

# Lindsay N. Hayes, Ph.D.

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## I. TRAINING AND EDUCATION

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<b>Clovis Community College</b> , Fresno, CA Adjunct Instructor, STEM & Computer Science <i>Biol-12 Research in Biology</i>	2022 - present
<b>Johns Hopkins University</b> , Baltimore, MD Research Associate, Department of Neuroscience <i>Microglia Dysfunction in Mouse Models of Neuropsychiatric Disorders</i>	2018 - present
<b>Johns Hopkins University</b> , Baltimore, MD Postdoctoral Fellow, Department of Psychiatry <i>Inflammation in Neuropsychiatric Disorders</i> Advisor: Dr. Akira Sawa, M.D., Ph.D.	2012 - 2018
<b>Brown University</b> , Providence, RI Ph.D., Neuroscience <i>Temporal Control of Sonic Hedgehog Signaling for Midbrain Dopamine Neuron Development</i> Advisors: Dr. Sohyun Ahn, Ph.D. and Dr. Mark Zervas, Ph.D.	2006 - 2012
<b>Evangel University</b> , Springfield, MO B.S. Chemistry (Major) and Mathematics (Minor)	2002 - 2006

## II. FUNDING, AWARDS, FELLOWSHIPS

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<u>Funding</u> Center for Advancement of HIV Neurotherapeutics (PI: Hayes) JHU/NIHM <i>Persistent HIV viral transcripts in brain-derived immune cells in NeuroHIV</i>	08/2022
Center for Novel Therapeutics for HIV-Associated Cognitive Disorders (PI: Hayes) JHU/NIMH <i>Isolation of brain-derived myeloid cells in NeuroHIV</i>	07/2021
<u>Awards</u> Brown University & NIH Graduate Student Retreat Award Summa Cum Laude Graduate, Evangel University	2009 2006
<u>Research Fellowships</u> Undergraduate Research Fellow, Evangel University Department of Science and Technology, Advisor: Dr. Steve Badger, Ph.D.	2005 - 2006
NSF-Undergraduate Research Fellow Award, Loyola University Department of Chemistry, Advisor: Dr. Duarte Mota de Freitas, Ph.D.	2005
NSF-Undergraduate Research Fellow Award, University of Kansas Department of Chemistry, Advisor: Dr. Jon Tunge, Ph.D.	2004

### III. PUBLICATIONS

<sup>#</sup>Foresee (maiden name), <sup>\*</sup>equal contribution, <sup>†</sup>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**. (Accepted)
2. Carloni E, Ramos A, **Hayes LN<sup>†</sup>**. (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<sup>\*</sup>**, Faust TE<sup>\*</sup>, 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<sup>\*</sup>, **Hayes LN<sup>\*</sup>**, Tanaka T<sup>\*</sup>, 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<sup>\*</sup>, Matsuda T<sup>\*</sup>, **Hayes LN<sup>\*</sup>**, 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<sup>\*</sup>**, Shevelkin A<sup>\*</sup>, Zeldon M, Steel G, Chen PL, Obie C, Pulver A, Avramopoulos D, Valle D, Sawa A<sup>\*</sup>, Pletnikov MV<sup>\*</sup> (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<sup>#</sup>**, 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<sup>#</sup>**, 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<sup>#</sup>**. (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](#)
2. Ramos A, Ishizuka K, Namkung H, **Hayes LN**, Saito A, Sengupta A, Srivastava R, Calva C, Hayashida A, Elkins N, Palen T, Carloni E, Tsujimura T, Gallego JA, Robinson DG, Malhotra AK, Ikemoto S, Rais R, Slusher BS, Niwa M, Saitoh T, Takimoto E, Sawa A. (2022) *The nuclear GAPDH-HMBG cascade in cortical microglia regulates cognitive flexibility* bioRxiv. 2022.06.21.497065 doi:10.1101/2022.06.21.497065

#### V. PRESENTATIONS

##### A. Invited Talks

- 2022 CSHL Workshop, Schizophrenia and Related Disorders. Title: Microglia Contributions to Immune Mechanism in Psychosis. Harbor, NY
- 2019 Johns Hopkins Perinatology, Neonatology Monthly Colloquium. Title: *Neuroimmune Interactions from Development to Mature Brain Function*. Baltimore, MD
- 2016 The 22<sup>nd</sup> Annual Stanley Meeting. Title: *Maternal Stress Alters Microglia Responsiveness: Influence on Brain Function and Behavior*. Baltimore, MD

##### B. Abstracts Selected for Oral Presentation [as a presenter]

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 on Neurodegeneration
  13. **Hayes LN**, Ahn S. (2010) *Where does dopamine neuron diversity come from?* NICHD Principal 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 54<sup>th</sup> 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 ventral mesencephalon mutually regulate the induction and cessation of Shh and Gli1 expression for proper dopamine neuron specification*. Society for Neuroscience Meeting
  10. **Hayes LN**, Zervas M, Ahn 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

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Co-Instructor, Research in Biology Clovis Community College & JHU 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	
<i>Research Opportunities for Community College STEM Students</i>	
Guest Lecturer, Chemistry for Health Sciences	2006
Teaching Assistant, General and Organic Chemistry	2003 - 2006

## VII. STUDENT MENTORSHIP

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Trained and Supervised 3 graduate students at Johns Hopkins University	
Chloë Trippaers, <i>Visiting Graduate Fellow</i> , <b>co-author</b> on 1 publication	2021 - 2022
Amedeo Primerano MD, <i>Visiting Medical Fellow</i>	2015
Anna J. Chang, Ph.D., <i>JHU Rotation Graduate Student</i>	2013
Mentored 2 research technicians for 2 years	
Elisa Carloni, <i>post-baccalaureate student</i> , <b>co-author</b> on 2 publication	2019 - 2021
Fangze Li, <i>post-baccalaureate student</i> , <b>co-author</b> on 1 publication	2019 - 2021
Mentored 3 students in summer research training programs for undergraduates	
Taechawidd Nantawisarakul, <i>JHU Summer Student</i>	2015
Carolyn Diaz, <i>JHU Summer Student</i>	2013
Molly Pfeifer, D.V.M., <i>NIH Summer Student</i>	2010
Mentored 4 undergraduates from Johns Hopkins University	
Lena Bless, <i>JHU Undergraduate</i>	2017 - 2018
Manish Paranjpe, <i>JHU Undergraduate</i> , <b>co-author</b> on 1 publication	2017 - 2018
Minjung Kim, <i>JHU Undergraduate</i> , <b>co-author</b> on 1 publication	2015 - 2017
Fatimah Alkhunaizi, M.D., <i>JHU Undergraduate</i>	2012 - 2013

## VIII. PROFESSIONAL SERVICES AND MEMBERSHIPS

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Ad hoc reviewer	2013 - present
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	
Schizophrenia Center Monthly Seminar Series	2021 - 2022
Brown Graduate Partnership Program In-House Seminar Series	2008 - 2011
Annual NIH Graduate Student Retreat	2008
Member, Society for Neuroscience Membership	2013 - present

## IX. MEDIA RELEASE AND INTERVIEWS

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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