

Brittany R. Howell, PhD

Assistant Professor in Neuroscience of Human Development, Fralin Biomedical Research Institute at VTC
Assistant Professor, Center for Transformative Research in Health Behaviors, Fralin Biomedical Research Institute at VTC
Assistant Professor, Department of Human Development and Family Science, Virginia Tech

Contact Information:

Fralin Biomedical Research Institute at VTC
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 Roanoke, VA 24016

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Education:

- 2006-2013 **Ph.D. in Neuroscience**
 Emory University, Neuroscience Graduate Program, Atlanta, GA
 Dissertation: *"Neurodevelopmental Consequences of Early Life Stress in Primates"*
 Mentor: Mar Sanchez PhD
 Committee: Jocelyne Bachevalier PhD, Mark Wilson PhD, Kim Wallen PhD, Todd Preuss PhD
- 2002-2006 **B.S. in Neuroscience, and Cell and Molecular Biology**
 Tulane University, New Orleans, LA
Magna Cum Laude with Honors in Neuroscience, and Cell and Molecular Biology
 Honors Thesis: Kinases and Dendritic Outgrowth
 Mentor: Fiona Inglis PhD

Professional Experience:

- 2019-present **Assistant Professor in Neuroscience of Human Development**
 Fralin Biomedical Research Institute at VTC, Roanoke, VA, Center for Transformative Research in Health Behaviors, and Department of Human Development and Family Science, Virginia Tech, Blacksburg, VA
- 2014-2019 **Postdoctoral Scholar**
 Institute of Child Development, University of Minnesota, Twin Cities
 Mentor: Jed Elison, PhD
- 2013-2014 **Postdoctoral Scholar**
 Yerkes National Primate Research Center, Emory University, Atlanta, GA
- 2010-2012 **Graduate Assistant**
 New Orleans Research Collaborative, Emory University, Atlanta, GA
- 2006-2013 **Graduate Student**
 Neuroscience Graduate Program, Emory University, Atlanta, GA
- 2003-2006 **Undergraduate Tutor**
 Tutoring Center, Tulane University, New Orleans, LA
- 2005 **Undergraduate Research Assistant**
 Department of Neurology, Harvard Medical School, Cambridge, MA
 Mentor: Jie Shen PhD
- 2005 **Undergraduate Research Assistant**
 National Institute of Alcohol and Alcoholism, Poolesville, MD
 Mentor: Dee Higley PhD
- 2004 **Undergraduate Research Assistant**
 National Institute of Alcohol and Alcoholism, Poolesville, MD
 Mentor: Dee Higley PhD

Additional Affiliations:

- 2016-2019 **Postdoctoral Member**, Center for Neurobehavioral Development, University of Minnesota
 2011-2014 **Graduate Member**, Center for Behavioral Neuroscience, Atlanta, GA

Research Interests:

Biological pathways of early experience and maternal influence on neurodevelopment
 Gut-brain-behavior axis development
 Early nutrition (e.g. breast milk) and brain development
 Magnetic resonance imaging (MRI)
 Diffusion weighted MRI
 Developmental social neuroscience
 Translational developmental neuroscience
 Intergenerational transmission of mental health

Scientific and Professional Organizations:

Fetal, Infant, and Toddler Neuroimaging Group (FIT'NG)
 Opioid Research Consortium of Central Appalachia (ORCCA)
 Studies to Advance Recovery Support (STARS) Network
 International Society/Congress of Infant Studies (ICIS)
 Society for Research in Child Development (SRCD)
 International Society for Developmental Psychobiology (ISDP)
 Organization for Human Brain Mapping (OHBM)
 Society for Neuroscience (SfN)

Additional Training/Education:

- 03/2016 Institute of Child Development, University of Minnesota, Statistics Short Course in Applied Latent Variable Modeling
 07/2016 Institute of Child Development, University of Minnesota, Statistics Short Course in Applied Latent Variable Modeling
 07/2012 OppNet-Improving Animal Models of Human Behavioral and Social Processes Workshop
 10/2011 Center for Translational Social Neuroscience, Workshop on the Biology of Prosocial Behavior
 07/2011 Gordon Research Conference, The Amygdala in Health and Disease
 06/2009 FSL and FreeSurfer Course

Honors and Awards:

- 2019 Adaptive Brain and Behavior Destination Area Professional Development Award
 2019 6th Annual Nutrition & Growth Meeting Abstract Award
 2018 Jacobs Foundation Conference Young Scholar, "Reconciling Genes and Contexts: Exploring the Genomic & Environmental Headwaters of Early Brain Development"
 2015 – 2017 NIMH Institutional Postdoctoral NRSA Award (T32 MH015755)
 2012 International Society for Developmental Psychobiology Travel Award
 2012 NIH OppNet Workshop on Translation of Animal Models Travel Award
 2012 Wisconsin Symposium on Emotion Travel Award
 2011 Wisconsin Symposium on Emotion Travel Award
 2011 – 2012 NIMH Early Experience, Stress, and Neurobehavioral Development Center (P50 MH078105, PI: M. Gunnar), Executive Committee Representative
 2010 – 2013 NIMH Individual Predoctoral NRSA Award (F31 MH086203, Neurodevelopmental Correlates of Psychopathology Following Infant Maltreatment)

2009 – 2013	NIMH Early Experience, Stress, and Neurobehavioral Development Center (P50 MH078105, PI: M. Gunnar) Trainee
2008 – 2009	NIMH Conference Series on Comparative and Primate Studies (U13 MH072330 , PI: J. Cameron) Fellowship
2007 – 2008	NIGMS Neuroscience Institutional Training Grant Award (T32 GM008605)
2005 – 2006	Mortar Board National Honor Society
2004 and 2005	NIH Summer Internship (IRTA) Awardee, National Institute of Alcohol Abuse and Alcoholism
2003 – 2005	Henry R. Clayton Scholarship, Tulane University
2002 – 2006	Tulane University Distinguished Scholar Award

Grants/Funding:

Awarded – Current

Title: “A Pilot Study of the Role of Gut Dysbiosis in the Neurodevelopmental Consequences of Neonatal Abstinence Syndrome”

Funding Agency: integrated Translational Health Research Institute of Virginia (iTHRIV) – University of Virginia
 Period: July 2020 – July 2022
 Amount: \$341,725 (direct costs)
 Role: iTHRIV Scholar Investigator

Title: “Encouraging self-care with healthy lifestyle change in obese pregnant women to improve maternal & infant outcomes”

Principal Investigators: Julia Basso, Jaclyn Nunziato, Brittany Howell
 Funding Agency: Center for Transformative Research in Health Behaviors – Fralin Biomedical Research Institute, Virginia Tech
 Period: July 2020 – June 2021
 Amount: \$20,000 (direct costs)
 Role: Co-Principal Investigator

Title: “UNC/UMN BCP Enriched”

Principal Investigator: Weili Lin
 Funding Agency: Nestle Nutrition Research
 Role: Co-investigator
 Award Period: 03/2017 – 06/2020
 Amount: \$600,000 (direct costs)

NIMH U01 MH110274-01

Title: “UNC/UMN Baby Connectome Project”

Principal Investigators: Weili Lin, Jed Elison, Joseph Piven, John Gilmore, Dingeng Shen, Kamil Ugurbil
 Role: Co-Investigator
 Date: 7/1/2016 – 5/30/2020
 Amount: \$2,700,000 (direct costs)

Awarded – Completed

NIH/NIMH 1 RO1 MH104324 -01 (BRAINS)

Infant Brain and Behavioral Signatures of Later Emerging Risk for Psychopathology.

Principal Investigator: Jed Elison
 Role: Postdoctoral Scholar
 Date: 08/2014 – 07/2019
 Amount: \$1,625,000 (total direct costs)

Jacobs Foundation

Young Scholar Award to attend the 2018 Jacobs Foundation Conference

Date: April 2018

Nestec Inc.

UMN-Nestec Breastfed Infant Fecal Sample Collection

Principal Investigator: Jed Ellison

Role: Co-investigator

Date: 12/2017 – 2/2018

Amount: \$15,475 (direct costs)

NIMH (T32 MH015755):

Child Development Psychopathology.

Principal Investigator: Dante Cicchetti

Role: T32 Postdoctoral Fellow

Date: March 2015 – August 2017

NIH/NIMH 3RO1 MH104324 -03S1 (BRAINS)

Administrative Supplement to Infant Brain and Behavioral Signatures of Later Emerging Risk for Psychopathology.

Principal Investigator: Jed Ellison

Role: Co-Investigator

Date: June 2016 – March 2017

Amount: \$70,254 (total direct costs)

NIMH (F31 MH086203):

Neurodevelopmental Correlates of Psychopathology Following Infant Maltreatment.

Principal Investigator: Brittany Howell

Role: F31 Predoctoral Fellow

Date: June 2010 – June 2013

Amount: \$91,452

International Society for Developmental Psychobiology (ISDP)

Student Travel Award to attend the Annual ISDP Meeting

Date: October 2012

Amount: \$450

National Institutes of Health Basic Behavioral & Social Science

Student Travel Award to attend the OppNet-Improving Animal Models of Human Behavioral and Social Processes Workshop

Date: July 2012

Amount: \$500

HealthEmotion Research Institute

Student Travel Award to attend the Wisconsin Symposium on Emotion

Date: April 2012

Amount: \$300

Center for Translational Social Neuroscience (Emory) Pilot Grant

The Role of Oxytocin in the Neurobiology of Infant Maltreatment and Poor Maternal Care.

Principal Investigator: Brittany Howell and Mar Sanchez

Date: 2011 - 2012

Amount: \$20,000

NIMH Early Experience, Stress, and Neurobehavioral Development Center Seed Grant (P50 MH078105, PI: M. Gunnar)

Comparative Resting State Functional Connectivity in Human and Nonhuman Primate Infants.

Principal Investigator: Brittany Howell and Alice Graham

Date: 2011 - 2012

Amount: \$9,024

HealthEmotion Research Institute

Student Travel Award to attend the Wisconsin Symposium on Emotion

Date: April 2011

Amount: \$300

NIMH Early Experience, Stress, and Neurobehavioral Development Center Seed Grant (P50 MH078105, PI: M. Gunnar)
 Understanding Effects of Repeated MRI Scanning on Neurodevelopment in Macaques
 Principal Investigator: Mar Sanchez and Martin Styner
 Role: Co-Investigator
 Date: 2010

NIGMS (T32 GM008605):
 Training in Systems and Integrative Biology: Neuroscience
 Principal Investigator: Yoland Smith
 Role: T32 Predoctoral Fellow
 Date: August 2007 – July 2008

Under review/In preparation

NIBIB Trailblazer Early Career R21
 Developing wearable OPM-MEG to assess brain function in mother-infant dyads during social interactions
 Principal Investigator: Brittany Howell
 Role: PI
 Submitted: 06/2020; to be reviewed 10/2020
 Award Period: April 2021 – March 2024 if funded
 Amount: \$400,000 direct costs

Service and Public Outreach:

Ad hoc Journal Reviews

JAMA Pediatrics, Child Development, Development and Psychopathology, Developmental Psychobiology, PLoS One, Frontiers in Behavioral Neuroscience, Scientific Reports, Translational Psychiatry, Journal of Intellectual Disability Research, NeuroImage, Developmental Cognitive Neuroscience.

Committee Memberships

2020-present	Research Committee, Child Health Investment Partnership of the Roanoke Valley (CHIP), Roanoke, VA
2020-present	Pioneers in Biomedical Research Seminar Series Theme Subcommittee Member for Human Neuroscience and Health Behaviors/Addiction, Fralin Biomedical Research Institute at VTC, Roanoke, VA
2017-2018	MN Children's Museum Research Advisory Council, St. Paul, MN
2015-2017	Education Committee, Eastside Neighborhood Services, Minneapolis, MN
2007-2009	Neuroscience Graduate Program Executive Committee, Emory University

Professional Organization Activities

SRCD: Submission reviewer for Biology and Neuroscience Panel for the 2017 Biennial Meeting
 October 2016

Organization of Conferences/Workshops/Panels/Symposia

2020	<i>Infant Imaging Pre-conference Workshop</i> , Organizer, FLUX Congress, virtual event, September 8, 2020.
2018	<i>Maternal pathways of pre/perinatal stress effects on neurobehavioral development</i> , Symposium chair, International Congress of Infant Studies Biennial Congress, Philadelphia, USA, July 1, 2018.
2017	Developmental Diffusion Weighted Imaging Workshop, Institute of Child Development, UMN

Publications:

E.L. Morin, **B.R. Howell**, E. Feczko, E. Earl, M. Pincus, K. Reding, Z.A. Kovacs-Balint, J.S. Meyer, M.A. Styner, D. Fair, M.M. Sanchez. (2020) Developmental outcomes of early adverse care on amygdala functional connectivity in nonhuman primates. *Development and Psychopathology*. Accepted.

A.G. Wakeford, B. Kochoian, E.R. Siebert, S. Katznelson, E.L. Morin, **B.R. Howell**, K.M. McCormack, M.A. Nader, M.M. Sanchez, L.L. Howell (2020). Effects of early life stress on cocaine intake in male and female rhesus macaques. *Psychopharmacology*, pp.1-7.

B.R. Howell, M. Ahn, Y. Shi, J. Godfrey, X. Hu, H. Zhu, M.A. Styner, M. Sanchez. (2019) Disentangling the effects of early caregiving experience and heritable factors on brain white matter development in rhesus monkeys. *NeuroImage*, 197: 625-642. DOI: 10.1016/j.neuroimage.2019.04.013

B.R. Howell, A. Tramacere. (2019). Putting microbiota-gut-brain research in a systemic developmental context: Focus on breast milk. *Behavioral and Brain Sciences*, 42.

E.L. Morin, **B.R. Howell**, J.S. Meyer, M.M. Sanchez. (2019) Effects of early maternal care on adolescent attention bias to threat in nonhuman primates. *Developmental Cognitive Neuroscience*, 38. DOI: 10.1016/j.dcn.2019.100643.

A.G.P. Wakeford, E.L. Morin, S.N. Bramlett, **B.R. Howell**, K.M. McCormack, J.S. Meyer, M.A. Nader, M.M. Sanchez, L.L. Howell. (2019) Effects of early life stress on cocaine self-administration in post-pubertal male and female rhesus macaques. *Psychopharmacology*, 236: 2785-2796. DOI: 10.1007/s00213-019-05254-8

T. Klengel, E.L. Morin, **B.R. Howell**, S. Bramlett, D. Guzman, J.S. Meyer, K.J. Ressler, M.M. Sanchez. Intergenerational effects of infant maltreatment on functional FKBP5 DNA 2 methylation in rhesus monkeys. Preprint, *bioRxiv*. DOI: 10.1101/791152

B.R. Howell*, M.A. Styner*, W. Gao*, P.T. Yap*, L. Wang*, K. Baluyot*, E. Yacoub*, G. Chen, T. Potts, A. Salzwedel, G. Li, J.H. Gilmore, J. Piven, J.K. Smith, D. Shen, K. Ugurbil, H. Zhu, W. Lin, J.T. Ellison. (2018) The UNC/UMN Baby Connectome Project (BCP): An overview of the study design and protocol development. *NeuroImage*. DOI: 10.1016/j.neuroimage.2018.03.049
*Equal contribution

S. Zhang*, X. Jiang*, W. Zhang*, T. Zhang, H. Cheng, Y. Zhao, Y. Lv, L. Li, Z. Li, L. Guo, **B.R. Howell**, M.M. Sanchez*, X. Hu*, T. Liu*. (2018) Joint Representation of Connectome-scale Structural and Functional Profiles for Identification of Consistent Cortical landmarks in Macaque Brain. *Brain Mapping and Behavior*, 13: 1427-1443. <https://doi.org/10.1007/s11682-018-9944-7>
*Equal first or senior author contribution

Z. Kovacs-Balint, E. Feczko, M.J. Pincus, **B.R. Howell**, E. Morin, E. Earl, L. Li, J. Steele, M. Styner, J. Bachevalier, D. Fair, M.M. Sanchez. (2018) Early developmental trajectories of functional connectivity along the visual pathways in rhesus monkeys. *Cerebral Cortex*. <https://doi.org/10.1093/cercor/bhy222>

W. Zhang*, X. Jiang*, S. Zhang*, **B.R. Howell***, Y. Zhao, T. Zhang, L. Guo, M. Sanchez, X. Hu (2017) Connectome-scale functional intrinsic connectivity networks in macaques. *Neuroscience*. 364:1-14. Doi: <https://doi.org/10.1016/j.neuroscience.2017.08.022>
*Shared first authorship.

Y. Shi, F. Budin, E. Yapuncich, A. Rumple, J.T. Young, C. Payne, X. Zhang, X.P. Hu, J. Godfrey, **B.R. Howell**, M.M. Sanchez, M.A. Styner (2017) UNC-Emory infant atlases for macaque brain image analysis: postnatal brain development through 12 months. *Frontiers in Neuroscience*. 10(617): 1-12. Doi: 10.3389/fnins.2016.00617

S. Drury, **B.R. Howell**, C. Jones, K. Esteves, R. Schlesinger, K. Baker, M. Sanchez (2017) Shaping long-term trajectories: early maternal maltreatment predicts telomere length trajectory across the first two years of life in rhesus macaques. *Development and Psychopathology*. Accepted.

B.R. Howell, M. McMurray, D. Guzman, G. Nair, Y. Shi, K. McMormack, X. Hu, M. Styner, M. Sanchez (2016) Maternal buffering beyond glucocorticoids: impact of early life stress on corticolimbic circuits that control infant responses to novelty. *Social Neuroscience*. 12(1): 50-64. doi: 10.1080/17470919.2016.1200481

M.M. Sanchez, K.M. McCormack, **B.R. Howell** (2015) Social buffering of stress responses in nonhuman primates: maternal regulation of the development of emotional regulatory brain circuits. *Social Neuroscience*, 10(5), 512-526. doi: 10.1080/17470919.2015.1087426

K.M. McCormack, **B.R. Howell**, D.B. Guzman, C. Villongco, K. Pears, H. Kim, M.R. Gunnar, M.M. Sanchez (2015). The development of an instrument to measure global dimensions of maternal care in rhesus macaques (*Macaca mulatta*). *American journal of primatology*, 77(1), 20-33.

B.R. Howell, A.P. Grand, K.M. McCormack, Y. Shi, J.L. LaPrarie, D. Maestriperi, M.A. Styner, M.M. Sanchez (2014). Early adverse experience increases emotional reactivity in juvenile rhesus macaques: Relation to amygdala volume. *Developmental psychobiology*, 56(8), 1735-1746.

B.L. Callaghan, R.M. Sullivan, **B.R. Howell**, N. Tottenham (2014). The international society for developmental psychobiology Sackler symposium: Early adversity and the maturation of emotion circuits – A cross-species analysis. *Developmental Psychobiology*, 56(8), 1635-1650.

B.R. Howell, J.R. Godfrey, D.A. Gutman, V. Michopoulos, X. Zhang, G. Nair, X. Hu, M.E. Wilson, M.M. Sanchez (2013) Social subordination stress and serotonin transporter polymorphisms: associations with brain white matter tract integrity and behavior in juvenile female macaques. *Cerebral Cortex*. doi: 10.1093/cercor/bht187

B.R. Howell, K.M. McCormack, A.P. Grand, X. Zhang, D. Maestriperi, X. Hu, M.M. Sanchez (2013) Long-term alterations in brain white matter microstructure detected with diffusion tensor imaging in adolescent rhesus monkeys exposed to early life stress: associations with high cortisol during infancy. *Biology of Mood & Anxiety Disorders*. 3:21. doi:10.1186/2045-5380-3-21

B.R. Howell, M.M. Sanchez (2011) Understanding Behavioral Effects of Early Life Stress Using the Reactive Scope and Allostatic Load Models. Special issue of *Development and Psychopathology*, Invited contribution, 23: 1001–1016.

Manuscripts in Revision/Under Review

A.G.P. Wakeford, B. Kochoian, E.R. Siebert, S. Katznelson, E.L. Morin, **B.R. Howell**, K.M. McCormack, M.A. Nader, M.M. Sanchez, L.L. Howell. Effects of early life stress on cocaine intake in male and female rhesus macaques. *Psychopharmacology*.

J. Young, **B.R. Howell**, E. Morin, K. Kuitchoua, G. Lubach, J. Noel, X. Hu, G.A. Caudill, A.L. Alexander, R. Santelli, Y. Shi, C. Coe, M.M. Sanchez. Early postnatal anesthesia exposure reduces white matter microorganization. Under review, *NeuroImage*.

Manuscripts In Preparation

B.R. Howell, S. Sung, J.J. Wolff, M.R. Swanson, M.A. Styner, K. Botteron, S. Dager, A. Estes, H.C. Hazlett, R.T. Scultz, J. Piven, Elison, J.T. for the IBIS Network. Assessment of developmental white matter networks in typically developing infants using a factor analysis framework. Target journal: *Journal of Neuroscience*.

K.M. McCormack, **B.R. Howell**, M. Higgins, D. Guzman, C. Villongco, J. Meyer, M.M. Sanchez (in prep) Developmental consequences of adverse caregiving in infant rhesus macaques: Longitudinal analysis of socioemotional behavior, physical growth and stress physiology. Target journal: *American Journal of Primatology*.

Book Chapters

W. Lin, K.R. Baluyot, M. Yao, J. Yan, L. Wang, G. Li, **B.R. Howell**, J.T. Ellison, D. Shen (2019). Early-Life Nutrition and Cognitive Development: Imaging Approaches. *Human Milk: Composition, Clinical Benefits and Future Opportunities*, 121–135. doi:10.1159/000490300

B.R. Howell, G. Neigh, M.M. Sanchez (2016) Animal Models of Developmental Psychopathology. In D. Cicchetti (Ed.) *Handbook of Developmental Psychopathology Third Edition*. Hoboken, NJ; Wiley & Co.

D.B. Guzman, **B.R. Howell**, M.M. Sanchez (2016). Early Life Stress and Development: Preclinical Science. In J.D. Bremner (Ed.) *Posttraumatic Stress Disorder: From Neurobiology to Treatment*. Hoboken, NJ; Wiley & Co.

Abstracts/Conference Proceedings

B. Kochoian, A.G. Wakeford, A. Ratliff, E.R. Siebert, K. Kuitouchoua, E.L. Morin, R. Hong, M.H. Kyle, S. Cowan, **B.R. Howell**, Z. Kovacs-Balint, M.A. Styner, L.L. Howell, M.A. Nader, M. Sanchez. (2019) Effects of early life stress on development of the prefrontal cortex, amygdala, hippocampus and nucleus accumbens in Rhesus monkeys: Associations with psychostimulant escalation during adolescence? 49th Annual Meeting of the Society for Neuroscience (SfN). (Chicago, IL; Oct. 19-23).

M.H. Kyle, A. Kaldas, M. Pincus, J. Godfrey, Z. Kovacs-Balint, E.L. Morin, D. De Leon, L. Li, **B.R. Howell**, M. A. Styner, C. Payne, K. Ethun, M.E. Wilson, M. Sanchez. (2019) Effects of social subordination and consumption of an obesogenic diet on total brain size and structural development of cortico-limbic regions: A longitudinal study in infant and juvenile macaques. 49th Annual Meeting of the Society for Neuroscience (SfN). (Chicago, IL; Oct. 19-23).

K.F. Ethun, Y. Liu, S. Bramlett, E. Morin, D. Guzman, **B.R. Howell**, M. Sanchez. (2019) The effect of stress hormones on NHP social and neurocognitive development. 42nd Meeting of the American Society of Primatologists (ASP). (Madison, WI; Aug. 21-24).

E. Morin, A. Wakeford, **B.R. Howell**, D. Guzman, J. Meyer, E. Siebert, A. Kazama, J. Nye, M. Sanchez. (2018) Maternal care affects the development of fear learning in adolescent nonhuman primates: Relationship with prefrontal 5HT1A receptor binding & attention bias to threat in nonhuman primates. 57th Annual Meeting of the American College of Neuropsychopharmacology (ACNP). (Hollywood, FL; Dec 9-13).

E. Morin, M. Pincus, A. Wakeford, **B.R. Howell**, D. Guzman, E. Siebert, A. Kazama, J. Nye, M.M. Sanchez. (2018). Maternal care controls the development of fear learning in adolescent nonhuman primates: relationship with prefrontal 5HT1A receptor binding and gut microbiome. 51st Annual Meeting of the International Society for Developmental Psychobiology (ISDP). (San Diego, CA; Oct 31 – Nov 2).

M. Kyle, A. Kaldas, M. Pincus, J. Godfrey, Z. Kovacs-Balint, E. Morin, **B.R. Howell**, M. Styner, K. Ethun, M. Wilson, M.M. Sanchez. (2018). Social status and an obesogenic diet affect amygdala, hippocampus, and prefrontal cortex development in infant and juvenile macaques. 48th Annual Meeting of the Society for Neuroscience (SfN). (San Diego, CA; Nov 3-7).

B.R. Howell, K. Ethun, J.R. Godfrey, M. Pincus, M. Wilson, M.M. Sanchez. (2018). Complex effects of maternal stress and diet on neurodevelopment in nonhuman primates. Symposium presented at International Congress of Infant Studies Biennial Congress, Philadelphia, USA, July 1, 2018.

E. Morin, K. Kuitouchoua, **B.R. Howell**, E. Feczko, E. Earl, M. Pincus, K. Reding, A. Ratliff, M. Styner, D. Fair, M.M. Sanchez (2017) Developmental outcomes of early adverse care on amygdala functional connectivity and structure in nonhuman primates. 47th Annual Meeting of the Society for Neuroscience (SfN). (Washington, DC; Nov 11-15).

- S. Bramlett, E. Morin, D. Guzman, **B.R. Howell**, J. Meyer, M.M. Sanchez (2017) Effects of early adverse maternal care on hypothalamic-pituitary-adrenal axis function in nonhuman primates. 47th Annual Meeting of the Society for Neuroscience (SfN). (Washington, DC; Nov 11-15).
- M. Kyle, M. Pincus, J.R. Godfrey, Y. Shi, M. Styner, L. Li, **B.R. Howell**, K. Ethun, M. Wilson, M.M. Sanchez (2017) Social stress and the dietary environment affect infant brain volumes in macaques: modulation by maternal factors. 47th Annual Meeting of the Society for Neuroscience (SfN). (Washington, DC; Nov 11-15).
- M.M. Sanchez, E. Morin, **B.R. Howell**, S. Bramlett, D. Guzman, C. Jones, K. Esteves, R. Schlesinger, J. Meyer, K. Baker, D. Fair, S. Drury. (2017). "Adverse maternal care affects the development of emotional and stress regulation and underlying neurocircuits in nonhuman primates: associations with telomere length shortening". Oral presentation at the panel: "Effects of Adversity on Brain Development and Mental Health: Converging Evidence from Rodents, Monkeys and Humans", American College of Neuropsychopharmacology (ACNP) 56th Annual Meeting. (Palm Springs, California; Dec 3-7, 2017).
- E.L. Morin, **B.R. Howell**, E. Feczko, E. Earl, K. Esteves, M.A. Styner, S.S. Drury, D. Fair, M.M. Sanchez (2016) *Developmental Changes in emotional neurocircuitry and cellular aging in nonhuman primates: Effects of early life stress* (nanosymposium presentation: Enduring Consequences of Early Stress). 46th Annual Meeting of the Society for Neuroscience (SfN). (San Diego, CA; Nov 12-16)
- E.L. Morin, **B.R. Howell**, E. Feczko, E. Earl, K. Esteves, M.A. Styner, S.S. Drury, D. Fair, M.M. Sanchez (2016) *Developmental changes in emotional neurocircuitry and cellular aging in nonhuman primates: Effects of early maternal care* (poster). 7th Annual Meeting of the Society for Social Neuroscience (S4SN). (San Diego, CA; Nov 11)
- Howell, B.R.**, Ahn, M., Godfrey, J.R., Shi, Y., Nair, G., Hu, X., Yacoub, E., Styner, M.A., Sanchez, M.M., **Elison, J.T.** (2016, May). Infant Neuroimaging: Toward Translational Connectivity. Symposium session presented at the XIX Biennial International Conference on Infant Studies, New Orleans, LA, USA.
- E.L. Morin, **B.R. Howell**, D.B. Guzman, A. Kazama, E. Siebert, E. Feczko, E. Earl, Y. Shi, M.A. Styner, D. Fair, M.M. Sanchez (2016) *Maternal Care Modulates the Development of Emotional Neurocircuitry in Nonhuman Primates: Functional Connectivity and Cognition* (poster). 71st Annual Meeting of the Society of Biological Psychiatry (SOBP). (Atlanta, GA; May 12-14, 2016)
- E.L. Morin, **B.R. Howell**, D.B. Guzman, A. Kazama, E. Siebert, E. Feczko, E. Earl, Y. Shi, M.A. Styner, D. Fair, M.M. Sanchez (2016) *Maternal care modulates the development of emotional and reward neurocircuitry in nonhuman primates* (poster). 22nd Annual Meeting of the Wisconsin Symposium on Emotion. (University of Wisconsin-Madison; April 19-20, 2016)
- B.R. Howell**, M. Ahn, J.R. Godfrey, Y. Shi, G. Nair, X. Hu, M.A. Styner, M.M. Sanchez (2015) *Infant maltreatment alters limbic white matter tracts: support for the match/mismatch hypothesis?* 45th Annual Meeting of the Society for Neuroscience (SfN). (Chicago, IL; Oct 17-21)
- T. Klengel, **B.R. Howell**, D.B. Guzman, Z. Johnson, E.B. Binder, K.J. Ressler, M.M. Sanchez (2015) *Intergenerational transmission of trauma exposure through FKBP5 DNA methylation in rhesus macaques*. 45th Annual Meeting of the Society for Neuroscience (SfN). (Chicago, IL; Oct 17-21)
- E. Morin, **B.R. Howell**, K. Reding, D.B. Guzman, E. Feczko, E. Earl, Y. Shi, M.A. Styner, D. Fair, M.M. Sanchez (2015) *Early maternal care modulates the development of emotional neurocircuitry in nonhuman primates: amygdala functional connectivity*. 45th Annual Meeting of the Society for Neuroscience (SfN). (Chicago, IL; Oct 17-21)
- Z.A. Kovacs-Balint, E. Feczko, **B.R. Howell**, E. Earl, L. Li, J. Steele, S. Lee, Y. Shi, M.A. Styner, L. Parr, J. Bachevalier, D. Fair, M.M. Sanchez (2015) *Normative development of functional*

connectivity in the rhesus monkey visual pathways. 45th Annual Meeting of the Society for Neuroscience (SfN). (Chicago, IL; Oct 17-21)

C.L. Fu, V.K. Wing, D.L. Padmanabhan, **B.R. Howell**, D.G. Guzman, J.R. Godfrey, Y. Shi, M.A. Styner, M.M. Sanchez (2015) *Effects of maternal care on amygdala, prefrontal cortex, and hippocampal development in infant rhesus monkeys*. 45th Annual Meeting of the Society for Neuroscience (SfN). (Chicago, IL; Oct 17-21)

M. Pincus, J.R. Godfrey, E. Feczko, E. Earl, Y. Shi, M.A. Styner, L. Li, **B.R. Howell**, D. Fair, K.F. Ethun, M.E. Wilson, M.M. Sanchez (2015) *Social rank and diet affect amygdala functional connectivity with prefrontal cortex during infancy in female rhesus macaques*. 45th Annual Meeting of the Society for Neuroscience (SfN). (Chicago, IL; Oct 17-21)

J. N. Kohn, **B.R. Howell**, D.B. Guzman, J.S. Meyer, C.C. Ibegbu, M.M. Sanchez (2014). 172. *Early life stress and perinatal glucocorticoid exposure produce complex immune system alterations, including accelerated T cell immunosenescence, in adolescent rhesus macaques*. *Brain, Behavior, and Immunity*, 40, e50.

B.R. Howell, Y. Shi, J.S. Meyer, X. Zhang, M. Styner, M. Sanchez. (2012) *Early life stress leads to increased fear and aggressive responses to threat in infant rhesus monkeys: associations with increased cortisol and amygdala volume*. 42nd Annual Meeting of the Society for Neuroscience (SfN). (New Orleans, LA; Oct 13-17)

B.R. Howell, Y. Shi, D. Grayson, X. Zhang, G. Nair, X. Hu, D. Fair, M. Styner, M. Sanchez. (2012) *Effects of early life stress on brain structural and functional development in a nonhuman primate model*. 42nd Annual Meeting of the Society for Neuroscience (SfN). (New Orleans, LA; Oct 13-17)

D.B. Guzman, **B.R. Howell**, C.M. Marsteller, Z.P. Johnson, J.S. Meyer, M.M. Sanchez. (2012) *Effects of adverse maternal care on HPA function: a longitudinal study in infant rhesus monkeys*. 42nd Annual Meeting of the Society for Neuroscience (SfN). (New Orleans, LA; Oct 13-17)

J.R. Godfrey, **B.R. Howell**, Y. Shi, X. Zhang, D. Grayson, G. Nair, X. Hu, D. Fair, M. Styner, M. Sanchez. (2012) *Brain structural and functional connectivity alterations in maltreating macaque mothers: an MRI, DTI and resting state fMRI study*. 42nd Annual Meeting of the Society for Neuroscience (SfN). (New Orleans, LA; Oct 13-17)

J.R. Godfrey, **B.R. Howell**, X. Zhang, G. Nair, X. Hu, M.E. Wilson, M.M. Sanchez (2012) *Experimentally delayed puberty interacts with social stress to produce widespread effects on the development of brain white matter tracts and behavior in rhesus monkeys*. American College of Neuropsychopharmacology (ACNP). (Hollywood, FL; Dec 2-6)

B.R. Howell, Y. Shi, X. Zhang, G. Nair, X. Hu, D. Fair, M. Styner, M.M. Sanchez. (2012) *Developmental Effects of Adverse Early Experience: Prefrontal-Amygdala Circuits*. Wisconsin Symposium on Emotion. (University of Wisconsin-Madison; Apr 18-19)

B.R. Howell, J.R. Godfrey, V. Michopoulos, X. Zhang, G. Nair, X. Hu, M.E. Wilson, M.M. Sanchez. (2011) *Social subordination stress and serotonin transporter (5HTT) polymorphisms affect the development of brain white matter tracts in juvenile female macaques: behavioral and neuroendocrine correlations*. 50th Annual Meeting of the American College of Neuropsychopharmacology (ACNP). (Waikoloa, HI; Dec 4-8)

M.M. Sanchez, Y. Shi, X. Zhang, G. Nair, D. Grayson, X. Hu, P. Fisher, D. Fair, M. Styner, **B.R. Howell**. (2011). *Effects of early life stress on infant macaque brain development: a longitudinal study of structural and functional connectivity changes using diffusion tensor imaging and resting state fMRI*. 50th Annual Meeting of the American College of Neuropsychopharmacology (ACNP). (Waikoloa, HI; Dec 4-8)

B.R. Howell, Y. Shi, X. Zhang, G. Nair, X. Hu, M.A. Styner, M.M. Sanchez. (2011) *Adverse early experience affects brain white matter tract integrity: a longitudinal DTI study in infant rhesus monkeys*. 41st Annual Meeting of the Society for Neuroscience (SfN). (Washington, DC; Nov 12-16)

M.M. Sanchez, K. Fomalont, Y. Shi, M. Styner, M. Wilson, **B.R. Howell**. (2011) *Neurodevelopmental effects of social subordination stress and serotonin transporter (5HTT) genotype in female macaques before and during puberty*. 41st Annual Meeting of the Society for Neuroscience (SfN). (Washington, DC; Nov 12-16)

B.R. Howell, K. McCormack, A. Graff, X. Zhang, M. Sanchez. (2011) *Developmental effects of adverse early experience on brain white matter and behavior*. Travel award, 2011 Wisconsin Symposium on Emotion. (Madison, WI; Apr 13-14)

B.R. Howell, V. Michopoulos, X. Zhang, X. Hu, M.E. Wilson, M.M. Sanchez. (2010) *Social subordination stress and serotonin transporter (5HTT) genotype affect brain white matter tract integrity in juvenile female macaques: a DTI study*. 40th Annual Meeting of the Society for Neuroscience (SfN). (San Diego, CA; Nov 13-17)

B.R. Howell, V. Michopoulos, Z. Johnson, X. Zhang, G. Bhagavatheeshwaran, X. Hu, M.A. Styner, M.E. Wilson, M.M. Sanchez. (2010) *Effects of social subordination stress and serotonin transporter (5HTT) genotype on brain volume and white matter tracts in juvenile female macaques*. 49th Annual Meeting of the American College of Neuropsychopharmacology (ACNP). (Miami Beach, FL; Dec 5-9)

M.M. Sanchez, M.A. Styner, K.M. McCormack, A. Graff, X. Zhang, D. Maestriperi, **B.R. Howell** (2009) *Decreased left amygdala volume is related to early life stress in an animal model of poor maternal care*. 39th Annual Meeting of the Society for Neuroscience (SfN). (Chicago, IL; Oct 17-22)

B.R. Howell, M. Glasser, W. Li, X. Zhang, A. Graff, D. Maestriperi, X. Hu, M.M. Sanchez (2009). *Long-term alterations in white matter microstructure in a rhesus macaque model of infant maltreatment measured using diffusion tensor imaging*. 15th Annual Meeting of the Organization for Human Brain Mapping (June 18-22, San Francisco, CA).

B.R. Copp*, K.M. McCormack, A.P. Grand, M. Glasser, W. Li, N. Sawyer, X. Zhang, A. Graff, D. Maestriperi, X. Hu, M.M. Sanchez (2008). *Alterations in white matter microstructure correlate with behavioral and physiological differences associated with infant maltreatment in rhesus monkeys (*M. mulatta*)*. 38th Annual Meeting of the Society for Neuroscience (SfN). (Washington, DC; Nov 15-19).

M.M. Sanchez, M. Glasser, W. Li, G. Pagnoni, A. Graff, X. Zhang, X. Hu, **B.R. Copp*** (2008). *Microstructural development of the rhesus monkey brain: white matter maturation using diffusion tensor imaging*. 38th Annual Meeting of the Society for Neuroscience (SfN). (Washington, DC; Nov 15-19).

M.M. Sanchez, O. Alagbe, **B.R. Copp***, X. Zhang, J. Felger, J. Zhang, A. Graff, A. Grand, D. Maestriperi, A. Miller (2007). *Infant maltreatment has long-term effects on neurobiology and inflammatory signaling of juvenile rhesus monkeys (*M. mulatta*)*. 38th Annual Conference of the International Society of Psychoneuroendocrinology (ISPNE). (Madison, Wisconsin; Aug 19-22).

B.R. Copp*, O. Alagbe, W. Li, X. Zhang, J. Felger, J. Zhang, A. Graff, A. Grand, D. Maestriperi, X. Hu, A. Miller, M.M. Sanchez (2007). *Long-term impact of infant maltreatment on neurobiology*

and inflammatory signaling of rhesus monkeys (*M. mulatta*). 37th Annual Meeting of the Society for Neuroscience (SfN). (San Diego, CA; Nov 3-7).

*Cited as Brittany Copp on work submitted prior to 8/8/2008

Invited Talks

B.R. Howell, M.M. Sanchez. (2019) *Neurodevelopmental consequences of infant maltreatment in nonhuman primates*. 41st Minnesota Symposium on Child Psychology: Early Life Adversity, Stress, and Neurobehavioral Development. (Minneapolis, MN; Oct 24-25).

B.R. Howell. (2019) *Goodnight scanner: Tips and tricks for collecting infant and toddler MRI during natural sleep*. FIT'NG In: Establishing best practices for infant neuroimaging, preconference workshop for the 7th Annual Flux Congress. (New York, NY; Aug 29)

B.R. Howell. (2019) *Evolution of the infant microbiome: Developmental considerations*. 8th Annual Wyeth Nutrition Science Center Global Summit. (Valencia, Spain; March 6-7).

B.R. Howell. (2018) *The Baby Connectome Project - Enriched: Development of the Intestinal Microbiome*. Center for Neurobehavioral Development, University of Minnesota. (Minneapolis, MN; Nov)

B.R. Howell, M. Ahn, J. Godfrey, Y. Shi, G. Nair, X. Hu, E. Yacoub, M. Styner, M. Sanchez, J. Ellison. (2016) *Infant neuroimaging: toward translational connectivity*. 20th Biennial meeting of the International Congress on Infant Studies (ICIS). (New Orleans, LA; May 26-28).

B.R. Howell, K.M. McCormack, D.B. Guzman, C. Villongco, K. Pears, H. Kim, G. Nair, X. Hu, M.R. Gunnar, M.M. Sanchez. (2012) *Associations of different aspects of maternal care with white matter microstructure in infant rhesus monkeys (*Macaca mulatta*)*. 43rd Annual Meeting of the Society for Neuroscience (SfN). (San Diego, CA; Nov 8-13)

B.R. Howell, Y. Shi, D. Grayson, X. Zhang, G. Nair, X. Hu, D. Fair, M.A. Styner, M.M. Sanchez. (2012) *Effects of early life stress on development of prefrontal-amygdala circuits*. Sackler Symposium: Effects of early-life adversity on amygdala-prefrontal interactions: Convergence across species, 45th Annual meeting of the International Society for Developmental Psychobiology (ISDP). (New Orleans, LA; Oct 10-13)

B.R. Howell, Y. Shi, D. Grayson, X. Zhang, G. Nair, X. Hu, D. Fair, M.A. Styner, M.M. Sanchez. (2012) *Effects of early life stress on brain structural and functional development in a nonhuman primate model*. 42nd Annual Meeting of the Society for Neuroscience (SfN). (New Orleans, LA; Oct 13-17)

B.R. Howell. (2012) *Effects of early life stress on infant macaque brain development*. Frontiers in Neuroscience Seminar Series, Emory University (Atlanta, GA; Feb 21)

B.R. Howell, Y. Shi, X. Zhang, G. Nair, X. Hu, M.A. Styner, M.M. Sanchez. (2011) *Effects of adverse early experience on the brain: translational approaches*. Dept. of Psychology, University of Hawaii Hilo (Hilo, HI; Dec 9)

B.R. Howell, K.M. McCormack, A. Grand, M.M. Styner, X. Hu, X. Zhang, M. Glasser, D. Maestriperieri, M.M. Sanchez. (2009) *Long-term effects of poor maternal care on the brain and behavior in rhesus macaques*. 39th Annual Meeting of the Society for Neuroscience (SfN). (Chicago, IL; Oct 17-22)

Advising/Mentoring:

Virginia Tech

- Eunkyung Shin, Postdoctoral Trainee July 2020 – present

- Dawn Wright, VTCSOM Medical Student Spring 2020 – present
- Sarah Yosief, VTCSOM Medical Student Spring 2020 – present
- Jasmine Johnson, TBMH PhD Student Spring 2020 – present

University of Minnesota

- Grace Kirkpatrick, Undergraduate Summer 2019
- Mia Keller, Undergraduate Spring 2019
- Ayush Patel, Undergraduate Fall 2018 – Spring 2019
- Brooke Leaf, Undergraduate Fall 2017 – Summer 2019
- Madison Powell, Undergraduate Fall 2017 – present
- Patrick Johnson, Research Staff Summer 2015 – Fall 2018

Emory University

- Divya Padmanabhan (Undergraduate at Emory University), 2014
- Vicki Wing (Undergraduate at Emory University), 2014
- Caroline Fu (Undergraduate at Emory University), 2013
- Chris Villongco (Undergraduate at Emory University), 2012
- Tacha Adelphin (Undergraduate at Gwinnett College), 2011
- Matthew McMurray (Undergraduate at Emory University), 2010-2012
- Jamal Garnett (Recent Graduate of Southwest DeKalb High School), 2008

Teaching Experience:

Undergraduate Courses

Project Lab in Neuroscience (NBB 301), TA, Emory University, Spring 2011

Graduate Courses

Scientific Logic and Analysis (TBMH 5404), Instructor, Virginia Tech, Fall 2020

Advanced Topics in Psychology: Biological, Clinical, and Developmental Perspectives on Stress and Trauma (PSYC 6954), Guest Lecturer, Virginia Tech, Fall 2020

Basic Biomedical and Biological Sciences (IBS 555), TA, Emory University, Fall 2007