BIOGRAPHICAL SKETCH

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NAME: Chandra Ann Reynolds

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

POSITION TITLE: Professor of Psychology

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 California, Irvine	BA	1988	Psychology
University of Southern California	MA, PhD	1991, 1994	Developmental Psych.
University of Colorado, Boulder	Postdoctoral	1994-5	Behavioral Genetics
University of Southern California	Postdoctoral	1996-7	Gerontology

A. Personal Statement

With a background in lifespan development and quantitative behavioral genetics, I have applied complex longitudinal and quantitative genetic models to understand variations in cognitive aging, health and longevity. I have led multi-site collaborative efforts (AG28555), considering direct and indirect impacts of genes in the cholesterol pathway on intermediate lipid biomarkers and ultimate behavioral and clinical cognitive phenotypes measured in Swedish case-control and four related twin samples (GENDER, OCTO-Twin, SATSA and Harmony). I have led projects on childhood and social factors that predict life course patterns of health, well-being, and longevity (AG02700; Terman Life Cycle Study) and as co-investigator examined early life factors on longitudinal cognitive, health and well-being profiles into early adulthood (HD010333; Colorado Adoption Project). I am a co-Investigator and site PI for the *Gene-Environment Interplay of Social Contexts and Aging-Related Outcomes* (AG037985; IGEMS consortia). I am a co-investigator on the VETSA Longitudinal Twin Study of Cognition and Aging (VETSA 3) (AG018386; Kremen, Lyons, MPIs). I serve as contact PI of the MPI project *Colorado Adoption/Twin study of Lifespan behavioral development and cognitive aging* (CATSLife) (AG046938; Reynolds, Wadsworth, MPIs), that is evaluating the unique saliency of early childhood factors to adult cognitive and physical functioning and change versus proximal influences and innovations that emerge across development.

B. Positions and Employment

1992	Visiting Researcher, Karolinska Institute, Stockholm
1997-2000	Research Assistant Professor/Research Associate, University of Southern California
2001-2006	Assistant Professor: University of California, Riverside
2006-2011	Associate Professor: University of California, Riverside
2011-present	Professor: University of California, Riverside

Honors

1997	Los Angeles Alzheimer's Association, Turken Scholarship Award recipient
2003	Faculty of the Year, UC Riverside Psychology Department
2012	PhD *honoris causa*, Jönköping University, Sweden

Professional and Policy

2007-2017 NIH Peer Review Committees. BGES: 10/09 to 06/13 (*ad hoc*: 10/07, 02/08); SEP: *ad*

hoc 01/09; SSPB: *ad hoc* 02/16. NIA P01 panel: *ad hoc* 10/11, 06/12; NIA U24 panel: *ad hoc* 01/17.

2007 Invited participant, NIA's 'Planning Meeting for the Genetics of Alzheimer's Disease'.

2010 Invited presenter and panel participant, NAS & NIA's: "Using GWAS to Explore Fundamental Questions about Aging in the Health and Retirement Study (HRS) Sample".

2012 Invited presenter and panel participant-- Institute of Gerontology, Jönköping University, Sweden: Workshop on "Ageing – Living Conditions and Health"

2013 Invited sub-committee participant -- National Advisory Council on Aging (NACA) review of the NIA's BSR section: "Behavioral and Social Aspects of the Genetics of Aging"

2017 Invited presenter -- A Workshop Co-sponsored by NIEHS and NIA: "Telomeres as Sentinels for Environmental Exposures, Psychosocial Stress, and Disease Susceptibility"

2008- Associate Editor, *Behavior Genetics*

2016/17 Consulting Editor, *Developmental Psychology*

C. Contributions to Science

1. My early publications challenged and refined understandings of the measurement and etiology of cognitive decline. At the time of my entry into cognitive aging research, the quantitative approaches applied to measuring cognitive change varied considerably and relatively little was known about the genetic and environmental etiologies of normative cognitive change. Initial work included a comparison of quantitative methods to address cognitive change, suggesting superiority of random effect approaches to other extant approaches at the time including annualized difference scores estimates, criterion-based methods, and two-stage least squares approaches. Applying random effects growth models to cognitive change across six years suggested, surprisingly, the primary importance of stochastic influences for entry into decline. Yet, unconvinced and challenged by dementia and AD findings, expanded examinations with longer follow-up suggested a nuanced set of findings: nonlinear change is moderately heritable in comparison to linear change and etiological contributions vary across age and domain.

a) Reynolds, C. A., Gatz, M., & Pedersen, N. L. (2002). Individual variation for cognitive decline: Quantitative methods for describing patterns of change. *Psychology & Aging*, *17*(2), 271-287.
b) Reynolds, C.A., Finkel, D., McArdle, J.J, Gatz, M., Berg, S. & Pedersen, N.L. (2005). Quantitative genetic analysis of latent growth curve models of cognitive abilities in adulthood. *Developmental Psychology*, *41*, 3-16.
c) Reynolds, C.A., Fiske, A., Fratiglioni, L., Pedersen, N.L., & Gatz, M. (2006). Heritability of an age-dependent categorical phenotype: Cognitive dysfunction. *Twin Research and Human Genetics, 9*, 17-23.
d) Tucker-Drob, E M, Reynolds, C A, Finkel, D, & Pedersen, N L (2014). Shared and Unique Genetic and Environmental Influences on Aging-Related Changes in Multiple Cognitive Abilities. *Developmental Psychology*, 50(1),152-66.

2. Working with a team of collaborators, I have led and participated in efforts to consider molecular genetic markers that might underlie the genetic and environmental etiologies of cognitive change trajectories. Early on, it was far less applied to quantitative traits measured in normative samples over multiple waves, and even less so using a twin approach. Recent work includes larger collaborative efforts including work on multiple variants and genetic risk scores. The *SORL1* study was the first to demonstrate association of risk set scores on longitudinal cognitive trajectories across domains; the results suggested a divergence of effects on cognitive change, not only dependent on the location of risk variants but with respect to effects for men and women.

a) Reynolds, C.A., Jansson, M., Gatz, M., & Pedersen, N.L. (2006). Longitudinal change in memory performance associated with HTR2A polymorphism. *Neurobiology of Aging*, *27*, 150-4.
b) Reynolds, C.A., Prince, J.A., Feuk, L., Gatz, M., & Pedersen, N.L. (2006). Longitudinal memory performance during normal aging: twin association models of *APOE* and other Alzheimer candidate genes. *Behavior Genetics*, *36*, 185-94.
c) Davies, G., Harris, S. E., Reynolds, C. A., Payton, A., Knight, H. M., Liewald, D. C., Lopez, L. M., Luciano, M., Gow, A. J., Corley, J., Henderson, R., Murray, C., Pattie, A., Fox, H. C., Redmond, P., Lutz, M. W., Chiba-Falek, O., Linnertz, C., Saith, S., Haggarty, P., McNeill, G., Ke, X., Ollier, W., Horan, M., Roses, A. D., Ponting, C. P., Porteous, D. J., Tenesa, A., Pickles, A., Starr, J. M., Whalley, L. J., Pedersen, N. L., Pendleton, N., Visscher, P. M., & Deary, I. J. (2014). A genome-wide association study implicates the APOE locus in nonpathological cognitive ageing. *Molecular Psychiatry*, 19(1):76-87. doi: 10.1038/mp.2012.159. Epub 2012 Dec 4.

d) Reynolds, C. A., Zavala, C., Gatz, M., Vie, L., Johansson, B., Malmberg, B., Ingelsson, E., Prince, J. A., & Pedersen, N. L. (2013). Sortilin receptor 1 predicts longitudinal cognitive change. *Neurobiology of Aging, 34(6),1710.e11-8. doi: 10.1016/j.neurobiolaging.2012.12.006.* [PMCID: PMC3839667]

3. With a team of collaborators, I have sought to further demonstrate the genetic and environmental etiologies of cognitive dysfunction and dementia by considering direct and indirect impacts of genes in the cholesterol pathway on intermediate lipid biomarkers and contributions to cognitive decline and dementia (e.g., lipid and immune/inflammatory pathways). A variety of strategies were applied, including discordant twin pair analysis, logistic regression and survival models, as well as pathway and whole gene methods to consider gene associations with lipids, cognitive change and dementia. Overall, findings from the cholesterol pathway work suggest that while serum lipid levels are predictive of cognitive decline and dementia, an increasingly complex picture was evident vis-à-vis: the relative lack of enrichment of cholesterol pathway variants on AD and dementia risk with some notable exceptions, the unique effects of *APOE* variants on LDL lipid levels versus dementia risk, and potential sex and age moderation of lipid-cognitive trajectory relationships.

a) Reynolds CA, Gatz M, Prince JA, Berg S, Pedersen NL. (2010). Serum lipid levels and cognitive change in late life. *Journal of the American Geriatrics Society*, *58*, 501-509. [PMCID: PMC2913576]
b) Reynolds, C, Hong, M, Eriksson, U, Blennow, K, Wiklund, F, Johansson, B, Malmberg, B, Berg, S, Alexeyenko, A, Grönberg, H, Gatz, M, Pedersen, N, Prince, J (2010). Analysis of lipid pathway genes indicates association of sequence variation near *SREBF1/TOM1L2/ATPAF2* with dementia risk. *Human Molecular Genetics*, *19*(10), 2068-2078. [PMCID: PMC2860895]
c) Reynolds, C. A., Gatz, M., Pedersen, N. L., & Prince, J. A. (2011). An assessment of CETP sequence variation in relation to cognitive decline and dementia risk. *Int J Mol Epidemiol Genet, 2*(2), 122-129. [PMCID: PMC3110386]
d) Hong, M. G., Reynolds, C. A., Feldman, A. L., Kallin, M., Lambert, J. C., Amouyel, P., Ingelsson, E., Pedersen, N. L., & Prince, J. A. (2012). Genome-wide and gene-based association implicates FRMD6 in Alzheimer disease. *Human Mutation, 33*(3), 521-529. [PMCID: PMC3326347]

4. Evaluating sensitive periods where genetic-environmental synergies may be most salient to health behaviors and cognitive functioning are important not only in early development but whether and when resurgent periods in late adulthood occur. With colleagues and students, I have led and participated in efforts to capitalize on the strengths of multi-decade longitudinal data to elucidate phenotypic and etiological relationships between potentially modifiable health and socio-emotional factors, cognitive aging, and longevity. For example, work on intra-pair MZ differences in cognitive trajectories was the first to demonstrate GxE interaction processes for cognitive trajectories: (1) variations in genes implicated in the regulation of serotonin, estrogen, and cholesterol (e.g., *APOE*), were associated with increased within-pair divergence in memory trajectories; and (2) divergence in trajectories were further amplified by synergies with environmental sequelae of depression for those at lower genetic risk (e.g., non-*APOE* e4). Other work has demonstrated the multi-factorial nature of early life and proximal influences on health and longevity, including unique pathways for men and women.

a) Reynolds, C.A., Gatz, M., Berg, S., Pedersen, N.L. (2007). Genotype-Environment Interactions: Cognitive Aging and Social Factors. *Twin Research and Human Genetics*, *10*, 241-254.
b) Dahl, A.K., Reynolds, C.A., Fall, T., Magnusson, P.K.E., & Pedersen, N.L. (2014) Multifactorial Analysis of Changes in Body Mass Index across the Adult Life Course – A Study with 65 Years of Follow-up. *International Journal of Obesity*, 38(8), 1133-41. doi: 10.1038/ijo.2013.204. [PMCID: PMC4012011]
c) Duggan, K. A., Reynolds, C. A., Kern, M. L., & Friedman, H. S. (2014). Childhood Sleep Duration and Lifelong Mortality Risk. *Health Psychology*, *33*(10), 1195-1203. http://dx.doi.org/10.1037/hea0000078
d) Reynolds, C. A., Gatz, M., Christensen, K., Christiansen, L., Dahl Aslan, A. K., Kaprio, J., Korhonen, T., Kremen, W. S., Krueger, R., McGue, M., Neiderhiser, J. M., Pedersen, N. L., for the IGEMS consortium (2016). Gene-Environment Interplay in Physical, Psychological, and Cognitive Domains in Mid to Late Adulthood: Is APOE a Variability Gene? *Behav Genet, 46*(1), 4-19. doi:10.1007/s10519-015-9761-3

5. Studies of mate selection have presented moderate marital correlations for a variety of behavioral and cognitive traits; yet, assortment is often ignored in biometrical models, or social mechanisms overlooked that may lead to over-estimation of heritable influences. With colleagues, I have led work on models of assortment in twin-kinships and have shown that educational attainment is a primary selection trait that evidences both active selection and social background processes through which assortment for cognition occurs. Moreover, we have shown that health behaviors are a key domain to study assortment processes, particularly due to variation in cultural and contextual effects (e.g., SES, government regulation). Last, in emergent work

colleagues and I are considering selection processes, including friendships, that imply that an individual's construction or selection of environments (rGE) may be salient to health and well-being across the lifespan.

a) Reynolds, C.A., Baker, L.A., Pedersen, N.L. (2000). Multivariate models of mixed assortment: phenotypic assortment and social homogamy for education and fluid ability. *Behavior Genetics*, *30*(6), 455-476.
b) Reynolds, C.A., Barlow, T., & Pedersen, N.L. (2006). Alcohol, tobacco and caffeine use: Spouse similarity processes. *Behavior Genetics*, *36*, 201-15.
c) Horwitz, B. N., Reynolds, C. A., & Charles, S. T. (2015). Understanding associations among family support, friend support, and psychological distress. *Personal Relationships, 22*(1), 79-91. doi: 10.1111/pere.12063
d) Horwitz, B. N., Reynolds, C. A., Walum, H., Ganiban, J., Spotts, E. L., Reiss, D., Lichtenstein, P., & Neiderhiser, J. M. (2016). Understanding The Role of Mate Selection Processes in Couples' Pair-Bonding Behavior. *Behav Genet, 46*(1), 143-149. doi:10.1007/s10519-015-9766-y

Complete List of Published Work in MyBibliography:
http://www.ncbi.nlm.nih.gov/sites/myncbi/1x_pryu6Jl457/bibliograpahy/48112169/public/?sort=date&direction=descending

D. Research Support

Ongoing Research Support

Colorado Adoption/Twin Study of Lifespan behavioral development & cognitive aging (CATSLife) (Reynolds, Wadsworth, MPIs)
1R01AG046938A1 06/01/2015 – 02/28/2020
3R01AG046938-03S1 09/15/2017 – 02/28/2020
The goals are to conduct a genetically sensitive study of individual differences in behavioral and cognitive change at the cusp of middle adulthood in 1600 participants studied almost yearly from birth to early adulthood; map individual differences in growth and maintenance of cognitive abilities; evaluate and trace measured physical factors and health behaviors, biochemical markers and measured genetic pathways important to sustaining cognitive performance; and track measured environmental factors that might decrease, sustain or boost cognitive performance.
The supplement takes advantage of new technology that will allow us to evaluate short-term variability in cognitive performance within and across 14 days using validated measures, and allow for direct comparisons with a more ethnically diverse sample of adults from the ESCAPE study overlapping in age with CATSLife.
Role: PI (contact)

Sex differences in the relationship between APOE and AD: Role of sexual differentiation (Pike, Gatz, LaDu, MPIs)
R01 AG058068 09/01/17 – 08/31/22
Sex differences in the relationship between APOE and AD: Role of sexual differentiation
This project uses human and rodent models to investigate the role of early neural development in sex differences in AD risk and how this modulated by *APOE4* genotype.
Role: Consultant

The VETSA Longitudinal Twin Study of Cognition and Aging (VETSA 3) (Kremen, Lyons, MPIs)
R01 AG018386 09/01/15-05/31/19
The VETSA 3 project provides a follow-up to the earlier waves to determine optimal MCI definitions and early identification, patterns of cognitive change from midlife to early old age, and polygenic and biomarker factors associated with resilience.
Role: Co-Investigator (PI on UCR subcontract)

Gene-Environment Interplay of Social Contexts and Aging-Related Outcomes (Pedersen, PI)
2R56 AG037985 - 06 9/15/2016 – 8/31/2017, extension to 9/15/2018
A consortium of longitudinal twin studies will explore the basis for the association of social factors and aging outcomes. The resulting analysis of the combined data from over 16,000 to now 50,000 participants aims to understand why early life adversity, including socioeconomic indices, as well as social factors such as isolation

and loneliness are associated with diverse outcomes including mortality, and physical, emotional and cognitive health.
Role: Co-investigator (PI on UCR subcontract)

The Pharmacological Enhancement of Sleep for Memory Improvement (Mednick, PI)
R01AG0466460 1/01/2014-12/31/2019
The project is devoted to examining the role of pharmacologically targeted sleep features on memory performance changes in individuals, including older adults. I serve as a co-I to the project, particularly aim 3, which will extend the examination of pharmacologically targeted sleep features on declarative and non-declarative memory consolidation in older adults.
Role: Co-investigator

Completed Research Support (last 3 years)

Settings for Success among Emancipating Foster Youth: Youth and Workers in Communication and Collaboration (Yates, PI)
WT grant foundation
07/01/2012-06/30/2017
The project examines the psychosocial transitions to adulthood among 400 emancipated foster youth as they come of age on opposite sides of a shifting California policy (AB12).
Role: Consultant

Strategies for Navigating Uncertainty (Sweeny, PI)
NSF 1251672 04/01/2013-03/31/2016
The primary goals of the proposed research are to better understand the experience of waiting, identify the processes by which people manage uncertainty, and to reveal the uncertainty navigation strategies that are most effective, both for managing anxiety during a waiting period and for maximizing benefit and minimizing harm upon learning the uncertain news.
Role: Collaborator