APPLICATION FOR FEDERAL ASSISTANCE
SF 424 (R&R)

3. DATE RECEIVED BY STATE	State Application Identifier

1. TYPE OF SUBMISSION*

4.a. Federal Identifier

○ Pre-application   ● Application   ○ Changed/Corrected Application

b. Agency Routing Number

2. DATE SUBMITTED 2016-01-12	Application Identifier 16-003652	c. Previous Grants.gov Tracking Number

5. APPLICANT INFORMATION

Organizational DUNS*: 0432075620000

Legal Name*: Yale University
Department: Grant Support FASPSY 598020
Division:
Street1*: Office of Sponsored Projects
Street2: 25 Science Park - 3rd Floor
City*: New Haven
County:
State*: CT: Connecticut
Province:
Country*: USA: UNITED STATES
ZIP / Postal Code*: 06520-8327

Person to be contacted on matters involving this application
Prefix: First Name*: Maria   Middle Name: Last Name*: Kwon   Suffix:
Position/Title: Proposal Manager
Street1*: 25 Science Park
Street2:
City*: New Haven
County:
State*: CT: Connecticut
Province:
Country*: USA: UNITED STATES
ZIP / Postal Code*: 06511-0000
Phone Number*: 203-785-7837   Fax Number: 203-785-4159   Email: gcat2@yale.edu

6. EMPLOYER IDENTIFICATION NUMBER (EIN) or (TIN)*   1060646973A1

7. TYPE OF APPLICANT*   O: Private Institution of Higher Education

Other (Specify):
Small Business Organization Type   ○ Women Owned   ○ Socially and Economically Disadvantaged

8. TYPE OF APPLICATION*

If Revision, mark appropriate box(es).

● New   ○ Resubmission   ○ A. Increase Award   ○ B. Decrease Award   ○ C. Increase Duration

○ Renewal   ○ Continuation   ○ Revision   ○ D. Decrease Duration   ○ E. Other *(specify)* :

Is this application being submitted to other agencies?* ○Yes ●No   What other Agencies?

9. NAME OF FEDERAL AGENCY* National Institutes of Health	10. CATALOG OF FEDERAL DOMESTIC ASSISTANCE NUMBER TITLE:

11. DESCRIPTIVE TITLE OF APPLICANT'S PROJECT*
Research Network on Decision Neuroscience and Aging

12. PROPOSED PROJECT	13. CONGRESSIONAL DISTRICTS OF APPLICANT
Start Date* Ending Date* 10/01/2016 09/30/2021	CT-003

SF 424 (R&R) APPLICATION FOR FEDERAL ASSISTANCE

14. PROJECT DIRECTOR/PRINCIPAL INVESTIGATOR CONTACT INFORMATION

Prefix: Mr.   First Name*: Gregory   Middle Name: Russell   Last Name*: Samanez-Larkin   Suffix:

Position/Title: Assistant Professor

Organization Name*:   Yale University

Department: General Administration FASPSY

Division:

Street1*:   2 Hillhouse Ave

Street2:

City*:   New Haven

County:

State*:   CT: Connecticut

Province:

Country*:   USA: UNITED STATES

ZIP / Postal Code*:   06511-6814

Phone Number*: 650-799-5715   Fax Number: 203-432-7172   Email*: g.samanezlarkin@yale.edu

15. ESTIMATED PROJECT FUNDING

a. Total Federal Funds Requested*	$1,463,389.00
b. Total Non-Federal Funds*	$0.00
c. Total Federal & Non-Federal Funds*	$1,463,389.00
d. Estimated Program Income*	$0.00

16.IS APPLICATION SUBJECT TO REVIEW BY STATE EXECUTIVE ORDER 12372 PROCESS?*

a. YES ○ THIS PREAPPLICATION/APPLICATION WAS MADE AVAILABLE TO THE STATE EXECUTIVE ORDER 12372 PROCESS FOR REVIEW ON:

DATE:

b. NO ● PROGRAM IS NOT COVERED BY E.O. 12372; OR

○ PROGRAM HAS NOT BEEN SELECTED BY STATE FOR REVIEW

17. By signing this application, I certify (1) to the statements contained in the list of certifications* and (2) that the statements herein are true, complete and accurate to the best of my knowledge. I also provide the required assurances * and agree to comply with any resulting terms if I accept an award. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 18, Section 1001)

● I agree*

* The list of certifications and assurances, or an Internet site where you may obtain this list, is contained in the announcement or agency specific instructions.

18. SFLLL or OTHER EXPLANATORY DOCUMENTATION   File Name:

19. AUTHORIZED REPRESENTATIVE

Prefix: First Name*: Maria   Middle Name: Last Name*: Kwon   Suffix:

Position/Title*:   Proposal Manager

Organization Name*:   Yale University

Department: Office of Sponsored Projects O

Division:

Street1*:   25 Science Park

Street2:

City*:   New Haven

County:

State*:   CT: Connecticut

Province:

Country*:   USA: UNITED STATES

ZIP / Postal Code*:   06511-0000

Phone Number*: 203-785-7837   Fax Number: 203-785-4159   Email*: gcat2@yale.edu

Signature of Authorized Representative*
Maria Kwon

Date Signed*
01/12/2016

20. PRE-APPLICATION   File Name:

21. COVER LETTER ATTACHMENT   File Name:

424 R&R and PHS-398 Specific
Table Of Contents

Project/Performance Site Location(s)

Project/Performance Site Primary Location

○ I am submitting an application as an individual, and not on behalf of a company, state, local or tribal government, academia, or other type of organization.

Organization Name:	Yale University
Duns Number:	0432075620000
Street1*:	SSS Building
Street2:	1 Prospect Street
City*:	New Haven
County:	
State*:	CT: Connecticut
Province:	
Country*:	USA: UNITED STATES
Zip / Postal Code*:	06511-8954
Project/Performance Site Congressional District*:	CT-003

File Name

Additional Location(s)

RESEARCH & RELATED Other Project Information

1. Are Human Subjects Involved?* ○ **Yes** ● **No**

1.a. If YES to Human Subjects

Is the Project Exempt from Federal regulations? ○ Yes ○ No

If YES, check appropriate exemption number: — 1 — 2 — 3 — 4 — 5 — 6

If NO, is the IRB review Pending? ○ **Yes** ○ **No**

IRB Approval Date:

Human Subject Assurance Number

2. Are Vertebrate Animals Used?* ○ **Yes** ● **No**

2.a. If YES to Vertebrate Animals

Is the IACUC review Pending? ○ Yes ○ No

IACUC Approval Date:

Animal Welfare Assurance Number

3. Is proprietary/privileged information included in the application?* ○ **Yes** ● **No**

4.a. Does this project have an actual or potential impact - positive or negative - on the environment?* ○ **Yes** ● **No**

4.b. If yes, please explain:

4.c. If this project has an actual or potential impact on the environment, has an exemption been authorized or an ○ Yes ○ No environmental assessment (EA) or environmental impact statement (EIS) been performed?

4.d. If yes, please explain:

5. Is the research performance site designated, or eligible to be designated, as a historic place?* ○ **Yes** ● **No**

5.a. If yes, please explain:

6. Does this project involve activities outside the United States or partnership with international collaborators?* ○ **Yes** ● **No**

6.a. If yes, identify countries:

6.b. Optional Explanation:

	Filename
7. Project Summary/Abstract*	r24abstractsummary.pdf
8. Project Narrative*	r24narrative.pdf
9. Bibliography & References Cited	r24references.pdf
10. Facilities & Other Resources	r24facilitiesresources.pdf
11. Equipment	r24equipment.pdf

PROJECT SUMMARY / ABSTRACT

The overall goal of this grant is to continue supporting the multidisciplinary Scientific Research Network on Decision Neuroscience and Aging. The integrative emerging area that this grant will support combines the strengths of several fields including psychology, neuroscience, and economics to facilitate rapid scientific progress and directly contribute to the development of effective interventions and policies to improve health and well being across the life span. Over five years this network grant will support scientific meetings, intensive training workshops for researchers at all stages, collaboration and mentorship initiatives, and pilot grant competitions for researchers new to the field. These activities will directly support the growth, development, and sustainability of the decision neuroscience of aging. This grant will support growth of the network through dissemination activities. Scientific meetings will increase awareness of the latest findings with the goal of drawing new researchers into the area and encouraging new collaborations. A small grant competition will encourage scientists to join the area and will stimulate new research through small scale pilots. This network grant will support development of the area through methods workshops and an outside mentorship program. Short, intensive workshops will focus on training researchers at all stages in the collection and analysis of various emerging behavioral (e.g., health-related, social, economic) and biological (e.g., neurochemical, genetic, hormonal) measures. The development of these skills is currently difficult to achieve in traditional single discipline training programs, but will be essential for taking advantage of the growing number of large multivariate and multi-level integrative datasets generated by this area in the future. In general the network will focus on investing in the sustainability of this field by ensuring that graduate students, post-doctoral fellows, and junior and senior faculty are invited to participate in all activities. Workshops, meetings, small pilot grants, and collaboration initiatives will facilitate the transition from a small group of individuals managing network activities to a strong field of researchers leading future work in this area. After completion of activities, this emerging area will be in better position for network members to pursue funding to support the network in the future using more traditional mechanisms.

PROJECT NARRATIVE

Relevance

As the proportion of older adults in the population continues to expand, magnifying the relative impact of their decisions, it is increasingly imperative to better understand changes in decision making across the life span. The recent, rapid rise in interdisciplinary research combining psychology, neuroscience, and economics has tremendous potential for increasing translation of science for real-world impact. The long-term goal of this network is to conduct integrative and multidisciplinary research that contributes directly to interventions aimed at improving health and well being in the daily lives of aging adults.

FACILITIES / RESOURCES

The facilities to be used for all activities include meeting and conference rooms located either at meeting/conference destinations across the country (for the preconference workshops) or Yale, Stanford, or UNC. To facilitate activities all conference rooms will be equipped with sufficient seating, audio-visual projection systems, and whiteboards.

A unique educational environment will result from the joint collaborative efforts of the committee which spans multiple institutions and a broad range of scientific expertise. Each member of the scientific key personnel has strong individual expertise, but as a group these individuals also have a great deal of overlapping interests. Key personnel have not only worked with each other on a number of previous projects, but also all have experience with managing multidisciplinary research projects, training, and events. This experience ensures a high probability of success in directing the proposed activities.

Administrative support for all activities will be provided by staff within the Samanez Larkin lab and grants management staff within the Department of Psychology at Yale University. These administrative staff have experience with planning and executing events and grants management. The support staff will assist with organizational (e.g., scheduling, reservations, creation/distribution of materials) and financial (e.g., payments, processing reimbursements, disbursing pilot grants) efforts allowing the key scientific personnel to focus efforts on the planning and execution of the scientific agenda.

EQUIPMENT

All existing major equipment to be used for the support of this network is currently located within the labs and offices of the PI (at Yale University) and committee members. Desktop computers, printers, and a web server will be used for the creation of meeting/conference/workshop materials, scheduling, reservations, processing reimbursements, disbursing small grants, and hosting the network's website.

RESEARCH & RELATED Senior/Key Person Profile (Expanded)

PROFILE - Project Director/Principal Investigator

Prefix: Mr.   First Name*: Gregory   Middle Name Russell   Last Name*: Samanez-Larkin   Suffix:

Position/Title*:   Assistant Professor
Organization Name*:   Yale University
Department: General Administration FASPSY
Division:
Street1*:   2 Hillhouse Ave
Street2:
City*:   New Haven
County:
State*:   CT: Connecticut
Province:
Country*:   USA: UNITED STATES
Zip / Postal Code*:   06511-6814

| Phone   Fax Number: 203-432-7172   E-Mail*: g.samanezlarkin@yale.edu
Number*: 650-799-5715 |
|---|

Credential, e.g., agency login: SAMANEZLARKIN.GREG

Project Role*: PD/PI   Other Project Role Category:

Degree Type: Degree Year:

	File Name
Attach Biographical Sketch*:	nihbio_sl.pdf
Attach Current & Pending Support:	

PROFILE - Senior/Key Person

Prefix:	First Name*: Laura	Middle Name	Last Name*: Carstensen	Suffix:

Position/Title*:
Organization Name*:   Stanford University
Department: Stanford University
Division:
Street1*:   Jordan Hall, Building 420 (Rm 167)
Street2:   Dept. of Psychology
City*:   Stanford
County:
State*:   CA: California
Province:
Country*:   USA: UNITED STATES
Zip / Postal Code*:   94305-2130

Phone Number*: 650-736-8643	Fax Number:	E-Mail*: laura.carstensen@stanford.edu

Credential, e.g., agency login: LAURACAR

Project Role*: Consultant	Other Project Role Category:

Degree Type:	Degree Year:

	File Name
Attach Biographical Sketch*:	nihbio_carstensen.pdf

Attach Current & Pending Support:

PROFILE - Senior/Key Person

Prefix:	First Name*: Camelia	Middle Name M	Last Name*: Kuhnen	Suffix:

Position/Title*:
Organization Name*:   University of North Carolina at Chapel Hill
Department: University of North Carolina a
Division:
Street1*:   300 Kenan Center Drive, MC #4407
Street2:
City*:   Chapel Hill
County:
State*:   NC: North Carolina
Province:
Country*:   USA: UNITED STATES
Zip / Postal Code*:   27599-5056

Phone Number*: 919-962-3284	Fax Number:	E-Mail*: camelia_kuhnen@kenan-flagler.unc.edu

Credential, e.g., agency login: CKUHNEN

Project Role*: Consultant	Other Project Role Category:

Degree Type:	Degree Year:

	File Name
Attach Biographical Sketch*:	nihbio_kuhnen.pdf

Attach Current & Pending Support:

PROFILE - Senior/Key Person	
Prefix:	First Name*: Ye Middle Name Last Name*: Li Suffix:

Position/Title*:
Organization Name*: University of California, Riverside
Department: University of California, Rive
Division:
Street1*: 900 University Avenue
Street2:
City*: Riverside
County:
State*: CA: California
Province:
Country*: USA: UNITED STATES
Zip / Postal Code*: 92521-9800

Phone Number*: 951-827-3694   Fax Number: E-Mail*: ye.li@ucr.edu

Credential, e.g., agency login: yl2629

Project Role*: Consultant   Other Project Role Category:

Degree Type: Degree Year:

Attach Biographical Sketch*:   File Name
nihbio_li_2.pdf

Attach Current & Pending Support:

PROFILE - Senior/Key Person	
Prefix:	First Name*: Nichole Middle Name R Last Name*: Lighthall Suffix:

Position/Title*:
Organization Name*: University of Central Florida
Department: University of Central Florida
Division:
Street1*: 4000 Central Florida Blvd, Building 99, Rm 330
Street2:
City*: Orlando
County:
State*: FL: Florida
Province:
Country*: USA: UNITED STATES
Zip / Postal Code*: 32816-1390

Phone Number*: 407-823-2216   Fax Number: E-Mail*: Nichole.Lighthall@ucf.edu

Credential, e.g., agency login: nlighta

Project Role*: Consultant   Other Project Role Category:

Degree Type: Degree Year:

Attach Biographical Sketch*:   File Name
nihbio_lighthall.pdf

Attach Current & Pending Support:

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: Gregory R. Samanez Larkin

eRA COMMONS USER NAME (credential, e.g., agency login): SAMANEZLARKIN.GREG

POSITION TITLE: Assistant Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
University of Michigan, Ann Arbor, MI	B.A.	1998-2002	Psychology
Stanford University, Stanford, CA	M.A.	2005-2008	Psychology
Stanford University, Stanford, CA	Ph.D.	2005-2010	Psychology
Vanderbilt University, Nashville, TN	Post-Doc	2010-2013	Neuroscience/Psychology

A. Personal Statement

Although at an early career stage, Dr. Samanez-Larkin is already a leading expert in the affective neuroscience and neuroeconomics of aging. His graduate training was under the supervision of Dr. Brian Knutson, a pioneering expert on reward processing in the brain, and Dr. Laura Carstensen, the world's leading expert on emotion and aging. His dissertation studies supported by an individual NRSA from the National Institute on Aging were among the first neuroimaging studies of reward processing and decision making in the aging human brain. His post-doctoral fellowship under David Zald, a leading expert on dopamine imaging in humans, included initial training in PET imaging and pharmacology and was supported by an individual NRSA from the National Institute on Aging and the first phase of his Pathway to Independence Award (K99). His experimental training has included measurement of behavior, measurement of peripheral physiology (undergraduate), functional brain imaging using fMRI (graduate, post-doc), and molecular brain imaging using PET (post-doc). The R00 phase of this Pathway to Independence Award is focused on individual and age differences in the function of neurobiological systems supporting incentive motivation, learning, and decision making.

1. **Samanez-Larkin, G.R.**, Carstensen, L.L. (2011) Socioemotional functioning and the aging brain. In J. Decety and J. Cacioppo (Eds.) *The Oxford Handbook of Social Neuroscience* (pp. 507–521). New York: Oxford University Press.
2. *Decision Making Over the Life Span* (2011) **G.R. Samanez-Larkin** (Ed.). New York: Annals of the New York Academy of Sciences.
3. **Samanez-Larkin, G.R.** (2015) Decision neuroscience and aging. In T.M. Hess, J. Strough, and C.E. Löckenhoff (Eds.). *Aging and decision making: Empirical and applied perspectives*. New York: Elsevier.
4. **Samanez-Larkin, G.R.**, Knutson, B. (2015) Decision making in the ageing brain: changes in affective and motivational circuits. *Nature Reviews Neuroscience*, 16 (5), 278-289. [PMC – In Progress]

B. Positions and Honors

Positions and Employment
2013-   Assistant Professor of Psychology, Yale University

Academic and Professional Honors

1999   Branstrom Prize for Freshman Scholars (top 10% of class), University of Michigan
2001   Psi Chi Psychology Honors Society
2002   University Honors, University of Michigan
2002   W.B. Pillsbury Thesis Award, University of Michigan
2006   NSF Graduate Research Fellowship, Honorable Mention
2006   Summer School in Neuroeconomics Fellowship, Stanford University
2007   Top Ten Scientific Advances, National Institute on Aging (for: Samanez-Larkin, et al., 2007)
2008   Department of Psychology Teaching Award, Stanford University
2009   Individual Pre-doctoral National Research Service Award (F31), National Institute on Aging
2010   Albert H. & Barbara R. Hastorf Prize for Teaching, Stanford University
2010   Adult Development and Aging Dissertation Award, APA Division 20
2010   Council of Graduate Schools / UMI Distinguished Dissertation Award in the Social Sciences
2011   Individual Post-doctoral National Research Service Award (F32), National Institute on Aging
2012   Rising Star, Association for Psychological Science
2012   Post-Doctoral Fellows Award, Cognitive Neuroscience Society
2012   Pathway to Independence Award (K99/R00), National Institute on Aging
2014   Theresa Seessel Postdoctoral Fellowship for Faculty, Yale University
2015   Poorvu Family Award for Interdisciplinary Teaching, Yale University

C. Contributions to Science

1. I have led or collaborated on a range of studies investigating adult age differences in the processing of emotional stimuli (a–c) and emotional experience in everyday life (d). This work has revealed that emotional experience improves with age and that higher emotional well being is associated with increased longevity. We've extended earlier findings demonstrating age-related positivity effects (i.e., increased attention and memory to positive relative to negative emotional material) by characterizing the neural systems associated with these effects (a–c) and showing that positivity effects are also present in reward-based decision making in old age (a–b).

    a. **Samanez-Larkin, G.R.**, Gibbs, S.E.B., Khanna, K., Nielsen, L., Carstensen, L.L., Knutson, B. (2007) Anticipation of monetary gain but not loss in healthy older adults. *Nature Neuroscience*, 10(6), 787–791. [PMC2268869]
    b. **Samanez-Larkin, G.R.**, Hollon, N.G., Carstensen, L.L., Knutson, B. (2008) Individual differences in insular sensitivity during loss anticipation predict avoidance learning. *Psychological Science*, 4(19), 320–323. [PMC2365707]
    c. **Samanez-Larkin, G.R.**, Robertson, E.R., Mikels, J.A., Carstensen, L.L., Gotlib, I.H. (2009) Selective attention to emotion in the aging brain. *Psychology and Aging*, 24(3), 519–529. [PMC2791508]
    d. Carstensen, L.L., Turan, B., Scheibe, S., Ram, N., Ersner-Hershfield, **Samanez-Larkin, G.R.**, Brooks, K.P., Nesselroade, J.R. (2011) Emotional experience improves with age: Evidence based on over 10 years of experience sampling. *Psychology and Aging*, 26(1), 21–33. [PMC3332527]

2. I have led a series of studies in which we examined how age differences in learning affect risky decision making. The studies show that older adults are impaired relative to younger adults when making decisions that require rapid learning from recent experience and this can sometimes lead to excessively risky decision making (even though many older adults self-identify as being more risk averse than they were when they were younger). We've linked these learning deficits to increases in striatal neural signal variability, reduced representation of prediction errors in the medial frontal cortex, and decreased white matter connectivity between the medial prefrontal cortex and ventral striatum. We've also shown that there are ways of displaying feedback in these tasks that enhance learning in old age, which we hope will inspire the development of decision aids that can be adapted for use in everyday life.

    a. **Samanez-Larkin, G.R.**, Kuhnen, C.M., Yoo, D.J., Knutson, B. (2010) Variability in nucleus accumbens activity mediates age-related suboptimal financial risk taking. *Journal of Neuroscience*, 30(4), 1426–

1434. [PMC2821055]

b. **Samanez-Larkin, G.R.**, Wagner, A.D., Knutson, B. (2011) Expected value information improves financial risk taking across the adult life span. *Social Cognitive and Affective Neuroscience*, 6(2), 207–217. [PMC3073388]

c. **Samanez-Larkin, G.R.**, Levens, S.M., Perry, L.M., Dougherty, R.F., Knutson, B. (2012) Frontostriatal white matter integrity mediates adult age differences in probabilistic reward learning. *Journal of Neuroscience*, 32(15), 5333–5337. [PMC3744863]

d. **Samanez-Larkin, G.R.**, Worthy, D.A., Mata, R., McClure, S.M., Knutson, B (2014) Adult age differences in frontostriatal representation of prediction error but not reward outcome. *Cognitive Affective and Behavioral Neuroscience*, 14 (2), 672–682. [PMC4072917]

3. Although many studies in the behavioral economics and neuroeconomics literatures use small amounts of real money in experimental tasks, shockingly few measures of performance on these laboratory tasks have been directly linked to real-world behavior. Highly relevant to the current proposal, my collaborators and I believe that validation of these tasks and prediction of real-world behavior is critical. Over the past few years, we have documented that performance on many laboratory tasks is related to real-world financial behavior (e.g., long-term financial saving, borrowing / credit card usage, credit scores).

    a. Ersner-Hershfield, H., Garton, M.T., Ballard, K., **Samanez-Larkin, G.R.**, Knutson, K. (2009) Don't stop thinking about tomorrow: Individual differences in future self-continuity account for saving. *Judgment and Decision Making*, 4(4), 280–286. [PMC2747683]

    b. Knutson, B., **Samanez-Larkin, G.R.**, Kuhnen, C.M. (2011) Gain and loss learning differentially contribute to life financial outcomes. *PLoS ONE*, 6(9), e24390. [PMC3167846]

    c. Kuhnen, C.M., **Samanez-Larkin, G.R.**, Knutson, B. (2013) Serotonergic genotypes, neuroticism, and financial choices. *PLoS ONE*, 8(1), e54632. [PMC3559795]

4. In addition to contributions to the specific topics above, I am also an active contributor to the development of new tools and methods for studying age differences in affective and cognitive function. I've collaborated on the collection of new emotional category norms for a set of commonly used emotional images, developed a set of guidelines for conducting neuroimaging studies comparing adults of various ages, co-developed (with Doug Garrett) new methods for measuring neural signal variability (which was a measure previously ignored in human brain imaging), and demonstrated ways of using structural equation modeling to examine neuromodulatory networks in human PET data.

    a. Mikels, J.A., Fredrickson, B.L., **Larkin, G.R.**, Lindberg, C.M., Maglio, S.J., Reuter-Lorenz, P.A. (2005). Emotional category data on images from the International Affective Picture System. *Behavior Research Methods*, 37(4), 626–630. [PMC1808555]

    b. **Samanez-Larkin, G.R.**, D'Esposito, M. (2008) Group comparisons: Imaging the aging brain. *Social Cognitive and Affective Neuroscience*, 3(3), 290–297. PMC2563421

    c. Garrett, D.D., **Samanez-Larkin, G.R.**, MacDonald, S.W.S., Lindenberger, U., McIntosh, A.R., Grady, C.L. (2013) Moment-to-moment brain signal variability: A next frontier in human brain mapping? *Neuroscience and Biobehavioral Reviews*, 37(4), 610–624. PMC3732213

    d. **Samanez-Larkin, G.R.**, Buckholtz, J.W., Cowan, R.L., Woodward, N.D., Li, R., Ansari, M.S., Arrington, C.M., Baldwin, R.M., Smith, C.E., Treadway, M.T., Kessler, R.M., Zald, D.H. (2013) A thalamocorticostriatal dopamine network for psychostimulant-enhanced human cognitive flexibility. *Biological Psychiatry*. [PMC3615042]

Complete list of published work:
PubMed
Google Scholar

D. Research Support

Active

NIA/NIH   R21-AG049293   Levy (PI)   9/30/2015–3/31/2017
Medical decision-making under uncertainty in older adults
Research grant to examine the behavioral and neurobiological processes that characterize decision making under risk and ambiguity by younger and older adults in financial versus medical domains.
Role: Co-Investigator

NIA/NIH   R00-AG042596   Samanez-Larkin (PI)   9/30/2014–3/31/2018
Neuromodulation of Motivated Cognition and Decision Making Across Adulthood
Pathway to Independence Award supporting research on the influence of motivation and cognition on decision making using multimodal neuroimaging including fMRI and PET imaging of dopamine receptors.
Role: PI

NIA/NIH   R01-AG043458   Zald, Samanez Larkin (MPI)   2/15/2014–1/31/2019
Dopaminergic Neuromodulation of Decision Making in Young and Middle-Aged Adults
Project aims to characterize individual and age differences in motivation and decision making in young and late middle-aged adults using multimodal neuroimaging techniques to assess dopamine receptors, transporters, and release.
Role: PI

NIA/NIH   R21-AG043741   Löckenhoff (PI)   7/1/2013–6/30/2016
Age Differences in Preferences for and Responses to Temporal Sequences
Research grant to quantify adult age differences in sequence preferences for monetary payouts, effortful performance, and aversive physical outcomes, examine age differences in trajectories of self-reported affect and physiological arousal over the course of different sequences, and investigate relevant explanatory variables including emotion-regulatory strategies, time horizons, and cognitive functioning.
Role: Co-Investigator

NIA/NIH   R01-AG044838   Zald (PI)   9/30/2012–5/31/2016
Dopaminergic modulation of subjective valuation across adulthood
The proposal aims to characterize individual and age differences in cost-benefit decision making over the adult life span using multimodal neuroimaging techniques.
Role: Co-PI

Completed

NIA/NIH   R24-AG039350   Carstensen, Samanez-Larkin (MPI)   09/30/10–05/31/15
Scientific Research Network on Decision Neuroscience and Aging
Network grant to support dissemination and training activities related to an emerging multidisciplinary science of decision making and aging.
Role: PI

NIA/NIH   K99-AG042596   Samanez-Larkin (PI)   8/1/2012–11/15/2013
Neuromodulation of Motivated Cognition and Decision Making Across Adulthood
Post-doctoral phase of Pathway to Independence Award supporting research on the influence of motivation on cognitive control and decision making using multimodal neuroimaging including fMRI and PET imaging of dopamine receptors.
Role: PI

FINRA Investor Education Foundation   Knutson (PI)   1/1/2011–10/31/2013
Individual Differences in Susceptibility to Investment Fraud
This study examines individual differences in cognitive and emotional characteristics associated with fraud victimization through focused assessment (including neuroimaging) of a northern California sample. The study

compared actual investment fraud victims to age-matched controls.
Role: Co-Investigator

NIA/NIH   F32-AG039131   Samanez-Larkin (PI)   7/1/2011–7/31/2012
Imaging the Human Reward System Across the Adult Life Span
Individual post-doctoral fellowship supporting multimodal (MRI, PET) neuroimaging training.
Role: PI

BIOGRAPHICAL SKETCH
Provide the following information for the key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME Laura L. Carstensen	POSITION TITLE Professor of Psychology
eRA COMMONS USER NAME LAURACAR	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
University of Rochester, Rochester, NY	B.S.	1978	Psychology
West Virginia University, Morgantown, WV	M.A.	1980	Psychology
University of Mississippi Medical Center		1982-83	Clinical Internship
West Virginia University, Morgantown, WV	Ph.D.	1983	Psychology

A. Personal Statement

I have considerable expertise in the ways that motivation changes across adulthood and how such changes come to influence emotional experience and cognitive processing. My research is grounded in socioemotional selectivity theory (SST), which postulates that time horizons influence goals; and, because aging is associated with systematic changes in perceived time horizons, there are reliable age-related differences in motivation. In addition to my theoretical work, my research team has considerable experience conducting laboratory experiments, web-based surveys, experience sampling, neuroimaging, actigraphy, and natural experiments. SST has demonstrated utility across a range of substantive domains and disciplines, including behavioral economics and medicine. I have a strong track record of publications (h-index over 60) and grantsmanship, with over 25 years of continuous funding from the National Institute of Aging (including a MERIT award). In addition to research, teaching, and mentoring, I am the founding director of the Stanford Center on Longevity (SCL). SCL involves faculty from the schools of engineering, education, medicine, business, law, humanities and sciences, as well as industries outside of academia, such as health insurers and financial services, who work together on interdisciplinary projects that target important challenges and opportunities for aging societies, including financial security. We bring together the best thinkers, policymakers, and business leaders to drive innovation and change around retirement planning issues and fraud prevention.

1. English, T. & Carstensen, L.L. (2014). Will interventions targeting conscientiousness improve aging outcomes? *Developmental Psychology, 50*, 1478-1481. doi: 10.1037/a0036073. PMCID: PMC4037915
2. Notthoff, N. & Carstensen, L.L. (2014). Positive messaging promotes walking in older adults. *Psychology and Aging, 29,* 329-341. doi: 10.1037/a0036748. PMCID: PMC4069032
3. Hershfield, H.E., Scheibe, S., Sims, T., & Carstensen, L.L. (2013). When feeling bad can be good: Mixed emotions benefit physical health across adulthood. *Social Psychological and Personality Science*, *4*(1), 54-61. doi: 10.1177/1948550612444616. PMCID: PMC3768126
4. Olshansky, J.S., Antonucci, T., Berkman, L., Binstock, R.H., Börsch-Supan, A., Cacioppo, J.T., Carnes, B.A., Carstensen, L.L., Fried, L.P., Goldman, D.P., Jackson, J., Kohil, M., Rother, J., Zheng, Y., & Rowe, J. (2012). Differences in life expectancy due to race and educational differences are widening, and many may not catch up. *Health Affairs*, *31*(8), 1-12. doi:10.1377/hlthaff.2011.0746

B. Positions and Honors

Positions and Employment
1983-1987   Assistant Professor, Indiana University
1987-1993   Assistant Professor, Stanford University
1993-1998   Associate Professor, Stanford University

1997-2001   Barbara D. Finberg, Director, Institute for Research Women and Gender, Stanford University
1998-present Professor of Psychology, Stanford University
2004-2006   Chair, Psychology Department, Stanford University
2011-present Fairleigh S. Dickinson Jr. Professor in Public Policy
2007-present Founding Director, Stanford Center on Longevity

Other Experience and Professional Memberships
1996-1999   Member, HUD-2, NIH Review Panel
1999-2000   Chair, National Research Council, Committee on Future Directions in Cognitive Aging Research
1999-2001   Core Faculty Member, NIMH, Bay Area University Consortium on Training in Affective Science
1999-2003   Core Faculty Member, American Psychological Association Minority Fellowship Program
2002-2005   Chair, Fachbeirat (External Advisory Board) Max Planck Institute for Human Development, Center for Life-span Psychology
2002-2005   Member, Behavior & Social Science of Aging Review Committee, National Institute on Aging
2003-2006   Chair, National Academy of Sciences Committee on Future of research on Social, Personality and Adult Developmental Aspects of Aging
2007-present Member, MacArthur Foundation Network on Aging Societies
2012-present Member, National Advisory Council on Aging (NACA)
2015-present Member, National Research Council, Board of Behavioral, Cognitive and Sensory Sciences.

Selected Honors
1993   Kalish Innovative Publication Award, Gerontological Society of America
1998   Stanford University Dean's Award for Distinguished Teaching
2003-2004   Guggenheim Fellow
2005   MERIT Award, National Institute on Aging
2006   Distinguished Career Contributions Award, Behavioral Science Section, Gerontological Society of America
2009-2010   Fellow, Center for the Advanced Study in the Behavioral Sciences
2010   Master Mentorship Award, American Psychological Association (Division 20)
2012   Honorary Doctorate, University of Leuven, Belgium
2014   Distinguished Mentorship in Gerontology Award, Behavioral Science Section, Gerontological Society of America
2014   Robert W. Kleemeier Award, Behavioral Science Section, Gerontological Society of America

C. Contributions to Science

1. **Socioemotional selectivity theory (SST).** Originally formulated in the early 1990s SST has guided a great deal of research on social relationships, motivation, emotion, decision making and cognitive processing. SST initially addressed what was called "the paradox of aging," namely, observations that emotional and social well-being was well-maintained despite well-documented losses. Over the years, it has been influential in research on many aspects of aging. According to SST, enhanced socioemotional functioning reflects a priority placed on emotionally meaningful goals when time horizons are constrained. SST is distinguished from many conceptual approaches in life-span developmental psychology in that it offers falsifiable hypotheses. Tests of SST have revealed that many age differences which were long presumed to reflect age-related decline reflect changes in goals that are associated with perceived time horizons. SST thus challenged the dominant thinking in the field of psychology and lead to identification of alternative mechanisms of influence. The key theoretical article published in the *American Psychologist* has been cited over 2000 times. SST is featured in most textbooks on adult development.
    a. Carstensen, L.L. (1995). Evidence for a life-span theory of socioemotional selectivity. *Current Directions in Psychological Science*, *4*, 151-156.
    b. Carstensen, L.L., Isaacowitz, D., & Charles, S.T. (1999). Taking time seriously: A theory of socioemotional selectivity. *American Psychologist*, *54*, 165-181.
    c. Carstensen, L.L. (2006). The influence of a sense of time on human development. *Science*, *312*, 1913-1915. doi:10.1126/science.1127488

2. **Time horizons change goals.** One very productive line of empirical research derived from SST concerns the role of time horizons in motivation. Findings showed that age differences in goals could be eliminated as a function of time horizons. In a series of experiments, my research group showed that experimental manipulations of time eliminated age differences in goals. When time horizons are expanded, older people display preferences similar to the young and when time horizons are limited, such as prior to geographical moves or illness, preferences of the young resemble those of the old. We also demonstrated similar effects following political upheavals, epidemics and terrorist attacks which activate perceived endings by priming the fragility of life.
    a. Fredrickson, B.L., & Carstensen, L.L. (1990). Choosing social partners: How old age and anticipated endings make us more selective. *Psychology and Aging*, *5*, 335-347. PMCID: PMC3155996
    b. Fung, H.L., & Carstensen, L.L. (2004). Motivational changes in response to blocked goals and foreshortened time: Testing alternative explanations of socioemotional selectivity theory. *Psychology and Aging*, *19*, 68-78. doi:10.1037/0882-7974.19.1.68
    c. Fung, H.H., & Carstensen, L.L. (2006). Goals change when life's fragility is primed: Lessons learned from older adults, the September 11th Attacks and SARS. *Social Cognition*, *24*, 248-278. doi:10.1521/soco.2006.24.3.248
    d. Lang, F.R., & Carstensen, L.L. (2002). Time counts: Future time perspective, goals and social relationships. *Psychology and Aging*, *17*, 125-139. doi:10.1037//0882-7974.17.1.125

3. **The positivity effect.** Because goals direct cognitive processing, my students and I postulated that age differences in goals may be associated with age differences in preferences in cognitive processing and thus may exert fundamental influences on what people see, hear and remember. Reasoning from SST, my research group identified the "positivity effect," which refers to an age-related trend in cognitive processing that favors positive over negative stimuli. Since the effect was initially identified and the conceptual basis articulated, scores of independent replications and related findings have appeared in the literature. When some investigations failed to observe the positivity effect, we began a program of research on the cognitive underlying mechanisms and moderators of the positivity effect. We showed that when findings were considered in the theoretical context of SST, a reliable pattern of evidence emerged that helped to refine conceptual tenets. The positivity effect stimulated research in visual attention, memory, decision-making, and neural activation. A recent meta-analysis of more than 100 articles published by Reed, Chan & Mikels (2014) showed the positivity effect to be robust and reliable. Our most recent research is exploring conditions where a focus on positive information may benefit and/or impair cognitive performance in older people.
    a. Charles, S.T., Mather, M., & Carstensen, L.L. (2003) Aging and emotional memory: The forgettable nature of negative images for older adults. *Journal of Experimental Psychology: General*, *132*, 310-324.
    b. Mather, M., Canli, T., English, T., Whitfield, S., Wais, P., Ochsner, K., Gabrieli, J., & Carstensen, L.L. (2004). Amygdala responses to emotionally valenced stimuli in older and younger adults. *Psychological Science, 15*, 259-263. doi:10.1111/j.0956-7976.2004.00662.
    c. Mather, M., & Carstensen, L.L. (2005). Aging and motivated cognition: The positivity effect in attention and memory. *Trends in Cognitive Science*, *9, 496-502.*
    d. Reed, A.E., & Carstensen, L.L. (2012). The theory behind the age-related positivity effect. *Frontiers in Psychology*, *3*, 1-9. doi:10.3389/fpsyg.2012.00339. PMCID: PMC3459016

4. **Emotional experience and development.** My group has made seminal contributions to the understanding of age differences in emotional experience. When we began our research on emotion, there was widespread belief that emotional experience in old age was dampened and/or largely negative. Using experience sampling, lab-based experiments, and surveys, we observed that that relative to early adulthood, emotional experience at advanced ages is, on balance, more positive than in youth. Importantly, improvements are accounted for primarily by a reduction in negative emotions, not increases in positive emotions. Emotions become more mixed. Poignancy increases in frequency. Again, we showed that time horizons are important. Both younger and older people experience mixed emotions in the face of meaningful endings.

a. Carstensen, L.L., Pasupathi, M., Mayr, U., & Nesselroade, J. (2000). Emotional experience in everyday life across the adult life span. *Journal of Personality and Social Psychology*, *79*, 644-655. doi: 10.1037/0022-3514.79.4.644

b. Carstensen, L.L., Turan, B., Scheibe, S., Ram, N., Ersner-Hershfield, H., Samanez-Larkin, G.R., Brooks, K., & Nesselroade, J.R. (2011). Emotional experience improves with age: Evidence based on over 10 years of experience sampling. *Psychology and Aging*, *26*, 21-33. doi: 10.1037/a0021285. PMCID: PMC3332527

c. Scheibe, S., English, T., Tsai, J.L., & Carstensen, L.L. (2013). Striving to feel good: Ideal affect, actual affect, and their correspondence across adulthood. *Psychology and Aging, 28*, 160-71. doi: 10.1037/a0030561. PMCID: PMC3756228

d. Ersner-Hershfield, H., Mikels, J.A., Sullivan, S.J., Carstensen, L.L. (2008) Poignancy: Mixed emotional experience in the face of meaningful endings. *Journal of Personality and Social Psychology*, *94*, 158-167. doi: 10.1037/0022-3514.94.1.158. PMCID: PMC2807633

5. **Behavioral interventions**. In recent years, we have adopted a theory-based approach to behavioral interventions aimed at improving health behaviors. We argue that interventions and messaging are most likely to be attended to and remembered when they appeal to chronically activated goals. In particular, focusing on positive rather than negative information heightens attention to messaging.

a. English, T., & Carstensen, L.L. (2015). Does positivity operate when the stakes are high? Health status and decision making among older adults. *Psychology and Aging, 30*(2): 348-255. doi: 10.1037/a0039121. PMCID: PMC4451383

b. Notthoff, N. & Carstensen, L.L. (2014). Positive messaging promotes walking in older adults. *Psychology and Aging, 29*, 329-341. doi: 10.1037/a0036748. PMCID: PMC4069032

c. Scheibe, S., Notthoff, N., Menkin, J., Ross, L., Shadel, D., & Carstensen, L.L. (2014). Forewarning reduces fraud susceptibility in vulnerable consumers. *Basic and Applied Social Psychology, 36*, 272-279. doi: 10.1080/01973533.2014.903844. PMCID: PMC4199235

Complete List of Published Work in MyBibliography:
http://www.ncbi.nlm.nih.gov/sites/myncbi/laura.carstensen.1/bibliograpahy/41332801/public/?sort=date&direction=ascending

D. Research Support

Ongoing Research Support

5 R37AG008816   Laura Carstensen (PI)   9/1/90-8/31/2015
NIH/NIA
Title*:* Socioemotional Functioning in Adulthood and Old Age
Goals: The major goals of this project are to better understand emotional development and its relationship to motivation in later life.

N/A   Laura Carstensen (PI)   10/15/2013-12/31/2015
Society of Actuaries
Title: Optimal Retirement Income Solutions
Goals: To encourage and facilitate defined contribution retirement plans to be operated as true retirement plans, in addition to capital accumulation plans.

Completed Research Support

1 R24 AG039350-01 Laura Carstensen, Gregory Samanez Larkin (MPI)   9/30/10-5/31/2015
NIH/NIA
Title*:* Research Network on Decision Neuroscience and Aging
Goals: The major goals of this project are to support the development of a subfield of research on decision neuroscience and aging.

5P30AG02495708   Mary Kane Goldstein (PI)   9/30/04-08/31/2014

NIH/NIA
Title*:*   Center on Advancing Decision Making in Aging
Goals: The major goal of this project is to promote the study of decision making processes and the determinants of choices that affect health and well-being in the later years of life. CADMA researchers plan to conduct basic and applied research on decision making processes with a goal of developing and implementing practical methods for improving fundamental decisions affecting the well-being of the elderly.

6414232   Laura Carstensen (PI)   09/01/2010-12/31/2014
MacArthur Foundation via subcontract from Columbia University
Title*:*   The Aging Society Network John Rowe (PI) – Santa Clara Volunteer Study
Goals: To identify incentives that effectively engage older workers in volunteer efforts that increase intergenerational relations and improve child outcomes.

2 (PG001923)   Laura Carstensen (PI)   12/01/2012-12/31/2014
MacArthur Foundation via subcontract from Columbia University
Title: The Aging Society Network John Rowe (PI) – Communities Aging in Place
Goals: To explore strategies that could step up the pace of change to prepare for an aging America to age independently, with appropriate choice in homes and neighborhoods.

N/A   Laura Carstensen (PI)   01/01/2012-02/28/2015
FINRA Investor Education Foundation
Title*:* Financial Fraud Research Center 2012 Supplement
Goals: The Financial Fraud Research Center is a joint project of the Stanford Center on Longevity and the Financial Industry Regulatory Authority (FINRA) Investor Education Foundation which serves as a hub in the fight against fraud. This is a financial supplement to the center.

2013-5-23-OWLM   Laura Carstensen (PI) (Co-PI Robert Willis, w Dawn Carr)   12/01/2013-12/01/2014
Sloan Foundation
Title: Is Working Longer Good For You?: Understanding Potential Pathways Between Working and Cognitive Performance
Goals: To examine individual and occupational differences in functioning prior to retirement as potential mediators of the relationship between work and cognition

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: Camelia M. Kuhnen

eRA COMMONS USER NAME (credential, e.g., agency login): CKUHNEN

POSITION TITLE: Associate Professor of Finance

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Massachusetts Institute of Technology, Cambridge, MA	B.S.	2001	Brain & Cognitive Sciences
Massachusetts Institute of Technology, Cambridge, MA	B.S.	2001	Finance
Stanford University, Stanford, CA	Ph.D.	2006	Finance

A. Personal Statement

Camelia Kuhnen is an expert in neuroeconomics, behavioral finance and corporate finance. Her work has an interdisciplinary nature, with the over-arching theme of trying to understand how people make financial and economic choices that concern them as individuals or as decision makers in firms. Her dual training in finance and neuroscience led her to conduct pioneering research in the new field of neuroeconomics. In this work Dr. Kuhnen has studied the micro-foundations of financial decision making by investigating the brain and genetic mechanisms responsible for learning and risk taking in financial markets. In her corporate finance work, Dr. Kuhnen has analyzed issues at the intersection of behavioral and organizational economics. She has studied how firms select and incentivize employees and has demonstrated the importance of social connections and social comparisons for these processes. Top neuroscience, finance and management journals have published her work, which has attracted significant media coverage and public interest. Her work has been recognized with her election to two roles. She is the outgoing president of the Society for Neuroeconomics (2014/2015) and she is a faculty research fellow at the National Bureau of Economic Research (NBER). Prior to joining the faculty at UNC Kenan-Flagler, Dr. Kuhnen served on the faculty of the Kellogg School of Management at Northwestern University. She is a past co-investigator on National Institute on Aging grants exploring the influence of age-related change on learning and decision making both in humans and non-human animals.

B. Positions and Honors

Positions and Employment

2006–2009	Assistant Professor of Finance, Kellogg School of Management, Northwestern University, Chicago, IL
2006–2013	Affiliated Faculty, Cognitive Neurology and Alzheimer's Disease Center, Northwestern University, Chicago, IL
2010–2013	Associate Professor of Finance, Kellogg School of Management, Northwestern University, Chicago, IL
2014–present	Associate Professor of Finance, Kenan-Flagler Business School, University of North Carolina (tenured 2015)
2014–present	Affiliated Faculty, UNC School of Medicine Biomedical Research Imaging Center

Academic and Professional Honors

2014-2015   Elected President of the Society for Neuroeconomics

2015   Winner of the Weatherspoon Award for Excellence in MBA Teaching, winner of the Teaching All Star Award, and of the Core Faculty Award for Outstanding Dedication at UNC Kenan-Flagler Business School

2014   Elected Faculty Research Fellow, National Bureau of Economic Research

2006   Best Paper Award in Financial Institutions & Regulation, Midwest Finance Association Meeting

2005   Best Paper Award, Financial Research Association Conference

2003   Jadicke Merit Award for outstanding academic performance, Stanford GSB

2001   MIT Dept. of Brain and Cognitive Sciences Award for outstanding research

C. Contributions to Science

1. Dr. Kuhnen has studied the micro-foundations of financial decision making by investigating the behavioral mechanisms responsible for learning and risk taking in financial markets.

    a. Asymmetric learning from financial information. *Journal of Finance*, 70 (5): 2029-2062, October 2015
    b. Gain and loss learning differentially contribute to life financial outcomes (with Brian Knutson and Gregory Samanez-Larkin). *PLoS ONE*, 6 (9), September 2011
    c. The influence of affect on beliefs, preferences and financial decisions (with Brian Knutson). *Journal of Financial and Quantitative Analysis*, 46 (3): 605-626, June 2011 (lead article)

2. Dr. Kuhnen has studied the micro-foundations of financial decision making by investigating the genetic mechanisms responsible for learning and risk taking in financial markets.

    a. Serotonergic genotypes, neuroticism, and financial choices (with Brian Knutson and Gregory Samanez-Larkin). *PLoS ONE*, 8 (1), January 2013
    b. Genetic determinants of financial risk taking (with Joan Y. Chiao). *PLoS ONE,* 4 (2), February 2009

3. Dr. Kuhnen has studied the micro-foundations of financial decision making by investigating the brain mechanisms responsible for learning and risk taking in financial markets. In 2005, she innovated new methods for predicting decision making based on brain activity (reversing the traditional IV and DV in neuroimaging analyses). This approach is now used in many papers across the field.

    a. Delays conferred by escalating costs modulate dopamine release to rewards but not their predictors (with Matthew Wanat and Paul Phillips). *Journal of Neuroscience*, 30 (36): 12020-12027, September 2010
    b. Variability in nucleus accumbens activity mediates age-related suboptimal financial risk taking (with Gregory Samanez-Larkin, Daniel Yoo, and Brian Knutson). *Journal of Neuroscience*, 30 (4):1426-1434, January 2010
    c. Nucleus accumbens activation mediates the influence of reward cues on financial risk taking (with Brian Knutson, G. Elliott Wimmer and Piotr Winkielman). *NeuroReport*, 19 (5): 509-513, March 2008
    d. The neural basis of financial risk taking (with Brian Knutson). *Neuron*, 47:763-770, September 2005

4. In her corporate finance work, Dr. Kuhnen has analyzed issues at the intersection of behavioral and organizational economics. She has studied how firms select and incentivize employees and has demonstrated the importance of social connections and social comparisons for these processes.

    a. CEO turnover in a competitive assignment framework (with Andrea Eisfeldt). *Journal of Financial Economics*, 109 (2): 351-372, August 2013 (download CEO turnover dataset)
    b. Public opinion and executive compensation (with Alexandra Niessen). *Management Science*, 58 (7): 1249-1272, July 2012
    c. Feedback, self-esteem and performance in organizations (with Agnieszka Tymula). *Management*

Science, 58 (1): 94-113, January 2012
   d. [Business networks, corporate governance and contracting in the mutual fund industry](). *Journal of Finance,* 64 (5): 2185-2220, October 2009

Complete list of published work:
http://public.kenan-flagler.unc.edu/faculty/kuhnenc/RESEARCH/research.html

D. Research Support

Active

UNC Interdisciplinary Initiatives Grant Award   Lindquist (PI)   2015–2016
Identifying Biomarkers of Peer Influence Susceptibility.
Role: Co-Investigator

Completed

NIA/NIH   R24-AG039350   Carstensen, Samanez-Larkin (MPI)   09/30/10–05/31/15
Scientific Research Network on Decision Neuroscience and Aging
Network grant to support dissemination and training activities related to an emerging multidisciplinary science of decision making and aging.
Role: Consultant / Committee Member

NIA/NIH   R21-AG030775   Phillips (PI)   08/15/07–7/31/10
Dopaminergic Modulation of Cost/Benefit Decision Making During Aging
The study is focused on the role of neurotransmitter dopamine in the coding of benefits, costs and risk during economic decision making and the influence of aging on these effects. We study the link between dopamine release in the rat brain and the economic trade-offs made regarding costs and benefits of actions and risks and rewards. We measure these effects in two animal groups, young and old, to see whether the diminished capacity for dopamine release that comes with aging influences these economic trade-offs.
Role: Co-Investigator

NIA/NIH   R21-AG030778   Knutson (PI)   08/15/07–6/30/10
Anticipation of Reward and Risk Across the Lifespan
This project examines not only how the brain anticipates reward and risk, but also how this may change with age. We use brain imaging technology with healthy humans to examine predictors of financial risk taking in young, middle-aged, and older adults with the goal of illuminating how individuals make both optimal and suboptimal financial decisions over the course of the life span.
Role: Consultant

FINRA   2006-07-004   Knutson (PI)   01/01/07–12/31/09
Individual Differences in Financial Risk Taking Across the Lifespan
This project investigated the influence of psychological individual difference variables on real world economic decision making.
Role: Co-Investigator

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: Ye Li

eRA COMMONS USER NAME (credential, e.g., agency login): yl2629

POSITION TITLE: Assistant Professor of Management & Marketing

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
California Institute of Technology, Pasadena, CA	B.S.	06/2004	Economics / Electrical Engineering
University of Chicago, Chicago, IL	M.B.A./Ph.D	08/2009	Behavioral and Experimental Economics / Judgment and Decision Making
Columbia University, New York, NY	Postdoctoral	06/2012	Decision Science

A. Personal Statement

My undergraduate, graduate and postdoctoral training have all been at the intersection of psychology and economics. I have a fair amount of theoretical training and practical experience designing and running experiments in the laboratory, online, and in the field. I am proficient with analysis of experimental data and have worked with multiple large panel datasets. My primary role in my recent postdoctoral fellowship at the Center for Decision Science was performing complex data analyses (including structural equation modeling) for research on the relationship between aging, cognitive processes, and decision-making. I am also versed in experimental psychology and economics literatures relevant to the present research.

B. Positions and Honors

Positions and Employment
2012-　　　　Assistant Professor of Management & Marketing, University of California, Riverside
2009-2012　　Postdoctoral Research Fellow, Center for Decision Sciences, Columbia University, New York

Other Experience and Professional Memberships
2008-　　　　Academy of Management
2011-　　　　Member, Association for Psychological Science
2011-　　　　Member, Association for Consumer Research
2015-　　　　Member, Behavioral Science & Policy Association
2005-　　　　Member, Society for Judgment and Decision Making

C. Contribution to Science

My research on aging and decision making has been funded by two NIA grants and partially by the National Endowment for Financial Education. In this set of papers, my coauthors and explore how cognitive aging affects decision making ability. In particular, we hypothesized that older adults' higher levels of *crystallized* intelligence would help offset their lower levels of *fluid* intelligence, and that both types of intelligence can help with good decision-making. We tested and confirmed this hypothesis by collecting a battery of cognitive measures and multiple measures of economically important decision-making traits including temporal

discounting, loss aversion, and financial literacy. The PNAS further developed our understanding by 1) using a real-world measure of financial decision making, credit scores, 2) distinguishing the roles of domain-specific crystallized intelligence, and 3) using a larger, more representative sample that includes the full adult age range.

1. **Li, Ye**, Jie Gao, *Zeynep Enkavi,* Lisa Zaval, Elke U. Weber, and Eric J. Johnson (2015) "Sound credit scores and financial decisions despite cognitive aging." *Proceedings of the National Academy of Sciences* [IF 9.809], 112(1), 65-69. DOI: 10.1073/pnas.1413570112

2. Zaval, Lisa, **Ye Li**, Eric J. Johnson, and Elke U. Weber (2015). "Complementary Contributions of Fluid and Crystallized Intelligence to Decision Making Across the Life Span." In T.M. Hess, J. Strough, & C.E. Löckenhoff (Eds.), *Aging and Decision-Making: Empirical and Applied Perspectives* (p.149-168), Academic Press.

3. **Li, Ye**, *Martine Baldassi*, Eric J. Johnson, and Elke U. Weber (2013). "Compensating Cognitive Capabilities, Economic Decisions, and Aging." *Psychology & Aging* [IF 2.913], 28(3), 595-613 [Lead Article]. DOI 10.1037/a0034172

4. Zaval, Lisa, **Ye Li**, and Eric J. Johnson. "Affective forecasting for future consumption improves across the life span." Revising for resubmission to *Journal of Consumer Research*.

My research on emotions and decision making takes a look at another important determinant of economics decisions, in this case, through a more automatic affective route. For example, Jennifer Lerner, Elke Weber, and I examine whether the sense of emptiness that accompanies sadness can lead to an increased urgency to acquire new goods. We tested this hypothesis by combining mood induction procedures with intertemporal choices. Sad participants were significantly more impatient than neutral or disgusted participants. Following up on this, and contrary to the idea that emotions are always a source of impatience, my coauthors and I also searched for emotions that improve patience. Importantly, rather than showing that any positive emotion helps patience, we show that general happiness has no effect on sadness and that gratitude's role in reciprocity is necessary to focus people on the future. We summarize the state of research in this domain in the annual review chapter.

5. Lerner, Jennifer S., **Ye Li**, Piercarlo Valdesolo, Karim Kassam (2015). "Emotion and Decision Making." *Annual Review of Psychology* [IF 16.833], 66, 799-823. DOI: 10.1146/annurev-psych-010213-115043

6. DeSteno, David, **Ye Li**, *Leah Dickens*, and Jennifer S. Lerner (2014). "Gratitude: A Tool for Reducing Economic Impatience." *Psychological Science* [IF 4.431], 25(6), 1262-1267. DOI 10.1177/0956797614529979

7. Lerner, Jennifer S., **Ye Li**, and Elke U. Weber (2013). "The Financial Cost of Sadness." *Psychological Science* [IF: 4.431], 24(1), 72-79. DOI 10.1177/0956797612450302

Most of my remaining projects focus on decision biases caused by overweighing of salient information. People often face decisions in which the information necessary for making an optimal choice is either difficult to find, too complex to understand, or hard to integrate. Instead of finding and integrating all the necessary information, people make use of what is most salient. For example, Nicholas Epley and I show that people's tendency to overweigh the vividness of recent hedonic experiences leads to order effects when evaluating options sequentially. When choosing from generally good options, all else equal, the most recent option is liked best because its hedonic experience is still fresh whereas earlier experiences have faded in memory to seem more average. For the same reason, when choosing from generally bad options, the most recent option is liked least, but now fading hedonic experience actually makes earlier options seem better in memory than they were in reality. Eric Johnson, Lisa Zaval, and I show that people's judgments about global warming are influenced by whether today's temperature is cooler or warmer than usual, a more readily available cue than the complex and conflicting news reports about global warming.

8. **Li, Ye**, Eric J. Johnson, and *Lisa Zaval* (2011). "Local Warming: Daily Temperature Deviation Affects Beliefs and Concern about Climate Change." *Psychological Science* [IF 4.431], 22(4), 454-459. DOI 10.1177/0956797611400913

9. **Li, Ye** and Nicholas Epley (2009). "When the best appears to be saved for last: Serial position effects on choice." *Journal of Behavioral Decision Making* [IF 2.082], 22(4), 378-389. [DOI 10.1002/bdm.638](DOI 10.1002/bdm.638)

D. Research Support

<u>Ongoing Research Support</u>

- **PI:** Whether and when patience levels determine real-world intertemporal choices. *Regents Faculty Fellowship*, University of California, Riverside.   2014-2016

- **Collaborator:** How can people become lastingly more humble? Development of a long-term humility-boosting program. *John Templeton Foundation* (58430)   2015-2018

<u>Completed Research Support</u>

- **PI:** Cognitive Capabilities, Decision-Making Ability, and Financial Outcomes Across the Lifespan. *National Endowment for Financial Education* (5236)   2012-2014

- **Consultant**: Cognitive and Emotional Sources of Wisdom in Decision Making Across the Lifespan. *National Institute on Aging* (1R01AG044941)   2012-2014

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: Lighthall, Nichole R.

eRA COMMONS USER NAME (credential, e.g., agency login): nlighta

POSITION TITLE: Assistant Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Univ. of California, Berkeley, Berkeley, CA	BA	12/2003	Psychology
Univ. of California, Santa Cruz, Santa Cruz, CA	(PhD student)	06/2007	Psychology (Cognitive)
Univ. of Southern California, Los Angeles, CA	PhD	08/2012	Gerontology
Duke University, Durham, NC	(Postdoc)	07/2015	Cognitive Neuroscience

A. Personal Statement

My training and research expertise have prepared me well to serve as a director of the Scientific Research Network on Decision Neuroscience and Aging. I hold a Ph.D. in gerontology from the University of Southern California where I was mentored by Dr. Mara Mather and conducted research on effects of stress on decision making in aging using behavioral research and functional magnetic resonance imaging (fMRI). This research highlighted the powerful impact that stress has on decision making across adulthood and indicated that stress effects on reward-related decision making may occur via modulation of the dopamine system, with older adults exhibiting maintained or enhanced stress effects relative to younger adults (Lighthall et al., 2012; 2013; Mather and Lighthall, 2012). In addition, I completed a postdoc in Cognitive Neuroscience at Duke, where I worked in the labs of Drs. Roberto Cabeza and Scott Huettel and collaborated on fMRI studies examining the impact of memory dependence and age-related memory decline on decision processing. This research revealed that age differences in decision processing are magnified by dependence on explicit memory (Lighthall et al., 2014), but that age differences in decision performance can be minimized through recruitment of additional brain activation. This year, I began a faculty position in the psychology department at the University of Central Florida (UCF). Broadly, my research program at UCF aims to determine mechanisms of decision processing, and how cognitive and affective factors modulate decision processing in human aging. To address this goal, I utilize an array of behavioral, physiological, and neuroimaging techniques. Relevant to the SRNDNA aims, I am collaborating with researchers from different fields in order to address novel questions about how brain aging affects economic decision making. I currently have collaborations with faculty from economics (Dr. Camelia Kuhnen, University of North Carolina, Chapel Hill), neurology (Dr. Stephen Berman, UCF), biomedical sciences (Dr. Kiminobu Sugaya, UCF), clinical psychology (Dr. Daniel Paulson, UCF), and developmental psychology (Dr. Natalie Ebner, University of Florida). Taken together, my research background clearly demonstrates a specialization in the emerging field of aging decision neuroscience. Finally, I have been an active participant in previous SRNDNA activities, including analysis workshops, conferences, and the grant program – the latter resulting in a pilot grant award. In sum, my background and experience with SRNDNA puts me in a unique position to foster the development of scientists in this field, as well as high-impact aging decision neuroscience research with translation potential.

B. Positions and Honors
Positions

2004-2006	Research Assistant, Department of Psychiatry and Behavioral Sciences, Stanford School of Medicine
2012-2013	Postdoctoral Associate, Center for Cognitive Neuroscience, Duke University
2013-2015	Postdoctoral Scholar, Center for Cognitive Neuroscience/Center for the Study of Aging and Human Development, Duke University
2015-	Assistant Professor, Department of Psychology, University of Central Florida

Honors

2003	Distinguished Service Award, Psychology Department, UC Berkeley
2003	Undergraduate Fellowship, Summer Training on Aging Research Topics – Mental Health, NIMH
2007	Graduate Research Fellowship Honorable Mention, NSF
2007	Graduate Fellowship, Summer Training on Aging Research Topics – Mental Health, NIMH
2007-2010	Institutional National Research Service Award Predoctoral Fellowship, University of Southern California, NIA
2011	Fellowship, Summer Institute in Cognitive Neuroscience, UC Santa Barbara, NIMH
2011-2012	Individual National Research Service Award Predoctoral Fellowship, University of Southern California, NIA
2012	Graduate Student Award, University of Southern California
2012	Heinz Osterburg Prize for Best Dissertation, Davis School of Gerontology, University of Southern California
2013-2015	Institutional National Research Service Award Postdoctoral Fellowship, Duke University, NIA

C. Contribution to Science

My research program uses cognitive neuroscience methods to determine mechanisms of decision processing, and how cognitive and affective factors modulate decision processing across adulthood.

Full list of publications:
http://www.ncbi.nlm.nih.gov/myncbi/browse/collection/47994131/?sort=date&direction=ascending

Effect of stress on cognition across adulthood
Aging is associated with declines in feedback-based learning which are thought to result from age-related declines in the dopamine system. As a PhD student, I led several projects examining the possibility that states triggering increased dopamine action could alter, and perhaps enhance, reward learning in older adults. The first study in this vein aimed to alter feedback-based learning by manipulating acute stress. Acute stress enhances phasic dopamine release and dopamine neuron firing rates. Thus, stress has the potential to enhance learning by amplifying dopamine-dependent reward and learning signals. We found that application of cold-pressor stress before a probabilistic learning task enhanced younger and older adults' ability to select cues associated with positive outcomes, with no age differences in the magnitude of stress effects on behavior or stress hormones (Lighthall et al., 2013). Notably, older adults' accuracy in selecting positive cues under stress reached the level of younger adults in the control condition. A follow-up study with social feedback showed that stress enhances the subjective motivation to obtain positive feedback (Lighthall et al., in prep). Again, these stress effects did not differ between younger and older adults. Based on these findings and similar results in the literature, we proposed the STARS Model of stress effects on dopamine-dependent processing, which posits that stress triggers additional reward salience (Mather and Lighthall, 2012). These findings suggest that, despite age-related declines in feedback-based learning and the dopamine system, older adults' ability to learn about reward predictors is amplified by stress, and in the same manner as we observe in young adults. Thus, emotion-based perturbations of the striatal learning system appear to have the same impact on behavior from early to late adulthood.

Interactions of memory and decision making in aging
Based on my earlier research, I began considering the possibility that decision processing may face greater age-related decline when it relies on declarative (e.g., hippocampal) versus implicit (e.g., striatal) memory systems. This idea was also strongly supported by behavioral research indicating greater decline in performance on hippocampal versus striatal memory tasks. As a postdoc, I received a pilot research grant from the Scientific Research Network on Decision Neuroscience and Aging to conduct this project (via the R24 grant proposed in this application) to test this hypothesis. The project examined age differences in striatal and

hippocampal contributions to feedback-based learning using functional magnetic resonance imaging (fMRI). In typical reinforcement learning tasks, feedback immediately follows choice, and learning signals (e.g., prediction errors) are typically observed in the striatum. However, recent fMRI research with young adults has shown that adding a delay between choice and outcome shifts learning signals from the striatum to the hippocampus. Using the same fMRI paradigm, my study examined age differences in feedback-timing effects on response to reward prediction errors in different memory systems. Study findings indicated an age-related decline in hippocampal response to reward prediction errors, but relative maintenance of the striatal prediction error signal (Lighthall et al., in prep). These findings hold important implications for intervention development to improve decision making in aging. Specifically, suggesting that efforts should target decision processing that relies on declarative memory.

Additional studies in my research program support this claim, suggesting that age differences everyday decision processing are magnified when choices rely on delayed retrieval. However, age differences in choice behavior may be reduced if older adults can recruit additional neural resources that support decision performance. Although such "functional compensation" is well documented in other cognitive domains, it remained unclear whether it can support memory-guided decision making, and if so, which brain regions play a role in compensation. To examine memory-dependent choice processing, I developed a novel fMRI paradigm in which pairs of consumer products from Amazon.com were evaluated with different delays between the first and second product (Lighthall et al., 2014). While there were no age differences in value-related processing, we found that ventromedial prefrontal cortex (vmPFC) activity increased with memory-retrieval demand during choice. Furthermore, greater vmPFC activation predicted better performance in older adults – evidence of successful compensation. We also found that connectivity between the vmPFC and dorsolateral PFC predicted external measures of decision competence in older adults. Together, our results indicate that when the older brain encounters decision challenges due to memory demand, it can compensate by recruiting the vmPFC in order to improve performance.

Risk taking: The impact of aging, acute stress and gender

It is commonly thought that older adults are more risk averse, but the evidence for this stereotype is inconsistent; thus, it is difficult to know whether feelings about risk change with age. To address this gap in our understanding of risk processing, my colleagues and I examined risk taking in younger and older adults during a driving game. In the game, participants earned points for driving a car through a yellow light, but lost points for the trial and heard a loud police siren if the light turned red before they braked (Mather, Gorlick and Lighthall, 2009). We found no age differences in risk taking under control conditions, but with exposure to cold-pressor stress, older adults showed reduced risk taking. Age differences in risk taking also depend on alternatives to risky options. Our research showed that, when presented with a risky option and a sure-thing option, older adults exhibit a greater preference for sure gains and a greater aversion for sure losses, with no age differences in risk preference when both options involved risk (Mather et al., 2012). Further, in this study, choices for sure-thing options were associated with more emotional decision making. These studies provide support for the idea that emotional states modulate risk taking, but emotion effects may be enhanced in older age. Another common stereotype is that women are more risk averse than men. In terms of real-world financial decisions, men do appear to take more risk, and also have higher rates of risk-related outcomes such as accidental death. Related to emotion interactions, it has been proposed that stress exerts different bio-behavioral effects on males and females given gender-specific evolutionary pressures. Applied to risk taking, evolution should select for more risk-averse behavior in females under stress (to protect dependent offspring) but potentially more risky behavior in males (to compete for resources). We tested this hypothesis by applying cold-pressor stress to young men and women, and then having them complete a computerized gambling task (Lighthall, Mather and Gorlick, 2009). In line with Taylor et al.'s evolutionary theory, we found that under stress, men's behavior became riskier and women's became more risk averse. To examine the neural correlates of these effects, we conducted a follow-up study using fMRI (Lighthall et al., 2012). Our results showed that, in the active-choice condition, stress increased activation in the anterior insula and dorsal striatum in men, but decreased activation in these regions in women. Further, increased stress hormones in males predicted striatal response to the task in the active-choice condition. Together with accumulating behavioral research, these studies indicated that stress amplifies gender differences in risk taking during early adulthood, resulting in a gender-divergence effect (Mather and Lighthall, 2012). Further, the findings from our fMRI study went beyond previous behavioral work to show that gender-dependent stress effects on risk taking involve brain regions associated with habit behavior (dorsal striatum) and integration of affective and cognitive signals (anterior insula). Notably, stress-by-gender effects were not observed in prefrontal regions associated with deliberate

processing, suggesting that stress effects alter risk taking via automatic/affective, rather than deliberative/cognitive, neural mechanisms.

D. Research Support
Current
UCF College of Medicine PI: Paulson (Co-Investigator: Lighthall)   award dates: 01/15/16 – 01/15/17
Caregiver support group interventions and stress
The overall aim of this project is to test the effectiveness of a behavioral intervention for caregivers of patients with dementia. The project will specifically target effectiveness in reducing psychological and biological measures of caregiver stress and how stress reduction predicts change in cognitive and emotional outcomes.

Completed
R24-AG039350   PI: Carstensen, Samanez Larkin (sub-award PI: Lighthall)
sub-award dates: 09/01/14 – 03/30/15
Sub-award title: *Feedback-based learning in aging: Specific contributions of striatal and hippocampal systems*
The goal of this study is to investigate age differences in striatal- and hippocampal-supported feedback learning using functional magnetic resonance imaging (fMRI).

F31-AG038137   PI: Lighthall   award dates: 04/01/2011 – 08/01/2012
Title: *Effects of stress on motivated behavior: Age differences in and neurophysiological mechanisms*
The overall aim of the proposed research is to determine the mechanisms driving effects of acute stress on learning involving rewarding and aversive feedback in normal aging.

BUDGET JUSTIFICATION

PERSONNEL

Gregory Samanez Larkin (PI)
Gregory Samanez Larkin will devote 1 summer month for grant years 1–4 and 2 summer months in the final grant year. Dr. Samanez Larkin will supervise the overall execution of the project including activity planning (invitation list, selection of topics for presentation / discussion / instruction for meetings and workshops), activity participation (chairing sessions, leading discussions), overseeing small grant application solicitation and review, and all annual reporting for the grant. He will be assisted in these activities by the co-organizers/ consultants Lighthall, Li, Kuhnen, and Carstensen.

Jennifer Crawford, Research Assistant / Lab Manager
Jennifer will devote 40% of her time in Years 1 and 5 (when most administrative support is needed for initial planning in Y1 and project wrap-up in Y5) and 33% of her time in Years 2–4. She will provide the majority of the administrative support. She has previously helped with network activities and has experience with planning and executing meetings, conferences, and workshops. She will handle travel arrangements, reimbursements, and general planning details for the proposed events. She will also maintain the web presence and newsletter of the network, which will publicize details about all activities, funding and career opportunities, and network affiliates. She will be assisted in the financial management of the network by grants management staff in the Department of Psychology at Yale.

Salaries are projected to increase 3% annually.

FRINGE BENEFITS

Fringe benefits for the Principal Investigator are calculated at the Exempt provisional rate of 31% throughout the project period. Fringe rate for the Research Assistant are calculated at the Non-exempt provisional rate of 57.9% throughout the project period. These rates are in accordance with our DHHS approved rate agreement, dated 9/18/15.

TRAVEL

Travel costs are associated with the workshops in Years 1, 3, and 4 and Conferences in Years 2 and 5. Meetings will be scheduled to maximize availability of key individuals in the field. Travel funds will cover all presenter, attendee, and administrative support staff travel to workshops and conferences. Based on experience over the past five years with this network, these estimated costs include flights (~$540-560 per person) and lodging at conference hotels or hotels near a hosting university (~$220/night). Up to two-night hotel stays will be provided for workshops and up to three-night stays for conferences. The travel budget covers 29 individuals for Workshop I, 30 individuals for Workshop II, 31 individuals for Workshop III, 38 individuals for Conference I, and 59 individuals for Conference II.

Year totals are calculated as follows:
Year 1: Workshop I $29,000
Year 2: Conference I $45,600
Year 3: Workshop II $30,000
Year 4: Workshop III $31,000
Year 5: Conference II $82,000

OTHER EXPENSES

Office supplies. Pens, paper, and general classroom supplies will be purchased for all events ($300 for preconference workshops and $500 for each conference).

Pilot Grants. Two seed grants of $20,000 will be awarded per year in Years 1–4 based on a competitive process. These will be issued as subawards and so we have included an additional ~60% (based on previous

awardee institutions) to account for indirect costs at the subaward institution bringing the total cost per award to ~$32,000.

Honoraria for Collaborative Review Volume Contributors. We will invite contributors to co-author chapters to a review volume who are working in previously disconnected but complementary areas and who have not previously worked together. To incentivize this collaborative effort, we will provide honoraria to the authors, which could be used to support time spent developing these research ideas or visits to each other's labs.

Honoraria for Presenters and Teaching Fellows. In addition to the lectures and teaching support offered during the events, faculty presenters and teaching fellows will need to spend time preparing course materials before the events. We will provide honoraria as compensation for this contribution to the courses ($1,000 per faculty presenter and $500 per teaching fellow). We estimate that faculty presenters and teaching fellows will invest 12-15 hours in preparation and lecturing (presenters) or helping students with projects (fellows).

Publication and Poster Awards. At each of the two conferences, we will present a Poster Award for the best conference poster ($1,000) and an Innovative Publication Award ($1,000) for a paper published in the past 3 years.

Conference Rental Fees. Based on previous activities we estimate that Conference I will require an ~$1,000 facility rental fee and Conference II will require a ~$4,000 facility rental fee (based on the size of the event). We also include a Poster Board and audiovisual equipment rental fee of ~$3,000 for each conference.

Videotaping services. A film crew will record the first workshop and create an online course using these clips for posting on the network website ($5,500).

Collaboration/Mentorship Stipends. Collaboration/mentorship stipends will be awarded in Years 3 and 4. Collaboration/Mentorship Stipends for graduate students and post-docs (to be split between advisors and trainees) will support the forging of a new mentor-mentee relationship that did not previously exist. We will award three $2000 stipends in each year. Student Summer Stipends (for increasing diversity in science) will be available to under-represented undergraduates who would like to spend the summer working full-time in a research lab before their senior year but do not have the financial means to do so. We will award three $5000 stipends in Year 3 and two $5000 stipends in Year 4.

Consultant Services. Consultant fees are budgeted for Professors Lighthall, Li, Kuhnen, and Carstensen at a rate of $500/day/person for 10 days per grant year.

INDIRECT COSTS

Indirect costs are calculated at the Federal On-campus rate of 67.5% for FY16-17, and at the same provisional rate for the remainder of the project period. These rates are in accordance with our DHHS approved rate agreement, dated 9/18/15.

RESEARCH & RELATED BUDGET - Cumulative Budget

	Totals ($)	
Section A, Senior/Key Person		87,268.00
Section B, Other Personnel		136,397.00
Total Number Other Personnel	5	
Total Salary, Wages and Fringe Benefits (A+B)		223,665.00
Section C, Equipment		
Section D, Travel		217,600.00
1. Domestic	217,600.00	
2. Foreign		
Section E, Participant/Trainee Support Costs		
1. Tuition/Fees/Health Insurance		
2. Stipends		
3. Travel		
4. Subsistence		
5. Other		
6. Number of Participants/Trainees		
Section F, Other Direct Costs		432,400.00
1. Materials and Supplies	1,900.00	
2. Publication Costs		
3. Consultant Services	100,000.00	
4. ADP/Computer Services		
5. Subawards/Consortium/Contractual Costs		
6. Equipment or Facility Rental/User Fees		
7. Alterations and Renovations		
8. Other 1	325,500.00	
9. Other 2	5,000.00	
10. Other 3		
Section G, Direct Costs (A thru F)		873,665.00
Section H, Indirect Costs		589,724.00
Section I, Total Direct and Indirect Costs (G + H)		1,463,389.00
Section J, Fee		

PHS 398 Research Plan

Please attach applicable sections of the research plan, below.

1. Introduction to Application (for RESUBMISSION or REVISION only)	
2. Specific Aims	r24specificaims.pdf
3. Research Strategy*	r24researchstrategy.pdf
4. Progress Report Publication List	

Human Subjects Sections	
5. Protection of Human Subjects	
6. Inclusion of Women and Minorities	
7. Inclusion of Children	

Other Research Plan Sections	
8. Vertebrate Animals	
9. Select Agent Research	
10. Multiple PD/PI Leadership Plan	
11. Consortium/Contractual Arrangements	
12. Letters of Support	all_letters_of_support.pdf
13. Resource Sharing Plan(s)	

Appendix (if applicable)	
14. Appendix	

SPECIFIC AIMS

The goal of this grant is to continue supporting a scientific network to increase multidisciplinary research on decision neuroscience and aging. The next five years of this research network will focus on continued growth (Aim 1), development and expansion (Aim 2), and sustainability (Aim 3).

Aim 1: All activities will support *growth* by increasing the number of researchers in the network from a variety of disciplines

The emerging field, the decision neuroscience of aging, that we seek to continue developing with this network grant lies at the intersection of several disciplines. The success of this network will depend on the inclusion of members from a variety of fields including psychology, economics, neuroscience, and genetics and possibly even computer science, sociology, and public health. Thus, we will attempt to recruit a representative and balanced network of researchers (from the key personnel primarily responsible for organizing the activities to the participants in the meetings, workshops, and funding opportunities) from all of these fields. We will also include a wide range of rank in the network from graduate students and post-doctoral fellows to junior- and senior faculty. The grant will also support growth of the network directly through dissemination activities. Meetings and workshops will increase awareness of the latest findings, foster collaboration opportunities, train individuals in new integrative methods, and update members on general network progress with the goal of drawing new researchers into this area. An annual small grant competition will encourage researchers to join the field and will stimulate new research in the area through small scale pilots.

Aim 2: All activities will support *development and expansion* by increasing the breadth of research and methodological expertise of all researchers in the network

An increase in multidisciplinary and integrative training of and research by scientists at all stages is essential to ensure the future success of the field this network supports. In addition to combining brain imaging methods from neuroscience, theories and experimental methods from psychology, and models and analysis strategies from economics to investigate individual decisions, this field has the potential for even greater impact through the inclusion of additional biomarkers (e.g., genetics, hormones), extension beyond the recent focus on financial decisions and into physical and mental health-related decision making and social decision making, and developing strategies for future integration with large panel datasets around the world. Short, intensive workshops will focus on training researchers at all stages in the collection, organization, and analysis of various emerging biological and behavioral measures. The development of these skills is currently difficult to obtain in traditional single discipline training programs, but will be essential for taking advantage of the growing number of large multivariate and multi-level integrative datasets generated in this field in the future.

Aim 3: All activities will contribute to the *sustainability* of this emerging field of research on decision neuroscience and aging

In general the network will focus on investing in the future of this field by ensuring that graduate students, post-doctoral fellows, and junior and senior faculty including those from underrepresented and diverse backgrounds are invited to all meetings and workshops. Workshops, meetings, and small grants opportunities will facilitate the transition from a growing but still small group of individuals managing network activities to a strong field of researchers taking ownership of future work in this area. Over the next five years, the committee will document changes in publications, major conferences presentations, grants, fellowships, and media coverage of work in this field. All activities should increase the number of integrative research and training applications submitted to NIA to support work in this area. After completion of activities, this emerging field will be further established and in a better position for network members to pursue funding to support the network in the future using more traditional mechanisms (e.g., research grants, conference grants, program projects, centers, institutional training grants, and individual fellowship applications).

SIGNIFICANCE

Unprecedented demographic changes are drastically and rapidly increasing the relative number of older adults across the globe [1]. A larger proportion of older decision makers will have tremendous impact on the economic, social, and heath outcomes of the population [2]. To address these important changes most effectively, we need to increase scientific research on decision making across the life span using radically new and integrative approaches [3]. Currently, life-span research is not sufficiently integrative. Research on adult development and aging often focuses narrowly on individual methods for data collection and the resulting restricted set of dependent variables impedes cross-talk between disciplines. Further, this research is often bound by the existing common practices within specific fields of psychology, neuroscience, and economics instead of combining the strength of different analytical techniques. For example, psychologists often focus on specific processing mechanisms in relatively small random samples of individuals. Additionally, psychologists use laboratory-based tasks that may be well controlled but also may be limited in ecological validity. Similarly, neuroscientists focus on specific systems in the brain in relatively small groups of individuals. Neuroscientists often examine the function of very specific structures supporting attention, memory, or motivation but less often examine the integration of these functions and often ignore individual differences. Economists develop powerful mathematical models of human decisions and have access to much larger and more representative datasets of human decisions, but also commonly ignore individual differences and often the traditional models do not account for cognitive and affective limitations or biases. This current within-field approach contributes to a fragmented understanding of decision making across the life span. However, the strengths of all of these fields can be integrated to overcome the weaknesses of each field on its own. Combining expertise from these different disciplines can and has produced powerful integrative scientific research [4,5] on decision making [6].

Decision neuroscience (or "neuroeconomics") (Figure 1) aims to better understand human decision making by integrating methods, theories, and approaches across multiple fields including but not limited to psychology, neuroscience, and economics [7-11] through team-based, multidisciplinary research. To date, the most productive and effective groups working in this area are composed of teams of scientists with a shared base of knowledge with each individual in the team possessing their own unique expertise from their home discipline. Although this field has only recently developed, the combination of methods and expertise has already produced high-impact basic research with translational implications. Recent examples based on data collected using the decision neuroscience approach have led to the development of effective solutions to overbidding in auctions [12], more accurate valuation strategies that address the free rider problem for public goods [13], and enhancements of public health messaging to reduce risky health behaviors related to lung and skin cancer [14-17]. Integrative research in decision neuroscience has the potential to contribute to the creation of novel and potentially more effective interventions (e.g., [14]) than will be produced within single disciplines. Further, this approach has the potential to inform the development and refinement of theories within all of these fields that will ideally directly

Figure 1. Decision Neuroscience is a new discipline resulting from the combination of methods and models from several fields including psychology, neuroscience, and economics.

contribute to significant improvements in policy and practice. However, the majority of studies using the decision neuroscience approach have been limited to data collected from undergraduate convenience samples. Critically, these may not be representative groups of subjects, especially when examining decision making [18-20]. The NIA has demonstrated commitment to extend this emerging and powerful field to the study of adult development and aging through an initial series of activities from 2006 to 2010 and through the support of the first wave of this research network from 2011 to 2015 (R24-AG039350). This grant will continue to support additional initiatives by the Scientific Research Network on Decision Neuroscience and Aging (www.srndna.org). Over the past five years we have had some initial success but this area needs sustained commitment to continue to expand research beyond financial decision making to a wide range of decisions throughout the life course that affect old age relevant health decision making and health outcomes. The area this network supports will not only lead to the creation of an independent field of research, but will also improve scientific knowledge within health economics, psychology, neuroscience, and potentially many other fields.

Although decision neuroscience research has been growing in recent years, the approach has been relatively slow to be applied to the study of aging and decision making. Initial research has begun to
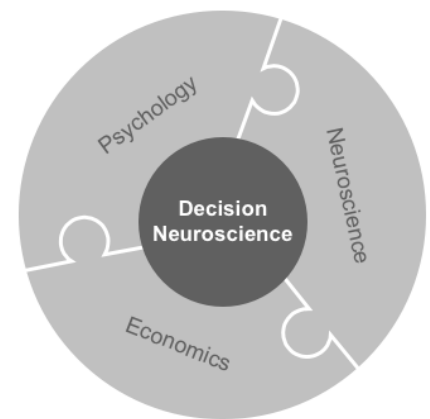
characterize how age differences in the structure and function of frontostriatal brain systems supporting reward-based decision making are related to age differences in sensitivity to monetary gains and losses, intertemporal decision making, risky decision making, and reward learning [6].

Simple Incentive Processing. Initial behavioral research revealed that although younger and older adults do not differ in their self-reported feelings of positive arousal/activation during the anticipation or receipt of monetary gains, older adults report lower levels of negative arousal/activation during the anticipation of monetary losses [23,24]. This asymmetry in gain and loss anticipation as a function of age is consistent with a large body of behavioral research demonstrating an age-related positivity effect [25,26]. Functional magnetic resonance imaging studies that have examined adult age differences in the basic function of the reward system are

Figure 2. Gain anticipation increased nucleus accumbens (NAcc) activity in both younger (ages 19–27) and older (ages 65–81) adults (left panels). Loss anticipation, however, increased AI activity in younger, but not older, adults (right panels). Y-axis represents percentage FMRI activity change in the ventral striatum (VS, including the NAcc). [24]

consistent with the behavioral effects reported above; neural activity in the striatum is similarly modulated by reward magnitude in younger and older adults during the anticipation [24] and receipt of monetary gains [24,27-29] (see Figure 2). These studies provide initial evidence that basic neural responses to the anticipation and receipt of monetary gains are relatively preserved from young adulthood to old age. However, a different pattern emerges for anticipatory responses to monetary losses. Older compared to younger adults show reduced reactivity in the caudate (within the striatum) and the anterior insula during anticipation of monetary loss [24] (see Figure 2). This asymmetry in anticipatory neural activity recently replicated in an independent sample [30]. Interestingly, these age differences do not extend to loss outcomes. When older adults lose money, they are as reactive to those losses as younger adults [24]. Further, the vast majority of decisions encountered in daily life require not only the simple processing of potential gains and losses but also the integration of these signals with each other and with other relevant information.

Intertemporal Decision Making. Intertemporal choices are decisions in everyday life that involve selecting between outcomes available at different times in the future. Individual differences in temporal discounting, or the reduction in the subjective value of a particular reward due to the time delay until delivery, are common [31]. Although discounting behavior is highly variable in humans, the majority of studies that have examined age differences in temporal discounting report either no age difference or an increasing willingness to wait in older age which corresponds to a lower discount rate for time [32]. This behavioral effect has been observed in both humans and rats [33]. Parallel to the behavioral findings, recent neuroimaging studies find that neural activation in the ventral striatum is reduced when the reward can only be obtained after a significant temporal delay in younger but not older adults [21,22]. Ventral striatal signal increases to both short and long delays in healthy older adults, which is not the case for younger adults. In general, the age group differences across the existing studies are strikingly similar (see Figure 3). One account is that these behavioral and neural effects are evidence for improvement over the life span [22]. Although there is some level of neurobiological decline in these regions with age, relatively similar responses to both short and long delays are observed in older adults. Others have speculated that this age-related improvement may be related to increased experience with the realization of delayed reward over an individual's lifetime [34]. Responses to delayed rewards in older adults may be the result of experience-
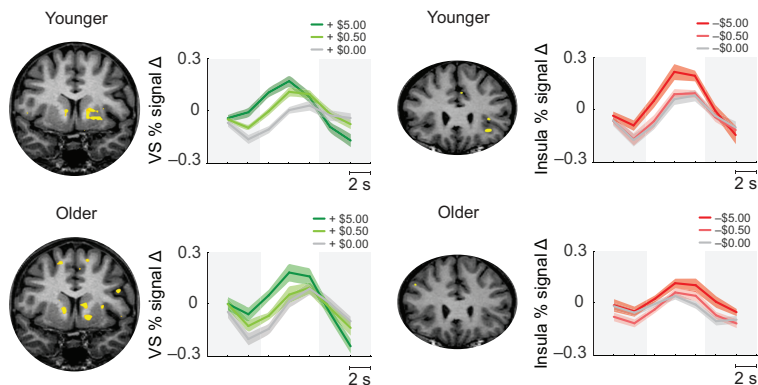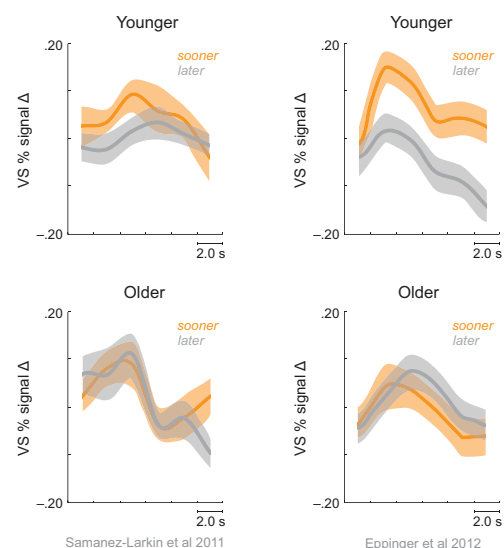

Figure 3. In two recent studies young adults show reduced activation of the ventral striatum (VS) for delayed rewards (grey) compared to rewards available now (orange), whereas this oversensitivity to immediacy was not present in older adults [21,22].

based tuning of reward signals [22] reducing the demand for new integration of novel information. This latter interpretation suggests that it is as if the older adults know that $20 is going to be just as good in two weeks as it is today. In contrast, the younger adults have not had the opportunity to realize interest rates over decades and appreciate the long-term rewards of waiting (however, see [33,35,36]). In contrast, another account of the data is that the reduced sensitivity to immediacy in old age is related to a motivational deficit and lack of reward sensitivity with age [21] (*we will return to this idea below*). Overall, these theoretical accounts are speculative and fully understanding these age differences will require much more experimental data. More generally, the extent to which these changes with age prove advantageous or disadvantageous for decision making in the real world depends on the context [37].

Figure 4. In a risky, learning-based decision task, older adults make more mistakes when choosing assets that are associated with risky rewards (selection of stocks) but do not differ from younger adults in risk aversion (selection of bonds). The behavioral age differences were associated with increased neural variability with age in the striatum (outlined grey areas overlaid on the brain are all voxels that exceeded $p < .0001$, uncorrected) and this neural measure of variability mediated the associations between age and risky stock (RS) mistakes. [29]

Risky Decision Making. In contrast to the certain benefits and certain delays offered in the intertemporal choices described above, many decisions encountered in everyday life are associated with uncertain rewards. There are strong societal stereotypes of older adults as being more risk averse than middle-aged or younger adults. However, stereotypes of risk aversion with age are not supported by results from well-controlled experimental tasks [38]. Focusing on gambling tasks and risky investment decisions, a recent meta-analysis found no evidence for systematic adult age differences in risk taking [39]. Rather, the meta-analysis identified a subset of tasks in which older adults are more risk averse and other tasks in which older adults are more risk seeking than younger adults [39]. It is important to note that in many of these tasks the expression of this "risk preference" is simply a deviation from the reward maximizing strategy in the task. Therefore, it is possible that what appear to be age differences in risk preferences are instead due to cognitive limitations [40] in performing these tasks that require a higher level of information integration. Very few decision neuroscience studies involving choices between low and high-risk options have compared younger and older adults [29,41,42]. One series of studies that used a financial investment task found great neural signal variability in the striatum in older adults was associated with poorer risky decision making [29] (see Figure 4). A parsimonious interpretation of these effects is older adults are having more difficulty learning rapidly from feedback in novel situations. The behavioral age differences replicated in two independent samples [29,43]. This research suggests that variability in forming representations of reward value that require integration of information in a novel environment may increase with age. These findings suggest that what may appear to be age differences in risk preference may instead be differences in cognitive ability. In support of this conclusion, neuroimaging studies of risky decisions that are not dependent on rapid learning from recent experience show similar neural activation of prefrontal regions in younger and older adults [42]. More recent studies, reviewed in the next section below, have focused specifically on age differences in rapid learning-based decisions.

Learning. Learning to integrate prior feedback is often crucial for making optimal decisions. The literature on reward learning reveals consistent age-related declines in performance [44]. In many cases older adults learn more slowly than younger adults although with enough experience they often reach the same performance asymptotes as younger adults [45,46]. Overall, age differences in reward learning and decision making tasks do not appear to be specifically due to the differential processing of gains or losses but are instead due to older adults' general difficulty with learning. Neuroimaging studies have revealed that older adults compared to younger adults show reduced ventral striatal activation especially during the early stages of learning [47] and reduced sensitivity of frontal cortical regions throughout learning [44,45,48]. Recent studies have extended these findings to show that these age differences may be due to older adults' difficulty with dynamically computing prediction errors in novel environments [49,50]. Supporting a dissociation between basic reward sensitivity and reward-based learning, striatal regions are similarly activated in younger and older adults during simple reward-based tasks that do not require novel learning, but these same regions in the
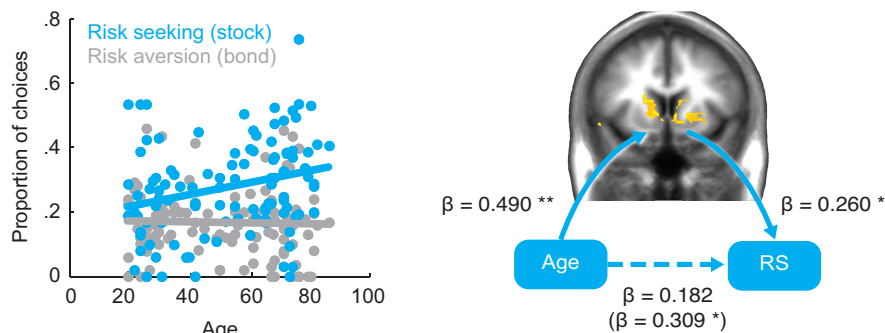
same subjects show increased neural activity variability [29] and reduced representation of prediction errors [46] during tasks that require learning.

The findings of a recent study suggest that the source of age-related striatal functional variability in the striatum observed in risky decision making [29] or the reduced representation of prediction errors in the medial prefrontal cortex and striatum [46,49,50] may be the result of structural changes affecting communication across regions supporting reward learning [52]
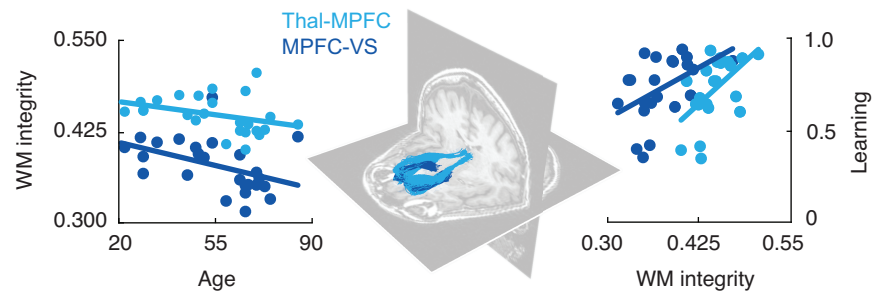

Figure 5. Structural coherence along a frontostriatal axonal tract extending from the dorsomedial nucleus of the thalamus (Thal) to the medial prefrontal cortex (MPFC; light blue) and from the MPFC to the ventral striatum (dark blue) was reduced in older age but associated with better learning. [52]

(see Figure 5). Future studies should directly examine associations between structural and functional measures of connectivity and how each are related to reward processing and decision performance to clarify the effects of structural change on function across this network.

Summary of Current Findings. In summary, many of the age differences in decision making reviewed above may be importantly related to age differences in learning (both over short and long histories of experiences). Arguably, most decisions made in everyday life are driven by predictions of reward based on previous experiences with a particular stimulus or action. Older adults may become more tolerant of delays when making intertemporal decisions partially due to accumulated experience with realizing rewards after delays – a result of a lifetime of learning that may have crystallized representations of delayed reward over time. In contrast, the increase in risky decision mistakes described above are likely due to the demands of the task which require rapid learning and integration of information in a novel environment — in which previous experience with risky rewards outside of the task does not confer any benefit. In both cases, understanding age differences in learning-based integration of information is critical. Future research should more directly assess the extent to which learning accounts for age differences in decision making. Already this work has identified interesting divergent patterns across adulthood; in some situations the elderly outperform young adults and in other situations they appear to make more mistakes. Taken together, the evidence suggests that older adults do well when making decisions that rely on accumulated life experience, and perform suboptimally in uncertain environments that require the fluid integration of novel information [6,34,53-55].

Current Limitations and Future Directions in the Decision Neuroscience of Aging. Overall, research on the decision neuroscience of aging is still very much in its infancy and there are many unexplored topics. There is still very little theory development in the area to guide future research. One emerging theory suggests that trouble with decision making in age is due to integration deficits between frontal and striatal systems in contexts that require fluid cognitive skills [6]. Another theory attributes slower learning and reduced temporal discounting to a motivational deficit with age due to dopamine loss; people become less reward sensitive as they get older [21,50]. However, it is important to acknowledge that nearly all studies to date have focused solely on financial decisions and there are almost no studies examining age differences in other types of rewards [56,57]. There are reasons to believe that social and health-related decisions may not show the same age differences [58-62], which would challenge emerging theories.

Some emerging findings are consistent with domain specificity and challenge a theory of an age-related motivational deficit. One neuroimaging study shows greater striatal responses to social relative to monetary rewards in older adults and the opposite pattern in younger adults [57]. Multiple recent studies show that age-related changes in risk preferences are domain-dependent [51,63]. Emerging evidence (Figure 6) from a large longitudinal sample (N>10,000) suggests that the stereotypical age-related decline in self-reported risk-taking is observed for recreational risks, but the
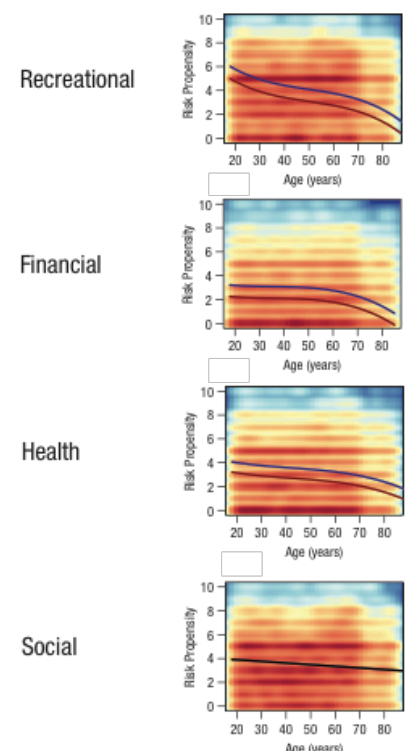
Figure 6. Longitudinal data reveal differences in age effects on self-reported risk tolerance across domains. [51]

slope of reduction in risk seeking is shallower for financial and health-related risk taking and non-significant for social risk taking [51]. In a smaller sample of several hundred participants there is an age-related reduction in the willingness to invest in an incentive-compatible lottery (financial risk) but no age difference in performance on an interpersonal trust task [51]. These findings suggest

Figure 7. Older adults were more likely to choose smaller magnitude, immediately available rewards over larger magnitude, delayed rewards in the social and health domains. Both linear and quadratic effects of age are depicted. [64]

that much more work needs to be done examining risk taking in other domains.

Recent pilot data from the lab of the PI show additional domain differences such that age effects on time preferences actually reverse when decisions are made for social and health-related rewards (N=92) (Figure 7) [64]. We believe that this is due to the sustained and possibly even increased salience of social and health-related rewards related to decreases in perceived future time horizons and prioritization of socioemotional goals [58-62]. These findings strongly challenge the theory of a motivational deficit because there is enhanced immediate reward sensitivity for rewards that are potentially more goal relevant in old age. To enable translation of neuroeconomic research to promote health and well being, the next wave of research in this area will need to address these and related issues.

Although it is encouraging that a growing number of studies are extending the neuroeconomic framework to examine age difference in health-related decision making (e.g., http://projectreporter.nih.gov/project_info_description.cfm?aid=8699641&icde=26330452&ddparam=&ddvalue=&ddsub=&cr=1&csb=default&cs=ASC & http://projectreporter.nih.gov/project_info_description.cfm?aid=8733507&icde=26330452), these studies are also limited by a lack of connection to real-life health outcomes. By using incentive-compatible tasks modeled after real world decision making, neuroeconomics is well-positioned for translation to real world intervention. However, there is shockingly little validation of laboratory-based tasks in the current literature. There are very few studies that link performance on laboratory tasks to real-world outcomes [65-67]. One major reason why more scientists are not making these connections may be that very few scientists have sufficient training or knowledge of how to connect these often lower-level laboratory behaviors to cumulative real-world outcomes. This issue needs more attention through some of the training opportunities proposed here. By offering broadly accessible training opportunities to the field, we hope more translational research will emerge in the future.

Although this initial research is suggestive, the relative lack of current work in this area – especially that focuses directly on health decision making and health outcomes – may create barriers. For example, researchers who seek support for research in this novel area may face review and funding challenges. Thus, the field needs to be further established by continuing to forge links, unite researchers and approaches, and broaden the scope of research.

This research network addresses what we see as four critical barriers to progress in the area: (1) a lack of scientists with integrative training; (2) a relatively limited number of existing laboratories for effectively conducting this work; (3) few existing truly multidisciplinary collaborations; and (4) perhaps most importantly, a lack of existing funding from traditional grant mechanisms. One major contribution to many of these barriers is likely the limited focus of research training that scientists receive within their home discipline [68]. This depth-focused training makes it difficult for scientists to conduct integrative research well on their own. As a result, it is currently difficult for individual researchers to ensure that appropriate psychological, neural, and economic measures are collected and analyzed appropriately. In fact, very few training programs exist for interdisciplinary interests in decision making (notable exceptions include Stanford, Caltech, Duke, NYU). Thus, the proposed network will support alternative training opportunities for researchers at all stages. Appropriately training new researchers in this area will increase course availability and training for the next generation. Importantly, by extending beyond traditional institutional walls, the network activities will reach more people than traditional training grants which are limited to individual institutions. Further, the short intensive dissemination and training opportunities are likely to rapidly raise enthusiasm for research in this area. This
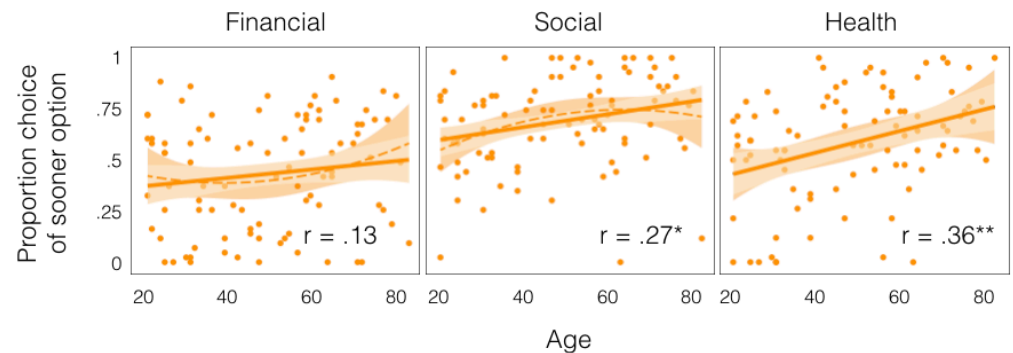
network will also lead to the training of more scientists focused on the study of human aging who take an integrative approach, and it will become more common for researchers from all of these fields to develop collaborative research projects. If successful, this network will create a new group of scientists with broad expertise, capable of expanding methodological approaches in existing longitudinal and large-scale panel studies and creating new large-scale studies based on this approach to improve models of decision making across the life span. If successful, this network will also increase the number of integrative grant proposals and thus multidisciplinary research in this emerging area.

The network will focus generally on combining multiple scientific disciplines for the study of decision making and aging [6,44,69-71] but will also focus on expanding the scope of research in this area for studying not only financial decisions but also health-related and social decision making across adulthood [72-74]. The overall goal of this network is to support the creation of a sustainable field of research on decision neuroscience and aging.

INNOVATION

The decision neuroscience approach challenges existing paradigms focused on the use of methods drawn selectively from within the boundaries of traditional fields. This network seeks to shift the current norm toward a more integrative research approach. This approach will facilitate the linking of age-relevant questions and methods from multiple disciplines. The network will produce many improvements and advantages over existing approaches including the development of and training in multiple complimentary techniques that combine behavior and brain imaging with computational modeling and advanced statistical analyses as well as solutions for overcoming the existing analytic challenges associated with the collection of large integrative multivariate behavioral and biological datasets. Using this integrative approach will contribute to the development of more comprehensive models of how decisions are made, more nuanced theories, and, thus, facilitate the development of more effective interventions.

APPROACH

The goal of this grant is to continue to support a research network on decision neuroscience and aging. This network will focus on growth, development and expansion, and sustainability through scientific meetings, small conferences, workshops, collaboration and mentorship initiatives, and small grant competitions. The research network will take advantage of emerging interest and research generated by initial NIA efforts in this area and the initial activities of this network over the past five years through an expansion of meetings and funding and training opportunities to produce a sustainable field of research on decision neuroscience and aging that can be more easily supported by traditional mechanisms (Figure 8). The network personnel and specific activities planned for the next five years (2016 – 2021) are described in detail below.

With the continued support of the Scientific Research Network on Decision Neuroscience and Aging, this emerging area will surely continue to grow and flourish. The integrative decision neuroscience approach has tremendous potential for scientific and societal impact. We are currently at a unique moment in human history where demographic changes are and will continue to drastically alter the profile of decision makers in the global population. The necessary independent fields and methods to address these issues are emerging, but we need to provide support to connect them through interdisciplinary collaborative research. To the extent that this emerging field can respond to the immediate demand for integrative and translational research, scientists have the potential to make major contributions to improving the well being of humans across the life span.

Network Affiliates

Committee
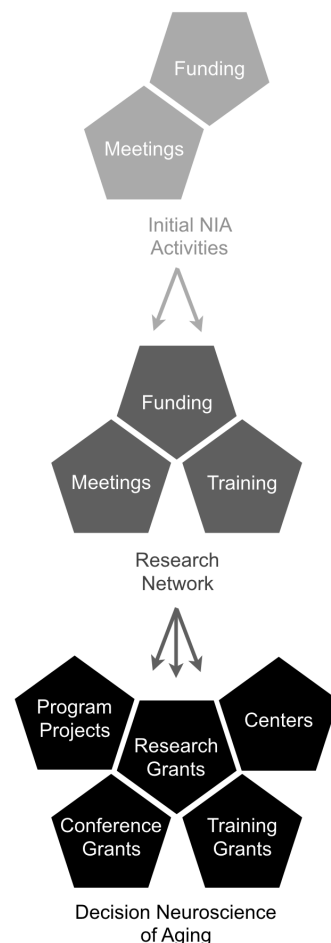A core committee of key personnel including Gregory Samanez-Larkin, Nichole

Figure 8. Our research network (center) is facilitating the transition of this area by building on initial NIA activities with the goal of creating a sustainable field of research, the Decision Neuroscience of Aging, that can be supported by traditional funding mechanisms.

Lighthall, Ye Li, Camelia Kuhnen, and Laura Carstensen will be primarily responsible for organizing network activities and monitoring progress. This committee is composed of a complementary set of senior and junior researchers. The senior researchers on the committee have the appropriate expertise and perspective on strategies for drawing established researchers to this emerging field, whereas the junior researchers are currently using this approach, which will support the development of strategies for how best to train new scientists in this area. Samanez Larkin, Kuhnen, and Carstensen were previously committee members but Lighthall and Li are new to the committee. Lighthall and Li are both new investigators who are among the first recent independent PIs to emerge with truly interdisciplinary training. The committee also includes experts with primary training in each of the relevant fields (neuroscience, psychology, economics) combined within decision neuroscience.

Gregory Samanez-Larkin is Assistant Professor of Psychology, Neuroscience, and Cognitive Science at Yale University. Research in his lab examines how individual and age differences in motivation, affect, and cognition influence decision making across the life span using a combination of behavioral, computational, and neuroimaging techniques ranging from detailed measurement of functional brain activity (fMRI) and neurotransmitter receptors (PET) in the laboratory to experience-sampling in everyday life. His research covers broad territory linking neuroreceptors at the cellular/molecular level to life outcomes such as health, wealth, and well-being through intermediate psychological and systems-level neurobiological function. He is the Founding Director of the Scientific Research Network on Decision Neuroscience and Aging (www.srndna.org) which was previously supported by an R24 from NIA (R24-AG039350, MPI with Carstensen). He wrote the initial grant and was the lead director for all activities of this network while also managing a similar number of lab projects to what he is currently managing in his lab. Thus, he has demonstrated experience in successfully leading and running the activities proposed in this application. However, the proposed activities will not be run by Samanez Larkin alone. He will be working closely with junior and senior colleagues listed in the next section and supported by administrative staff at Yale University (where he has a guaranteed faculty position, pending renewals, until at least 2023). He will be primarily responsible for monitoring and assessing the program and submitting all documents and reports as required.

Nichole Lighthall is an Assistant Professor of Psychology at the University of Central Florida. Dr. Lighthall's research aims to develop a neural model of decision processing in human aging that can be used to identify age-related vulnerabilities and pathways to compensation. Her work has focused on the cognitive and affective processes that impact decision quality using a variety of methods including behavioral measurement and manipulations, biomarker measurement, functional neuroimaging, and more recently, computational modeling. Her recent work has begun to integrate emerging findings from the decision neuroscience of aging with the larger body of cognitive research on aging [75]. As a post-doctoral fellow at Duke, she was a former pilot grantee whose work was supported by this research network. She is extremely enthusiastic about becoming a committee member for the network.

Ye Li is an Assistant Professor of Management and Marketing in the School of Business Administration at the University of California, Riverside. Dr. Li's research focuses on important life course decisions like saving, preferences, and intertemporal choice. His behavioral economics research integrates methods and modeling approaches from both psychology and economics (e.g., laboratory and online experiments, archival data analysis, mathematical modeling and simulations). He has a great deal of experience with both behavioral economics in a laboratory setting and large-scale datasets that include measures of real-world decision making. In recent high-impact publications, he presents a theory that builds on classic psychological models of intelligence to explain compensatory cognitive processes that support decision making across adulthood [34,55]. He has experience publishing in both economics and psychology journals as well as in high-impact general science journals (e.g., *PNAS*).

Camelia Kuhnen is an Associate Professor of Finance at the Kenan-Flagler Business School at The University of North Carolina, Chapel Hill. She is one of the only researchers in the world who has degrees in both finance and neuroscience. Her neuroeconomic research is focused on learning and decision making and integrates behavioral measures from the lab with functional neuroimaging and genetics [65,76,77]. She has also has experience collaborating on neuroeconomic studies with non-human animals [78].

Laura Carstensen is the Founding Director of the Stanford Center on Longevity, a Professor of Psychology, and the Fairleigh S. Dickinson Jr. Professor in Public Policy at Stanford University. Dr. Carstensen is a pioneer in research on the psychosocial aspects of human aging. She is an expert on the study of aging using behavioral measurement both inside the lab [31] and in everyday life [32]. Her career has been supported by strong theory development [33-35], and she has developed a number of collaborations with health economists and neuroscientists to study decision making and aging [36, 37]. She is best known in

academia for socioemotional selectivity theory, a life-span theory of motivation, and with her students and colleagues, has published more than 150 articles on life-span development. Her research has been supported by the National Institute on Aging for more than 20 years and she was recognized with a MERIT Award in 2005. In 2011, she authored *A Long Bright Future: Happiness, Health, and Financial Security in an Age of Increased Longevity*. She is a member of the MacArthur Foundation's Research Network on an Aging Society and served on the National Advisory Council on Aging.

All committee members have experience conducting multidisciplinary research, have experience with organizing small conferences and individual symposia, have experience with designing and executing teaching and training efforts, and are highly invested in the development of this field.

In addition to the above-named committee members, we will recruit additional individuals as planning committee members for many of the network events. For example, both Russell Poldrack, Professor of Psychology at Stanford University, and David Laibson, Professor of Economics at Harvard University (and a former co-director of this network) have agreed to advise on the organization of training activities related to replicability and data sharing/management (Poldrack) and integrating behavioral and biological measures at large scale (Laibson). The PI, Samanez Larkin, has also previously communicated with Jack McArdle and Bob Willis about co-organizing an event to bring HRS measures to neuroscience labs (see *Workshop II* below).

Other Network Members
The emerging field, the decision neuroscience of aging, which we seek to continue developing with this network lies at the intersection of several fields. The success of this network will depend on the inclusion of members from a variety of disciplines including psychology, economics, neuroscience, and genetics and possibly even computer science, sociology, and public health. Thus, we will continue to recruit a representative and balanced network of researchers from all of these fields to all network activities. A focus in the next five years will be on recruiting individuals who directly study health decisions but may not use neuroscience or economics methods yet. We will also continue to include a wide range of rank in the network from graduate students and post-docs to junior and senior faculty. Recruitment efforts for drawing junior- and senior-level researchers will primarily be accomplished through direct invitations from members of the core committee. To recruit less well-known but potentially relevant network affiliates, electronic advertisements will be distributed to a wide range of relevant research groups from various universities. We will take advantage of existing distribution lists from centers on Neuroeconomics at Stanford, Duke, Caltech, and NYU, and will contact other universities and research centers to access similar distribution lists. Advertisements will also target individuals in disciplines such as computer science, sociology, and public health who conduct research relevant to decision making across the life span.

Support Personnel and Institutional Environment
Although activities will exist beyond traditional walls of a single university, the grant will be administered at the PI's local institution, Yale University. In addition to the grants management staff in the Department of Psychology at Yale (that manage all of Samanez Larkin's grants and awards), Samanez Larkin's lab manager will provide the majority of the administrative support. She has previously helped with network activities and has experience with planning and executing meetings, conferences, and workshops. She will handle travel arrangements, reimbursements, and general planning details for the proposed events. She will also maintain the web presence and quarterly newsletter of the network, which will publicize details about all activities, funding opportunities, and network affiliates. The departmental grants manager, Christine James, will be primarily responsible for organizing subawards for pilot grantees (which she has previously done for this network in the past) and will assist with annual progress reports and general institutional administration of this grant. The support staff will assist with organizational (e.g., scheduling, reservations, creation/distribution of materials) and financial (e.g., payments, processing reimbursements, disbursing pilot grants) efforts allowing the key scientific personnel to focus efforts on network promotion and development. Some of the events will take place at Yale, Stanford, or UNC. All three universities offer world-class facilities for hosting workshops and conferences.

Diversity Recruitment Plan
Diversity is a high priority. We will make sure to select speakers and presenters that are diverse in age, race, gender, background, and scientific expertise. We will encourage participation in workshops, events, and grants competitions from diverse backgrounds by reaching out to the Resource Centers for Minority Aging Research (RCMAR) and asking them to distribute advertisements for our activities and identify potential junior scientists that we should invite directly. We will encourage applications to participate from individuals with disabilities. For all workshops and conferences we will have a percentage of female speakers and attendees that meets or

exceeds the field averages (according to http://biaswatchneuro.com) and will report on the gender balance for all of our events on http://biaswatchneuro.com. In previous events hosted by our network (see http://biaswatchneuro.com for evidence of our previous success in gender balance), childcare was offered to all attendees to encourage women and new parents to participate. We will also offer childcare for the workshops and conferences (expenses for this are included in the travel budget). For the annual progress reports we will provide information on the success of recruitment strategies and ways we plan to improve recruitment in future years. Note that we are proposing a new initiative to increase diversity starting at the earliest stages of training for undergraduates and early stage graduate students (see *Summer Research Awards* below).

Annual Plans for Years 1–4

Committee Planning Meeting
The core committee will hold annual planning meetings via videoconference (which is how planning meetings were conducted previously). The goal of these meetings is to plan the events for the coming year, evaluate the success of recent events, create a list of updates for the network website and upcoming newsletters, and discuss any potential changes of plans based on network member feedback or recent advances in the field. The committee will review participant feedback forms from prior activities (conferences, workshops, collaboration/mentorship initiatives) and discuss what should remain or be changed for future activities. Note that we have fine-tuned the organization and execution of many of these activities based on participant feedback over the past five years. Event plans will include finalizing the date and location, creating a list of potential presenters and participants, designing additional recruitment materials, and organization of topics and sessions. The committee will also discuss the small pilot grant competitions including finalizing the due/review/disbursement dates, creating an official request for applications, finalizing review criteria and review plans, making a list of potential reviewers, and discussing the progress of recent awardees.

Website and Quarterly Newsletter
We will keep the network website (www.srndna.org) up to date throughout the year. It will advertise all network activities, provide applications, and keep track of relevant research in the area. We will also distribute a quarterly newsletter to a broad network of individuals working in this area via email (and posted on the website) similar to society newsletters distributed by the Cognitive Neuroscience Society or the Society for Neuroeconomics. One current limitation in this area is that there is currently no single place to find a list of relevant PhD programs, postdoc or faculty positions, grant opportunities, or meetings relevant to our field. We will be the information hub for all of these announcements.

Small Pilot Grant Call for Applications, Review, and Awards
During the fall of each grant year, applications for a small grant competition will be due (via online submission through the network website). These small pilot research awards are intended for researchers new to the area. Two awards per year at ~$20,000 each for 12 months will be available and priority will go to junior researchers. Specifically, we will prioritize lab groups that have not received a research grant from NIH or NSF for this work, did not receive a previous network pilot grant from us, and are not currently working directly in this area. This small funding opportunity will provide additional and less well established research groups with the resources to collect data to support larger grant applications. This small grant competition will encourage researchers to join the field and will stimulate new research in the area through small scale pilots. Evaluation criteria include the use of a variety of measures, sophisticated statistical analysis strategies, a comprehensive research team with expertise in all relevant disciplines, and a focus on life course decisions that impact old age relevant outcomes. At least three anonymous reviewers will review all applications and use NIH score sheets to provide feedback within six weeks after submission. Previous unfunded applicants noted that this NIH-style feedback was very helpful in preparing future grant applications and served as a form of external pre-review. The winners will be selected by the reviewers and network committee and announced on the network website (for an example, see: http://www.srndna.org/funding/2014-grants/). Awardees will submit a progress report after 6 months and a final report after 12 months. These reports include results, presentations, manuscripts, and grant applications (whether funded or not) that resulted from this work.

Specific Plans for Year 1

Pilot Grants I
See details above in *Annual Plans for Years 1–4*.

Collaborative Edited Review Volume

The committee has already initiated plans for the creation of an edited volume in the first grant year. The PI just signed a contract with APA Books for a volume entitled *The Aging Brain*. The goal of this volume will be to summarize research on the aging brain relevant to decision making. Although a number of volumes have summarized what is presently known about cognitive losses with age, we are not aware of any existing volumes that have covered a broad range of psychological and neural functions (e.g., affective, socioemotional, motivational, cognitive, and decision-related processes) that decline, remain stable, or improve with age. In the multidisciplinary spirit of the network, the goal of this volume will be to combine multiple perspectives on aging from previously disconnected but highly complementary lines of research. Within each section of the volume, we will invite contributors to co-author chapters together who are working in previously disconnected but complementary areas and who have not previously worked together. To incentivize this collaborative effort, we will provide honoraria to the authors, which could be used to support visits to each other's labs. The hope is that this activity will not only provide a unique resource to the field and beyond in the near term but will also inspire new lines of collaborative interdisciplinary research (and grant applications to support that work) that have greater potential for enhancing well being in old age in the long term.

Workshop I (Data Science Workshop)
The first one-and-a-half day workshop will focus on a range of strategies for dealing with data before and after collecting it. There has been much recent focus in the sciences on the so-called "replicability crisis" and it's not clear yet how big of a problem it is in the neurosciences [79-85]. Although students in psychology and neuroscience PhD programs take statistics courses and more rarely a research methods course, it is not common for these important recently raised issues to be discussed or dealt with systematically in traditional training programs. The first session on the first day will focus on data management, data organization, and statistical planning and analysis of behavioral and neuroimaging data (e.g., using high-performance computing). The second session will focus on data sharing, transparency, and replicability. The third session on the first day will focus on analysis of public datasets and meta-analysis. The morning session on the second day will be a hands-on activity where participants will draft plans for a future study with these new approaches and ideas in mind [85-88] and get feedback and assistance throughout the session from teaching fellows and instructors. This workshop will be co-sponsored by the Stanford Center for Reproducible Neuroscience (http://reproducibility.stanford.edu). Russell Poldrack, director of the center, has already agreed to co-organize this workshop and co-lead it with center staff. The sessions on the first day will be videorecorded and digital videos will be created and hosted on the network website to increase access to this critical training opportunity. Future pilot grantees will be required to complete these online training modules. All network members will be encouraged to complete the modules. In the past we ran one day workshops but participants suggested that the group activities, which they found very helpful, be moved to a second day (noting that previous workshops felt too compressed). All workshops proposed here will be one-and-a-half day events. Participants in the workshop will be graduate students, post-doctoral fellows, junior faculty, and senior faculty new to the area. All workshop participants will provide feedback in an exit survey. The anonymous comments will be used for tuning future activities.

Specific Plans for Year 2

Pilot Grants II
See details above in *Annual Plans for Years 1–4*.

Conference I (Decision Neuroscience and Aging)
A general meeting on decision neuroscience and aging will be held in Spring 2018. This small conference will be modeled after the conference our network hosted in Spring 2015 (http://www.srndna.org/conference2015/) to continue to increase awareness of the latest findings and general network progress with the goal of drawing new researchers into this area. Previous small grant award winners will be asked to present preliminary findings. There was unanimous enthusiasm about the success of the last conferences and several faculty and student attendees asked when this could happen again. A number of unique collaborations were formed due to discussions around the event (e.g., a new line of studies between the labs of Alan Castel and Todd Maddox). The most recent meeting in 2015 had a fairly balanced number of faculty (junior and senior) and trainees (post-docs and students) in attendance. This gives trainees lots of opportunity for face-to-face discussion with more senior colleagues. We plan to have a similar ratio for this event. Holding a general meeting approximately every 2–3 years should allow enough time for new research to be completed. To expand the field from prior meetings, additional relevant researchers who have not previously participated in earlier meetings will be invited to present recent work (prioritizing those with more primary expertise related to health). Both scientists

currently using the decision neuroscience approach and scientists exploring topics that may be enhanced through decision neuroscience will be asked to present. An awards committee (of two faculty members) will decide on the winner of a Poster Award and it will be presented at the end of the conference along with an Innovative Publication Award (that the committee preselected before this event from all papers published in the past three years). The goal of the awards is to recognize great research but also help network affiliates strengthen their CV to successfully navigate future career transitions. Awards also create enthusiasm and motivation for the winners to continue working in this area. As we have done in the past, all conference participants will provide feedback in an exit survey. The anonymous comments will be used for tuning future activities.

Specific Plans for Year 3

Pilot Grants III
See details above in *Annual Plans for Years 1–4*.

Workshop II (Combining Intensive Lab Research with Large-Scale Studies of Real-World Behavior)
The second one-and-a-half day workshop will focus on potential ways to combine the strengths of intensive laboratory research (e.g., that includes neuroimaging and genetics) with the strengths of large cross-national panel data collection efforts. The morning of the first day will feature panel discussions between faculty who have worked on the Health and Retirement Study (HRS) or other similar large panel datasets and decision neuroscience faculty who have integrated real-world measures into intensive lab studies. The goal of this discussion will be to discuss potential barriers and potential models for leveraging the strengths of both of these approaches. The Kavli HUMAN Project (http://kavlihumanproject.org) will also be presented as a potential resource and model for future, large-scale integrative study designs. The afternoon session on day one will focus on analytic strategies for integrating behavioral and biological measures from the laboratory with measures collected in the real world. The decision neuroscience approach encourages the collection of large multivariate datasets, but very little training in dealing with datasets of this type is provided in common graduate training. The development of these skills is currently uncommon and difficult to obtain in traditional single discipline training programs, but will be essential for taking advantage of the growing number of large multivariate and multi-level integrative datasets generated in this field in the future. This training will increase competiveness for grants and promote methodological strategies necessary for successful research in this field. The morning session on the second day will provide a brief introduction to the design, measures, and data access for the Health and Retirement Study (a highly compressed version of what is done in the typical HRS data workshops) and the Kavli HUMAN Project. This will be followed by a group activity where participants will develop proposals for integrating real-world measures into future decision neuroscience studies. David Laibson, a former network committee member, has already agreed to help with the planning of this event. The PI has also previously discussed the idea of "bringing the HRS to the neuroimagers" with Bob Willis and Jack McArdle, who are both enthusiastic about helping to make something like this happen. We will invite both of them to participate in and help plan the event. Participants in the workshop will be graduate students, post-doctoral fellows, junior faculty, and senior faculty new to the area. All workshop participants will provide feedback in an exit survey. The anonymous comments will be used for tuning future activities.

Collaboration/Mentorship Stipends I
The awarding of collaboration and mentorship stipends is a new initiative that we will implement in the next five years. We will offer two forms of stipends (one to support multidisciplinary career transitions and the other to support under-represented minorities in the pursuit of careers in multidisciplinary science). The first stipend mechanism (for supporting career transitions) will be aimed at graduate students and post-doctoral fellows who would benefit from having an additional senior mentor at a different institution collaborate on an existing project, advise them on a future study design or a manuscript in preparation, and/or advise on navigating a career in science. The stipends (to be split between advisors and trainees) will support the forging of a new mentor-mentee relationship that did not previously exist. The committee has noted that the most successful junior faculty candidates in recent years often had outside senior colleagues that they were able to lean on for advice and support through their years of training. However, these relationships can sometimes be challenging to initiate on your own. We will prioritize applications seeking a mentor in a completely different field. The other stipend mechanism (for increasing diversity in science) will be available to under-represented undergraduates who would like to spend the summer working full-time in a research lab before their senior year but do not have the financial means to do so. The ability to address the necessary increase in faculty scientist diversity is severely constrained by a pipeline problem from the earliest career stages [89-91]. Priority will go to students

who have some initial lab experience and already have a network-relevant senior thesis plan. Faculty mentors who currently have major research grants with NIH will not be eligible mentors as they already have access to a similar support system through Research Supplements to Promote Diversity in Health-Related Research (PA-12-149). These will be aimed at providing a similar resource for new investigators who have not yet successfully obtained a major research grant. Stipend awardees will also be invited to attend and present at the network conferences.

Specific Plans for Year 4

Pilot Grants IV
See details above in *Annual Plans for Years 1–4*.

Workshop III (Integrating Emerging Analysis Techniques)
The third one-and-a-half day workshop will focus on strategies for integrating cutting edge neuroscience methods to study decision making across the life span. The topics of the workshop will include the integration of multiple neuroimaging methods (e.g., combining DTI and fMRI [92] or PET and fMRI [93]) and cutting-edge statistical modeling techniques used with neuroimaging data (e.g., individual differences in functional brain organization [94,95] and individual network parcellation [96]). Each presentation on day one will provide a description of how the instructor has previously used these methods, specific instruction in the use of these methods, and identification of key resources for using these methods after the workshop is over. This is modeled after our previous network workshops (e.g., http://www.srndna.org/training/methods-workshop-2011/). A hands-on session on day two will allow participants to become familiar with some of these methods using data they bring to the workshop or sample data provided. Instructors and teaching fellows will be available for one-on-one assistance during the hands-on session. We have had great success with hands-on sessions in previous network workshops (e.g., http://www.srndna.org/conference2015/workshop/). Participants in the workshop will be graduate students, post-doctoral fellows, junior faculty, and senior faculty new to the area. All workshop participants will provide feedback in an exit survey. The anonymous comments will be used for tuning future activities.

Collaboration/Mentorship Stipends II
See description above in Year 3 for details.

Specific Plans for Year 5

Conference II (Decision Neuroscience and Aging)
A second general meeting on decision neuroscience and aging will be held in Spring 2021. The event will be modeled after the conference hosted in Year 2 (see above for details). This conference will be more focused on the future of the field with more panel discussion sessions. There will also be a breakout group session to allow individuals to meet and discuss possible Program Project plans. We did a similar activity at our Translational Workshop in 2014 (http://www.srndna.org/events/workshop-on-translation/) and the activity inspired a series of unique studies between Steve Chang and Natalie Ebner that was later partially supported by a network pilot grant.

Final Meeting of Committee
The core committee will hold a final meeting in Spring 2021. The goal of this meeting is to evaluate the success of all activities, review the final reports of the pilot grants as a group, and outline and begin to draft the final report for NIA. This final discussion will focus on sustainability (and will be documented in the grant's final report to NIA). The committee will again discuss and document progress in the field through the evaluation of increases in the number of publications in this area, the breadth of measures currently included in large datasets, talks/symposia at conferences, media coverage, and grants on the topic. Evidence that the network activities successfully facilitated the transition from a small group of individuals managing network activities to a strong field of researchers taking ownership of future work in this area will be documented.

Overview of Timeline
The following activities (described in detail above) will occur during the proposed grant years.

Year 1 (2016/2017): Planning Meeting; Collaborative Review Volume; Workshop I; Pilot Grants I
Year 2 (2017/2018): Planning Meeting; Pilot Grants II, Conference I
Year 3 (2018/2019): Planning Meeting; Pilot Grants III; Workshop II; Collaboration/Mentorship Stipends I
Year 4 (2019/2020): Planning Meeting; Pilot Grants IV; Workshop III; Collaboration/Mentorship Stipends II
Year 5 (2020/2021): Planning Meeting; Conference II; Final Committee Meeting

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STANFORD UNIVERSITY
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January 7, 2016

Dear Greg,

I am providing this letter for you to include in your R24 application. I am delighted that you have decided to pursue another wave of funding for the Network on Decision Neuroscience and Aging. By way of history, it is important for the review section to know that the only reason you were not the PI on the initial round of funding was because your post-doctoral status rendered you ineligible. For all intents and purposes, however, it is clear that you have lead this work from the start. Of course, your leadership is reflected in the fact that the grant was converted to MPI once you started your faculty position at Yale.

Given your primary role in the development of the first wave of funding, and your execution of planning and overseeing grant activities for the past 6 years, you are well positioned to oversee the execution of the planned activities as the primary PI on this renewal application.

The ideas that you outline are impressive and I am confident that you will continue to lead this field in exciting new directions while attracting top-notch researchers at all stages to the area. Although we have made progress with this Network, this is an extremely important area of research with great potential for impact that needs additional support for several more years. I look forward to continuing to work together on the proposed Network with you and the rest of the committee.

Sincerely,

Laura L. Carstensen, Ph.D.
Professor of Psychology and the
Fairleigh S. Dickinson Jr. Professor in Public Policy
Director, Stanford Center on Longevity

January 6, 2016

Dear Greg,

I would be delighted to continue serving as a consultant on the research network on decision neuroscience and aging. My research combines finance, psychology, and neuroscience, and covers economic decision making in humans and non-human animals across the life span. Thus, I have some insight about what it might take to draw high profile scientists into and sustain their participation in this emerging area.

I am happy to continue contributing to this network through participation in planning meetings, providing advice on the organization of training workshops, and helping to review and select pilot grant applications. I very much enjoyed working with you on this over the past 6 years and I look forward to working with you again to develop this important subfield over the next five years.

Thank you. Best regards,

Camelia M. Kuhnen
Associate Professor of Finance
UNC Kenan-Flagler Business School
E-mail: camelia_kuhnen@kenan-flagler.unc.edu
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The A. Gary Anderson
Graduate School of Management
Anderson Hall
Riverside, CA 92521
Phone: 951-827-3694
Email: ye.li@ucr.edu

Dear Greg,

I am writing to confirm that I will be pleased to serve as a committee member for the research network on decision neuroscience and aging. As you know, my own career has been greatly enhanced through interdisciplinary research in this area. Research in this area has the potential for tremendous impact and a network of this kind will surely attract talented scientists, from emerging junior researchers to well-established senior researchers. I am highly invested in facilitating an increase in interdisciplinary research focused on health and well-being over the life span.

For the duration of this grant, I will play a role in the network through participation in annual planning meetings, conferences, training workshops, and the selection of pilot grant awardees. If you have any questions, please feel free to contact me at ye.li@ucr.edu.

I look forward to hearing good news about the NIA proposal.

Sincerely,

Ye Li
Assistant Professor of Management and Marketing
University of California, Riverside

University of
**Central
Florida**

Psychology Department

January 7, 2016

Dear Greg,

Thank you again for the invitation to join the SRNDNA committee. As you know, I am a former recipient of an SRNDNA pilot award (from my time as a postdoc at Duke). I could not have completed that project without the support of this network. The work that we were able to do has so far resulted in the development of one high-impact publication and there are others in preparation. The grant also played a key role in my obtaining my current faculty position and inspired a line of decision neuroscience research that I am running now as an independent investigator. Furthermore, I plan to use the findings from this study as preliminary data for an independent NIA grant proposal in the near future.

As a former trainee who benefitted greatly from the activities of the network (I also attended and presented at workshops and the conference), I look forward to contributing this unique perspective to the planning committee. My impression is that the first five years of activities were successful, but I believe that our plans for the next five years have the potential to push this field in important new directions (e.g., toward more direct studies of health outcomes) while providing necessary yet rare resources for a diverse group of emerging scientists from the earliest stages of training. I look forward to working together.

Sincerely,

Nichole Lighthall
Assistant Professor
Psychology Department
University of Central Florida

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