Lindsay N. Hayes, Ph.D.

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I. TRAINING AND EDUCATION

Clovis Community College, Fresno, CA
Adjunct Instructor, STEM & Computer Science 2022 - present
Biol-12 Research in Biology

Johns Hopkins University, Baltimore, MD
Research Associate, Department of Neuroscience 2018 - present
Microglia Dysfunction in Mouse Models of Neuropsychiatric Disorders

Johns Hopkins University, Baltimore, MD
Postdoctoral Fellow, Department of Psychiatry 2012 - 2018
Inflammation in Neuropsychiatric Disorders
Advisor: Dr. Akira Sawa, M.D., Ph.D.

Brown University, Providence, RI 2006 - 2012
Ph.D., Neuroscience
Temporal Control of Sonic Hedgehog Signaling for Midbrain Dopamine Neuron Development
Advisors: Dr. Sohyun Ahn, Ph.D. and Dr. Mark Zervas, Ph.D.

Evangel University, Springfield, MO 2002 - 2006
B.S. Chemistry (Major) and Mathematics (Minor)

II. FUNDING, AWARDS, FELLOWSHIPS

Funding
Center for Novel Therapeutics for HIV-Associated Cognitive Disorders (PI: Hayes)
JHU/NIMH 07/2021
Isolation of brain-derived myeloid cells in NeuroHIV

Awards
Brown University & NIH Graduate Student Retreat Travel Award 2009
Summa Cum Laude Graduate, Evangel University 2006

Fellowships
Undergraduate Research Fellow, Evangel University 2005 - 2006
Department of Science and Technology
Advisor: Dr. Steve Badger, Ph.D.

NSF-Undergraduate Research Fellow Award, Loyola University 2005
Department of Chemistry
Advisor: Dr. Duarte Mota de Freitas, Ph.D.

NSF-Undergraduate Research Fellow Award, University of Kansas 2004
Department of Chemistry
Advisor: Dr. Jon Tunge, Ph.D.

III. PUBLICATIONS

#Foresee (maiden name), *equal contribution, †Senior Author

1. **Hayes LN**, An K, Carloni E, Li F, Vincent E, Paranjpe M, Trippaers C, Dölen G, Goff LA, Ramos A, Kano SI, Sawa A. (2022) *Prenatal immune stress blunts microglia reactivity which impairs neurocircuitry. Nature.* (revision under review) link
2. Carloni E, Ramos A, **Hayes LN**†. (2021) *Developmental Stressors Induce Innate Immune Memory in Microglia and Contribute to Disease Risk.* International Journal of Molecular Sciences. 22(23), 13035 link
3. Xiao MF, Roh SE, Zhou J, Chien CC, Lucey BP, Craig MT, **Hayes LN**, Coughlin JM, Leweke FM, Jia M, Xu D, Zhou W, Talbot C, Arnold DB, Staley M, Jiang C, Reti IM, Sawa A, Pelkey KA, McBain CJ, Savonenko A, Worley P. A biomarker-authenticated model of schizophrenia implicating NPTX2 loss of function. (2021) Scientific Advances. 26;7(48):eabf6935 link
4. Mueller FS, Richetto J, **Hayes LN**, Zambon A, Pollak D, Sawa A, Meyer U, Weber-Stadlbauer U. (2019) *Influence of poly(I:C) variability on thermoregulation, immune responses and pregnancy outcomes in mouse models of maternal immune activation* Brain Behavior Immunity. 80,406-418 link
5. Fukudome D, **Hayes LN*,** Faust TE*, Foss CA, Kondo MA, Lee BJ, Saito A, Kano SI, Coughlin JM, Kamiya A, Pomper MG, Sawa A, Niwa M. (2018) *Translocator protein (TSPO) and stress cascades in mouse models of psychosis with inflammatory disturbances.* Schizophrenia Research. 197, 492-497. link
6. Nucifora LG, Tanaka T, **Hayes LN**, Kim M, Lee BJ, Matsuda T, Nucifora FC, Sedlak T, Mojtabai R, Eaton WW, Sawa A. (2017) *Reduction in plasma glutathione in psychosis associated with schizophrenia and bipolar disorder in translational psychiatry.* Translational Psychiatry. 7(8): e1215. link
7. Coughlin JM*, **Hayes LN***, Tanaka T*, Xiao M, Yolken RH, Worley P, Leweke FM, Sawa A (2017) *Reduced superoxide dismutase-1 (SOD1) in cerebrospinal fluid of patients with early psychosis in association with clinical features*. Schizophrenia Research. 183, 64-69. link
8. Tanaka T*, Matsuda T*, **Hayes LN***, Yang S, Rodriguez K, Severance EG, Yolken RH, Sawa A, Eaton WW. (2017) *Infection and inflammation in schizophrenia and bipolar disorder*. Neuroscience Research. 115, 59-63. link
9. **Hayes LN***, Shevelkin A*, Zeldon M, Steel G, Chen PL, Obie C, Pulver A, Avramopoulos D, Valle D, Sawa A*, Pletnikov MV* (2016) *Neuregulin 3 knockout mice exhibit behaviors consistent with psychotic disorders.* Molecular Neuropsychiatry 2(2), 79-87. link
10. Coughlin JM, Wang Y, Ambinder EB, Ward RE, Minn I, Vranesic M, Kim PK, Ford CN, Higgs C, **Hayes LN**, Schretlen DJ, Dannals RF, Kassiou M, Sawa A, Pomper MG (2016) *In vivo markers of inflammatory response in recent-onset schizophrenia: a combined study using [(11)C]DPA-713 PET and analysis of CSF and plasma.* Translational Psychiatry 6,e777. link
11. **Hayes LN**, Severance EG, Leek J, Leweke FM, Yolken RH, Sawa A (2014) *Inflammatory molecular signature associated with infectious agents in psychosis.* Schizophrenia Bulletin. 40(5), 963-972. link
12. **Hayes L**, Ralls S, Wang H, Ahn S. (2013). *Duration of Shh signaling contributes to mDA neuron diversity.* Developmental Biology. 374:1, 115-126. link
13. **Hayes L**, Zhang Z, Albert P, Zervas M, Ahn S. (2011). *The Timing of Sonic Hedgehog and Gli1 Expression Segregates Midbrain Dopamine Neurons.* Journal of Comparative Neurology. 519:15, 3001-3018. link
14. Brown A, Machan JT, **Hayes L**, Zervas M. (2011) *Molecular organization and timing of Wnt1 expression define cohorts of midbrain dopamine neuron progenitors in vivo.* Journal of Comparative Neurology. 519:15, 2978-3000. link
15. Carney R, Mangin JM, **Hayes L,** Mansfield K, Sousa V, Gord F, Machold R, Ahn S, Gallo V, Corbin J. (2010). *Sonic hedgehog expressing and responding cells generate neuronal diversity in the medial amygdala*. Neural Development. 5:14. link
16. Devore M, **Foresee L**#, Michno N, Badger S. (2006). *Determination of Environmental Conditions of Four Greene County Caves*. Transactions of the Missouri Academy of Science. 40, 22-29.
17. Li K, **Foresee LN**#, Tunge JA. (2005). *Trifluoroacetic Acid-Mediated Hydroarylation: Synthesis of Dihydrocoumarins and Dihydroquinolones*. Journal of Organic Chemistry. 70, 2881-2883. link
18. Tunge JA, **Foresee LN**#. (2005). *Mechanistic Studies of Fujiwara Hydroarylation. C-H Activation versus Electrophilic Aromatic Substitution.* Organometallics. 24(26), 6440-6444. link

IV. Preprints

1. Hayes LN, An K, Carloni E, Li F, Vincent E, Paranjpe M, Dölen G, Goff LA, Ramos A, Kano SI, Sawa A. (2021) *Prenatal immune stress induces a prolonged blunting of microglia activation and impacts striatal connectivity. bioRxiv.* 2021.12.27.473694 doi:10.1101/2021.12.27.473694 link

V. PRESENTATIONS

A. Invited Talks

2022 CSHL Workshop, Schizophrenia and Related Disorders. Title: Neuroinflammation and Brain Immune Cells in Neuropsychiatric Disorders. Harbor, NY

2019 Johns Hopkins Perinatology, Neonatology Monthly Colloquium. Title: *Neuroimmune Interactions from Development to Mature Brain Function.* Baltimore, MD

2016 The 22nd Annual Stanley Meeting. Title: *Maternal Stress Alters Microglia Responsiveness: Influence on Brain Function and Behavior*. Baltimore, MD

B. Abstracts Selected for Oral Presentation [speaker underlined]

1. **Hayes LN**, An K, Carloni E, Li F, Vincent E, Paranjpe M, Trippaers C, Dölen G, Goff LA, Ramos A, Kano SI, Sawa A. (2022) *Prenatal immune stress induces a prolonged blunting of microglia reactivity that impairs striatal connectivity*. Keystone: Neuro-Immune Interactions in the Central Nervous System
2. **Hayes LN**, An K, Vincent E, Paranjpe M, Bless L, Chang AJ, Diaz C, Dölen G, Kano SI, Ramos A, Goff LA, Sawa A (2021) *Prenatal immune stress induces a prolonged blunting of microglia activation and neuronal connectivity*. EMBO Microglia Workshop (Flash Talk)
3. **Hayes LN**, An K, Vincent E, Paranjpe M, Bless L, Chang AJ, Diaz C, Dölen G, Kano SI, Ramos A, Goff LA, Sawa A (2019) *Prenatal immune stress induces a prolonged blunting of microglia activation and impacts social behavior and neuronal connectivity*. Glia Biology: Functional Interactions Among Glia and Neurons Gordon Research Seminar
4. **Hayes LN**, An K, Vincent E, Paranjpe M, Kim M, Chang AJ, Diaz C, Ramos A, Goff LA, Sawa A (2018) *Early maternal stress diminishes microglia reactivity and striatum connectivity*. Baltimore Brain Series October 30, 2018
5. **Hayes LN**, An K, Paranjpe M, Kim M, Vincent E, Goff LA, Sawa A (2018) *Early Maternal Stress Alters Microglia Responsiveness to Activation and Impacts Striatal Circuit Function and Behaviors*. EMBO Microglia 2018 meeting.
6. **Hayes LN**, An K, Barodia S, Moore J, Kim S-H, Jaaro-Peled H, Fukudome D, Faust T, Niwa M, Sawa A. (2015) *Alterations in adolescent stress cascades in genetic and environmental mouse models of major mental illness and the implications on adult behavioral deficits*. Society for Neuroscience Meeting.
7. Coughlin JM, Tanaka T, Ford CN, Kim PK, **Hayes LN**, Marsman A, Barker PB, Sawa A. (2015) *Alterations in markers associated with oxidative stress, inflammation, and protein misfolding in patients with recent onset psychosis.* Society for Biological Psychiatry
8. **Hayes LN**, Sawa A. (2015) *Angiotensin Signaling in Development and Pathology of Immune-Associated Psychosis*. International Congress on Schizophrenia Research.
9. **Hayes LN**, Sawa A. (2014) *Inflammation in schizophrenia patients and maternal immune activation new insights from the angiotensin pathway*. Neuroscience Department Lecture Series
10. **Hayes LN**, Sawa A. (2014) *Angiotensin signaling as a key regulator of neuroinflammation: a role in developmental psychotic disease*. Society for Neuroscience Meeting
11. **Hayes LN**, Alkhunaizi F, Sawa A. (2013) *Molecular and cellular characterization of microglia-like cells derived from patients with schizophrenia and their implications for the developmental insult hypothesis*. Society for Neuroscience
12. **Hayes LN**, Zhang Z, Albert P, Zervas M, Ahn S. (2011). *The Timing of Sonic Hedgehog and Gli1 Expression Segregates Midbrain Dopamine Neurons.* Keystone Symposium

13. **Hayes LN**, Ahn S. (2010) *Where does dopamine neuron diversity come from?* NICHD Principle Investigator Retreat
14. **Hayes LN**, Ahn S. (2009) *Not all dopamine neurons are alike: How early Sonic Hedgehog signaling may influence later diversity*. NIH Neurobiology Interest Group

C. Conference Abstracts for Poster Presentation

1. **Hayes LN**, An K, Vincent E, Paranjpe M, Kim M, Chang AJ, Diaz C, Ramos A, Goff LA, Sawa A (2018) *Early maternal stress diminishes microglia reactivity and striatum connectivity*. Glia-Neuron Interaction in Developing Circuits Rockefeller University
2. **Hayes LN**, An K, Kim M, Nardou R, Chang AJ, Dolen G, Sawa A. (2017) *Microglia priming through maternal immune stress influences brain function and behavior*. Society for Neuroscience
3. Nucifora LG, Tanaka T, **Hayes LN**, Kim M, Lee BJ, Matsudo T, Nucifora FC, Sedlak T, Mojtabai R, Eaton W, Sawa A. (2017) *Reduction of plasma glutathione in psychosis associated with schizophrenia and bipolar disorder in translational psychiatry*. Society for Neuroscience
4. **Hayes LN**, An K, Vincent E, Paranjpe M, Nardou R, Kim M, Dolen G, Goff LA, Sawa A. (2017) *Microglia priming by early maternal stress diminishes immune responsiveness and task switching*. Neuro-Immune Axis: Reciprocal Regulation in Development, Health, and Disease Cell Symposia
5. **Hayes LN**, Diaz C, Nardou R, Chang A, Dolen G, Sawa A. (2016) *Developmental deficits in microglia influence brain function and behavior*. Keystone Symposia, Microglia in the Brain
6. Niwa M, **Hayes LN**, Tanaka T, Faust T, Fukudome D, Cash-Padgett T, Jaaro-Peled H. (2015) *Oxidative Stress in the Pathophysiology of Psychiatric Disorders: Studies of Patient Biospecimens and Animal Models*. ACNP 54th Annual Meeting
7. Coughlin JM, Wang Y, Tanaka T, Ma S, **Hayes LN**, Pomper MG, Sawa A. (2014) *Probing molecular markers of inflammation and oxidative stress in patients with early stage schizophrenia: A combined study of CSF and PET-based imaging.* ACNP 53rd Annual Meeting
8. **Hayes LN**, Kim J, Sawa A. (2014) *Angiotensin signaling in schizophrenia patients and mice after maternal immune activation: Potential molecular regulator of neuroinflammation*. Cold Spring Harbor Glia in Health and Disease
9. **Hayes LN**, Zervas M, Ahn S. (2011) *The progenitors in the venral mesencephalon mutually regulate the induction and cessation of Shh and Gli1 expession for proper dopamine neuron specification.* Society for Neuroscience Meeting
10. **Hayes LN**, Zervas M, Ahh S. (2009) *Linking the Shh and Gli1 lineages to dopamine neuron diversity: Discovering how the subtypes and circuits are established in the adult*. Society for Neuroscience Meeting
11. Carney R, **Hayes LN**, Sousa V, Mansfield K, Fishell G, Machold R, Ahn S, Corbin, J. (2009) *Genetic specification of neuronal diversity in the medial amygdala*. Society for Neuroscience Meeting
12. **Hayes LN**, Zervas M, Ahn S. (2008) *Sonic hedgehog signaling contributes to midbrain dopamine neuron development*. Society for Neuroscience Meeting

VI. TEACHING EXPERIENCE

Lead Teaching Assistant, Research in Biology Clovis Community College, Carnegie Institute	2021 - 2022
Lead Teaching Assistant, Practical Genomics Workshop JHU, Center for Computational Genomics	2021
Instructor, Neuroscience: A Single Cell Story Johns Hopkins University Winter 2020 Intersession	2020
Teaching Assistant, Practical Genomics Workshop JHU, Center for Computational Genomics	2019
Guest Lecturer, Lunch-n-Learn Seminar Series	2016

JHU, Psychiatry Summer Research and Training Program

Keynote speaker, STEM Honors Conference 2014
Ozarks Technical Community College, Springfield, MO
Research Opportunities for Community College STEM Students

Guest Lecturer, Chemistry for Health Sciences 2006

Teaching Assistant, General and Organic Chemistry 2003 - 2006

VII. MENTORSHIP

Chloë Trippaers, *Visiting Graduate Fellow* 2021 - 2022
Fangze Li, *post-baccalaureate student*, co-author on 1 publication 2019 - 2021
Elisa Carloni, *post-baccalaureate student*, co-author on 2 publication 2019 - 2021
Lena Bless, *JHU Undergraduate* 2017 - 2018
Manish Paranjpe, *JHU Undergraduate*, co-author on 1 publication 2017 - 2018
Minjung Kim, *JHU Undergraduate* 2015 - 2017
Taechawidd Nantawisarakul, *JHU Summer Student* 2015
Amedeo Primerano MD, *Visiting Medical Fellow* 2015
Anna J Chang, Ph.D., *JHU Rotation Graduate Student* 2013
Carolyn Diaz, *JHU Summer Student* 2013
Fatimah Alkhunaizi, M.D., *JHU Undergraduate* 2012 - 2013
Molly Pfeifer, D.V.M., *NIH Summer Student* 2010

VIII. PROFESSIONAL SERVICES

Reviewer for manuscripts 2013 - present
Lancet, Neuropsychopharmacology, Neuropsychopharmacology Reviews, Schizophrenia Bulletin, Schizophrenia Research, Brain Behavior Research, Experimental Neurology, Frontiers in Neuroscience, Translational Psychiatry

Admissions Committees
Johns Hopkins Summer Research and Training Program 2012 - 2014
Brown-NIH Graduate Partnership Program 2010 - 2011

Organizer/Co-organizer
Schizophrenia Center Monthly Seminar Series 2021 - 2022
Brown Graduate Partnership Program In-House Seminar Series 2008 - 2011
Annual NIH Graduate Student Retreat 2008

IX. MEDIA RELEASE AND INTERVIEWS

Media Releases
"CSF Biomarkers Studied as Factors to Predict Schizophrenia Onset" Jun 2, 2014
"A Blood Pressure Hormone Implicated in Psychosis" Nov 19, 2014

Contributed Interview Statement
"The next hot topic in autism research? Immune cells" Nov 16, 2014