

NICHOLAS M. KANAAN, PhD

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EDUCATION

PhD: Neurological Sciences; Rush University Medical Center, Chicago, IL (2007)

BS: Neuroscience, Psychology, and Sociology; Central Michigan University (2001)

Honors: Magna Cum Laude

CURRENT POSITIONS

Assistant Professor **2010-Current**

Michigan State University
College of Human Medicine
Department of Translational Science and Molecular Medicine (TSMM)

Director of Advanced Microscopy **2014-Current**

Michigan State University
College of Human Medicine
Department of Translational Science and Molecular Medicine (TSMM)

PROFESSIONAL EXPERIENCE

Assistant Professor **2010-Current**

Michigan State University
College of Human Medicine
Department of Translational Science and Molecular Medicine

Director of Advanced Microscopy **2014-Current**

Michigan State University
Department of Translational Science and Molecular Medicine

Postdoctoral Fellow **2007-2010**

Department of Cell and Molecular Biology
Northwestern University, Chicago, Illinois
Mentor: Lester "Skip" I. Binder, Ph.D., Professor of Cell and Molecular Biology

Graduate Research Fellow **2001-2007**

Department of Neurological Sciences
Rush University Medical Center, Chicago, Illinois
Advisors: Timothy J. Collier, Ph.D., Professor of Neurological Sciences

Undergraduate Research Assistant Fellow **1998-2001**

Department of Psychology
Central Michigan University, Mount Pleasant, Michigan
Advisor: Gary L. Dunbar, Ph.D., Professor of Psychology

ACADEMIC APPOINTMENTS

<u>Assistant Professor</u>	2010-Current
Michigan State University College of Human Medicine <i>Department of Translational Science and Molecular Medicine (TSMM)</i>	
<u>Neuroscience Program Faculty</u>	2011-Current
Michigan State University	
<u>Cell and Molecular Biology Program Faculty</u>	2016-Current
Michigan State University	
<u>Associate Visiting Scientist</u>	2015-Current
Mercy Health Saint Mary's Mercy Health Hauenstein Neuroscience Center	

PROFESSIONAL MEMBERSHIPS AND ACTIVITIES

- ✧ Society for Neuroscience (SFN)(Current)
- ✧ American Society for Neural Therapy and Repair (ASNTR) (Current)
- ✧ Alzheimer's Association International Society to Advance Alzheimer's Research and Treatment (ISTAART) (Current)
- ✧ American Association for the Advancement of Science (AAAS) (Past)
- ✧ Biophysical Society (Past)
- ✧ International Society for Neural Transplantation and Repair (ISNTR) (Past)
- ✧ International Brain Research Organization (IBRO) (Past)

Scientific Meeting Roles

1. Co-Chair of "Peering Behind the Curtain: New Concepts in Dementia Research Session" at American Society for Neural Therapy and Repair 2016 Conference
2. Presenter in a Society for Neuroscience Minisymposium at the 2015 meeting (Presentation: Mechanisms mediating axonal transport deficits induced by Alzheimer's disease-related forms of tau protein)
3. Presenter in selected symposium at the American Society for Neurochemistry 2014 meeting (Presentation: Disease-related forms of tau induce axonal degeneration in cultured neurons and in vivo)

HONORS AND AWARDS

- ✧ 2013 NINDS Udall Center Directors' Conference Poster Presentation Award
- ✧ Received The Carl & Marie Duncan Prize for Memory Disorders Research Award in 2010 at The 16th Annual Alzheimer Day Meeting in Chicago, IL.
- ✧ NIH National Research Service Award Institutional Research Training Grant Post-doctoral Position (2009-2010): Title – Mechanisms of Aging and Dementia Training Grant (John Disterhoft, Ph.D. - T32 AG020506-07)
- ✧ Conference Student Travel Award to ASNTR in 2007
- ✧ Conference Student Travel Award to ASNTR in 2006

- ✧ Conference Student Travel Award to ASNTR in 2003
- ✧ Member of Golden Key International Honor Society since 2000
- ✧ NIH National Research Service Award Institutional Research Training Grant Pre-doctoral Position (2001-2006): Title - Basic Neuroscience Training in Age-Related Disorders (Leyla deToledo-Morrell, Ph.D. - T32 AG00269)

COMMITTEE ASSIGNMENTS AND ADMINISTRATIVE SERVICES

University Level Service

- ✧ **Chair** of the NRSA Research Plan Exam Committee for the MSU Neuroscience Program comprehensive exam (2016)
- ✧ Member of the NRSA Research Plan Exam Committee for the MSU Neuroscience Program comprehensive exam (2015)
- ✧ Member of the Specialized Component Examination Committee for Megan Duffy's (NSP PhD Student) comprehensive exam

College Level Service

- ✧ Member of the CHM Grievance/Complaint Hearing Panel Committee (2015-Current)
- ✧ Participant in the interview sessions during the Liaison Committee on Medical Education (LCME) CHM accreditation site visit (2014)

Department Level Service

- ✧ **Chair** of the Search Committee for the Alzheimer's Cluster Senior Faculty Position (2014-Current)
- ✧ **Director** of TSMM Seminar Series (2016-Current)
- ✧ **Chair** of the TSMM Authorship in Publication Subcommittee (2016)
- ✧ **Chair** of the TSMM Shared and Core Labs Committee for the new MSU Grand Rapids Research Center Building (2014-2016)
- ✧ **Director** of TSMM Departmental Journal Club (2011 – 2014)
- ✧ **Assistant Director** of Research in Progress Symposium (2011 – 2013)
- ✧ **Elected member** of the Executive Committee for TSMM (2014-Current)
- ✧ Global Impact Initiative (GII) Faculty Search Committee Member (2016-Current)
- ✧ ObGyn and TSMM GRRC Committee (2016-Current)
- ✧ TSMM Trainee Individual Development Plan Committee Member (2014-Current)
- ✧ Member of the TSMM Research Labs and Support Offices Committee for the new MSU Grand Rapids Research Center Building (2014-2015)
- ✧ Member of TSMM Reappointment, Promotion, Tenure Document Committee (2010 - 2013)
- ✧ Member of TSMM Bylaws Committee (2010 - 2013)

Community Service

- ✧ Steering Committee Member for Rethinking Dementia: Accelerating Change

Other Service

- ✧ Rush University Medical Center Institutional Animal Care and Use Committee (IACUC) –

Student Member (2004 – 2007).

Scientific Review Boards: NIH

- ✧ Brain Disorders and Clinical Neuroscience (BDCN), PAR-15-357 “Understanding Alzheimer's Disease in the Context of the Aging Brain” Special Emphasis Panel, NIH study section
- ✧ Molecular, Cellular, and Developmental Neuroscience (MDCN) N03 Special Emphasis Panel, NIH study section
- ✧ BDCN ZRG1 BDCN-K 03M Special Emphasis Panel, NIH study section
- ✧ Chronic Dysfunction and Integrative Neurodegeneration (CDIN) NIH study section (ad hoc reviewer)
- ✧ Member of the Early Career Reviewer Program at the Center for Scientific Review (CSR), National Institutes of Health (2013-2015)

Scientific Review Boards: Other Extramural Agencies/Universities

- ✧ Medical Research Council of the United Kingdom (International Agency)
- ✧ The Alzheimer’s Association
- ✧ University of South Florida Health Byrd Alzheimer Institute Proposal Reviewer
- ✧ Banner Sun Health Research Institute's Alzheimer's Consortium

Scientific Review Boards: Intramural MSU Reviews

- ✧ Jean P. Schultz Biomedical Research Fund Proposals (MSU)
- ✧ Office of the Vice President for Research and Graduate Studies Discretionary Funding Initiative Grants at MSU

EDUCATIONAL ACTIVITIES

- ✧ **Anatomy/Physiology Lab, MSU CHM, Shared Discovery Curriculum**
pECE Neuro Lab 2: Brainstem and Cerebellum Lab Instructor, Fall 2016
- ✧ **Problem-Based Learning, MSU CHM**
 - Preceptorship**
HM528 Metabolic, Endocrine, Reproductive Domain (3 credits), Spring 2016
HM517 Musculoskeletal Domain (2 credits), Fall 2016
 - Preceptor Shadowing**
HM513 Neurological Domain (3 credits), Fall 2015
HM511 Infectious Disease Domain (3 credits), Fall 2015
HM516 Disorders of Thought, Emotion & Behavior Domain (4 credits), Fall 2015
- ✧ **MSU Neuroscience Program Comprehensive Exams**
Spring 2016 NRSA component of Comprehensive Exam Question (Chairman) – all students
Spring 2015 NRSA component of Comprehensive Exam Question – all students
Spring 2015 Specialized Component of Comprehensive Exam – Megan Duffy

✧ **Instructor / Advisor:**

CMB 800: Therapeutic Strategies for Neurodegenerative Diseases (1 credit), Spring 2016
NEU 890: Independent Study – Andrew Kneynsberg (2 credit), Fall 2012
NEU 890: Independent Study – Nicole Polinski (2 credit), Fall 2012
NEU 999: Doctoral Dissertation Research – Andrew Kneynsberg (25 credits), Spring 2014 – Spring 2016
NEU 999: Doctoral Dissertation Research – Kyle Christensen (8 Credits), Spring 2015 – Summer 2016

✧ **Lecturer:**

Summer 2015 TSMM Technique Course, “Peering Into the Microscopic World: Using Confocal Microscopy and Transmission Electron Microscopy for Research”
Summer 2014 TSMM Technique Course, “Recombinant Protein Production and Use in Protein Aggregation Assays”
NEU800 Spring 2013 Neuroscience Research Forum, “How to write a manuscript with the inevitable review process in mind” (1 credit)
NEU800 Spring 2012 Neuroscience Research Forum, “How to critically review a manuscript” (1 credit)

✧ **PhD Committee Memberships**

Andrew Kneynsberg, MSU NSP, Advisor, Dissertation Committee Chair
Kyle Christensen, MSU NSP, Advisor, Dissertation Committee Chair
Megan Duffy, MSU NSP, Dissertation Committee Member
Sarah Kelly, MSU CMB Program, Dissertation Committee Member
Leslie Wyman, Van Andel Research Institute, Dissertation Committee Member

✧ **External PhD Candidacy Comprehensive Exam Member**

Spring 2016: Lindsey Cunningham, PhD candidate, Van Andel Research Institute Graduate School

✧ **Individual Development Planning Committees for Trainees**

Andrew Kneynsberg, MSU PhD Candidate, Advisor
Kyle Christensen, MSU PhD Candidate, Advisor
Megan Duffy, MSU PhD Candidate, IDP Liaison
Matthew Benskey, MSU Postdoc, IDP Liaison

✧ **Trainees:**

Benjamin Combs, Postdoctoral Fellow (current)
Chelsea Tiernan, Postdoctoral Fellow (current)
Kristine Cox, Postdoctoral Fellow (2013-2015)

Andrew Kneynsberg, PhD Candidate (current)
 Kyle Christensen, PhD Candidate (current)
 Carlos Nogueras-Ortiz, Visiting PhD Candidate from University of Puerto Rico (summer 2014)
 Emi Bulica, MSU Medical School Student (summer 2012)
 Matthew Orbain, MSU Undergraduate (summer 2015)
 Ashley Bowman, MSU Undergraduate (summer 2014)
 Nicholas Collier, MSU Undergraduate (summer 2012)
 Corey Shaffer, High school Student (spring and summer 2015)

✧ **Training Grant Roles**

T32 NS044928 (Sisk-PI, Kanaan - Training Faculty) 7/1/2002 - 6/30/2016
 NINDS (NIH) “Interdisciplinary training program in neuroscience”
 T32 GM092715 (Galligan-PI, Kanaan - Training Faculty) 7/1/2011 - 6/30/2016
 NIGMS (NIH) “Integrative Training in Pharmacological Sciences”
 T32 GM092715 (Neubig-PI, Kanaan - Training Faculty) 7/01/2016 - 6/30/2021
 NIGMS (NIH) “Integrative Pharmacological Sciences Training Program”

OTHER ACTIVITIES AND COMMUNITY OUTREACH

- ✧ Mentee in the MSU-CHM Tenure Mentor Program (2013-Currently)
- ✧ Attended Congressman Fred Upton’s Roundtable event to discuss translational research as an MSU representative (invitation by Dr. Walt Esselman) (Mar 2016)
- ✧ Representative of MSU at the Forum of HOPE for Alzheimer’s Disease Act with Senator Debbie Stabenow in Kalamazoo, MI. During the forum I fielded several questions from the Senator and other attendees, which was covered by several news outlets (2015)
- ✧ MSU representative at the Alzheimer’s Advocacy Day Event at the Michigan State Capitol Building and met with Senator Dave Hildenbrand, State Representative Brandon Dillon and State Representative Winnie Brinks to discuss the importance of Alzheimer’s disease support (Lansing, MI) (2015)
- ✧ Represented MSU at a meeting with Alzheimer’s Association Officials (Jennifer Howard, the Executive Director of the Michigan Chapter and Heather Snyder, the National Director of Medical and Scientific Operations) to discuss our efforts in Alzheimer’s disease research and how we can work with the Alzheimer’s Association (2015)
- ✧ Represented the CHM junior faculty in the CHM LCME accreditation site visit
- ✧ Representative of faculty in Grand Rapids during the MSU Neuroscience Graduate Program External Review site visit – interview sessions with site visit evaluators (2014)
- ✧ Subject of a Grand Rapids Press article that focused on private donations funding research in relation to obtaining the Schultz Biomedical Research Endowment Award at MSU (2015).
- ✧ Represented MSU and TSMM in an article in the Grand Rapids Press related to the MSU-CHM Mini Cooper Raffle Promotion to purchase our Nikon Confocal System because I was the lead MSU-TSMM contact for this effort.
- ✧ Represented MSU in a press conference attended by press, public and Michigan legislators at the State Capitol Building in Lansing to promote MSU, CHM, TSMM and the Mini Cooper Raffle (2014)

- ✧ Appointed the lead contact on the expansion of TSMC into new space within the Van Andel Institute, which involved coordinating numerous aspects of the construction of the space, ordering new general lab equipment to outfit the space and getting 3 labs (my lab, Dr. Lester Binder and Dr. Scott Counts) moved into the space (2013)
- ✧ Representative of MSU as an expert in Alzheimer's disease for a Detroit News article on Alzheimer's disease and the National Alzheimer's Project Act (2012)
- ✧ Guest on IMPACT 89FM, an MSU radio station, as an MSU expert in Alzheimer's disease to discuss NIH funding and the National Alzheimer's Project Act (2012)
- ✧ Live interview on the local FOX news as an expert in Alzheimer's disease at MSU to discuss recent publications on the genetic risk factors for Alzheimer's disease (2011)
- ✧ Highlighted in an article in the Saint Mary's Hauenstein Neuroscience Center's "Neuroscience Report to the Community 2011" to highlight the success of junior faculty at MSU that were supported by funding from Saint Mary's (2011)
- ✧ Interviewed for MSU's MD Magazine for an article introducing the new MSU-CHM faculty in Grand Rapids (2010)

EDITORIAL BOARD APPOINTMENTS AND MANUSCRIPT REVIEWING

- ✧ Review Editor at *Frontiers in Neuroscience: Neurodegeneration* (2016-Currently)
- ✧ Scientific Review Associate for the *European Journal of Neuroscience* (2011-Currently)
- ✧ Manuscript Reviewer for:
 - *Neuropsychopharmacology*
 - *Journal of Neuropathology and Experimental Neurology*
 - *Journal of Neuroscience Research*
 - *European Journal of Neuroscience*
 - *International Immunotherapy*
 - *Progress in Neurobiology*
 - *European Biochemical Societies Journal*
 - *Neuropsychologia*
 - *Cytometry (Part A)*
 - *Cellular and Molecular Neurobiology*

PUBLICATIONS

PubMed: <http://www.ncbi.nlm.nih.gov.proxy2.cl.msu.edu/pubmed/?term=Kanaan+NM%5BAuthor%5D>

1. Grabinski T and **Kanaan NM**. Novel non-phosphorylated serine 9/21 GSK3 β / α antibodies: Expanding the tools for studying GSK3 regulation. *Front. Mol. Neurosci.* 2016. 9:123.
2. Koss DJ, Jones G, Cranston A, Gardner H, **Kanaan NM** and Platt B. Soluble pre-fibrillar tau and β -amyloid species emerge in early human Alzheimer's disease and track disease progression and cognitive decline. *Acta Neuropath.* 2016. 132(6):875-895. PMID: 27770234
3. Imamura K, Sahara N, **Kanaan NM**, Tsukita K, Kondo T, Kutoku Y, Ohsawa Y, Sunada Y, Kawakami K, Hotta A, Yawata S, Watanabe D, Hasegawa M, Trojanowski JQ, Lee VMY, Sahara T, Higuchi M, Inoue H. Calcium dysregulation contributes to neurodegeneration in FTLD patient iPSC-derived neurons. *Sci Rep.* 2016. 6:34904. PMID: 27721502.
4. Cox K, Combs B, Abdelmesih B, Morfini G, Brady ST and **Kanaan NM**. Analysis of Isoform-

- specific Tau Aggregates Suggests a Common Toxic Mechanism Involving Similar Pathological Conformations and Axonal Transport Inhibition. *Neurobiol Aging* 2016. 47:113-126. PMID: 27574109.
5. Mufson EJ, Perez SE, Muhammad N, Mahady L, **Kanaan NM**, Abrahamson EE, Ikonomic MD, Crawford F, Stein T, Alvarez V and McKee AC. Progression of tau pathology within cholinergic nucleus basalis neurons in chronic traumatic encephalopathy: A Chronic Effects of Neurotrauma Consortium Study. *Brain Injury*. 2016, 30(12):1399-1413. PMID: 27834536
 6. Hamano T, Shirafuji N, Makino C, Yen S, **Kanaan NM**, Ueno A, Suzuki J, Ikawa M, Matsunaga A, Yamamura O, Kuriyama M, and Nakamoto Y. Pioglitazone Prevents Tau Oligomerization. *Biochem Biophys Res Comm*. 2016. 478(3):1035-42. PMID: 27543203
 7. Tiernan CT, Combs B, Cox K, Morfini G, Brady ST, Counts SE, and **Kanaan NM**. Pseudophosphorylation of Tau at S422 Enhances SDS-Stable Dimer Formation and Impairs Both Anterograde and Retrograde Fast Axonal Transport. *Exp Neurol*. 2016. 283(Pt A):318-329. PMID: 27373205. PMCID: PMC4992631. *Cover Illustration*
 8. Combs B, Hamel C and **Kanaan NM**. Pathological conformations involving the amino terminus of tau occur early in Alzheimer's disease and are differentially detected by monoclonal antibodies. *Neurobiol Dis*. 2016 94:18-31. PMID: 27260838. PMCID: PMC4983528
 9. Kneynsberg A, Collier TJ, Manfredsson FP and **Kanaan NM**. Quantitative and semi-quantitative measurements of axonal degeneration in tissue and primary neuron cultures. *J Neuro Meth*. 2016. 266:32-41. PMID: 27031947. PMCID: PMC4874894.
 10. Tiernan C, Ginsberg S, Guillozet-Bongaarts A, Ward S, He B, **Kanaan NM**, Mufson EJ, Binder LI, Counts SE. Protein homeostasis gene dysregulation in pretangle-bearing nucleus basalis neurons during the progression of Alzheimer's disease. *Neurobiol Aging*. 2016, 42:80-90. PMID: 27143424. PMCID: PMC4973891
 11. **Kanaan NM**, Cox K, Alvarez VE, Stein TD, Poncil S, McKee AC. Characterization of early pathological tau conformations and phosphorylation in chronic traumatic encephalopathy. *J Neuropathol Exp Neurol*. 2016. 75(1): 19-34. PMID: 26671985. PMCID: PMC4891281.
 12. Combs B, Kneynsberg A, **Kanaan NM**. Gene Therapy Models of Alzheimer's Disease and Other Dementias. *Methods Mol Biol*. 2016 1382:339-66. PMID 26611599. PMCID: PMC4734109.
 13. Fá M, Puzzo D, Piacentini R, Staniszewski A, Zhang H, Baltrons MA, Li Puma DD, Chatterjee I, Li J, Saeed F, Berman HL, Ripoli C, Gulisano W, Gonzalez J, Tian H, Costa JA, Lopez P, Davidowitz E, Yu WH, Haroutunian V, Brown LM, Palmeri A, Sigurdsson EM, Duf KE, Teich AF, Honig LS, Sierks M, Moe JG, D'Adamio L, Grassi C, **Kanaan NM**, Fraser PD, and Arancio O. Extracellular tau oligomers produce an immediate impairment of LTP and memory. *Sci Rep*. 2016, 6:19393. PMCID: PMC4726138.
 14. **Kanaan NM**, Collier TJ, Cole-Strauss A, Grabinski T, Mattingly ZR, Winn ME, Steece-Collier K, Sortwell CE, Manfredsson FP, Lipton JW. The longitudinal transcriptomic response of the substantia nigra to intrastriatal 6-hydroxydopamine reveals significant upregulation of regeneration-associated genes. *PLoS ONE*. 2015,10(5). PMCID: PMC4439078
 15. Grabinski TM, Kneynsberg A, Manfredsson FP and **Kanaan NM**. A method for combining RNAscope in situ hybridization with immunohistochemistry in thick free-floating brain sections and primary neuronal cultures. *PLoS ONE*. 2015. 10(3):1-19. PMCID: PMC4368734
 16. Paumier KL, Luk KC, Manfredsson FP, **Kanaan NM**, Lipton JW, Collier TJ, Steece-Collier K, Kemp CJ, Celano S, Schulz E, Sandoval IM, Fleming S, Dirr E, Polinski NK, Trojanowski JQ, Lee VM, Sortwell CE. Intrastriatal injection of pre-formed mouse α -synuclein fibrils into rats

- triggers α -synuclein pathology and bilateral nigrostriatal degeneration. *Neurobiol Dis.* 2015, 82:185-199. PMID: 26093169. PMCID: PMC4640952.
17. Polinski NK, Gombash SE, Manfredsson FP, Lipton JW, Kemp CJ, Cole-Strauss A, **Kanaan NM**, Steece-Collier K, Kuhn NC, Wohlgenant SL, Sortwell CE. Recombinant adenoassociated virus 2/5-mediated gene transfer is reduced in the aged rat midbrain. *Neurobiol Aging.* 2015. 36(2):1110-20. PMID: 25457558. PMCID: PMC4315740.
 18. **Kanaan NM**, Himmelstein DS, Ward SM, Combs B, and Binder LI. 2015. Tau Protein: Biology and Pathobiology. In M.S. LeDoux (2nd Ed), *Movement Disorders: Genetics and Models* (Ch. 56). p857-869. Burlington, MA. Elsevier Academic Press.
 19. **Kanaan NM**, Pigino GF, Brady ST, Lazarov O, Binder LI, Morfini GA. Axonal degeneration in Alzheimer's disease: When signaling abnormalities meet the axonal transport system. *Exp. Neurol.* 2013; PMID: 22721767. PMCID: PMC3465504.
 20. **Kanaan NM**, Manfredsson FP. Loss of functional alpha-synuclein: a toxic event in Parkinson's disease? *J Parkinson's Dis.* 2012;2(4):249-67. PMID: 23938255. PMCID: PMC4736738.
 21. **Kanaan NM**, Morfini GA, Pigino G, LaPointe NE, Andreadis A, Song Y, Leitman E, Binder LI, and Brady ST. Phosphorylation in the Amino Terminus of Tau Prevents Inhibition of Axonal Transport. *Neurobiol of Aging*, 2012; 33(4):826, 15-30. PMID: 21794954 PMCID: PMC3272324.
 22. **Kanaan NM**, Morfini GA, LaPointe NE, Pigino GF, Patterson KR, Song Y, Andreadis A, Fu Y, Brady ST, and Binder LI. Pathogenic Forms of Tau Inhibit Kinesin-Dependent Axonal Transport Through a Mechanism Involving Activation of Axonal Phosphotransferases. *J. Neurosci.* 2011; 31(27):9858-9868. PMID: 2173427. PMCID: PMC3391724.
 23. Collier, TJ, **Kanaan NM****, Kordower JH. Aging as a primary risk factor for Parkinson's disease: evidence from studies of non-human primates. *Nat. Rev. Neurosci.* 2011; 12(6):359-366. PMID: 21587290. PMCID: PMC3387674. ****co-first authorship**
 24. Patterson KR, Ward SM, Combs B, Voss K, **Kanaan NM**, Morfini G, Brady ST, Gamblin TC, Binder LI. Heat shock protein 70 prevents both tau aggregation and the inhibitory effects of preexisting tau aggregates on fast axonal transport. *Biochemistry.* 2011 Nov 29;50(47):10300-10. PMID: 22039833 PMCID: PMC3387688.
 25. Patterson KR, Remmers C, Fu Y, Brooker S, **Kanaan NM**, Vana L, Ward S, Reyes JF, Philibert K, Glucksman MJ, Binder LI. Characterization of prefibrillar tau oligomers in vitro and in Alzheimer's disease. *JBC.* 2011; 286(26):23063-23076. PMID: 21550980. PMCID: PMC3123074
 26. Vana L, **Kanaan NM**, Hakala KW, Weintraub ST, Binder LI. Peroxynitrite induced nitrative and oxidative modifications alter tau filament formation. *Biochem.* 2011; 50(7):1203-1212. PMID: 21210655 PMCID: PMC3040256.
 27. Vana L, **Kanaan NM**, Ugwu IC, Wu J, Mufson EJ, Binder LI. Progression of Tau Pathology in Cholinergic Basal Forebrain Neurons in MCI and AD. *Am. J. Path.* 2011, 179(5):2533-50. PMID: 21945902; PMCID: PMC3204017.
 28. Reyes JF, Fu Y, Vana LC, **Kanaan NM**, and Binder LI. Tyrosine Nitration Within the Proline Rich Region of Tau in Alzheimer's Disease. *Am. J. Path.* 2011; 178(5):2275-2285. PMID: 21514440. PMCID: PMC3081178
 29. **Kanaan NM**, Kordower JH, Collier TJ Age-related changes in glial cells of dopamine midbrain subregions in rhesus monkeys. *Neurobiol. Aging.* 2010; 31(6): 937-952. PMID: 18715678 PMCID: PMC2872507.
 30. Morfini, G., Burns, M., Binder, L. **Kanaan, N.M.**, LaPointe, N., Bosco, B., Brown, H., Brown,

- B., Jr, Tiwari, A., Hayward, L., Edgar, J., Atagi, Y., Song, Y., Pigino, G., and Brady, S. Axonal Transport Defects in Neurodegenerative Diseases. *J. Neurosci.* 2009; 29(41):12776-86. PMID: 19828789 PMCID: PMC2801051. **“Highly Cited Paper” in Web of Science**
31. **Kanaan NM**, Kordower JH, Collier TJ. Age and region-specific responses of microglia, but not astrocytes, suggest a role in selective vulnerability of dopamine neurons after 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine exposure in monkeys. *Glia* 2008; 56(11):1199-214. PMID: 18484101 PMCID: PMC3388430.
 32. **Kanaan NM**, Kordower JH, Collier TJ. Age-related changes in dopamine transporters and accumulation of 3-nitrotyrosine in rhesus monkey midbrain dopamine neurons: relevance in selective neuronal vulnerability to degeneration. *Eur. J. Neurosci.* 2008; 27(12):3205-15. PMID: 18598263 PMCID: PMC3391583.
 33. **Kanaan NM**, Kordower JH, Collier TJ. Age-related accumulation of Marinesco bodies and lipofuscin in rhesus monkey midbrain dopamine neurons: relevance to selective neuronal vulnerability. *J. Comp. Neurol.* 2007; 502(5):683-700. PMID: 17436290
 34. Kordower JH, **Kanaan NM**, Chu Y, Suresh Babu R, Stansell J 3rd, Terpstra BT, Sortwell CE, Steece-Collier K, Collier TJ. Failure of proteasome inhibitor administration to provide a model of Parkinson's disease in rats and monkeys. *Ann. Neurol.* 2006; 60(2):264-8. PMID: 16862579
 35. Campbell NG, Koprlich JB, **Kanaan NM**, Lipton JW. MDMA administration to pregnant Sprague-Dawley rats results in its passage to the fetal compartment. *Neurotoxicol. Teratol.* 2006; 28(4):459-65. PMID: 16905291
 36. **Kanaan NM**, Collier TJ, Marchionini DM, McGuire SO, Fleming MF, Sortwell CE. Exogenous erythropoietin provides neuroprotection of grafted dopamine neurons in a rodent model of Parkinson's disease. *Brain Res.* 2006; 1068(1):221-9. PMID: 16368081
 37. Koprlich JB, Chen EY, **Kanaan NM**, Campbell NG, Kordower JH, Lipton JW. Prenatal 3,4-methylenedioxymethamphetamine (ecstasy) alters exploratory behavior, reduces monoamine metabolism, and increases forebrain tyrosine hydroxylase fiber density of juvenile rats. *Neurotoxicol. Teratol.* 2003; 25(5):509-17. PMID: 12972064

SYMPOSIA PRESENTATIONS

1. **Kanaan N.M.** Tau conformations and molecular mechanisms of tau-mediated degeneration. Neurology Rehabilitation Grand Rounds. Michigan State University College of Osteopathic Medicine and College of Human Medicine. November 2016. **Invited**
2. **Kanaan N.M.** Pathological tau conformations and toxicity: Recent insights into mechanisms of disease. Faculty of Medicine and Department of Experimental Biology Seminar Series at Universidade do Porto. Porto, Portugal. July 2016. **Invited (International)**
3. **Kanaan N.M.** Pathological tau conformations may provide insight into mechanisms of toxicity in chronic traumatic encephalopathy. American Society for Neural Therapy and Repair. April 2016
4. **Kanaan N.M.** From CMU to MSU and In-between: My Journey to Becoming a Neuroscientist. Central Michigan University. Brain Awareness Conference. March 2016. **Invited Keynote Lecture.**
5. **Kanaan N.M.** Recent advances in understanding the connection between tau conformation and molecular mechanisms of tau toxicity. University of Michigan. Ann Arbor, MI. January 2016. **Invited.**
6. **Kanaan N.M.** The Tau Protein: A potential signaling molecule and its role in molecular mechanisms of toxicity. Drexel University. Philadelphia, PA. December 2015. **Invited**

7. **Kanaan N.M.** Mechanisms mediating axonal transport deficits induced by Alzheimer's disease-related forms of tau protein. Program No. 7.04, Society for Neuroscience Minisymposium Presentation. October 2015
8. **Kanaan N.M.** The role of the amino terminus of tau in toxicity and disease. University of Pennsylvania. Philadelphia, PA. September 2015. **Invited**
9. **Kanaan N.M.** Novel gene therapy-based therapeutics for neurodegenerative diseases. MSU Drug Discovery Seminar Series. East Lansing, MI. February 2015. **Invited**
10. **Kanaan N.M.** Bad news comes in threes: Pathogenic tau conformations, signaling dysregulation and cell toxicity. University of St. Louis Chemistry & Biochemistry Colloquium Seminar Series. November 2014. **Invited**
11. **Kanaan N.M.** Disease-related forms of tau induce axonal degeneration in cultured neurons and *in vivo*. American Society of Neurochemistry Annual Meeting. Long Beach, CA. March 2014. **Invited**
12. **Kanaan N.M.** Axonal Degeneration in Alzheimer's disease and Parkinson's disease. MSU Neuroscience Program Cross Campus Research Symposium. East Lansing, MI. October 2013. **Invited**
13. **Kanaan, N.M.** Alzheimer's disease, tau and axonal transport: What's new and what's next? Van Andel Research Institute Retreat Symposium. Crystal Mountain Thompsonville, MI. June 2011. **Invited**
14. **Kanaan, N.M.** Alzheimer's disease: From Protein to Patients. MSU College of Human Medicine. Bridging the Gap for the Underserved in Medicine Conference. Grand Rapids, MI, April 2011.
15. **Kanaan, N.M.** Conformation and Phosphorylation in Tau-mediated Inhibition of Anterograde Fast Axonal transport. M.A.D. Training Program Symposium, Northwestern University, April 2010.
16. **Kanaan, N.M.** The Amino Terminus of Tau Inhibits Anterograde Transport: Implications in Tauopathies. Guest Speaker. Michigan State University Grand Rapids Campus, November 2009.
17. **Kanaan, N.M.** Aging in the Rhesus Monkey as a Model of Parkinson's Disease. Chicago Chapter Society for Neuroscience Meeting, Graduate Student Symposium, March 2007.
18. **Kanaan, N.M.** Aging in the Rhesus Monkey as a Model of Parkinson's Disease. Rush University Medical Center Annual Research Forum, Graduate Student Symposium, April 2007.

POSTER PRESENTATION AND ABSTRACTS (SELECTED FROM >60)

1. Tiernan CT, Mufson EJ, **Kanaan NM**, Counts SE. Progression of tau oligomer pathology in cholinergic nucleus basalis neurons in mild cognitive impairment and Alzheimer's disease. Program No. 308.4, Society for Neuroscience 2016.
2. Combs B, Hamel C, **Kanaan NM**. Pathological changes in the amino-terminus of tau detected by antibodies. American Society of Neural Therapy and Repair 2016. *Postdoctoral travel award winner (Combs)*
3. Combs B, Alberts AS, **Kanaan NM**. Differential recognition of pathological forms of tau protein with N-terminal antibodies in tauopathies and in vitro assays. Program No. 579.28, Society for Neuroscience 2015.
4. Tiernan CT, Ward SM, Guillozet-Bongaarts AL, **Kanaan NM**, He B, Ginsberg SD, Mufson EJ, Binder LI, Counts SE. Early tau pathology within cholinergic nucleus basalis neurons coincides with neurotrophic gene dysregulation during the progression of Alzheimer's disease. Program

- No. 483.12, Society for Neuroscience 2015.
5. Sortwell CE, Kemp CJ, Lipton JW, Cole-Strauss A, Manfredsson FP, **Kanaan NM**, Duffy MF, Markini N, Collier TJ. Generation and characterization of a brain derived neurotrophic factor (BDNF rs6265) knockin rat. Program No. 572.14, Society for Neuroscience 2015.
 6. Sellnow R, Steece-Collier K, **Kanaan NM**, Sortwell CE, Collier TJ, Cole-Strauss A, Lipton JW, Manfredsson FP. Using rAAV to interrogate the ability of Nurr1 to reverse levodopa-induced dyskinesia in parkinsonian rats. Program No. 463.08, Society for Neuroscience 2015, Nanosymposium Presentation.
 7. Steece-Collier K, Sellnow R, Stancati JA, **Kanaan NM**, Sortwell CE, Collier TJ, Cole-Strauss A, Lipton JW, Meredith GE, Manfredsson FP. Striatal nurr1 silencing as a novel antidyskinetic target for Parkinson's disease. 2015 Alzheimer's Disease/Parkinson's Disease Meeting, Nice, France.
 8. Polinski NK, Gombash SE, Kemp CJ, Kuhn NC, Cole-Strauss A, Wohlgenant SL, **Kanaan NM**, Steece-Collier K, Lipton JW, Manfredsson FP, and Sortwell CE. Decreased Viral Vector Transducibility in the Aged Rat Midbrain. International Symposium on Neurobiology and Neuroendocrinology of Aging. Bregenz, Austria 2015.
 9. **Kanaan NM**, Grabinski T, Combs B, Kneynsberg A, Cole-Strauss A, Mattingly Z, Manfredsson FP, Collier TJ, Lipton JW. Small proline-rich repeat 1a protein protects nigrostriatal axons from degeneration in the 6-hydroxydopamine lesion rat model of Parkinson's disease. Program No. 218.04, Society for Neuroscience 2014.
 10. Cox KK, Himmelstein DS, **Kanaan NM**. Differential oligomer formation and phosphatase-activating domain exposure in tau isoforms. Program No. 788.10, Society for Neuroscience 2014.
 11. Tiernan CT, Himmelstein DS, Counts SC, **Kanaan NM**. Tau oligomer formation and phosphatase-activating domain exposure in disease-related forms of tau. Program No. 788.11, Society for Neuroscience 2014.
 12. Combs B, Alberts AL, **Kanaan NM**. Characterization of tau aggregation induced by arachidonic acid and eicosanoids. Program No. 788.12, Society for Neuroscience 2014.
 13. Kneynsberg A, Grabinski T, **Kanaan NM**. Age-related changes of the axon initial segment and subcellular localization of tau protein in the rat brain. Program No. 793.16, Society for Neuroscience 2014.
 14. Benskey MJ, Jiang C, Sortwell CE, **Kanaan NM**, Manfredsson FP. Alpha synuclein loss-of-function toxicity can be rescued by a non-aggregatable form of the protein. Program No. 386.03, Society for Neuroscience 2014. Nanosymposium Presentation.
 15. Sellnow RC, Steece-Collier K, **Kanaan NM**, Sortwell CE, Collier TJ, Cole-Strauss A, Lipton JW, Manfredsson FP. rAAV-Mediated Nurr1 overexpression in striatal neurons results in enhanced levodopa-induced dyskinesias in the 6-OHDA rat model of Parkinson's disease. Program No. 512.14, Society for Neuroscience 2014.
 16. Sellnow R, Steece-Collier K, **Kanaan NM**, Sortwell CE, Collier TJ, Cole-Strauss A, Lipton JW, Manfredsson FP. rAAV-Mediated Modulation of Striatal Nurr1 Expression Alters the Severity of Levodopa-Induced Dyskinesias in the 6-OHDA Rat Model of Parkinson's Disease. Udall Center Director's Meeting, NIH/NINDS. 2014.
 17. **Kanaan NM**, Sortwell C, Gombash S, Kuhn N, Grabinski T, Hauswirth W, Boye S, Chiodo V, and Manfredsson F. Enhanced CNS transduction and transgene expression by rAAV capsid tyrosine mutants. Program No. 728.05, Society for Neuroscience, 2013.
 18. Kneynsberg A, Collier TJ, Manfredsson FP and **Kanaan NM**. Investigating axonal

- degeneration in the early stages of a striatal 6-hydroxydopamine lesion model of Parkinson's disease. Program No. 137.16, Society for Neuroscience, 2013.
19. Paumier KL, Luk KC, Manfredsson FP, **Kanaan NM**, Lipton JW, Collier TJ, Kemp C, Celano S, Trojanowski JQ, Lee VM, and Sortwell CE. Exogenous pre-formed α -synuclein fibrils initiate the formation of Lewy body-like intracellular inclusion and nigrostriatal degeneration in naïve rats. Program No. 623.19, Society for Neuroscience, 2013.
 20. **Kanaan NM**, Manfredsson FP, Grabinski T, Sortwell CE, Collier TJ, Steece-Collier K and Lipton JW. Identifying novel targets for mitigating dopamine neuron loss and preventing levodopa-induced dyskinesias in Parkinson's disease. Udall Center Director's Meeting, NIH/NINDS. 2014. *Presentation Award Winner*.
 21. **Kanaan NM**, Sortwell CE, Gombash SE, Kuhn NM, Hauswirth WW, Boye SE, Chiodo VA, Grabinski T, Manfredsson FP. Enhanced CNS transduction and transgene expression by rAAV capsid tyrosine mutants. The American Society of Gene and Cell Therapy (Mol Ther), 2013.
 22. Kneynsberg A, Collier TJ, Manfredsson FP and **Kanaan NM**. Investigating axonal degeneration in the early stages of a striatal 6-hydroxydopamine lesion model of Parkinson's disease. 3rd World Parkinson Congress, 2013.
 23. Paumier KL, Luk KC, Manfredsson FP, **Kanaan NM**, Lipton JW, Collier TJ, Kemp C, Celano S, Trojanowski JQ, Lee VM, and Sortwell CE. Intra-striatal injection of pre-formed alpha-synuclein fibrils initiates the formation of Lewy body-like intracellular inclusions and nigrostriatal degeneration in naïve rats. 3rd World Parkinson Congress, 2013.
 24. Lipton JW, **Kanaan NM**, Cole-Strauss A, Sortwell CE, Steece-Collier KA, Daley BF, Collier TJ. Examination of gene expression over time using tissue microarrays provides insight into the progressive compensatory responses within the nigrostriatal tract following intra-striatal 6-hydroxydopamine in the rat. Winter Conference on Brain Research, 2013.
 25. **Kanaan NM**, Kuhn NM, Sortwell CS, Jiang C, and Manfredsson FP. Overexpression of Non-Aggregatable Alpha-Synuclein Protects Against Human Wildtype Alpha-Synuclein Mediated Toxicity. American Society for Neural Therapy and Repair Abstracts (Exp Neurol), 2012.
 26. Himmelstein DS, Patterson K, Fu Y, Ward S, **Kanaan NM**, Lancia J, Binder LI. Characterization of the oligomeric forms of tau. Program No. 437.05, Society for Neuroscience, 2012.
 27. Collier TJ, **Kanaan NM**, Steece-Collier K, Sortwell CE, Manfredsson FP, Rademacher DJ, Daley BF, Cole-Strauss A, Mattingly ZR, Lipton JW. Longitudinal analyses of gene expression changes in the nigrostriatal tract following intra-striatal 6-hydroxydopamine in the rat. Program No. 757.23, Society for Neuroscience, 2012.
 28. Sahara N, Ward SM, Ren Y, Himmelstein D, Fu Y, Yu XW, Patterson K, **Kanaan NM**, Lewis J, Dickson DW, Binder LI. Investigating tau oligomers in an inducible tauopathy mouse model. Program No. 825.06, Society for Neuroscience, 2012.
 29. **Kanaan NM**, Kuhn NM, Sortwell CS, Jiang C, and Manfredsson FP. Overexpression of Non-Aggregatable Alpha-Synuclein Protects Against Human Wildtype Alpha-Synuclein Mediated Toxicity. The American Society of Gene and Cell Therapy (Mol Ther), 2012.
 30. Steece-Collier KA, Levine ND, Sisson K, Lipton JW, Sortwell CE, Cole-Strauss A, Daley BF, Kuhn NC, Strauss KI, **Kanaan NM**, Collier TJ, Rademacher DJ, Meredith GE. Striatal target repair: A study on dendritic spine recovery of medium spiny neurons in the young and aged parkinsonian rats. Program No. 883.03, Society for Neuroscience, 2011.
 31. **Kanaan, N.M.**, Morfini, G., Fu, Y., Brady, S.T., and Binder, L.I. Exposure of the N-terminal phosphatase-activating domain of tau: Implications in axonal transport dysfunction and disease

- pathogenesis. Program No. 347.16, Society for Neuroscience, 2010.
32. Patterson, K.R., **Kanaan, N.M.**, Glucksman, M.J., Gamblin, T.C., and Binder, L.I. Characterization of tau oligomers and the role of Hsp70 in tau oligomerization. Program No. 347.17, Society for Neuroscience 2010.
 33. Vana, L.C., **Kanaan, N.M.**, Ugwu, I.C., Mufson, E.J. and Binder, L.I. Progression of tau pathology in cholinergic nucleus basalis neurons in MCI and AD. Program No. 347.20, Society for Neuroscience, 2010.
 34. Song, Y., Schilling A., **Kanaan, N.M.**, Binder, L.I., Brady, S.T. Neuronal Stable Microtubules are Not Built in One Day: A Novel Mechanism of Microtubule Stability During Neuronal Development and Maturation. Chicago Cytoskeleton Meeting. 2010.
 35. **Kanaan, N.M.**, Morfini, G., Pigino, G., LaPointe, N.E., Brady, S.T., and Binder, L.I. Phosphorylation in the N-Terminal Region of Tau can Regulate Tau-Mediated Inhibition of Anterograde Fast Axonal Transport in the Squid Axoplasm. Program No. 44.8, Society for Neuroscience, 2009.
 36. Vana, L., **Kanaan, N.M.**, Silva, A., Hakala, K., Weintraub, S., and Binder, L.I. Peroxynitrite Mediated Tau Modifications Inhibit Polymerization In Vitro. Program No. 44.8, Society for Neuroscience, 2009.
 37. Patterson, K.R., **Kanaan, N.M.**, Rice, S.E., and Binder, L.I. Presence of an SDS-stable tau oligomer in vitro and in Alzheimer's disease brain extracts. Program No. 237.6, Society for Neuroscience, 2009.
 38. Reyes, J.F., Fu, Y., **Kanaan, N.M.**, Geula, C., Binder, L.I. Tau Susceptibility to Tyrosine Nitration within the Proline-Rich Region: Implications for Alzheimer's Disease and Other Tauopathies. Program No. 237.12, Society for Neuroscience, 2009.
 39. **Kanaan, N.M.**, Morfini, G., Pigino, G., LaPointe, N.E., Brady, S.T., and Binder, L.I. The N-terminal Isoforms of Tau, 6D and 6P, Inhibit Axonal Transport in the Squid Axoplasm. Northwestern University's Cognitive Neurology and Alzheimer's Disease Center, Alzheimer's Day Meeting, 2009.
 40. Patterson, K.R., **Kanaan, N.M.**, Rice, S.E., and Binder, L.I. 180 kDa oligomer of tau associated with polymer formation and Alzheimer's disease. Northwestern University's Cognitive Neurology and Alzheimer's Disease Center, Alzheimer's Day Meeting, 2009.
 41. Vana, L.C., **Kanaan, N.M.**, Mufson, E.J., and Binder, L.I. The Progression of Tau Pathology in the Cholinergic Basal Forebrain. Northwestern University's Cognitive Neurology and Alzheimer's Disease Center, Alzheimer's Day Meeting, 2009.
 42. Patterson, K.R., **Kanaan, N.M.**, and Binder, L.I. Structural Differences Between Tau Isoforms During Aggregation and Filament Formation Using Atomic Force Microscopy. Northwestern University's Cognitive Neurology and Alzheimer's Disease Center, Alzheimer's Day Meeting, 2008.
 43. **Kanaan, N.M.**, Kordower, J.H., and Collier, T.J. The glial environment during normal aging and in response to MPTP: Relevance to differential susceptibility to degeneration. American Society for Neural Therapy and Repair 2007, *Student Travel Award Winner*
 44. Collier, T.J., **Kanaan, N.M.**, and Kordower, J.H. *Aging and the Natural History of Parkinson's Disease*. American Society for Neural Therapy and Repair Abstracts, 2007.
 45. Monahan, A., Ling, Z., **Kanaan, N.M.**, Zhao, C., Desai, B., and Carvey, P. Prenatal LPS Exposure Leads to Reduced Dopamine Process Extension: Proposed Mechanism for Prenatal LPS Model of Parkinson's Disease. American Society for Neural Therapy and Repair 2007.
 46. **Kanaan, N.M.**, Kordower, J.H., and Collier, T.J. Accumulation of Intracellular Inclusions in

- Dopaminergic Subregions of the Midbrain During Normal Aging in the Rhesus Monkey: Relevance in Differential Susceptibility to Degeneration. Program No. 75.1, Society for Neuroscience 2006.
47. **Kanaan, N.M.** and Collier, T.J. Intracellular Inclusions: Differential Accumulation in Dopaminergic Subregions of the Midbrain during Normal Aging in the Rhesus Monkey. *Experimental Neurology*, 198(2):272-273, American Society for Neural Therapy and Repair 2006. *Student Travel Award Winner*
 48. Terpstra BT, Collier TJ, **Kanaan NM**, Levine ND, Wohlgenant SM, Kordower JH, Sortwell CE. Re-evaluation of systemic proteasome inhibition as an animal model for Parkinson's disease. *Experimental Neurology*, 198(2):590-591, American Society for Neural Therapy and Repair 2006.
 49. Lipton, J.W., Koprach, J.B., Chen, E., **Kanaan, N.M.**, Kordower, J.H., and Campbell, N.G. Prenatal MDMA-Induced Increases in Mesocortical DA Axon Density in the Prefrontal Cortex: Evidence for Target-derived Collateral Sprouting. Program No. 111.21, Society for Neuroscience 2005.
 50. Terpstra, B.T., Paumier, K.L., **Kanaan, N.M.**, Wohlgenant, S., Levine, N., and Sortwell, C.E. Creatine Augments Mesencephalic Dopamine Neuron Survival In Vitro and the Functional Capacity of Mesencephalic Grafts. Program No. 258.1, Society for Neuroscience 2005.
 51. Paumier, K.L., Sortwell, C.E., **Kanaan, N.M.**, Koprach, J.B., Wohlgenant, S., Terpstra, B.T., and Collier, T.J. Transplanted Undifferentiated Midbrain Neural Progenitor Cells Preserve Host Dopamine Neurons in the Rat Intrastratial 6-OHDA Model of Parkinson's Disease. *Experimental Neurology*, 193: 255-256, American Society for Neural Therapy and Repair 2005.
 52. Koprach J.B, Chung C., Lin L., Isacson O., Chen E., Cambell N.G., **Kanaan N.M.**, Kordower J.H., and Lipton J.W. Increase in Dopamine Fiber Density From Prenatal MDMA Exposure are Associated with Altered Expression of Axonal Guidance Cues. Program No. 917.5, Society for Neuroscience 2004.
 53. **Kanaan N.M.**, Collier T.J., Fleming M.F., McGuire S.O., Daley B.F., Marchionini D.M. and Sortwell, C.E. Erythropoietin Pretreatment Significantly Increases Survival of Mesencephalic Suspension Grafts in a Rodent Model of Parkinson's Disease. *American Society for Neural Therapy and Repair, Experimental Neurology*, 181: 95, 2003. *Student Travel Award Winner*
 54. Koprach, J.B., Chen, E.Y., **Kanaan, N.M.**, Campbell, N.G., Kordower, J.H., Lipton. J.W. Juvenile Rats Prenatally Exposed to MDMA Show Alterations in Exploratory Behavior, Reductions in Monoamine Metabolism, and Increases in Forebrain Tyrosine Hydroxylase Fiber Density. Program No. 643.8, Society for Neuroscience 2003.
 55. **Kanaan N.M.**, McGuire S.O., Sortwell C.E., and Collier T.J. The Influence of Neurosphere Integrity on the Viability of Mesencephalic Progenitor Cells. Program No. 34.14, Society for Neuroscience 2002.

ACTIVE FUNDING

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| 1. R01 AG044372 (Kanaan-PI) | 9/30/2014 – 4/30/2019 | 3 mo |
| NIA (NIH) | \$1,152,363 (Tot DC)/\$616,514 (Tot IDC) | “Tau-induced axonal degeneration in Alzheimer’s disease and tauopathies” |
| The main goal of this proposal is to identify the molecular mechanisms underlying axonal degeneration induced by AT8 phosphorylated tau using a viral vector rat model and a rat primary neuron model. | | |
| 2. R01 NS082730 (Kanaan-PI, Brady-PI) | 4/01/2014 – 3/31/2019 | 3 mo |

NINDS (NIH) \$990,001(Tot DC)/\$529,650 (Tot IDC) (MSU's portion) "Tau Conformation in Tauopathies and Neuronal Function"

This R01 is aimed at studying how tau conformation in various oligomeric forms affects its toxicity through axonal transport impairment and how tau conformation is regulated under normal biological conditions.

3. A2013364S (Kanaan-PI) 7/01/2013 – 6/30/2017 1.2 mo
BrightFocus Foundation \$250,000 (Tot DC)/\$0 (Tot IDC) "Tau oligomers and their potential role in toxicity leading to Alzheimer's Disease"
Goal: This project is aimed at further characterizing the structure and toxicity of tau oligomers generated under different experimental conditions (i.e. oxidative or reducing) and with various mutant forms of tau.
4. P01 AG14449 (Mufson-PD, Kanaan-CoI) 7/01/1997 – 6/30/2019 1.2 mo
NIA (NIH) \$901,770 (Tot DC)/ \$482,447 (Tot IDC) (MSU's portion)
"Neurobiology of Mild Cognitive Impairment in the Elderly"
This PPG contains multiple projects that investigate the neurobiological substrates of cognitive decline in the elderly using the cholinergic basal forebrain as a model system for selective vulnerability.
5. AZ140095 (Arancio-PI; Kanaan-CoI) 12/01/2015 – 11/30/2018 0.6 mo
DoD \$125,000 (Tot DC)/\$ 66,875 (Tot IDC) (MSU's portion) "TBI-Induced Formation of Toxic Tau and Its Biochemical Similarities to Tau in AD Brains"
The purpose of this grant is to explore the molecular mechanisms that underlie the cognitive decline and mental health problems resulting from repetitive traumatic brain injuries
6. Secchia Family Foundation Fund (Kanaan-PI) 2/01/2014 – 1/31/2017 0 mo
"Inducers of Tau Aggregation" \$75,000 (Tot DC)/\$0 (Tot IDC)
This study is focused on identifying biological inducers of tau aggregation and utilizing microinjections of potential inducers into cells expressing human tau to study tau aggregation in situ.
7. 146962 (Sortwell-PI, Kanaan- CoI) 3/01/2016 – 2/28/2018 0.36 mo
Michael J. Fox Foundation \$160,000 (Tot DC)/\$40,000 (Tot IDC) "Optimization of Nigrostriatal Degeneration in the Rat Alpha-Synuclein PFF Model"
The purpose of this project is to better optimize a relatively novel rat model of Parkinson's disease and to establish the formation of and role of alpha-synuclein oligomeric species in this model.
8. X01 NS099361 (Kanaan-PI) 3/01/16 – 2/28/17 0 mo
NINDS (NIH) \$0 (Tot DC)/\$0 (Tot IDC)
"Tau in Early Parkinson's Disease"
The purpose of this resource access program request is to obtain early Parkinson's disease tissue for a pilot project on the presence of toxic tau conformation.

PAST FUNDING

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1. NIRG-10-174461 (Kanaan-PI) 11/01/2010 – 10/31/2012 3 mo
Alzheimer's Assoc New Investigator Grant \$72,567 (Tot DC)/\$7,079(Tot IDC)
"Tau-Mediated Axonal Transport Dysfunction"

2. Saint Mary's Doran Foundation (Kanaan-PI) 1/01/2013 – 12/31/2013 0 mo
\$24,907 (Tot DC)/\$0 (Tot IDC)
"Understanding tau's role in neurodegenerative diseases"
3. Jean P. Shultz Biomed Res Endowment (Kanaan-PI) 9/01/2013 – 8/31/2014 0 mo
\$30,000 (Tot DC)/ \$0 (Tot IDC)
"Molecular mechanisms of tau-induced neurodegeneration"
4. P50 NS058830 (Collier-PI, Kanaan-CoI) 7/01/2009 – 6/30/2015 1.2 mo
NINDS (NIH) \$2,843,146 (Tot DC)/ \$1,478,436 (Tot IDC) "Aging and Parkinson's Disease: Models of Therapeutics and Neurologic Comorbidity"
5. Alpha-Syn RFA (Manfredsson-PI, Kanaan-CoI) 9/01/2013 – 8/31/2014 0.36 mo
Michael J. Fox Foundation \$181,818 (Tot DC)/\$18,182 (Tot IDC) "Alpha-Synuclein Aggregation Leads to Loss of Functional Forms of the Protein and Toxicity"
6. Saint Mary's Doran Foundation (Lipton-PI) 1/01/2012 – 12/31/2012 0 mo
\$25,000 (Tot DC)/\$0 (Tot IDC)
"Enhancement of Joint Translational Neuroscience Research Programs between Saint Mary's Healthcare and MSU's College of Human Medicine"