Curriculum Vitae

Paul Leon Brown, Ph.D.
Assistant Professor, Department of Psychiatry
University of Maryland School of Medicine

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Contact Information

Business Address: Maryland Psychiatric Research Center
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Education

1993-1996 S.B., Psychology and Economics, St. Lawrence University (*summa cum laude*)
1996-1998 M.A., Physiological Psychology, University of New Hampshire
2007-2014 Ph.D., Neuroscience, University of Maryland Baltimore

Post Graduate Education and Training

2014-2019 Fellowship, Neuroscience, Maryland Psychiatric Research Center

Employment History

Academic Appointments

2019-2023 Instructor, Department of Psychiatry, UMSOM
2023-Present Assistant Professor, Department of Psychiatry, UMSOM

Other Employment

1998-2000 Research Associate, Maryland Psychiatric Research Center
2000-2007 Research Associate, NIDA Intramural Research Program

Professional Society Memberships

1997-present Member, Society for Neuroscience

Honors and Awards

2010 Graduate Research Conference Poster Session Award Winner, University of Maryland Baltimore
2016 Postdoctoral Travel Award, University of Maryland Baltimore

Administrative Service

Institutional

2015-2018 Fellows Training Meeting Coordinator, Maryland Psychiatric Research Center
2022-Present Faculty Advisory Council, Department of Psychiatry, UMSOM

Local and National Service

2013	Ad hoc Reviewer	*Journal of Addiction and Prevention*
		European Neuropsychopharmacology
2015	Ad hoc Reviewer	*Schizophrenia Bulletin*
2016	Ad hoc Reviewer	*International Journal of Neuropsychopharmacology*
		Biological Psychiatry
		Journal of Neurology & Neuromedicine
2017	Ad hoc Reviewer	*Schizophrenia Bulletin*
		Metabolic Brain Disease
2018	Ad hoc Reviewer	*The Anatomical Record*
		Schizophrenia Bulletin
		Psychopharmacology
2019	Ad hoc Reviewer	*Schizophrenia Bulletin*
		Nature Reviews Neuroscience
2021	Ad hoc Reviewer	*European Neuropsychopharmacology*
		Frontiers in Behavioral Neuroscience
		Schizophrenia Bulletin
2022	Ad hoc Reviewer	*Brain Structure and Function*
2023-Present	Associate Editor	*Frontiers in Behavioral Neuroscience*

Teaching Service

Undergraduate Teaching

1996-1998 Substitute Lecturer, Various Courses (Various lectures)
Department of Psychology, University of New Hampshire
20-40 undergraduates per lecture, 1-2 lectures/semester

2013 Guest Lecturer, Physiological Psychology (Psychopathology: Schizophrenia)
Department of Psychology, University of Maryland Baltimore County
100 undergraduates, 1 lecture/semester

2017-2018 Research Lecturer, Conte Center Summer Student Research Seminar
Maryland Psychiatric Research Center
15 undergraduate students, 1 lecture/summer

2018 Research Mentor, Conte Center Summer Student Research Seminar
Maryland Psychiatric Research Center
1 undergraduate student, 15 hours/week

Graduate Teaching

2013-2014 Class Discussion Leader, Neuropharmacology (Dopamine action/mechanisms)
Program in Neuroscience, University of Maryland Baltimore
15 graduate students, 1 lecture/semester

Post-Graduate Teaching

2018 Guest Lecturer, Schizophrenia (Modeling psychopathology in preclinical science)
Fellows Training Program, Maryland Psychiatric Research Center
10 postdoctoral fellows, 1 lecture/semester

Grant Support

Active Grants

09/01/2019 - 06/30/2024 (Key Personnel, 58%; PI, Robert Schwarcz)
"*Kynurenic acid and cognitive abnormalities in schizophrenia*"
NIH P50 MH103222
Annual Direct Costs: $2,820,000
Total Direct Costs: $14,100,000
Responsible for performing and analyzing electrophysiology experiments in pre-clinical projects associated with Conte Center.

01/01/2020 - 06/30/2024 (PI, 0%; salary support not allowed)
"*Effect of direct kynurenic acid delivery on neuronal burst firing and depression-like behavior*"
NIH P50 MH103222 (Conte Center Pilot Grant)
Annual Direct Costs: $3,625
Total Direct Costs: $14,500

11/01/2022 - 10/31/2023 (PI, 0%; salary support not allowed)
"*An anatomical investigation of the lateral habenula and its role in ADHD*"
Betty Huse Award, Department of Psychiatry, UMSOM
Annual Direct Costs: $40,000
Total Direct Costs: $40,000

01/20/2023 - 01/19/2025 (PI, 25%)
"*Estrogen modulation of the lateral habenula and its ability to inhibit midbrain dopamine neurons*"
NIH R21 MH129809
Annual Direct Costs: $137,500
Total Direct Costs: $275,000

Completed Grants

07/01/2011 - 06/30/2014 (PI, 100%)
"*A novel habenulo-mesencephalic circuit in aversive signaling*"

NIH F31 DA030893
Annual Direct Costs: $28,847
Total Direct Costs: $86,541

01/15/2017 - 07/14/2019 (PI, 0%; no salary support)
"*Sex differences in lateral habenular regulation of dopamine neurons in the rat and their implications for substance abuse liability*"
NARSAD Young Investigator Grant (25300)
Annual Direct Costs: $35,000
Total Direct Costs: $70,000

Publications

Peer-reviewed journal articles

1. Austin M, Myles V, **Brown PL**, Mammola B, Drugan RC (1999) FG 7412- and restraint induced alterations in ataxic effects of alcohol and midazolam are time dependent. *Pharmacology, Biochemistry, and Behavior* 62(1): 45-51.
2. O'Gara BA, **Brown PL**, Dlugosch D, Kandiel JW, Abbasi A, Kounalakis N (1999) Regulation of pharyngeal motility by FMRFamide and related peptides in the medicinal leech, *Hirudo medicinalis*. *Invertebrate Neuroscience* 4(1): 41-53.
3. **Brown PL**, Hurley C, Repucci N, Drugan RC (2001) Behavioral analysis of stress controllability effects in a new swim stress paradigm. *Pharmacology, Biochemistry, and Behavior* 68(2): 263-272.
4. Kiyatkin EA, **Brown PL**, Wise RA (2002) Brain temperature fluctuation: a reflection of functional neural activation. *European Journal of Neuroscience* 16(1): 164-168.
5. Kiyatkin EA, **Brown PL** (2003) Fluctuations in neural activity during cocaine self-administration: clues provided by brain thermorecording. *Neuroscience* 116(2): 525-538.
6. Kiyatkin EA, **Brown PL** (2003) Naloxone depresses cocaine self-administration and delays its initiation on the following day. *Neuroreport* 14(2): 252-255.
7. **Brown PL**, Wise RA, Kiyatkin EA (2003) Brain hyperthermia is induced by methamphetamine and exacerbated by social interaction. *Journal of Neuroscience* 23(9): 3924-3929.
8. Kiyatkin EA, **Brown PL** (2004) Brain temperature fluctuations during passive vs. active cocaine administration: clues for understanding the pharmacological determination of drug-taking behavior. *Brain Research* 1005(1-2): 101-116.
9. **Brown PL**, Kiyatkin EA (2004) Brain hyperthermia induced by MDMA (ecstasy): modulation by environmental conditions. *European Journal of Neuroscience* 20(1): 51-8.
10. Kiyatkin EA, **Brown PL** (2004) Modulation of physiological brain hyperthermia by the environment and impaired blood flow. *Physiology and Behavior* 83(3): 467-474.
11. Kiyatkin EA, **Brown PL** (2005) Brain and body temperature homeostasis during sodium pentobarbital anesthesia with and without body warming in rats. *Physiology and Behavior* 84(4): 563-570.

12. **Brown PL**, Kiyatkin EA (2005) Fatal intra-brain heat accumulation induced by meth-amphetamine at normothermic conditions. *International Journal of Neuroprotection and Neuroregeneration* 1(2): 86-90.
13. Kiyatkin EA, **Brown PL** (2005) Dopamine-dependent and dopamine-independent actions of cocaine as revealed by brain thermorecording in freely moving rats. *European Journal of Neuroscience* 22(4): 930-938.
14. **Brown PL**, Kiyatkin EA (2005) Brain temperature change and movement activation induced by intravenous cocaine delivered at various injection speeds in rats. *Psychopharmacology* 181(2): 299-308.
15. **Brown PL**, Kiyatkin EA (2006) The role of peripheral Na(+) channels in triggering the central excitatory effects of intravenous cocaine. *European Journal of Neuroscience* 24(4): 1182-1192.
16. Kiyatkin EA, **Brown PL** (2006) The role of peripheral and central sodium channels in mediating brain temperature fluctuations induced by intravenous cocaine. *Brain Research* 1117(1): 38-53. (PMC1847334)
17. **Brown PL**, Bae DD, Kiyatkin EA (2007) Relationships between locomotor activation and alterations in brain temperature during selective blockade and stimulation of dopamine transmission. *Neuroscience* 145(1): 335-343. (PMC1850994)
18. Bae DD, **Brown PL**, Kiyatkin EA (2007) Procedure of rectal temperature measurement affects brain, muscle, skin and body temperatures and modulates the effects of intravenous cocaine. *Brain Research* 1154: 61-70. (PMC1974888)
19. Kiyatkin EA, **Brown PL**, Sharma HS (2007) Brain edema and breakdown of the blood-brain barrier during methamphetamine intoxication: Critical role of brain hyperthermia. *European Journal of Neuroscience* 26(5): 1242-1253.
20. Kiyatkin EA, **Brown PL** (2007) IV cocaine induces rapid, transient excitation of striatal neurons via its action on peripheral neural elements: single-cell, iontophoretic study in awake and anesthetized rats. *Neuroscience* 148(4): 978-995. (PMC2084066)
21. **Brown PL**, Kiyatkin EA (2008) Sensory effects of intravenous cocaine on dopamine and non-dopamine ventral tegmental area neurons. *Brain Research* 1218: 230-249. (PMC2527219)
22. Roesch MR, Singh T, **Brown PL**, Mullins SE, Schoenbaum G (2009) Ventral striatal neurons encode the value of the chosen action in rats deciding between differently delayed or sized rewards. *Journal of Neuroscience* 29(42): 13365-13376. (PMC2788608)
23. Burke KA, Takahashi YK, Correll J, **Brown PL**, Schoenbaum G (2009) Orbitofrontal inactivation impairs reversal of Pavlovian learning by interfering with 'disinhibition' of responding for previously unrewarded cues. *European Journal of Neuroscience* 30(10): 1941-1946. (PMC2810348)
24. **Brown PL**, Shepard PD, Elmer GI, Stockman S, McFarland R, Cadet JL, Krasnova IN, Greenwald M, Schoonover C, Vogel MW (2012) Altered spatial learning, cortical plasticity, and hippocampal anatomy in a neurodevelopmental model of schizophrenia-related endophenotypes. *European Journal of Neuroscience* 30(6):2773-2781. (PMC3902091)
25. **Brown PL**, Shepard PD (2013) Lesions of the fasciculus retroflexus alter footshock induced cFos expression in the mesopontine rostromedial tegmental area of rats. *PLoS*

One 8(4): e60678. (PMC3625179)

26. Wang LM, Lu H, Rea W, **Brown PL,** Vaupel B, Yang Y, Stein E, Shepard PD (2015) Manganese-enhanced MRI reflects both activity-independent and activity-dependent uptake within the rat habenulomesencephalic pathway. *PLoS One* 10(5): e0127773. (PMC4443977)
27. **Brown PL**, Shepard PD (2016) Functional evidence for a direct excitatory projection from the lateral habenula to the ventral tegmental area in the rat. *Journal of Neurophysiology* 116(3): 1161-1174. (PMC5013172)
28. Elmer GI, **Brown PL**, Shepard PD (2016) Engaging Research Domain Criteria (RDoC): Neurocircuitry in search of meaning. *Schizophrenia Bulletin* 42(5): 1090-1095. (PMC4988756)
29. **Brown PL**, Palacorolla H, Brady D, Rieger K, Elmer GI, Shepard PD (2017) Habenula-induced inhibition of midbrain dopamine neurons is diminished by lesions of the rostromedial tegmental nucleus. *Journal of Neuroscience* 37(1): 217-225. (PMC5214632)
30. **Brown PL**, Zanos P, Wang L, Elmer G, Gould TD, Shepard PD (2018) Isoflurane but not halothane prevents and reverses helpless behavior: A role for EEG burst suppression? *International Journal of Neuropsychopharmacology* 21(8): 777-785. (PMC6070045)
31. Elmer GI, Palacorolla H, Mayo CL, **Brown PL**, Jhou TC, Brady D, Shepard PD (2019) The rostromedial tegmental nucleus modulates the development of stress-induced helpless behaviour. *Behavioural Brain Research* 359: 950-957.

Abstracts and/or Proceedings

1. **Brown PL**, Drugan RC (1997) Ethanol-induced motor ataxia in the rat in response to acute and chronic swim stress. 27th Annual Meeting of the Society for Neuroscience, New Orleans, LA.
2. Drugan RC, Austin MK, Myles V, **Brown PL** (1997) Beta-carboline-induced alterations in the motor incoordinating effects of alcohol in rats are time dependent. 27th Annual Meeting of the Society for Neuroscience, New Orleans, LA.
3. **Brown PL**, Mammola BN, Drugan, RC (1998) Controllability of forced swim fails to produce differences in contextual fear, behavioral despair, and running wheel activity. 28th Annual Meeting of the Society for Neuroscience, Los Angeles, CA.
4. **Brown PL**, Hurley C, Drugan RC (1999) Swim stress controllability: Effects on behavioral despair, stress-induced analgesia and alcohol-induced motor ataxia. 29th Annual Meeting of the Society for Neuroscience, Miami, FL.
5. Drugan RC, Mammola B, Crompton A, **Brown PL** (1999) Acute versus chronic swim stress: Effects of alcohol and midazolam. 29th Annual Meeting of the Society for Neuroscience, Miami, FL.
6. **Brown PL**, Kiyatkin EA, Wise RA (2001) Brain hyperthermia as a reflection of emotional arousal. 31st Annual Meeting of the Society for Neuroscience, San Diego, CA.
7. **Brown PL**, Wise RA, Kiyatkin EA (2002) Social interaction potentiates the hyperthermic effects of meth-amphetamine. 32nd Annual Meeting of the Society for Neuroscience, Orlando, FL.
8. Kiyatkin EA, **Brown PL** (2002) Fluctuations in neural activity during cocaine

self-administration: clues provided by brain thermorecording. 32nd Annual Meeting of the Society for Neuroscience, Orlando, FL.

9. **Brown PL**, Kiyatkin EA (2003) Brain hyperthermia induced by MDMA: Individual differences and modulation by environmental conditions. 33rd Annual Meeting of the Society for Neuroscience, New Orleans, LA.
10. **Brown PL**, Kiyatkin EA (2004) Modulation of physiological and MDMA-induced brain hyperthermia through impaired heat dissipation. 34th Annual Meeting of the Society for Neuroscience, San Diego, CA.
11. Kiyatkin EA, **Brown PL** (2004) Pharmacological and behavioral determination of cocaine self-administration: findings provided by brain thermorecording. 34th Annual Meeting of the Society for Neuroscience, San Diego, CA.
12. **Brown PL**, Kiyatkin EA (2005) Dopamine-dependent and dopamine-independent actions of cocaine as revealed by brain thermorecording in freely moving rats. 35th Annual Meeting of the Society for Neuroscience, Washington, DC.
13. Kiyatkin EA, **Brown PL** (2005) Activity state as a predictor of cocaine-induced motor activation and brain temperature change. 35th Annual Meeting of the Society for Neuroscience, Washington, DC.
14. **Brown PL**, Bae D, Kiyatkin EA (2006) Relationships between locomotor activation and alterations in brain temperature during selective pharmacological activation and blockade of dopamine transmission. 36th Annual Meeting of the Society for Neuroscience, Atlanta, GA.
15. Kiyatkin EA, **Brown PL** (2006) The role of cocaine's interaction with peripheral and central sodium channels in mediating its central effects. 36th Annual Meeting of the Society for Neuroscience, Atlanta, GA.
16. **Brown PL**, Kiyatkin EA (2007) Phasic excitatory responses of striatal neurons to intravenous cocaine in awake rats: The mechanisms and role in sensory drug effects. 37th Annual Meeting of the Society for Neuroscience, San Diego, CA.
17. Kiyatkin EA, **Brown PL**, Sharma HS (2007) Breakdown of the blood-brain barrier during methamphetamine intoxication: Critical role of brain temperature. 37th Annual Meeting of the Society for Neuroscience, San Diego, CA.
18. Mejias-Aponte D, **Brown PL**, Wise RA, Kiyatkin EA (2008) IV cocaine causes rapid activation of VTA neurons: signals from the peripheral nervous system. 38th Annual Meeting of the Society for Neuroscience, Washington, DC.
19. Singh T, **Brown PL**, Mullins SE, Schoenbaum G, Roesch MR (2008) Decision-related activity in ventral striatum reflects value and direction. 38th Annual Meeting of the Society for Neuroscience, Washington, DC.
20. Burke KA, Takahashi YK, Correll J, **Brown PL**, Schoenbaum G (2008) Orbitofrontal cortex is critical for disinhibiting responding for a previously unrewarded cue in pavlovian reversal learning. 38th Annual Meeting of the Society for Neuroscience, Washington, DC. 42nd Annual Winter Conference on Brain Research, Copper Mountain, CO.
21. **Brown PL**, Stockman S, McFarland R, Elmer GI, Shepard PD, Vogel MW (2009) Disrupting neurogenesis at E19/20 impairs Morris Water Maze performance and attenuates hippocampal-mPFC LTP in adult male rats. 39th Annual Meeting of the Society for Neuroscience, Chicago, IL; and 32nd Annual Graduate Research Conference, UMB,

Baltimore, MD.

22. **Brown PL,** Shepard PD (2011) Footshock-induced cFos in dopamine innervated portion of the lateral habenula diminished following lesion of the fasciculus retroflexus. 41st Annual Meeting of the Society for Neuroscience, Washington, DC; and 15th Annual UMB Program in Neuroscience Retreat, Baltimore, MD.
23. Wang L**, Brown PL**, Elmer GI, Mayo CL, Gould TD, Shepard PD (2012) Isoflurane impedes the development of a depression-like phenotype in rats. 42nd Annual Meeting of the Society for Neuroscience, New Orleans, LA; and 35th Annual Graduate Research Conference, UMB, Baltimore, MD.
24. **Brown PL,** Shepard PD (2012) Low-intensity, but not high-intensity, footshock induces cFos in the RMTg that is dependent upon habenular input through the fasciculus retroflexus. 42nd Annual Meeting of the Society for Neuroscience, New Orleans, LA.
25. **Brown PL**, Shepard PD, Elmer GI, Mayo C (2013) A role for the lateral habenula in encoding negative valence via the RMTg. 2013 NIH National Graduate Student Research Conference, Bethesda, MD.
26. Shepard PD, **Brown PL**, Palacorolla, Brady D, Riegger K, Mayo C, Klima M, Elmer GI (2014) Partial excitotoxic lesions of the rostromedial tegmentum (RMTg) diminish the inhibitory effects of lateral habenula stimulation on midbrain dopamine neurons *in vivo* and reduce the incidence of learned helplessness in rats. 44th Annual Meeting of the Society for Neuroscience, Washington, DC.
27. **Brown PL**, Shepard PD (2014) Paradoxical excitation of VTA neurons during electrical stimulation of the fasciculus retroflexus in rat sagittal brain slices. 44th Annual Meeting of the Society for Neuroscience, Washington, DC.
28. Shepard PD, Palacorolla HL, **Brown PL**, Brady DB, McMahon RP, Elmer GI (2015) The effects of RMTg lesions on the response of nigral dopamine neurons to footshock and habenula stimulation: An electrophysiological study in anesthetized rats. 45th Annual Meeting of the Society for Neuroscience, Chicago, IL; and 2016 UMB Department of Psychiatry Research Day, Baltimore, MD.
29. **Brown PL**, Shepard PD (2016) VTA neurons in rat sagittal slices are predominantly excited by electrical stimulation of the fasciculus retroflexus regardless of projection target or developmental stage. 46th Annual Meeting of the Society for Neuroscience, San Diego, CA; and 2017 UMB Department of Psychiatry Research Day, Baltimore, MD.
30. Brady D, **Brown PL** (2017) Lateral habenula induced inhibition of midbrain dopamine neurons in male and female rats. 2017 SABV Workshop, NIH-ORWH, Bethesda, MD.
31. Kochunov P, Summerfelt AT, **Brown PL**, Terzi MC, Yachera K, Sathyasaikumar KV, Du X, Hong LE, Schwarcz R, Shepard PD (2022) Longitudinal assessment of developmental changes in the structure and function of white matter tracts in adolescent minipigs. 52nd Annual Meeting of the Society for Neuroscience, San Diego, CA.
32. Milosavljevic S, Beggiato S, **Brown PL**, Thomas MAR, Piroli MV, Sathyasaikumar KV, Notarangelo FM, Schwarcz R, Pocivavsek A (2022) Prolonged kynurenic acid elevation during the prenatal period elicits electrophysiological and behavioral changes in adult mice. 52nd Annual Meeting of the Society for Neuroscience, San Diego, CA; and 61st Annual Meeting of the American College of Neuropsychopharmacology, Phoenix, AZ.
33. BeggiatoS, Milosavljevic S, Piroli MV, **Brown PL**, Thomas MAR, Sathyasaikumar KV,

Notarangelo FM, Schwarcz R, Pocivavsek A (2023) Biochemical and behavioral assessments of heterozygous mice with a reduction in kynurenine-3-monooxygenase (*Kmo+/-* mice). 53rd Annual Meeting of the Society for Neuroscience, Washington, DC.

34. Bell D, **Brown PL** (2023) Sex differences in habenula-induced inhibition of midbrain dopamine neurons in the rat. 53rd Annual Meeting of the Society for Neuroscience, Washington, DC.

Presentations

Invited Communications

Local

1. **Brown PL**, "A novel habenulo-mesencephalic circuit for the encoding of aversive events", The Second Dopamine Summit, University of Maryland Baltimore, MD, 2012
2. **Brown PL**, "A case for the vapours: Isoflurane as a potential anti-depressant", Brain Science Research Consortium Unit Seminar Series, Baltimore, MD, 2017
3. **Brown PL,** "The lateral habenula and estrogen: a potential path toward exploring sex-differences in drug abuse", Baltimore Brain Series, Johns Hopkins University, Baltimore, MD, 2018