (direct costs)

State of Arizona, DHS Grant (Ahern)

Title: Arizona Alzheimer's Consortium - Risk factors for brain aging and cognitive health

Date: 07/01/11 – 06/30/12

Amount: \$7,500/year (direct costs)

1 P30 AG019610-11 (PI: Reiman – Ahern co-PI, UAHSC Clinical Core)\*

Title: Arizona Alzheimer's Disease Core Center

Dates: 07/01/11 – 06/30/12 (7/06 – 7/11 project period)

Amount: \$60,748/year (\$46,853 direct costs)

1 R01 AG025526 (PI: Alexander)

Title: Neuroanatomical Substrates of Aging & Cognitive Decline

Dates: 07/1/12 – 6/30/13 (7/98 – 6/13 project period w/ no cost extension)

Amount: \$1,066,581/year (\$798,381 direct costs)

2 R01 MH57899 (PI: Reiman – Alexander co-PI)

Title: PET, APOE, & the Preclinical Course of Alzheimer disease  
Dates: 04/1/11 – 6/30/12 (7/98 – 6/13 project period)  
Amount: 164,417/year (\$116,769 direct costs)

Western Alliance to Expand Student Opportunities (Glisky, E.L.)

Title: Self-imagination in normal aging and mild cognitive impairment  
Dates: Jan.1, 2012 – June 30, 2012  
Amount: \$2,500 (Underrepresented Undergraduate Student Support)

2 P30 AG019610 (PI: Reiman – Kaszniak co-PI, Education and Information Core)\*

Title: Arizona Alzheimer's Disease Core Center  
Dates: 07/01/11 – 06/30/12 (7/01 – 6/16 project period)  
Amount: \$75,562/year (\$51,187 direct costs)

Mind and Life Summer Research Institute and Varela Awards (PI: Kaszniak)  
John Templeton Foundation

Dates: 01/01/12 – 12/3/13 (dates of project)  
Amount: \$64,938/year

R01 AG032315 (PI: Rance)

Title: The Role of Neurokinin B in the Generation of Menopausal Flushes  
Dates: 08/01/11 – 06/30/12 (8/08 – 6/13 project period)  
Amount: \$277,576 (\$183,325 direct costs)

#### Grants Submitted – from Barnes

1 PO1 AG041126-01A1 (PI: Alexander; co-PIs: Barnes, Billheimer, Coleman, Huentelman,  
Ryan, Trouard)

Title: Successful Cognitive Aging: Genetics, Health Status & Neural Systems  
Dates: 04/01/13 – 03/31/18 (requested dates of project)  
Amount: \$1,459,248/year (requested annual direct costs)  
Status: Not funded

1 R43 AG045004-01 (P.I.: Zhou; co-PI Barnes)

Title: Array Confocal Fluorescent Microscope for Whole-Brain Tissues Slides  
Dates: 04/01/13 – 03/31/18 (requested dates of project)  
Amount: \$33,033/year (requested direct costs)  
Status: Not funded

1 T32 AG044402-01 (PI: Barnes; co-PI: Coleman)

Title: Postdoctoral Training, Neurobiology of Aging and Alzheimer's disease  
Dates: 06/01/13 – 05/30/18 (requested dates of project)  
Amount: \$406,164/year (requested direct costs)  
Status: Not funded

1 F32 AG042240-01A1 (Sponsor: Barnes; NRSA to James Engle)

Title: The Contribution of Degraded Sensory Systems on Memory Function in the Aged

Dates: 07/01/13 – 03/31/15 (requested dates of project)

Amount: \$52,190/year (requested direct costs)

Status: Under review

1 T32 NS082164-01A1 (PI: Zinsmaier; co-PI: Barnes)

Title: Pre-doctoral Training Program in Neuroscience

Dates: 06/01/13 – 05/30/18 (requested dates of project)

Amount: \$211,120/year (requested direct costs)

Status: Under review

RO1 AG032315 (PI: Rance)

Title: The Role of Neurokinin B in the Generation of Menopausal Flushes

Dates: 07/01/13 – 06/30/18 (requested dates of project)

Amount: \$2,610,275 (total funds requested)

#### Grants Submitted - From Selected Affiliates

1 PO1 AG041126-01A1 (PI: Alexander; co-PIs: Barnes, Billheimer, Coleman, Huentelman, Ryan, Trouard)

Title: Successful Cognitive Aging: Genetics, Health Status & Neural Systems

Dates: 04/01/13 – 03/31/18 (requested dates of project)

Amount: \$1,459,248/year (requested annual direct costs)

Status: Not funded

2 R01 MH57899 (PI: Reiman – Kaszniak co-PI)

Title: PET, APOE, & the Preclinical Course of Alzheimer disease

Dates: 04/1/12 – 3/31/13

Amount: 9,839/year

Status: Pending

2 R01 MH57899 (PI: Reiman – Alexander co-PI)

Title: PET, APOE, & the Preclinical Course of Alzheimer disease

Dates: 04/1/12 – 3/31/13

Amount: 89,290/year

Status: Pending

2 R01 MH57899 (PI: Reiman – Alexander co-PI)

Title: PET, APOE, & the Preclinical Course of Alzheimer disease

Dates: 07/01/13 – 06/31/18

Amount: 236,140/year

Status: Pending



## 12. Educational programs focusing on age related memory loss (January 1, 2012 – December 31, 2012)

### Scientific

Event: Fifth McKnight Inter-Institutional Meeting  
Date: May 1-3, 2011  
Venue: Lowes Ventana Canyon Resort and Spa (Hosted by The University of Arizona)  
Participating Institutions:  
UA Evelyn F. McKnight Brain Institute, University of Arizona  
UAB Evelyn F. McKnight Brain Institute, University of Alabama  
Evelyn F. and William L. McKnight Brain Institute, University of Florida  
Evelyn F. McKnight Brain Institute, University of Miami  
Summary: The University of Arizona hosted the 5<sup>th</sup> McKnight Inter-Institutional Meeting at Lowes Ventana Canyon Resort. The meeting was well attended by over 100 faculty, trainees and administrators and a core group of 91 faculty and trainees (39 from Arizona, 115 from Birmingham; 18 from Gainesville, 9 from Miami) as well as the Trustees of the McKnight Brain Research Foundation.

### Public

Event: Living Beyond 100 Lecture Series  
Title: The Aging of the Brain  
Date: February 23, 2011  
Venue: Centennial Hall, University of Arizona  
Speaker: Carol A. Barnes, Ph.D.

## 13. Collaborative programs with McKnight institutions and research programs

### Huentelman /Coleman/Barnes

We have begun to explore the possibility of using laser capture microdissection technologies for isolating specific cells in the hippocampus. Barnes has provided the tissue from young and aged rats to Huentelman and Coleman who are testing to determine whether their methodologies for examining transcriptional fidelity and methylation processes can be successfully applied following our specific brain extraction techniques. Additionally, we are working out the details for a method that will allow us to select out single *Arc*-positive and *Arc*-negative cells in the hippocampus of young and old rats. If we can achieve this, it will enable, for the first time, experience-driven gene expression in the precise cells that are activated by specific behaviors. We have the preliminary data, and have used it to apply for grant support.

### Trouard/Alexander/Barnes

Dr. Trouard has conducted a number of pilot experiments on a group of young and old rats with his small animal 7T magnet here at the University of Arizona. We are attempting to optimize the pulse sequences and the duration of the scanning to times that will allow scanning of larger numbers of rats to make rat brain templates, against which the effects of aging can be tracked. Dr. Alexander has begun to do the network analysis that he has developed for humans, on these

preliminary rat brain data, and remarkably, the patterns of volumetric change in rats mimics remarkably well those observed in the human. We used these data as preliminary data for the Program Project Grant that we submitted last year, and have finished a full study. Dr. Alexander is taking the lead in writing this up for publication.

#### Peterson/Ryan

We are just now beginning to understand how normative aging processes affect regions of the medial temporal lobe that are involved in recognition memory – both in humans and animal models (such as rats – e.g., Burke et al., 2010, and now our bonnet macaques as well, Burke et al., 2011). Drs. Ryan and Peterson are collaborating on an MRI experiment supported by the EMBI in Tucson that will use Dr. Ryan’s MRI sequences and her elderly subjects, and Dr. Peterson’s figure-ground perceptual displays that should allow them to examine perirhinal cortex function with functional imaging methods as well as with sophisticated psychophysical behavioral methods. They have collected the data, are analyzing it now, and have a target submission date of March for the final manuscript to be completed that shows age-related object recognition impairments that appear to result from a diminished ability in advanced age to pattern separate between complex stimuli that share common features.

#### Trouard /Alexander/Burke/Barnes

At the end of the past summer, we spent 5 very long days conducting a thorough MRI study on our 14 bonnet macaques. Even with anesthetic treatment for over 2 hours, we had no recovery issues with the older monkeys, and we look forward for using these images in several ongoing studies, the ones that are best worked out, mentioned below.

#### Gothard/Barnes/Burke/Thome

Sara Burke and Kojo Plange have finished a behavioral study with the young and old bonnet macaques that implicates changes in the function of the amygdala and orbitofrontal cortex. We plan to put the data on the reinforcer devaluation task together with volumetric analysis of these two cortical structures. Dr. Gothard is an expert on the amygdala, and will be able to guide us in our assessment of this very complex region.

#### Engle/Burke/Barnes

Dr. Engle came out to Tucson this fall to administer auditory evoked potential and visual evoked response tests to our young and old bonnet macaques. He serves as a postdoctoral fellow in my laboratory out at the Primate Center in Davis, and he has expertise in sensory system function with aging. These electrophysiological methods are well-studied clinical measures of auditory and visual function. During the next year, Drs. Engle and Burke are going to do volumetric analysis from the MRIs obtained from these animals of primary auditory and visual cortex, to determine if there are any relationships between the physiology obtained and brain structure.

### **14. Collaborative programs with non-McKnight institutions:**

#### Fanselow/Chawla/Barnes

We have used our catFISH single cell imaging method on a problem that requires circuit analysis across wide regions of the brain with Dr. Michael Fanselow from UCLA. This collaboration

involves an investigation of how context-activated neuronal ensembles change when a context has been fear conditioned. Dr. Fanselow behaviorally prepared the animals for us, and Dr. Chawla sectioned and conducted *in situ* hybridization of the tissue for this experiment. We trained Dr. Fanselow's graduate student, Moriel Zelikowsky, to conduct the cell segmentation and gene product cell localization analysis using our 3D catFISH software. The data from neurons in the hippocampus, amygdala and medial prefrontal cortex are analyzed.

#### Gazzaley/Burke/Plange/Barnes

Gazzaley has investigated the ability of young and healthy older adults to ignore information that is not relevant to the performance of simple working memory tasks. He noted that the elderly that he interacts with as a Neurologist often complain that they are much more distractible than they were when younger, and there have been many psychological experiments that have shown that older individuals are disproportionately affected by distractors in a variety of tasks. While Gazzaley has obtained behavioral, fMRI and event related potential data that show that healthy older adults have a deficit in suppression of cortical activity that is associated with task-irrelevant representations, it remains an open question what underlying mechanisms are responsible for these changes in memory and attention. To understand this better, nonhuman primate aging models will be extremely helpful. Over the past two years, a series of behavioral studies were designed and completed in our young and old bonnet macaques that examined the effects of distraction and interruption forms of interference on delay non-matching to sample task performance. We will continue collecting behavioral data from the remaining monkeys on these experiments, and hope to be able to have enough data for publication by summer.

#### Redish/Busch/Bohanick/Barnes

Dr. Redish and his students have reported that neural representations of space exist at fast time scales when animals are at decision points on mazes. These location representations reflect future possible choices rather than recently traveled paths. This suggests that the hippocampus is involved in active, forward-shifted spatial representations, as well as instantaneous local neural representations. We continue to collaborate with Dr. Redish to examine whether aged rats show these transient nonlocal representations at critical choice points, and whether the decisions made by the animals at such choices are reflected in an individual animal's ability to accurately represent these nonlocal activity patterns in hippocampal cells. The older rats that we have trained had some difficulty at learning the multiple-choice T maze task in which many decision points can be examined within recording sessions. We have scaled back the number of decision points, and the older animals are now able to learn this task. We have continued to have issues with the health of the old rats, and their ability to make it to the end of the study. But we are gearing up for a major effort on this project in the upcoming year, after Andrew Busch finishes his comprehensive exams. Our prediction for the outcome of this experiment is that old rats may never be as accurate as younger rats, and that the sweeping forward of spiking activity that reflects future spatial locations at decision points will be defective in the old animals and correlated with deficits in spatial behavioral tasks.

#### Small/Coleman/Barnes

A gene involved in transcriptional silencing was identified that increases over age in Dr. Small's normal aged human population. Barnes looked across the lifespan in the rat, and found that RbAp48 also changes over age in rats, and that lower expression of RbAp48 was correlated with

defective spatial memory. We are waiting to publish these data until results from monkey brain tissue can also be analyzed. Barnes provided brain tissue from hippocampus and entorhinal cortex from young and old behaviorally-characterized monkeys to Dr. Coleman to perform this analysis. Coleman has been able to use his newly developed laser capture technology to facilitate measurement of mRNA content in the fixed tissue that Barnes provided. For additional sensitivity, fluorescent quantum dots have been attached to the RbAp48 probe which was hoped to increase sensitivity for detection of age-related changes. The quantum dot labeling procedures proved to be problematic, and even after enlisting the assistance of Dr. Eberwine at SUNY (one of the pioneers of this technology), we were unsuccessful in optimizing quantification with this method. Over the past year, however, Dr. Coleman has found a procedure that does work. He has completed the full set of animals, and we have a teleconference call about the data scheduled in January. If we believe that the data are robust, then we can combine the rat, monkey and human RbAp48 data together for publication.

#### DeCarli/Barnes/Kohama

Dr. DeCarli has been interested in the use of MRI methodologies that quantify characteristic hippocampal shape parameters, and that have been useful in detecting early Alzheimer's disease pathology and in children with autism spectrum disorder. The question with respect to our collaboration is whether there are hippocampal deformations that specifically identify memory-related performance variables in young and/or aging human populations, and specifically whether we could see evidence for changes in hippocampal shape in a population of nonhuman primates that were imaged and behaviorally characterized. We explored the possibility of looking at samples of monkeys – and Barnes included a group from Oregon Primate Center (Steve Kohama) in this discussion who will be able to add “n” to the study. Once the animals are behaviorally tested and given MRI tests, we will be able to analyze all the animals together, and write the manuscript.

#### Beach/Barnes

Although it appears that no other animal other than humans develop the hallmark neuropathological markers of Alzheimer's disease (amyloid plaques and neurofibrillary tangles), a variety of animals have been found to have some amyloid accumulation, and others scattered intraneuronal tangles. Because of Barnes' tissue bank of behaviorally-characterized rhesus macaques, a systematic analysis can be done in these animals of the distribution and extent of the appearance of these markers in the monkey brain in relation to memory. Barnes identified tissue that was sent to Beach, and he reports that he has it all stained for amyloid markers.

#### Jezek/ Barnes

There was a remarkable Nature paper that was published during 2011 by Karel Jezek, who was a postdoctoral fellow in the Moser's laboratory in Trondheim. Because of my yearly visits to that lab, I was aware of this work – which he refers to as his “teletransportation” experiment. The fascinating thing about the behavioral apparatus that he developed is that he can “instantly” change all the features of the room, essentially switching between one environment and another, and can do this while recording ensembles of hippocampal neurons. The way in which the hippocampal representation flickers between that of one environment then the other, until it stabilizes into the representation of the environment that is present, is a measure of the network “settling in” the correct representation. Dr. Jezek now has his own laboratory in Prague, but has

agreed to collaborate to set up the behavioral apparatus and computer control necessary to assist with a full aging experiment. This is a very exciting study that I believe will be the next critical step to provide a fuller understanding of how network dynamics change in the normal aged brain.

Maier/Barnes/Barrientos/Hoang

At the second Cognitive Aging Summit I heard a talk given by a colleague that I had had in Boulder, when I was at the University of Colorado from 1982-1990 – Steve Maier. The gist of his talk was that older organisms are more vulnerable to the consequences of a peripheral immune challenge (such as peripheral injection of *E. coli*) than are younger animals. I was amazed to see that not only do the old rats have memory deficits that suggest that consolidation of hippocampus-dependent memory processes are disrupted, but that when they went on to do the physiology, the durability of long-term potentiation, the presumed biological mechanism of memory, was also altered. The idea that a negative life event such as an infection can produce memory impairments, and may contribute to the variability noted in older animals, is intriguing – especially since these effects may be great therapeutic targets for protecting animals from age-related cognitive deterioration. We have begun a collaboration to assess what brain regions are affected by the immune challenge, using the catFISH method. We prepared the animals, trained them and tested their memory, and sacrificed them all in August. Lan Hoang and I brought the brains back from Boulder to Tucson, and sectioned, performed the *in situ* hybridization for *Arc*, and have collected data from the high resolution confocal microscope, so that the catFISH analysis can begin. This is a long-term investment – but the study may be very “high pay off”, and we may use the data to apply for funding to start trying to test agents that may prevent this negative cognitive outcome in older organisms.

**15. Plans for future research**

Future research will include the collaborations mentioned above, but in addition to those experiments, we continue with the cognitive testing in the young and old bonnet macaques as well as continued technological developments for electrophysiological recording and brain imaging with single cell resolution. We hope to begin electrophysiological recording of the bonnet macaques in 2013.

**16. Endowment investment results (July 1, 2011 to June 30, 2012)**

**Endowed Chair**

Summary for 12 months ending June 30, 2012

Account Name: Evelyn F. McKnight Chair for Learning and Memory in Aging

A. Beginning Balance on July 1, 2011	\$ 866,326
B. Investment Growth	\$ (13,174)
C. Distributions (to Endowed Chair Expendable Account)	\$ (32,548)
D. Additional Contributions	\$ 0
E. Ending Balance on June 30, 2012	\$ 820,604

**Institute**

Summary for 12 months ending June 30, 2012

Account Name: Evelyn F. McKnight Brain Institute

A. Beginning Balance on July 1, 2011	\$ 4,136,487
B. Investment Growth	\$ (65,866)
C. Distributions (to Institute Expendable Account)	\$ (743,519)
D. Additional Contributions	\$ 0
E. Ending Balance on June 30, 2012	\$ 3,327,102

**17. Where 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. Negative Events**

No

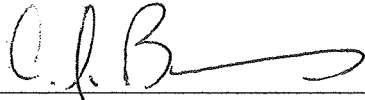
**21. Additional comments**

This was a great year in terms of research output from the Tucson Evelyn F. McKnight Institute principle lab itself and with collaborators, as well as for its affiliate labs. The main goal of identifying a "McNaughton replacement" was successful. The Clinical and Translational Neuroscience position also has a finalist that will be exceptional if we are successful in this recruitment.

The other remarkable aspect of the past year is that this Institute spearheaded the publication of two separate, and important special issues – one in *Frontiers of Aging Neuroscience* and one in *Hippocampus*. The first set of papers on Cognitive Testing across Species was generated out of the special Cognitive Testing working group that the Trustees supported. The first meeting of the group was held August 3 and 4 of 2011 in New Orleans, the second in Denver December 1 and 2. We had all articles submitted, revised and in press before the Tucson Inter-institutional meeting April 10, 2012. This was a remarkably focused effort, one that all Institutes are proud to have been involved in. The camaraderie generated amongst the groups was tangible – and we

have many ideas for taking these efforts to the next level of implementation. The second special issue effort was generated out of a meeting the Barnes put together for the Spring Hippocampal Research Conference in Verona that the Institute partially supported. The perirhinal cortex turns out to be a temporal lobe structure very sensitive to the effects of aging, and this conference allowed the speakers to interact and develop ideas for collaboration and publication of a series of articles that is currently the state of the art overview of this brain structure. The issue was available in time for the Society for Neuroscience meeting October 2012 – and was displayed by the journal at their booth. Three of 9 research articles had an aging component.

22.



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Carol A. Barnes, Ph.D.  
Director, Evelyn F. McKnight Brain Institute

January 14, 2013  
Date