**Harvard Medical School Curriculum Vitae**

**Date Prepared:**    July 27, 2018

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**Place of Birth:**    East Orange, New Jersey

**Signature:**

**Education**

| | | | |
|---|---|---|---|
| 1997 | B.S. | Biology, Psychology | Duke University |
| 2004 | A.M. | Psychological & Brain Sciences | Duke University |
| 2006 | Ph.D. | Psychology & Neuroscience (Advisor: Kevin S. LaBar, Ph.D.) | Duke University |

**Postdoctoral Training**

| | | | |
|---|---|---|---|
| 09/06-06/10 | Post-doctoral Fellow | Affective Neuroscience (PI: Diego A. Pizzagalli, Ph.D.) | Department of Psychology, Harvard University |

**Faculty Academic Appointments**

| | | | |
|---|---|---|---|
| 07/10 – 03/14 | Instructor | Psychiatry | Harvard Medical School |
| 04/14 – present | Assistant Professor | Psychiatry | Harvard Medical School |

**Appointments at Hospitals/Affiliated Institutions**

| | | | |
|---|---|---|---|
| 07/10 – 03/14 | Assistant Neuroscientist | Research (Center for Depression, Anxiety and Stress Research) | McLean Hospital |

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| 04/14 – present | Associate Neuroscientist | Research (Center for Depression, Anxiety and Stress Research) | McLean Hospital |
| 04/14 – present | Director, Motivated Learning & Memory Laboratory | Research (Center for Depression, Anxiety and Stress Research) | McLean Hospital |

## Other Professional Positions

| 1997-1998 | Teaching Assistant | Duke University, Biology Department |
| 1998-1999 | Research Assistant | Duke University, Center for Human Genetics |
| 1999-2001 | Researcher | Harvard University Graduate School of Education, Project Zero |
| 2001-2006 | Graduate Research and Teaching Assistant | Duke University |

## Committee Service

**Local**

| 2003-2005 | Carnegie Initiative on the Doctorate | Duke University Leadership team member |
| 2005 | Graduate Student Recruitment Conference | Duke University Poster session committee member |
| 2015-present | CDSAR Speaker Series | McLean Hospital/Harvard Medical School Series organizer (with Dr. Isabelle Rosso and Dr. Randy Auerbach) |
| 2016-present | Research Administration Advisory Committee | McLean Hospital/Harvard Medical School Faculty member |

## Professional Societies

| 2017-present | Association for Psychological Science | Faculty member |
| 2013-present | Society of Biological Psychiatry | Regular member |
| 2003-present | Cognitive Neuroscience Society | |
| | 2003-2006 | Student member |
| | 2008-2010 | Post-doctoral member |
| | 2011-present | Faculty member |
| 2002-present | Society for Neuroscience | |
| | 2002-2005 | Student member |

|           |                                    |                       |
|-----------|------------------------------------|-----------------------|
| 2007-2009 |                                    | Post-doctoral member  |
| 2014-     |                                    | Faculty member        |
| 2004-2006 | American Psychological Association | Student affiliate     |

## Grant Review Activities

| 2013, 2016, 2017 | NIH Centers of Biomedical Research Excellence (COBRE) [P20] Study Section | *Ad hoc* Member |
|------------------|--------------------------------------------------------------------------|-----------------|

## Editorial Activities

### *Ad hoc* reviewer
*Acta Psychologica*
*Archives of General Psychiatry*
*American Journal of Psychiatry*
*Biological Psychology*
*BMC Psychiatry*
*Brain Research*
*Cerebral Cortex*
*Clinical EEG and Neuroscience*
*Cognition*
*Cognition & Emotion*
*Cognitive, Affective, & Behavioral Neuroscience*
*Cognitive Electrodynamics*
*Depression & Anxiety*
*Emotion*
*Experimental Brain Research*
*International Journal of Neuropsychopharmacology*
*International Journal of Psychophysiology*
*JAMA Psychiatry*
*Journal of Child Psychology and Psychiatry*
*Journal of Experimental Psychology: General*
*Journal of Psychiatric Research*
*Journal of Social and Clinical Psychology*
*Motivation & Emotion*
*Neuroimage*
*Neuroimage: Clinical*
*Neuropsychologia*
*Neuroscience & Biobehavioral Reviews*
*Neuroscience Letters*
*Psychological Medicine*
*Psychological Science*
*Psychonomic Bulletin & Review*
*Psychophysiology*
*Schizophrenia Research*
*Social Cognitive and Affective Neuroscience*
*Sensors*
*Theory & Psychology*

**Other Editorial Roles**

| 2006 | *Ad hoc* reviewer | R. Cabeza & A. Kingstone (Eds.). (2006). *Handbook of Functional Neuroimaging of Cognition* (2nd Ed.). Cambridge, Massachusetts: MIT Press |
|------|------------------|------------------------------------------------|
| 2013 - 2015 | Consulting Editor | *Emotion* |
| 2015 - | Editorial Board Member | *Neuroscience and Biobehavioral Reviews* |

**Honors and Prizes**

| 1994-1996 | Dean's List | Duke University | Scholarship |
|-----------|-------------|-----------------|-------------|
| 1995, 1997 | Dean's List with Distinction | Duke University | Scholarship |
| 2001-2005 | James B. Duke Graduate Fellowship | Duke University | Research/Scholarship |
| 2002 | Honorable Mention (Graduate Research Fellowship) | National Science Foundation | Research |
| 2002 | Fellowship (Summer Institute in Cognitive Neuroscience) | National Institute of Mental Health | Research |
| 2003 | Travel Fellowship (Attendance at the Annual Meeting of the Society for Neuroscience) | Duke University | Research |
| 2004 | Travel Fellowship (Conference on Biological Basis of Personality & Individual Differences) | National Institute of Mental Health | Research |
| 2004 | Dissertation Research Award | American Psychological Association | Research |
| 2007 | HealthEmotions Research Institute Symposium Fellow | University of Wisconsin | Research |
| 2009 | Post-doctoral Travel Grant (Attendance at the Annual Meeting of the Cognitive Neuroscience Society) | Harvard University | Research |

# Report of Funded and Unfunded Projects

**Funding Information**

**Past**

2008-2010    *Emotion Regulation in Depression: Neural Bases of Reappraisal*
NIH/NIMH Ruth L. Kirchstein Individual Post-doctoral National Research Service Award (NRSA) (5F32MH081394-02)
<u>Total Direct Costs</u>: $88,361
<u>Role</u>: Principal Investigator
<u>Faculty Sponsor</u>: Diego A. Pizzagalli, Ph.D.
<u>Faculty Co-sponsor</u>: Randy L. Buckner, Ph.D.
<u>Goals</u>: This multi-modal (behavior, fMRI, ERP) project examined the neurocognitive mechanisms implicated in emotion regulation failures in major depressive disorder.

2009-2012    *Toward a Functional Dissection of Anhedonia in Major Depression: Dissociating Decision-Making Deficits from Reward Insensitivity*
NARSAD Young Investigator Award
<u>Total Direct Costs</u>: $59,530
<u>Role</u>: Principal Investigator
<u>Faculty Sponsor</u>: Diego A. Pizzagalli, Ph.D.
<u>Goals</u>: This combined behavioral/fMRI study investigated the negative effects of depression on episodic memory for stimuli paired with rewarding outcomes.

2012-2014    *Neuroscience of Reward-Related Learning and Memory in Depression*
NIH/NIMH Pathway to Independence Award (K99) (1K99MH094438-01A1)
<u>Total Direct Costs</u>: $167,962
<u>Role</u>: Principal Investigator
<u>Faculty Sponsor</u>: Diego A. Pizzagalli, Ph.D.
<u>Faculty Co-Sponsor</u>: Michael J. Frank, Ph.D.
<u>Goals</u>: This project combined computational modeling, fMRI, and behavioral measures to investigate neurocognitive mechanisms that support reward-driven reinforcement learning and episodic memory in a community sample.

2014-2018    Neuroscience of Reward-Related Learning and Memory in Depression
NIH/NIMH Pathway to Independence Award (R00) (4R00MH094438-03)
Total Direct Costs: $519,440
Role: Principal Investigator
Goals: This project used computational modeling, fMRI, and behavioral measures to study dysfunction in reinforcement learning and episodic memory in depressed adults.

**Current**

# Report of Local Teaching and Training

**Teaching of Students in Courses**

| | | |
|---|---|---|
| 1997-1998 | *Principles of Biology* | Duke University |
| | [Biology 25L] | |
| | Undergraduate students | 2 hours per week for 30 weeks. |
| 2002 | *Drugs, Brain, and Behavior* | Duke University |

[Psychology 127]
Undergraduate students
1 hour per week for 15 weeks.

| | | |
|---|---|---|
| 2002 | *Cognitive Psychology*<br>[Psychology 92]<br>Undergraduate students | Duke University<br><br>2 hours per week for 15 weeks. |
| 2003 | *Biological Bases of Behavior*<br>[Psychology 91]<br>Undergraduate students | Duke University<br><br>2 hours per week for 15 weeks. |
| 2004-2005 | *Teaching and Ethics Workshop*<br>Graduate students | Duke University<br>1 hour a month for 9 months. |
| 2018 | *Psychology 910r: Supervised Research*<br>Undergraduate students | Harvard University<br>1 hour a week for 15 weeks. |

**Laboratory and Other Research Supervisory and Training Responsibilities**

| | | |
|---|---|---|
| 2002-2003 | Mentored undergraduate in cognitive neuroscience research/Duke University | Multiple weekly meetings for 9 months |
| 2005-2006 | Mentored undergraduate in cognitive neuroscience research/Duke University | Multiple weekly meetings for 5 months |
| 2008-2009 | Mentored undergraduate in cognitive neuroscience research/Harvard University | Weekly mentorship for 9 months |
| 2009 | Mentored visiting graduate student in neuroscience research/Harvard University | Daily mentorship for 3 months |
| 2010-2011 | Instructor, seminar on functional magnetic resonance imaging/Harvard University, Department of Psychology (2010) & McLean Hospital, Center for Depression, Anxiety and Stress Research (2011) | Developed and delivered six 1-hour seminars during spring semesters |
| 2011 | Mentored visiting undergraduate in cognitive neuroscience research/McLean Hospital, Center for Depression, Anxiety and Stress Research | Daily mentorship for 2 months |
| 2012-2013 | Mentored two post-baccalaureate research assistants/McLean Hospital, Center for Depression, Anxiety and Stress Research & Harvard University | Approximately bi-weekly meetings for 5 months |
| 2013-2014 | Mentored three undergraduate research | Approximately bi-weekly meetings |

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|---|---|---|
| | assistants/McLean Hospital, Center for Depression, Anxiety and Stress Research & Harvard University | |
| 2015 | Mentored undergraduate student visitor | Weekly meetings for 3 months |
| 2016- | Mentored undergraduate student visitor<br>Mentored Ph.D.-level visiting scientist | Weekly meetings<br>Weekly meetings |
| 2017 | Mentored post-doctoral fellow at Annual Meeting of the Society of Biological Psychiatry | One on-site meeting |
| 2017 | Committee member for dissertation presented to the Faculty of the Graduate School of Arts and Sciences of Brandeis University, Waltham, Massacusetts, by Xuejie Chen (title: *From acute stress to long-term health: the role of stress systems habituation and basal activities*). | Dissertation committee member |
| 2017-2018 | Mentored two undergraduate student visitors | Weekly meetings |
| 2016, 2018 | Faculty reviewer for Neurobiology Senior Thesis (Harvard University) | Faculty reviewer |

**Formally Supervised Trainees**

| | |
|---|---|
| 2005-2006 | Brian Johnson, B.A.<br>Undergraduate research under my supervision, co-author on publication #4. |
| 2009 | Oliver Hager, Ph.D. student in Neuroeconomics & Social Neuroscience, Univ. of Zurich<br>Visiting graduate student under my supervision, co-author on poster presentation (Dillon, Hager, & Pizzagalli, 2010). |
| 2015 | Michelle Basta<br>Undergraduate student visitor (Brown University) who worked on an electrophysiological study of source memory retrieval in healthy and depressed adults. |
| 2017 | Hannah Becker<br>Undergraduate student visitor (Washington University in Saint Louis) working on an fMRI study of memory retrieval for rewarded and non-rewarded material in depressed and healthy adults, and an electrophysiological study of memory for emotional material following exposure to an acute stressor (also in healthy and depressed adults). |
| 2017-2018 | Sarah Ryan<br>Externally funded undergraduate researcher (Harvard University) working on an electrophysiological study of recognition and source memory for emotional material |

following exposure to an acute stressor, in healthy and depressed adults. Co-author on poster presentation.

2017-2018   Christian Lin
Undergraduate (Harvard University) student visitor working on an electrophysiological study of the effects of stress on recognition and source memory for emotional items in healthy and depressed adults. Co-author on poster presentation.

2016-2018   Victoria Lawlor
Undergraduate (Northeastern Univeristy) working on application of the hierarchical drift diffusion model (HDDM) to reinforcement learning data in depressed individuals, electrophysiological studies of memory retrieval in healthy and depressed adults, and a study of individual differences in global dopamine concentration. First author on HDDM paper, co-author on multiple poster presentations.

2016-2018   Jonathan Kane, Ph.D.
Visiting scientist transitioning out of geophysics and into clinical/quantitative psychology, working on time-frequency analysis of electrophysiological data collected from depressed and healthy adults during performance of a source memory retrieval task. First author on time-frequency EEG paper and poster presentation.

2014-2018   Elyssa Barrick
Full-time research assistant who supported fMRI studies of reinforcement learning and episodic memory in healthy and depressed adults, as well as EEG studies of source and recognition memory (pre/post acute stress) in healthy and depressed adults. First author on EEG study of source memory and multiple poster presentations.


## Local Invited Presentations

**No presentations below were sponsored by outside entities**.

2009   *Emotion meets cognition: probing reward processing and emotion regulation*/Invited seminar
Center for Sleep and Cognition, Beth Israel Deaconess Medical Center, Harvard Medical School (Director: Robert Stickgold, Ph.D.)

2010   *Motivation meets cognition: Probing reward processing and emotion regulation in depression*/Colloquium talk
Department of Psychology, Harvard University

2010   *Motivation meets cognition: Probing reward processing and emotion regulation in depression*/Lunchtime speaker series
Laboratories of Cognitive Neuroscience, Children's Hospital, Harvard Medical School (Director: Charles Nelson, Ph.D.)

2010   *Emotion regulation in depression/*Invited talk
McLean Hospital, Harvard Medical School

2011   *Motivation meets cognition: probing reward processing and emotion regulation in*

*depression*/Student Visitor Seminar Series
McLean Hospital, Harvard Medical School

2012      *A functional neuroimaging investigation of explicit memory for rewards in depression*/Invited seminar
Behavioral Genetics Laboratory, McLean Hospital, Harvard Medical School (Director: William Carlezon, Ph.D.)

2013      *Remember to look on the bright side: Blunted reward memory in depressed adults*/Invited talk, 2013 McLean Hospital Research Day
McLean Hospital, Harvard Medical School

2013      *Depression, anhedonia, and reward-driven learning and memory*/Invited seminar, Neuroscience Work-in-Progress Series
McLean Hospital, Harvard Medical School

2014      *Emotional memory in depression*/Invited talk, Affective and Social Neuroscience seminar (Professor: Dr. Christine Hooker)
Department of Psychology, Harvard University

2015      *On the nature of episodic memory in depression*/Invited seminar, Neuroscience Work-in-Progress Series
McLean Hospital, Harvard Medical School

2015      *A neural mechanism for positive memory deficits in depression*/Student Visitor Seminar Series, McLean Hospital

2016      *A trip down memory lane*/Invited seminar, Massachusetts General Hospital Research Assistant Seminar Series

2017      *Using drift diffusion modeling to re-think decision-making in the Probabilistic Reward Task (PRT)*/Invited seminar, Neuroscience Work-in-Progress Series
McLean Hospital, Harvard Medical School

2017      *Prior feedback modulates memory persistence in healthy and depressed adults*/Invited seminar, OCD Institute, McLean Hospital, Harvard Medical School

# Report of Regional, National and International Invited Teaching and Presentations

**Invited Presentations and Courses**

**No presentations below were sponsored by outside entities**.

**Regional**

2004      *Conscious regulation of emotions elicited by pictures is sensitive to arousal but not valence*/Conference presentation
Annual Meeting of the North Carolina Cognition Group, Raleigh, NC

2009        *The affective neuroscience of reward processing in health and depression: Conceptual foundations and empirical findings*/Colloquium talk
            Philosophy & Psychology Departments, Simmons College, Boston, MA

2010        *Motivation meets cognition: Probing reward processing and emotion regulation*/Colloquium talk
            Department of Psychology, Harvard University, Cambridge, MA

2012        *A functional neuroimaging investigation of explicit memory for rewards in depression*/Invited seminar
            Laboratory for Neural Computation and Cognition
            Brown University (Director: Michael Frank, Ph.D.)

2013        *Depression, anhedonia, and reward-driven learning and memory*/Invited seminar
            Joint meeting of the Lab for Neural Computation and Cognition (Director: Michael Frank, Ph.D.) and the Cognitive Neuroscience of Cognitive Control & Memory Lab (Director: David Badre, Ph.D.)
            Brown University

2014        *Searching for the silver lining: poor memory for positive material as a foundation for depression research*/Invited seminar
            Laboratory for Neural Computation and Cognition
            Brown University (Director: Michael Frank, Ph.D.)

2014        *Searching for the silver lining: poor memory for positive material as a foundation for depression research*/Invited seminar
            Cognitive Neuroscience of Cognitive Control & Memory Lab
            Brown University (Director: David Badre, Ph.D.)

2015        *Positive reinforcement enhances encoding of upcoming information/*Symposium talk
            8th Annual Meeting of the Social & Affective Neuroscience Society (Boston, MA)

2015        *On the nature of episodic memory deficits in depression*/Colloquium talk
            Yale University, Department of Psychology (New Haven, CT)

2015        *Investigating the formation of episodic memories during feedback-driven learning*/Invited seminar
            Cognitive Neuroscience of Cognitive Control & Memory Lab
            Brown University (Director: David Badre, Ph.D.)

2016        *Neuroimaging pitfalls*/Invited seminar
            McLean/MGH Adult Residency Program: Lecture to the PGY3s

2016        *An ERP study of controlled retrieval in depression*/Invited seminar
            Cognitive Neuroscience of Cognitive Control & Memory Lab
            Brown University (Director: David Badre, Ph.D.)

2016        *The effect of prior feedback on episodic memory in health and depression*/Invited seminar

Laboratory for Neural Computation and Cognition
Brown University (Director: Michael Frank, Ph.D.)

2017    *Neuroimaging pitfalls*/Invited seminar
McLean/MGH Adult Residency Program: Lecture to the PGY3s

2018    *Neuroimaging*/Invited seminar
McLean/MGH Adult Residency Program: Lecture to the PGY3s

2018    *Mechanisms of (positive) memory disruption in depression/*Invited seminar
McLean/MGH Adult Residency Program: Lecture to the PGY2s

**National**

2004    *Duke University Department of Psychological and Brain Sciences: Key Ideas*/Conference presentation
Winter Convening of the Carnegie Initiative on the Doctorate, Palo Alto, CA

2009    *Motivation meets cognition: probing reward processing and emotion regulation*/Colloquium talk
Department of Psychology, Brooklyn College, Brooklyn, NY

2016    *The neuroscience of positive memory deficits in unipolar depression*/Talk in symposium, "The computational neuroscience of disrupted learning and memory in depression", delivered at the 71st Annual Meeting of the Society of Biological Psychiatry, Atlanta, GA (Role: Symposium chair).

2017    *The impact of depression on brain activity during source memory retrieval/*Talk in symposium, "Mapping (and modulating) memory circuitry in depression, anxiety, and psychosis", delivered at the 72nd Annual Meeting of the Society of Biological Psychiatry, San Diego, CA (Role: Symposium chair).

2017    *Prior feedback modulates memory persistence in healthy and depressed adults*/Talk in symposium, "The neurobiology of depression: from genes to behavior, from illness to outcome", delivered at the 31st Annual Meeting of the Society for Research in Psychopathology, Denver, CO (Role: Symposium chair).

2018    *Mechanisms of memory disruption in depression*/Invited talk in the Cognitive Neuroscience Colloquium, Duke University, Durham, NC

2018    *EEG and behavioral predictors/moderators of treatment response in major depression: evidence from the EMBARC study*/Talk in symposium, "Multimodal predictors and moderators of treatment response in major depression: first results from the EMBARC study", delivered at the 2018 Annual Meeting of the American Psychiatric Association, New York, NY

**International**

2008    *Action monitoring, reward processing, and attention in depression/*Invited seminar
Department of Experimental and Clinical Health Psychology, Ghent University, Belgium

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2013        *Blunted reward source memory in major depressive disorder reflects weak reward responses in the parahippocampus, midbrain, and anterior cingulate cortex at encoding*/Symposium talk
53rd Annual Meeting, Society for Psychophysiological Research, Florence, Italy

# Report of Scholarship

**Publications**

**Peer reviewed publications in print or other media**

**Research investigations**

1. Fichtenholtz, H. M., Dean, H. L., **Dillon, D. G.**, Yamasaki, H., McCarthy, G., & LaBar, K. S. (2004). Emotion-attention network interactions during a visual oddball task. Cogn Brain Res, 20, 67-80.

2. **Dillon, D. G.**, & LaBar, K. S. (2005). Startle modulation during conscious emotion regulation is arousal-dependent. Behav Neurosci, 119, 1118-1124.

3. **Dillon, D. G.**, Cooper, J. J., Grent-t'-Jong, T., Woldorff, M. G., & LaBar, K. S. (2006). Dissociation of event-related potentials indexing arousal and semantic cohesion during emotional word encoding. Brain Cogn, 62, 43-57.

4. **Dillon, D. G.**, Ritchey, M., Johnson, B. D., & LaBar, K. S. (2007). Dissociable effects of conscious emotion regulation strategies on explicit and implicit memory. Emotion, 7, 354-365.

5. **Dillon, D. G.**, Holmes, A. J., Jahn, A. L., Bogdan, R., Wald, L. L., & Pizzagalli, D. A. (2008). Dissociation of neural regions associated with anticipatory versus consummatory phases of incentive processing. Psychophysiology, 45, 36-49.

6. Santesso, D. L., **Dillon, D. G.**, Birk, J. L., Holmes, A. J., Goetz, E., Bogdan, R., & Pizzagalli, D. A. (2008). Individual differences in reinforcement learning: Behavioral, electrophysiological, and neuroimaging correlates. Neuroimage, 42, 807-816.

7. Wacker, J., **Dillon, D. G.**, & Pizzagalli, D. A. (2009). The role of the nucleus accumbens and rostral anterior cingulate cortex in anhedonia: Integration of resting EEG, fMRI, and volumetric techniques. Neuroimage, 46, 327-337.

8. Pizzagalli, D. A., Holmes, A. J., **Dillon, D. G.**, Goetz, E. L., Birk, J. L., Bogdan, R., Dougherty, D. D., Iosifescu, D. V., Rauch, S. L., & Fava, M. (2009). Reduced caudate and nucleus accumbens response to rewards in unmedicated subjects with Major Depressive Disorder. Am J Psychiatry, 166, 702-710.

9. **Dillon, D. G.**, Holmes, A. J., Birk, J. L., Brooks, N., Lyons-Ruth, K., & Pizzagalli, D. A. (2009). Childhood adversity is associated with left basal ganglia dysfunction during reward anticipation. Biol Psychiatry, 66, 206-213.

10. **Dillon, D. G.**[*], Bogdan, R. H., Fagerness, J., Holmes, A. J., Perlis, R. H., & Pizzagalli, D. A. (2010). Variation in TREK1 gene linked to depression-resistant phenotype is associated with potentiated neural responses to rewards in humans. Hum Brain Mapp, 31, 210-221.

11. Vanderhasselt, M. A., De Raedt, R., **Dillon, D. G.**, Dutra, S. J., Brooks, N., Pizzagalli, D. A. (2012). Decreased cognitive control in response to negative information in remitted depression: an event-related potential study. J Psychiatry Neurosci, 37, 250-258.

12. **Dillon, D. G.**, & Pizzagalli, D. A. (2013). Evidence of successful modulation of brain activation and subjective experience during reappraisal of negative emotion in unmedicated depression. Psychiatry Res, 212, 99-107.

13. **Dillon, D. G.**, Dobbins, I. G., & Pizzagalli, D. A. (2014). Weak reward source memory in depression reflects blunted activation of VTA/SN and parahippocampus. Soc Cogn Affect Neurosci, 9, 1576-1583.

14. Treadway, M. T., Waskom, M. L., **Dillon, D. G.**, Holmes, A. J., Park, M. T. M., Chakravarty, M. M., Dutra, S. J., Polli, F. E., Iosifescu, D. V., Fava, M., Gabrieli, J. D. E., Pizzagalli, D. A. (2015). Illness progression, recent stress and morphometry of hippocampal subfields and medial prefrontal cortex in major depression. Biol Psychiatry, 77, 285-294.

15. Admon, R., Nickerson, L. D., **Dillon, D. G.**, Holmes, A. J., Bogdan, R., Kumar, P., Dougherty, D. D., Iosifescu, D. V., Mischoulon, D., Fava, M., & Pizzagalli, D. A. (2015). Dissociable cortico-striatal connectivity abnormalities in major depression in response to monetary gains and penalties. Psychol Med, 45, 121-131.

16. Beard, C., Donahue, R. J., **Dillon, D. G.**, Van't Veer, A., Webber, C., Lee, J., Barrick, E., Hsu, K. J., Foti, D., Carroll, F. I., Carlezon, W. A., Jr., Bjögvinsson, & Pizzagalli, D. A. (2015). Abnormal error processing in depressive states: a translational examination in humans and rats. Transl Psychiatry, 5, e564.

17. **Dillon, D. G.**[*], Wiecki, T. W.[*], Pechtel, P., Webb, C., Goer, F., Murray, L., Trivedi, M., Fava, M., McGrath, P.J., Weissman, M., Parsey, R., Kurian, B., Adams, P., Carmody, T., Weyandt, S., Shores-Wilson, K., Toups, M., McInnis, M., Oquendo, M. A., Cusin, C., Deldin, P., Bruder, G., & Pizzagalli, D. A. (2015). A computational analysis of flanker interference in depression. Psychol Med, 45, 2333-2344.

18. Webb, C. A., **Dillon, D. G.**, Pechtel, P., Goer, F., Murray, L., Huys, Q. J. M., Fava, M., McGrath, P. J., Weissman, M., Parsey, R., Kurian, B., Adams, P., Weyandt, S., Trombello, J., Grannemann, B., Cooper, C., Deldin, P., Tenke, C., Trivedi, M., Bruder, G., & Pizzagalli, D.A. (2015). Neural correlates of three promising endophenotypes of depression: evidence from the EMBARC study. Neuropsychopharmacology, 41, 454-463.

19. Hsu, K. J., Beard, C., Rifkin, L., **Dillon, D. G.**, Pizzagalli, D. A., & Björgvinsson, T. (2015). Transdiagnostic mechanisms in depression and anxiety: the role of rumination and attention control. J Affect Disord, 188, 22-27.

20. Kaiser, R., Whitfield-Gabrieli, S., **Dillon, D. G.**, Goer, F., Beltzer, M., Minkel, J., Smoski, M., Dichter, G., & Pizzagalli, D. A. (2015). Dynamic resting-state functional connectivity in major depression. Neuropsychopharmacology, 41, 1822-1830.

21. Admon*, R., Kaiser*, R. H., **Dillon, D. G.**, Beltzer, M., Goer, F., Olson, D. P., Vitaliano, G., & Pizzagalli, D. A. (2016). Dopaminergic enhancement of striatal response to reward in major depression. Am J Psychiatry, 174, 378-386.

22. Tenke, C., Kayser, J., Pechtel, P., Webb, C., **Dillon, D. G.**, Goer, F., Murray, L., Deldin, P., Kurian, B., McGrath, P., Parsey, R., Trivedi, M., Fava, M., Weissman, M., McInnis, M., Abraham, K., Alvarenga, J., Alschuler, D., Cooper, C., Pizzagalli, D., & Bruder, G. (2017). Demonstrating test-retest reliability of electrophysiological measures for healthy adults in a multisite study of biomarkers of antidepressant treatment response. Psychophysiology, 54, 34-50.

23. Whitton, A. E., Van't Veer, A., Kakani, P., **Dillon, D. G.**, Ironside, M. L., Haile, A., Crowley, D. J. & Pizzagalli, D. A. (2017). Acute stress impairs frontocingulate activation during error monitoring in remitted depression. Psychoneuroendocrinology, 75, 164-172.

24. Sperl, M. F. J., Panitz, C., Rosso, I. M., **Dillon, D. G.**, Kumar, P., Hermann, A., Whitton, A. E., Hermann, C., Pizzagalli, D. A., & Mueller, E. M. (2018). Fear extinction recall modulates human fronto-medial theta and amygdala activity. Cereb Cortex. https://doi.org/10.1093/cercor/bhx353

25. Barrick, E. M., & **Dillon, D. G.** (2018). An ERP study of multidimensional source retrieval in depression. Biol Psychol, 132, 176-191.

26. **Dillon, D. G.***, Gonenc, A.*, Belleau, E., & Pizzagalli, D. A. (2018). Depression is associated with dimensional and categorical effects on white matter pathways. Depress Anxiety, 35, 440-447.

27. Pizzagalli, D. A.*, Webb, C. A.*, **Dillon, D. G.**, Tenke, C.E., Kayser, J., Goer, F., Fava, M., McGrath, P., Weissman, M., Parsey, R., Adams, P., Trombello, J., Cooper, C., Deldin, P., Oquendo, M.A., McInnis, M.G., Carmody, T., Bruder, G., Trivedi, M.H. (2018). Pretreatment rostral anterior cingulate cortex theta activity in relation to symptom improvement in depression: A randomized clinical trial. JAMA Psychiatry, manuscript in press.

28. Kumar, P., Goer, F., Murray, L., **Dillon, D. G.**, Beltzer, M. L., Cohen, A. L., Brooks, N. H., & Pizzagalli, D. A. (2018). Impaired reward prediction error encoding and striatal-midbrain connectivity in depression. Neuropsychopharmacology, 43, 1581-1588.

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the EMBARC study. Psychol Med, in press. doi: https://doi.org/10.1017/S0033291718001708

31. Wu, C.*, **Dillon, D. G.***, Hsu, H., Huang, S., Barrick, E., & Liu, Y. (2018). Depression detection using relative EEG power induced by emotionally positive images and a conformal kernel support vector machine. Appl Sci, 8, 1244.

**\***These authors made equal contributions to the manuscript.

## Other peer-reviewed publications

1. **Dillon, D. G.**, & Pizzagalli, D. A. (2007). Inhibition of action, thought, and feeling: A selective neurobiological review. Appl Prev Psychol, 12, 99-114.

2. **Dillon, D. G.**, Rosso, I. M., Pechtel, P., Killgore, W. D. S., Rauch, S. L., & Pizzagalli, D. A. (2014). Peril and pleasure: an RDoC-inspired examination of threat responses and reward processing in anxiety and depression. Depress Anxiety, 31, 233-249.

3. **Dillon, D. G.** (2015). The neuroscience of positive memory deficits in depression. Front Psychol, 6, 1295.

4. **Dillon, D. G.**, & Pizzagalli, D. A. (2018). Mechanisms of memory disruption in depression. Trends Neurosci, 41, 137-149.

## Non-peer reviewed scientific or medical publications/materials in print or other media

## Reviews and chapters

1. **Dillon, D. G.**, & Pizzagalli, D. A. (2010). Maximizing positive emotions: a translational, transdiagnostic look at positive emotion regulation. In A. M. Kring & D. M. Sloan (Eds.), Emotion Regulation and Psychopathology. New York: Guilford Press.

2. **Dillon, D. G.**, Deveney, C. M., & Pizzagalli, D. A. (2011). From basic processes to real-world problems: How research on emotion and emotion regulation can inform understanding of psychopathology, and vice versa. Emot Rev, 3, 74-82.

3. Pizzagalli, D. A., **Dillon, D. G.**, Bogdan, R., & Holmes, A. J. (2011). Reward and punishment processing in the human brain: clues from affective neuroscience and implications for depression research. In O. Vartanian & D. R. Mandel (Eds.), Neuroscience of Decision Making (pp. 199-220). New York: Psychology Press.

4. Rosso, I., **Dillon, D. G.**, Pizzagalli, D. A., & Rauch, S. L. (2015). Translational perspectives on anxiety disorders and the Research Domain Criteria construct of potential threat. In K. J. Ressler, D. Pine, and B. O. Rothbaum (Eds.), *Anxiety Disorders: Translational Perspectives on Diagnosis and Treatment*. New York, Oxford University Press.

5. **Dillon, D. G.** (2018). A neuroscientific hypothesis concerning poor memory for positive material in depression. Accepted for publication in J. Gruber (Ed.), *Oxford Handbook of Positive Emotion and Psychopathology*. New York, Oxford University Press.

**Thesis**

Dillon, D. G. (Doctoral thesis). *Voluntary emotion regulation: Physiological correlates and mnemonic consequences*. Durham, NC: Department of Psychology & Neuroscience, Duke University.

**Abstracts, Poster Presentations and Exhibits Presented at Professional Meetings**
**Below are listed accepted abstracts/poster presentations within the last three years which have not already been published as full length manuscripts.**

**Dillon, D. G.,** Frank, M. J., & Pizzagalli, D. A. (2015). *Prepare for success: reward delivery facilitates episodic encoding of upcoming information.* Poster presented at McLean Research Day, Belmont, MA.

**Dillon, D. G.,** Frank, M. J., & Pizzagalli, D. A. (2015). *Reward delivery enhances encoding of upcoming information: a novel paradigm for detecting memory deficits in anhedonic depression*. Poster presented at the 70th Annual Meeting of the Society of Biological Psychiatry, Toronto, Canada.

**Dillon, D. G.,** Frank, M. J., Badre, D., & Pizzagalli, D. A. (2015). *Positive reinforcement enhances encoding of upcoming information*. Poster presented at the 45th Annual Meeting of the Society for Neuroscience, Chicago, Illinois.

Cavanagh, J. F., Coffman, B., & **Dillon, D. G.** (2016). *Memento malum: Mistakes boost memory via fronto-hippocampal theta synchrony*. Poster presented at the 6th Motivation and Cognitive Control (MCC) Symposium, St. Andrews, Scotland.

Cardenas, E. F., Ironside, M., Clegg, R., Kaiser, R., Admon, R., Goer, F., **Dillon, D. G.**, Olson, D., Vitaliano, G., & Pizzagalli, D. A. (2017). *Effects of amisulpride on reinforcement learning*. Poster presentation at McLean Research Day, Belmont, MA.

Lawlor, V., Barrick, E., & **Dillon, D. G.** (2017). *Piloting a behavioral assessment of dopamine capacity*. Poster presentation at McLean Research Day, Belmont, MA.

Vogel, S., Auerbach, R., Stewart, J., **Dillon, D.**, & Germaine, L. (2017). Mobile assessment of cognitive control in depression and aging. Poster presentation at McLean Research Day, Belmont, MA.

Ironside, M., Admon, R., Kaiser, R., **Dillon, D.**, Clegg, R., Beltzer, M., Goer, F., Olson, D., Vitaliano, G., Pizzagalli, D. (2017). *Effects of childhood sexual abuse on positive versus negative reinforcement learning in MDD and resilient groups*. Poster presented at the Anxiety and Depression Association of American Annual Conference, San Francisco, CA.

Webb, C. A., Trivedi, M. H., Fava, M., McGrath, P., Weissman, M., Parsey R., **Dillon, D. G.**, Pechtel, P., Goer, F., Adams, P., Trombello. J., Cooper, C., Deldin, P., Tenke, C., Carmody, T., Bruder, G., & Pizzagalli, D. P. (2017). *The incremental predictive validity of rostral anterior cingulate cortex activity in relation to treatment response in depression: evidence from the EMBARC study*. Poster presented at the 72nd Annual Meeting of the Society of Biological Psychiatry, San Diego, CA.

Lawlor, V., Webb, C., Trivedi, M., Fava, M., McGrath, P. J., Weissman, M., Parsey, R., McInnis, M., Oquendo, M. A., Cusin, C., Deldin, P., Bruder, G., Pizzagalli, D. A., & **Dillon, D. G.** (2017). *Drift-*

*diffusion modeling of reward learning in depression*. Poster presented at the 29th Annual Convention of the Association for Psychological Science, Boston, MA.

Cavanagh, J. F., Coffman, B., & **Dillon, D. G.** (2017). *Memento malum: Negative prediction errors boost episodic encoding via theta band synchrony*. Symposium talk (given by J. F. Cavanagh) at the 2017 meeting of the Organization for Human Brain Mapping in Vancouver, BC.

Barrick, E. B., & **Dillon, D. G.** (2017). *Major Depressive Disorder disrupts reward-guided choice during reinforcement learning*. Poster presented at the 31st Annual Meeting of the Society for Research in Psychopathology, Denver, CO.

Lawlor, V., Webb, C., Trivedi, M., Fava, M., McGrath, P. J., Weissman, M., Parsey, R., McInnis, M., Oquendo, M. A., Cusin, C., Deldin, P., Bruder, G., Pizzagalli, D. A., & **Dillon, D. G.** (2017). *Drift-diffusion modeling of reward learning and cognitive control in depression*. Poster presented at the 31st Annual Meeting of the Society for Research in Psychopathology, Denver, CO.

Barrick, E., & **Dillon, D. G.** (2018). *An investigation of reinforcement learning in Major Depressive Disorder*. Poster presented at McLean Research Day, Belmont, MA.

Kane, J., & **Dillon, D. G.** (2018). *Time-frequency analysis of neural activity during source memory retrieval in healthy and depressed adults*. Poster presented at McLean Research Day, Belmont, MA.

Lawlor, V., Webb, C., Trivedi, M., Fava, M., McGrath, P. J., Weissman, M., Parsey, R., Oquendo, M. A., Deldin, P., Bruder, G., Pizzagalli, D. A., & **Dillon, D. G.** (2018). *Drift-diffusion modeling of reward learning in depression*. Poster presented at McLean Research Day, Belmont, MA.

**Dillon, D. G.**, Barrick, E., Lawlor, V., Ryan, S., & Lin, C. (2018). *Investigating the impact of depression on episodic memory for emotional stimuli*. Poster presented at McLean Research Day, Belmont, MA.

Kayser, J., Tenke, C. E., Petkova, E., Wong, L. Y. X., Wickramaratne, P., Alschuler, D. M., Alvarenga, J. E., Abraham, K., Pechtel, P., Webb, C. A., **Dillon, D. G.**, Deldin, P., Cooper, C., Trombello, J., McGrath,

Lawlor, V., Webb, C., Trivedi, M., Fava, M., McGrath, P. J., Weissman, M., Parsey, R., Oquendo, M. A., Deldin, P., Bruder, G., Pizzagalli, D. A., & **Dillon, D. G.** (2018). *Drift-diffusion modeling of reward learning in depression*. Poster presented at the annual meeting of the Cognitive Neuroscience Society, Boston, MA.

Kayser, J., Tenke, C. E., Petkova, E., Wong, L. Y. X., Wickramaratne, P., Alschuler, D. M., Alvarenga, J. E., Abraham, K., Pechtel, P., Webb, C. A., **Dillon, D. G.**, Deldin, P., Cooper, C., Trombello, J., McGrath, P. J., Fava, M., Oquendo, M. A., Trivedi, M. H., Weissman, M. M., Pizzagalli, D. A., & Bruder, G. E. (2018). *Loudness dependency of auditory evoked potentials (LDAEP) as a differential predictor of antidepressant treatment response in Major Depressive Disorder (MDD): results from the sertraline/placebo-controlled EMBARC study*. Poster to be presented at 73rd Annual Meeting of the Society of Biological Psychiatry, New York, NY.

Keilp, J., Alvarenga, J. E., Webb, C., **Dillon, D. G.**, Deldin, P., Alschuler, D. M., Abraham, K., Adams, P., Fava, M., McGrath, P., Oquendo, M. A., Trivedi, M., Weissman, M., Pizzagalli, D. A., & Bruder, G. E. (2018). *Cognitive performance predictors of response to antidepressants in 2nd treatment phase of the*

*multisite EMBARC study: word fluency and psychomotor speed findings*. Poster to be presented at 73rd Annual Meeting of the Society of Biological Psychiatry, New York, NY.

Lawler, V., Singleton, P., Webb, C. A., Auerbach, R. P., & **Dillon, D. G.** (2018). *Drift-diffusion modeling of reward learning in depressed adolescents: baseline, reliability, and treatment effects*. Poster to be presented at the 32nd Annual Meeting of the Society for Research in Psychopathology, Indianapolis, IN.

Mirin, N., Baker, J. T., **Dillon, D. G.**, Vogel, S.C., Rutter, L. A., Pizzagalli, D. A., & Germine, L. (2018). *Development of an RDoC field test battery for capturing neurocognition and digital phenotypes*. Poster to be presented at the 32nd Annual Meeting of the Society for Research in Psychopathology, Indianapolis, IN.

**Narrative Report**

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I am a neuroscientist focused on learning and memory in major depressive disorder (MDD). After completing my doctoral research with Dr. Kevin LaBar at Duke University, I joined Dr. Diego Pizzagalli at Harvard University as a post-doctoral fellow. In 2010, I was appointed Instructor at Harvard Medical School and Assistant Neuroscientist at McLean Hospital, and in 2014 I was promoted to Assistant Professor of Psychiatry at Harvard Medical School and Associate Neuroscientist at McLean Hospital. I direct the Motivated Learning & Memory Laboratory in the Center for Depression, Anxiety and Stress Research at McLean, and the majority of my effort is devoted to research. I am committed to understanding how depression affects reinforcement learning and episodic memory, and I investigate these topics using behavioral measures, functional neuroimaging, scalp-recorded electrophysiology, and computational modeling. I pursue this work because I believe that the cognitive consequences of depression are critically important but woefully understudied, and because the extensive learning and memory literature in non-human animals provides an extremely solid foundation for translational research. I am actively seeking additional funding to support these efforts (e.g., I have submitted three R01 applications as PI in the last 18 months), and I am confident that I will secure it.

**Area of Excellence: Investigation**

Anhedonia is a cardinal symptom of MDD that likely reflects stress-induced inhibition of dopaminergic networks that extend from the midbrain, through the striatum, and into frontal cortex (Pizzagalli et al., 2011; Dillon et al., 2014). This hypothesis has received strong support from human neuroimaging experiments, many designed by my mentor Dr. Diego Pizzagalli, and I have had the good fortune to contribute directly to many of these studies (e.g., Dillon et al., 2008, 2009, 2010; Admon et al., 2016; Whitton et al., 2017). My laboratory is taking this line of work in two new directions.

First, we are looking beyond the immediate response to rewarding stimuli to ask how anhedonia affects a critical downstream process: memory. For over two decades, we have known that depression impairs episodic memory for positive events, but we have no mechanistic understanding of this phenomenon. Recent data from non-human animals has established that dopamine release in the hippocampus causes synapses to shift from early long-term potentiation (LTP) to late LTP, which corresponds to the transition from an unstable, short-term memory to a lasting, long-term memory. Because dopamine neurons preferentially respond to rewarding (i.e., positive) experiences, this is a mechanism for forming lasting positive memories, and because of the aforementioned link between ahendonia and dopaminergic abnormalities, I have proposed that anhedonia causes the positive memory deficit in depressed adults by short-circuiting the transition from early to late LTP (Dillon, 2015, 2017). In an initial fMRI study supported by a NARSAD Young Investigator Award, I found evidence consistent

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with this idea—I observed a positive effect of reward delivery on memory in healthy but not depressed adults, and this was mirrored by blunted reward responses in the dopaminergic midbrain and parahippocampus in the depressed group (Dillon et al., 2014). In the ensuing years, with support from an NIMH K99/R00 award, I have worked with Drs. Michael Frank and David Badre at Brown University to design a new experimental paradigm that can more precisely probe the effects of reward delivery on memory. After developing the paradigm, I collected behavioral and fMRI data from unmedicated adults with MDD ($n$ = 43), diagnostically screened healthy controls ($n$ = 43), and two unscreened samples from the community (behavior, $n$ = 36; fMRI, $n$ = 22). Data collection for this multi-experiment study (total $n$ = 104) was completed in May 2017, and a publication is in preparation (Dillon, Frank, Badre, Nassar, Nock, Barrick, & Pizzagalli, in prep). I also presented preliminary data from this work in a symposium that I chaired at the 2016 meeting of the Society of Biological Psychiatry, and I will present the final data in a symposium that I will chair at the 2017 meeting of the Society for Research in Psychopathology.

In parallel to this work on encoding and consolidation (the transition from early to late LTP), my group is exploring the possibility that depression impairs memory via an independent mechanism— namely, disruption of cortical circuits that support memory retrieval. To test this hypothesis, we used start-up funding generously provided by McLean Hospital to collect event-related potential (ERP) data as unmedicated adults with MDD ($n$ = 24) and healthy adults ($n$ = 24) attempted to retrieve neutral memories that had been encoded in different conceptual and perceptual contexts. To our surprise, memory was not globally impaired in MDD. Instead, memory accuracy and confidence were particularly sensitive to contextual factors in the depressed group. When depressed adults engaged in "deep" encoding and were cued to retrieve conceptual memories, they responded confidently and accurately, and this was reflected in large amplitude ERPs over left parietal cortex, which are a signature of recollection. By contrast, when depressed adults engaged in "shallow" encoding and were cued to retrieve perceptual memories, they responded with lower confidence, guessed frequently, and generated lower amplitude left parietal ERPs, all of which are signs of poor recollection. Furthermore, the amplitude of the left parietal ERPs was related to sleep disruption, such that those depressed adults who reported the worst sleep also showed the lowest amplitude left parietal ERPs. Collectively, these data suggests that recollection is rendered fragile by depression: depressed adults can recollect memories accurately and confidently if sufficient support is provided at encoding and retrieval, but if that support is missing (e.g., if encoding is shallow) or if sleep disruption is severe, then recollection is impaired. I presented this work in a symposium that I chaired at the 2017 Meeting of the Society of Biological Psychiatry, and a manuscript describing the work received positive reviews and will be resubmitted in the coming weeks (Barrick & Dillon, in revision). We are now building on this work by conducting another ERP study of retrieval in depressed and healthy adults, in which we are examining retrieval of positive, negative, and neutral memories before and after exposure to acute stress. This research is also supported by start-up funding from McLean Hospital, and it involves collaborative work with the Laboratory for Biological Health Psychology at Brandeis University.

Second, we are using computational modeling to better understand how anhedonia disrupts reward processing. An extensive neuroscience literature indicates that dopamine neurons signal prediction errors (PEs), which encode the discrepancies between expectations and reality. Accordingly, work in our lab is building on this literature to determine if MDD is associated with reduced PE signaling. For instance, every participant who completed our new paradigm linking reward delivery to episodic memory (total $n$ = 144) also completed a separate reinforcement learning task in which PEs are used to guide behavior. I have applied temporal difference models to these data and we are currently determining whether MDD reduces PE signals that are typically observed in the ventral striatum. We will begin preparing a manuscript as soon as the data analysis is complete, and we are scheduled to present a poster describing our findings at the upcoming meeting of the Society for Research in Psychopathology.

We have also extended our computational modeling in another direction. A large literature on decision-making in healthy humans and non-human primates has emphasized evidence accumulation in cortical circuits, particularly the lateral intraparietal area (area LIP), as the basis for choosing between alternatives. Consequently, impaired reinforcement learning in MDD may reflect disrupted evidence accumulation in these cortical circuits, independent of any effect of MDD on PE signals. To test this idea, we applied a Bayesian, Hierarchical Drift Diffusion Model (similar to a model used in publication #17) to multiple behavioral datasets in which depressed and healthy adults completed a probabilistic reward task developed by Dr. Pizzagalli. The model consistently indicated that evidence accumulation is slower in depressed adults, and this result was stronger than the negative effect of depression on response bias, which is the typical variable of interest in this task. We are currently examining EEG data to see if slow evidence accumulation in depression is reflected in weak EEG signals over area LIP. If so, this will provide an exciting bridge from depression research to the basic neurophysiology of decision-making. We will begin preparing a manuscript describing these results as soon as data analysis is complete, and we are scheduled to present our preliminary findings in an upcoming poster session at the annual meeting of the Society for Research in Psychopathology (an earlier version of this work was presented at the 2017 meeting of the Association for Psychological Science).

These lines of work on memory, reinforcement learning, and computational modeling are central to my laboratory, and in fall 2017 I will resubmit an R01 application to support this research. We are also currently engaged in collaborative research on similar topics with Dr. Jim Cavanagh at the University of New Mexico and Dr. Michael Treadway at Emory University. Moreover, we are working with Dr. Chien-Te Wu at National Taiwan University to develop machine learning tools that can distinguish healthy from depressed adults solely on the basis of EEG data, and a manuscript describing this work is in preparation. Furthermore, we are collaborating with Dr. Justin Baker (McLean Hospital) and Dr. Avram Holmes (Yale University) on a large-scale resting-state fMRI project that seeks to determine how functional connectivity is affected by unipolar depression, bipolar depression, and psychosis (total $n = 1,010$). In a smaller collaborative project, our group worked with Dr. Attila Gonenc in the McLean Imaging Center to show that depression is associated with reduced fractional anisotropy in several key white matter pathways, including the genu of the corpus callosum, unicinate fasciculus, and the anterior limb of the internal capsule. A manuscript describing these results is currently being revised following helpful comments from reviewers (Gonenc*, Dillon*, Belleau, & Pizzagalli, in revision; *co first authors). And in February 2017 I submitted a multi-PI R01 with Dr. Greg Hajack of Florida State University that would administer several reward processing tasks to anhedonic adults with a broad spectrum of psychiatric diagnoses, in an effort to (a) test the hypothesis that anhedonia is truly a transdiagnostic construct and (b) determine which tasks and neural measures yield an anhedonia signal that is temporally stable and lawfully related to clinical symptoms. This R01 will also be resubmitted, most likely in the fall of 2017 along with my R01 application focused on memory.

Finally, the programming and modeling skills that I have developed are broadly applicable, and in the last three years I have coded experimental paradigms and analysis pipelines for several colleagues, typically using the Python programming language. For instance, I generated novel reward-learning paradigms that are currently being used in an fMRI/PET study of placebo responses in healthy and depressed adults (R01MH102279, "Neurobiological Underpinnings of Placebo Response in Depression", PIs: Fava, Cusin, & Pizzagalli), and in an fMRI study of the appetite hormone ghrelin (R01DK104772, "Ghrelin Modulation of Mesolimbic Reward Signaling in Stress-induced Hyperphagia", PI: Holsen). As another example, I adapted my paradigm for examining reward-modulated memory so that Dr. Randy Auerbach could use it with adolescent samples, and his group has currently tested over 100 individuals

with the task. I also coded data processing pipelines for behavioral probes of cognitive control and reward learning that were used in the multi-site EMBARC study (U01MH092221, "Establishing Moderators/Biosignatures of Antidepressant Response-Clinical Care"), and the data produced by this code has been published in multiple manuscripts (e.g., Dillon et al., 2015; Webb et al., 2015); I am aware of two additional manuscripts using these data that have been submitted by researchers outside McLean. I have enjoyed these collaborative projects, and improving computation in the context of psychiatric research is a goal for my laboratory going forward, because I believe the field will derive tremendous benefits with regard to efficiency, reproducibility, and rigor by adopting tools from modern data science.

**Teaching and Education**

I have always been committed to teaching and education, but my commitment has grown deeper since my appointment as lab director in late 2014. At that time, I hired my first research assistant (Elyssa Barrick), and over the past three years my lab has been joined by a visiting scientist (Dr. Jonathan Kane), a Harvard University undergraduate with external funding (Sarah Ryan), and three student volunteers (Michelle Basta, Hannah Becker, and Victoria Lawlor), one of whom has since pursued a six month co-operative learning experience in the lab and a program of directed study via Northeastern University (Victoria Lawlor). I have been fortunate to work with each of these talented people, and because of the laboratory's small size I have been able to engage in hands-on mentorship with all of them. In particular, I have trained each of them in the acquisition, analysis, and interpretation of EEG and behavioral data collected in the context of learning and memory tasks. In most cases, this has involved writing code in Python, R, and MATLAB that automates data processing, computes a wide variety of statistical tests, and generates publication-ready figures. In addition, because of the well-known replication crisis in psychology, I have placed particular emphasis on the need to conduct well-powered studies, correct for multiple comparisons, and report all results clearly and transparently so as to avoid introducing bias into manuscripts and presentations. I am certain that this emphasis on rigor has caused us to publish fewer papers than we could have otherwise. However, because we expect that our work will ultimately inform decisions about patient care, I firmly believe that we are obligated to prioritize accuracy and reproducibility above a lengthy list of publications, and I have consistently communicated this to my trainees. By combining advanced technical training with a principled understanding of statistics and experimental methods, I aim to provide my trainees with a strong foundation for their future endeavors.

**Conclusion**

My laboratory is focused on making core contributions to the neuroscience of learning and memory in depression. Depression impairs recollection and blunts memory for positive experiences, and these memory problems are troubling for patients. Moreover, many of our treatments depend on memory for their mechanism of action. For instance, multiple antidepressants have their effects at least in part because they stimulate neurogenesis in the hippocampus, the brain region most consistently implicated in episodic memory. As another example, psychotherapy depends on one's ability to recall difficult incidents from the past and then imagine similar episodes unfolding differently in the future—and both retrieval and mental simulation of future events depend on memory and memory circuitry. Thus, memory is central to depression and its treatment. Unfortunately, we know very little about how depression affects the neural and cognitive processes that support memory encoding, consolidation, and retrieval. My goal is to address this key gap in the literature, to advance clinical science and ultimately improve treatment for our patients.