BIOGRAPHICAL SKETCH

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NAME: Laurienti, Paul J.

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

POSITION TITLE: Professor

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
University of Colorado, Denver, Colorado		1986-87	Psychology
University of Houston, Houston, Texas	B.S.	1987-91	Psychology
Univ. of Texas Medical Branch, Galveston, Texas	Ph.D.	1991-95	Neuroscience
Univ. of Texas Medical Branch, Galveston, Texas	M.D.	1995-99	Medicine

A. Personal Statement

As director of the Laboratory for Complex Brain Networks (LCBN), I oversee the development and application of image analysis methodologies to a range of human brain imaging studies. The LCBN utilizes advanced methodologies to understand the brain as a complex system. We develop and implement network analysis methods to assess whole-brain connectivity rather than focusing on individual brain regions. I have an extensive background in human brain imaging, including functional imaging, perfusion imaging, and network analyses. The majority of my efforts have focused on using imaging methods to understand normal and abnormal brain function. Prior to focusing on brain networks, I contributed to the development of several new methods/software tools. WFU PickAtlas is one of the software packages that I participated in developing, serving as the experimentalist/end-user. That software is still widely used and has been referenced by over 2200 investigators. Over the past 8 years I have focused on developing and utilizing methodologies for brain network analyses. A substantial portion of this work has been dedicated to developing new methodologies and furthering the theoretical aspects of the field. I have published manuscripts relating to reproducibility in fMRI networks, statistical models for comparing brain networks, and theoretical aspects of generating networks. As a result of these innovative methodologies I serve as the network science advisor on multiple NIH funded research studies and have been an invited speaker at many national international scientific meetings. Select publications related to developing new image analysis methods and software are listed below.

a. Maldjian JA, **Laurienti PJ**, Kraft RA, Burdette JH. An automated method for neuroanatomic and cytoarchitectonic atlas-based interrogation of fMRI data sets. NeuroImage 2003; 19: 1233-1239.
b. Simpson SL, Moussa MN, **Laurienti PJ.** An exponential random graph modeling approach to creating group-based representative whole-brain connectivity networks. Neuroimage. 2012; 60(2): 1117-1126. PMCID: PMC3303958
c. Casanova R, Ryali S, Baer A, **Laurienti PJ**, Burdette JH, Hayasaka S, Flowers L, Wood FB, Maldjian JA. Biological Parametric Mapping: A Statistical Toolbox for Multi-Modality Brain Image Analysis. NeuroImage 2006; 34(1): 137-143. PMCID: PMC1994117
d. Simpson SL, **Laurienti PJ**. A two-part mixed-effects modeling framework for analyzing whole-brain network data. Neuroimage. 2015; 113: 310-319. PMCID: PMC4433821

B. Positions and Honors

2002-2006	Assistant Professor, Department of Radiology, Wake Forest School of Medicine, Winston-Salem, North Carolina.
2003-present	Associate, Department of Biomedical Engineering, Wake Forest School of Medicine, Winston-Salem, North Carolina.

2005-present	Faculty, Kulynych Center for Memory and Cognition Research, Wake Forest School of Medicine, Winston-Salem, North Carolina.
2006-2011	Associate Professor, Department of Radiology, Wake Forest School of Medicine, Winston-Salem, North Carolina.
2007-present	Faculty, Sticht Center on Aging, Wake Forest School of Medicine, Winston-Salem, North Carolina.
2010-present	Associate Professor, Translational Science Institute, Wake Forest School of Medicine, Winston-Salem, North Carolina.
2010-present	Scientific Director of the Translational Science Center at Wake Forest University, Winston-Salem, North Carolina.
2011-present	Professor, Departments of Radiology and Translational Science, Wake Forest School of Medicine, Winston-Salem, North Carolina.

NIH Consultancies
2004 (February)	NCCAM Basic and pre-clinical R21 applications *ad hoc* member
2004, 2005, 2006	MEDI *ad hoc* member
2006-2010	MEDI regular member
2006 (April)	NINDS Neuroscience Blueprint Center Study Section
2007 (July)	NINDS Neuroscience Blueprint Software Design Study Section
2010 (Sept)	Psychosocial Risk and Disease Prevention (PRDP) Study Section *ad hoc* member
2011 (June)	Clinical/Translational Study Section *ad hoc* member
2013 (April)	National Science Foundation Major Instrumentation Grant Review

Honors & Awards
1998	Alpha Omega Alpha Honor Society
2003-2009	National Institutes of Health Loan Repayment Scholar
2005	Wake Forest University New Investigator in Clinical Science Award
2011	Outstanding Mid-Career Faculty Research Award, Wake Forest School of Medicine
2014	Team Science Research Award, Wake Forest School of Medicine

C. Contribution to Science
1. Since 2007 I have dedicated my research efforts toward understanding the brain as a complex system. Network science has become a valuable tool in this effort. I was an early adopter of network analyses in the human brain and hosted the first Network Science and the Brain at the 2009 Organization of Human Brain Mapping conference. During this time I have published over 35 network science manuscripts directed at understanding normal and abnormal brain function. My research has spanned studies understanding obesity and eating behavior, aging, cognition, agent-based brain models, and music perception. Ongoing studies include evaluation of brain networks in dysautonomia, in pesticide exposed farmworkers, in diabetics after lifestyle intervention (Look Ahead), and in obese older adults after exercise and weight loss.
   a. Steen M, Hayasaka S, Joyce K, **Laurienti PJ**. Assessing the consistency of community structure in complex networks. Physical Review E 2011; 84:016111. PMCID: PMC3292265
   b. Telesford QK, Burdette JH, **Laurienti PJ**. An exploration of graph metric reproducibility in complex brain networks. Front in Neuroscience 2013; 7:67. PMCID: PMC3652292
   c. Joyce KE, Hayasaka S, **Laurienti PJ**.A Genetic Algorithm for Controlling an Agent-Based Model of the Functional Human Brain. ISA Conference Proceedings for RMBS 2012; 48:210-217. PMCID: PMC3616422
   d. Paolini BM, **Laurienti PJ**, Simpson SL, Burdette JH, Lyday RG, Rejeski WJ. Global Integration of the Hot-State Brain Network of Appetite Predicts Short Term Weight Loss in Older Adult. Front. Aging Neurosci. 2015; doi.org/10.3389/fnagi.2015.00070. PMCID: PMC4423432

2. I have been studying the aging brain my entire career. My goal has been to understand the neurobiology that underlies successful aging and to identify factors and interventions associated with healthy brain aging. I have contributed to studies examining the implications of obesity, blood flow, and physical function on the aging brain as well as numerous clinical trials directed at improving brain health in older adults. These studies have included cognitive interventions, exercise interventions, and lifestyle interventions. A few specific examples include designing and implementing an NIA-funded pilot intervention to assess the effects of a sensory training program in older adults (B-fit), serving on the brain imaging team of the NIH-

funded Look Ahead Brain study, which is one of the few longitudinal clinical trial lifestyle interventions still active to date, and leading the brain network analyses from the CLIP-II exercise intervention, to be expanded into a new exploratory project.

    a. Moussa MN, Vechlekar CD, Burdette JH, Steen MR, Hugenschmidt CE, **Laurienti PJ**. Changes in cognitive state alter human functional brain networks. Front. Human Neuroscience 2011; 5:1-15. PMCID: PMC3159402

    b. Mozolic JL, Hayaska S, **Laurienti PJ**. A cognitive training intervention increases resting cerebral blood flow in healthy older adults. Front. Hum. Neurosci. 2010; 4:16. PMCID: PMC2841485

    c. **Laurienti PJ**, Burdette JH, Maldjian JA, Wallace MT. Enhanced Multisensory Integration in Older Adults. Neurobiology Aging. 2006; 27(8): 1155-1163.

    d. Hugenschmidt CE, Burdette JH, Morgan AR, Williamson JD, Kritchevsky SB, **Laurienti PJ**. Graph Theory Analysis of Functional Brain Networks and Mobility Disability in Older Adults. Journal of Gerontology: Medical Sciences 2014; 69(11):1399-406. doi: 10.1093/gerona/glu048. PMCID: PMC4204616

3. The neurobiology of alcohol and drug use remains one of my active research interests. I have been active in studies examining other drugs such as alcohol, cocaine, and marijuana and their effects on the brain. My current work, funded by an NIAAA P01, examines the complex relationship between stress and alcohol consumption. As a member of the translational science team for this project that spans rodents, non-human primates, and humans, my major focus is leading the team on the human project investigating the effects of alcohol on cognition and brain networks. Our studies are designed to determine how stress and aging interact with alcohol consumption by ecologically valid momentary assessments, cognitive and behavioral measures, and fMRI imaging.

    a. Moussa MN, Simpson SL, Mayhugh RE, Grata ME, Burdette JH, Porrino LJ, **Laurienti PJ**. Long-term moderate alcohol consumption does not exacerbate age-related cognitive decline in healthy, community-dwelling older adults. Front. Aging Neurosci. 2015. PMCID: PMC4283638

    b. Telesford QK, **Laurienti PJ**, Friedman DP, Kraft RA, Daunais JB.The Effects of Alcohol on the Nonhuman Primate Brain: A Network Science Approach to Neuroimaging. Alcohol Clin Exp Res. 2013; 37(11):1891-900. PMCID: PMC3812370

    c. Telesford QK, **Laurienti PJ**, Davenport AT, Friedman DP, Kraft RA, Daunais JB. The effects of chronic alcohol self-administration in nonhuman primate brain networks. Alcohol Clin Exp Res. 2015; 39(4):659-71. doi: 10.1111/acer.12688. PMCID: PMC3812370

    d. Whitlow CT, Liguori A, Livengood LB, Hart SL, Mussat-Whitlow BJ, Lamborn CM, **Laurienti PJ**, Porrino LJ. Long-term heavy marijuana users make costly decisions on a gambling task. Drug Alcohol Depend 2004; 76: 107-111.

4. Caffeine is the most used stimulate worldwide. I have studied the effects of caffeine and caffeine withdrawal on the brain and cognition for 15 years. My research on the effects of caffeine on the human brain has contributed to the understanding of the neural and vascular consequences of acute caffeine ingestion. We were the first to demonstrate that the effect of caffeine on the BOLD signal were dependent on use history. We further showed that the BOLD signal changes associated with caffeine is related to recent abstinence. Our work also clearly demonstrated that some of the cognitive enhancement that is associated with caffeine is actually due to withdrawal reversal. My previous contributions and publications continue to have an impact on the field and have resulted in both national and international interviews on the topic. It has also lead to research opportunities within the business community.

    a. Addicott MA and **Laurienti PJ**. A comparison of the effects of caffeine following abstinence and normal caffeine use. Psychopharmacology 2009; 207(3): 423-431. PMCID: PMC2941158

    b. Addicott MA, Peiffer AM, **Laurienti PJ**. The effects of dietary caffeine use and abstention on blood oxygen level dependent activation and cerebral blood flow. Journal of Caffeine Research 2012; 2(1): 15-22. PMCID: PMC3621312

    c. **Laurienti PJ**, Field AS, Burdette JH, Maldjian JA, Yen Y-F, Moody DM. Dietary caffeine consumption modulates fMRI measures. NeuroImage 2002; 17: 751-757.

    d. Addicott MA, Yang LL, Peiffer AM, **Laurienti PJ**. Methodological considerations for the quantification of self-reported caffeine use. Psychopharmacology 2009; 203(3): 571-578. PMCID: PMC2829439

5. My past work on multisensory integration has had a considerable impact both in furthering our understanding of neurobiology of integration and on the methods used to assess integration. My first NIH grant was a K-award to examine age-related changes in multisensory integration. Many of my research projects examined how multisensory integration changed with age and demonstrated that older adults experienced enhanced integration. Having also performed numerous brain imaging studies to evaluate the neural correlates of multisensory integration, I developed a model to quantify multisensory integration using functional MRI. This model (dubbed by other researchers as the Laurienti Model) provides a more statistically accurate calculation of multisensory integration and has been highly influential in guiding study design for functional imaging assessments of multisensory processing. I have published 13 manuscripts and multiple book chapters on multisensory integration.
   a. **Laurienti PJ**. Deactivations, global signal, and the default mode of brain function. J Cogn Neuroscience 2004; 16: 1481-1483.
   b. **Laurienti PJ**, Burdette JH, Wallace MT, Yen Y-F, Field AS, Stein BE. Deactivation of sensory-specific cortex by cross-modal stimuli. J Cogn Neuroscience 2002; 14: 420-429.
   c. Mozolic JL, Joyner D, Hugenschmidt CE, Peiffer AM, Kraft RA, Maldjian JA, **Laurienti PJ**. Cross-modal deactivations during modality-specific selective attention. BMC Neurology 2008; 8:35. PMCID: PMC2569962
   d. Hugenschmidt CE, Mozolic JL, **Laurienti PJ**. Suppression of multisensory integration by modality-specific attention in aging. Neuroreport 2009; 20(4): 349-353. PMCID: PMC2692738

The complete publication list can be found at: https://scholar.google.com/citations?user=OTJwdDQAAAAJ&hl=en

D. Research Support
Ongoing
5 P01 AA021099-03 (Weiner)   09/01/2013 - 08/31/2017
Project PI (**Laurienti**)
NIAAA
Translational Studies On Early-Life Stress And Vulnerability To Alcohol Addiction
This project will use network science to investigate the effects of life stressors and aging compounded with moderate alcohol use.
Role: Project PI

5 R01 DK092237-04 (Espeland)   09/15/2011 - 08/31/2015
NIDDK
Action for Health in Diabetes Brain Magnetic Resonance Imaging Ancillary Study
The goal of this project is the care of adults with type 2 diabetes mellitus, who are at increased risk for atrophy, cerebrovascular disease, and cognitive impairment.
Role: Co Investigator

5 R01 MH097751-03 (Ho)   09/01/2012 - 08/31/2017
Subcontract PI (**Laurienti**)
NIMH
Adolescent Cannabis Use, Complex Brain Network Connectivity & Schizophrenia
This project will look at the use of marijuana in adolescents as compared with a control group of children/siblings of diagnosed schizophrenics. MRI and DTI brain imaging data will be evaluated using
Role: Co Investigator

3 R01 ES008739-16S1 (Arcury)   03/01/2013 - 02/28/2016
NIEHS
CBPR on Pesticide Exposure & Neurological Outcomes for Latinos: PACE4
This supplemental funding will be used to obtain magnetic resonance brain imaging for the parent study examining the effects of agricultural pesticides in migrant and seasonal Latino farmworkers.
Role: Co Investigator

5 P30 AG21332-12 (Kritchevsky)   06/01/2013 - 05/31/2018
NIA

Wake Forest School of Medicine Claude D. Pepper Older Americans Independence Center
The major goals of this project are the developing, testing and dissemination of effective therapies for the treatment and prevention of physical disability in later life, and training the next generation leaders in clinical geriatrics research.
Role: Co Investigator

5 K25 EB012236-03 (Simpson)   07/01/2012 - 06/30/2017
NIDDK
Statistical Methods for Whole-Brain Connectivity Networks
The training activities will focus on deepened understanding of the brain as a complex system, enabling reasonable modeling and evaluating of this system in a biologically meaningful way.
Role: Mentor

Completed

R21 ES019720 (Arcury)   09/09/2011-08/31/2015
NIEHS
Pesticide Exposure And Age-Related Changes In Cognitive Function
The overall goal of this project is to determine whether age-pesticide exposure interactions are important in the progression of cognitive impairment and decline.
Role: Co Investigator

The Hershey Company (**Laurienti**/Burdette)   03/01/2014 – 02/28/2015
Effects of a Cocoa Shot on the Human Brain II
The Hershey Company is interested in investigating the effects of various chocolate beverages on brain physiology and cognitive function. (NCT02080845)
Role: Co-PI

F31 AA021639 (Moussa)   07/01/2013 - 02/30/2015
Ruth L. Kirschstein NRSA, NIAAA
The Effects of Moderate Alcohol Use in Age Related Cognitive Decline
This study looks at the cognitive peformance and functional brani connectivity of low and moderate alcohol use in older adults (65-80).
Role: Mentor

R01 NS070917 (Hayasaka)   05/01/2010 - 01/30/2015
NINDS
Connecting Brain Networks Across Subjects and Across Modalities
In this project a methodological framework will be developed to analyze brain network data from multiple subjects and modalities together.
Role: Co Investigator

The Hershey Company (**Laurient**i/Burdette)   09/01/2013 - 08/31/2014
Effects of a Cocoa Shot on the Human Brain
The Hershey Company is interested in investigating the effects of various chocolate beverages on brain physiology and cognitive function. (NCT01924481)
Role: Co-PI

T35 DK007400 (**Laurienti**)   05/01/1980 - 04/30/2013
NIDDK
Short Term Research Training of Medical Students
This training grant is for the support of 16 trainees for a 12 weeks research training period each. Trainees are selected on a competitive basis from research applications developed in conjunction with selected faculty.
Role: PI