

**March 7, 2017**

**Elizabeth P. Bauer**

Assistant Professor, Biology Department

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**Degrees in Higher Education**

Ph.D., Center for Neural Science, New York University, Dr. Joseph LeDoux (2004)  
Doctoral Dissertation: Cellular Mechanisms of Fear Learning in the Lateral Amygdala  
A.B., Magna Cum Laude with High Distinction, Neuroscience, Amherst College (1997)

**Additional Professional Training**

Postdoctoral Fellow, Center for Molecular and Behavioral Neuroscience, Rutgers University,  
Mentor: Dr. Denis Paré, April 2005-May 2008  
Postdoctoral Fellow, Psychology Department, Yale Univ., Mentor: Dr. Glenn Schafe,  
September 2004-March 2005.  
Predoctoral research, Center for Neural Science, New York University, Mentor: Dr. Joseph  
LeDoux 1999-2004  
Predoctoral research, Center for Neural Science, NYU, Dr. Nava Rubin, 1998

**Professional Experience in Higher Education**

Assistant Professor, Department of Biological Sciences, Barnard College July 2008-present  
Adjunct Assistant Professor, Department of Biological Sciences, Barnard College. September  
2007-June 2008.

**Academic and Professional Honors**

Honorable Mention, Emily Gregory Award, Barnard College (2015)  
Dean's Dissertation Fellowship (2002-2003, GSAS, New York University)  
James Olds Memorial Neuroscience Award (1997, Amherst College).

**Current Membership in Professional Societies**

American Psychological Association  
Molecular and Cellular Cognition Society  
Pavlovian Society  
Society for Neuroscience

**Courses Taught**

Cellular and Molecular Neuroscience (BC BIOL 3362)  
Laboratory in Cellular and Molecular Neuroscience (BC BIOL 3363)  
Contemporary Issues in Biology (BC BIOL 1002)  
Guided Research and Seminar (BC BIOL 3592; BC BIOL 3595)  
Senior Research Seminar (BC NSBV 3593; 3594)  
Research Methods Seminar (BC BIOL 2900; CHEM 2900)

*Senior Theses (Barnard)*

Dobson, C. (2008). The role of the hippocampus in the acquisition of spatial information.

- Debora Goldschmidt (Biology Department; 2008) The role of the bed nucleus of the stria terminalis in fear conditioning and anxiety.
- Sarah DeWitt (Neuroscience and Behavior; 2009) The role of the bed nucleus of the stria terminalis and corticotropin-releasing factor in fear conditioning and anxiety.
- Angela Lu (Biology Department; 2009) The critical effects of the bed nucleus of the stria terminalis on neural systems involving fear and anxiety.
- Amanda Miller (Neuroscience and Behavior, 2010) Effects of corticotropin-releasing factor on fear memory.
- Elzbieta Jacek (Neuroscience and Behavior, 2010) Brain modulation of anxiety during stressful events.
- Stephanie Davis (Neuroscience and Behavior, 2011) The effects of blocking L-type voltage-gated calcium channels on fear extinction.
- Tina Shah (Neuroscience and Behavior, 2011) Corticotropin-releasing factor in the basolateral amygdala enhances fear extinction.
- Solange Wong (Neuroscience and Behavior, 2011) Stress and fear learning in juvenile rats.
- Dina Abiri (Neuroscience and Behavior, 2012) Corticotropin releasing factor infused into the basolateral amygdala in rats impairs fear extinction.
- Daly Franco (Neuroscience and Behavior 2012) Stress- and age-related differential activation of the amygdala during auditory fear conditioning in male rats.
- Christina Douglas (Neuroscience and Behavior 2013) The effect of corticotropin-releasing factor in the basolateral amygdala on fear conditioning
- Katina Calakos (Neuroscience and Behavior 2014) CRF-1 receptor localization in the basolateral nucleus of the amygdala.
- Sara Pasik (Neuroscience and Behavior 2014) Active cells in the BNST involved in the acute anxiety initiated by SSRIs contain 5-HT<sub>2C</sub> receptors.
- Eliza Pelrine (Neuroscience and Behavior 2014) Serotonin receptors of the BNST mediate antidepressant-induced anxiety.
- Leyla Bayat (Neuroscience and Behavior, 2015) Activation of extended amygdala circuits by selective serotonin reuptake inhibitors.
- Georgia Barbayannis (Neuroscience and Behavior, 2015) The effects of age and stress on the amygdala of male rats.
- Lindsey Bell (Psychology, 2016) Characterization of the bed nucleus of the stria terminalis pathways: Implications for fear learning.
- Alexandra Schulz (Neuroscience and Behavior, 2016) Effects of acute Selective Serotonin Reuptake Inhibitor administration on fear memory reconsolidation

## Publications

### *Book chapters*

- Bauer, E.P, Pare, D. (2016) "Behavioral neuroscience of circuits involved in fear processing"  
In: Neurobiology of PTSD. I. Liberzon and K. Ressler, ed. Oxford: Oxford University Press. pp 5-26.

### *Peer-reviewed journal articles (Barnard undergraduates are in **bold**)*

- Calakos K.C., Blackman D., Schulz A.M.,** Bauer E.P. (2017) Distribution of corticotropin-releasing factor (CRF) receptors on GABAergic neurons within the basolateral amygdala. *Synapse*, 71(4). doi: 10.1002/syn.21953.
- Pelrine E., Pasik S.D., Bayat L.,** Bauer E.P. (2016) 5-HT<sub>2C</sub> receptors in the BNST are necessary for the enhancement of fear learning by selective serotonin reuptake inhibitors. *Neurobiology of Learning and Memory*, 136:189-195.
- Bauer, E.P. (2015) Serotonin in fear conditioning processes. *Behavioral Brain Research*, 277:68-77.
- Abiri D., Douglas C.E., Calakos K.C., Barbayannis G.,** Roberts, A., Bauer, E.P. (2014) Fear extinction learning can be impaired or enhanced by modulation of the CRF system in the basolateral nucleus of the amygdala. *Behavioral Brain Research*, 271:234-9.
- Burghardt, N.S., Bauer, E.P. (2013) Acute and chronic effects of SSRI treatment on fear

- conditioning: implications for underlying fear circuits. *Neuroscience*, 247:253-72.
- Ravinder, S., Burghardt, N.S., **Brodsky, R.**, Bauer, E.P., Chattarji, S. (2013) A role for the extended amygdala in the fear-enhancing effects of acute selective serotonin reuptake inhibitor treatment. *Translational Psychiatry* Jan 15;3:e209.
- Davis, S.E.**, Bauer E.P. (2012) L-type voltage-gated calcium channels in the basolateral amygdala are necessary for fear extinction. *Journal of Neuroscience*, 32(39):13582-6.
- Duvarci, S., Bauer E.P., Paré, D. (2009) The bed nucleus of the stria terminalis mediates inter-individual variations in anxiety and fear. *Journal of Neuroscience*, 29(33):10357-61.
- Paz, R., Bauer, E.P., Paré, D. (2009) Measuring correlations and interactions between four simultaneously recorded brain regions during learning. *Journal of Neurophysiology*, 101(5):2507-15.
- Paz, R., Bauer, E.P., Paré, D. (2008) Theta synchronizes the activity of medial prefrontal neurons during learning. *Learning and Memory*, 15(7):524-31.
- Bauer, E.P., Paz, R., Paré, D. (2007) Gamma oscillations coordinate amygdalo-rhinal interactions during learning. *Journal of Neuroscience*, 27(35):9369-79.
- Paz, R., Bauer, E.P., Paré, D. (2007) Learning-related facilitation of rhinal interactions by medial prefrontal inputs. *Journal of Neuroscience* 27(24):6542-51.
- Paz, R., Pelletier, J.G., Bauer, E.P., Paré, D. (2006) Emotional enhancement of memory via amygdala-driven facilitation of rhinal interactions. *Nature Neuroscience*, 9(10) 1321-29.
- Schafe, G.E., Bauer, E.P., Rosis, L.R., Farb, C., Rodrigues, S.M., LeDoux, J.E. (2005) Memory consolidation of Pavlovian fear conditioning requires nitric oxide signaling in the lateral amygdala. *European Journal of Neuroscience*, 22: 201-211.
- Bauer, E.P., LeDoux, J.E. (2004) Heterosynaptic potentiation of inhibitory interneurons in the lateral amygdala. *Journal of Neuroscience*, 24(43) 9507-9512.
- Rodrigues, S.M., Farb, C.R., Bauer, E.P., LeDoux, J.E., Schafe, G.E. (2004) Pavlovian fear conditioning regulates Thr<sup>286</sup> autophosphorylation of Ca<sup>2+</sup>/calmodulin-dependent protein kinase II at lateral amygdala synapses. *Journal of Neuroscience* 24(13) 3281-3288.
- Bauer, E.P., Schafe, G.E., LeDoux, J.E. (2002) Both NMDA receptors and L-type voltage-gated calcium channels contribute to long-term potentiation and different components of fear memory formation in the lateral amygdala. *Journal of Neuroscience*, 22(12) 5239-5249.
- Rodrigues, S.M., Bauer, E.P., Farb, C.R., Schafe, G.E., LeDoux, J.E. (2002) The Group I metabotropic glutamate receptor mGluR5 is required for fear memory formation and long-term potentiation in the lateral amygdala. *Journal of Neuroscience*, 22(12) 5219-5229.
- Blair, H.T., Schafe, G.E., Bauer, E.P., Rodrigues, S.M., LeDoux, J.E. (2001) Synaptic plasticity in the lateral amygdala: A cellular hypothesis of fear conditioning. *Learning and Memory*, 8(5):229-242.
- Bauer, E.P., LeDoux, J.E., Nader, K. (2001) Fear conditioning and LTP in the lateral amygdala are sensitive to the same stimulus contingencies. *Nature Neuroscience*, July 4(7): 687-8.
- Schafe, G.E., Atkins, C.M., Swank, M.W., Bauer, E.P., Sweatt, J.D., LeDoux, J.E. (2000) Activation of ERK/MAP kinase in the amygdala is required for memory consolidation of Pavlovian fear conditioning. *Journal of Neuroscience*, 20(21):8177-8187.
- Weisskopf, M.G., Bauer, E.P., and LeDoux, J.E. (1999) L-type voltage-gated calcium channels mediate NMDA-independent associative long-term potentiation at thalamic input synapses to the amygdala. *Journal of Neuroscience*, 19(23), 10512-10519.

*Abstracts presented at conferences (Barnard undergraduates are in **bold**)*

- Acevedo, K., Stein, N., Breunig, E., Ryckman, A.,** Bauer, E.P. (2016) Extended amygdala circuits recruited by the expression of contextual fear conditioning. *Pavlovian Society Conference*
- Barbayannis, G., Franco, D., Wong, S., Galdamez, J.,** Bauer, E.P., Romeo, R.D. (2016) The effects of stress on fear learning and activation of the amygdala in pre-adolescent and adult male rats. *Society for Behavioral Neuroendocrinology*.
- Calakos, K.,** Bauer, E.P. (2014) CRF receptor localization in the basolateral nucleus of the amygdala. *Society for Neuroscience Abstracts*

- Pelrine, E., Pasik, S.D.,** Bauer, E.P. (2014) 5HT<sub>2C</sub> receptors in the bed nucleus of the stria terminalis (BNST) are implicated in the enhanced fear learning induced by SSRIs. *Society for Neuroscience Abstracts.*
- Roquet R.F., Bauer E.P., Monfils M. (2014) Fear conditioning at p17/p25: The effects of fluoxetine on retention and re-conditioning in adulthood. *Society for Neuroscience Abstracts.*
- Roquet R.F., Bauer E.P., Monfils M.H. (2013) Fear conditioning in early life: the effects of fluoxetine on retention and re-conditioning in adulthood. *Society for Neuroscience Abstracts.*
- Abiri, D., Shukla, A., Calakos K.,** Bauer, E.P. (2012) Corticotropin-releasing factor in the basolateral amygdala impairs fear extinction. *Pavlovian Society Conference.*
- Davis, S.,** Bauer E.P. (2011) L-type voltage gated calcium channels in the basolateral amygdala are necessary for fear extinction. *Society for Neuroscience Abstracts.*
- Ravinder S., Bauer, E.P., Burghardt, N.S., **Brodsky, R.,** Chattarji, S. (2011) A role for the central nucleus of the amygdala in mediating the anxiogenic effects of acute SSRI administration. *Society for Neuroscience Abstracts.*
- Duvarci, S., Bauer E.P., Paré, D. (2008) Lesions of the bed nucleus of the stria terminalis abolish behavioral heterogeneity in a differential fear conditioning paradigm. *Society for Neuroscience Abstracts.*
- Paz, R., Bauer, E.P., Paré, D. (2008) Nonlinear interactions between the basolateral amygdala and medial prefrontal cortex modulate perirhinal-entorhinal communication during learning. *Society for Neuroscience Abstracts.*
- Paz, R., Bauer, E.P., Paré, D. (2007) Learning-induced theta oscillations, phase locking and spike synchronization within the medial prefrontal cortex. *Society for Neuroscience Abstracts.*
- Bauer, E.P., Paz, R. Paré, D. (2007) Learning-related changes in coordinated fast oscillations (35-45 Hz) in the basolateral amygdala and rhinal cortices during the acquisition of a trace-conditioning task. *Cosyne: Computational and Systems Neuroscience.*
- Bauer, E.P., Paz, R. Paré, D. (2006) Learning-related changes in coordinated fast oscillations (35-45 Hz) in the basolateral amygdala and rhinal cortices during the acquisition of a trace-conditioning task. *Society for Neuroscience Abstracts.*
- Paz, R., Bauer, E.P., Paré, D. (2006) Learning-related changes in the activity of medial prefrontal and rhinal neurons during the acquisition of a trace conditioning task. *Society for Neuroscience Abstracts*
- Paz, R., Pelletier, J.G., Bauer, E.P., Paré, D. (2006) Emotional enhancement of memory via amygdala-driven facilitation of rhinal interactions. *Society for Neuroscience Abstracts.*
- Bauer, E.P., LeDoux, J.E., Nader, K. (2005) Amygdala LTP is sensitive to probability, as opposed to the coincidence, of pre- and postsynaptic activation. *Cosyne: Computational and Systems Neuroscience.*
- Bauer, E.P., LeDoux, J.E. (2004) Potentiation of inhibitory interneurons in the lateral amygdala is not input-specific. *Forum of European Neuroscience; Lisbon, Portugal*
- Burghardt, N.S., Bauer, E.P., McEwen, B.S., LeDoux, J.E. (2003) Different effects of acute and chronic treatment with tianeptine in the acquisition of conditioned fear. *Society for Neuroscience Abstracts.*
- Bauer, E.P., LeDoux, J.E. (2003) Potentiation of inhibitory neurons in the lateral amygdala is not input-specific. *Learning and Memory meeting; Cold Spring Harbour.*
- Bauer, E.P., LeDoux, J.E. (2002) Heterosynaptic potentiation of inhibitory transmission in the lateral amygdala. *Society for Neuroscience Abstracts.*
- Bauer, E.P., LeDoux, J.E., Nader, K. (2001) Pavlovian fear conditioning and associative LTP in the lateral amygdala are sensitive to the same stimulus contingencies. *Society for Neuroscience Abstracts.*
- Rodrigues, S.M., Bauer, E.P., Schafe, G.E., LeDoux, J.E. (2001) The mGluR5 metabotropic glutamate antagonist MPEP impairs the acquisition of conditioned fear and the induction of long-term potentiation in the lateral amygdala. *Society for Neuroscience Abstracts.*
- Bauer, E.P., Schafe, G.E., and LeDoux, J.E. (2000) Different induction protocols recruit NMDA and L-type calcium channel-dependent LTP in the lateral amygdala: correlation with fear

- memory. *Society for Neuroscience Abstracts*, 26:1253.
- Schafe, G.E., Atkins, C.M., Bauer, E.P., Sweatt, J.D., LeDoux, J.E. (2000) Blockade of ERK/MAP kinase activation in the amygdala impairs memory consolidation of Pavlovian fear conditioning. *Society for Neuroscience Abstracts*, 26:1252.
- Bauer, E.P., Weisskopf, M.G., and LeDoux, J.E. (1999) Excitatory and inhibitory LTP at thalamic input synapses to the lateral amygdala. *Society for Neuroscience Abstracts*, 25:879.
- Rubin, N., Bauer, E. and Reitzen, S. (1999) Scene segmentation occurs in two stages: experimental evidence and a model. *Invest. Opth. and Vis. Sci. (Suppl.)*, 40, 4192.
- Bauer, E.P., George, S.A. (1997) NMDA reduces asymmetry of horizontal optokinetic nystagmus in frogs. *Society for Neuroscience Abstracts*, 22:452.

### **Invited talks**

- “Extended amygdala circuits involved in fear learning and expression” (2016) Hunter College, CUNY, Biological Sciences Seminar Series
- “Extended amygdala circuits involved in fear learning” (2015) City College of New York, Biology department seminar series
- “Extended amygdala circuits involved in fear learning” (2015) Hofstra University, Biology department seminar series
- “The extended amygdala mediates the effects of acute SSRIs on fear conditioning” (2013) Gordon Research Conferences, “Amygdala in Health and Disease”
- “Acute SSRI treatment enhances fear conditioning: a role for the extended amygdala” (2012) Pavlovian Society Conference
- “The bed nucleus of the stria terminalis determines inter-individual variations in anxiety and fear” (2009) Behavioral Neuroscience Journal Club, Columbia University

### **Symposia organized**

- “Stress, anxiety and fear conditioning” (2012), Pavlovian Society Conference

### **Works in Progress**

- Barbayannis, G., Franco, D., Wong, S., Galdamez, J., Romeo, R.D., Bauer, E.P.** The effects of stress on fear learning and activation of the amygdala in pre-adolescent and adult male rats. *Submitted*.

### **Grant Activity**

#### *Active Grants*

Grant # 1R15MH107008-01A1 (Elizabeth Bauer PI)  
National Institutes of Mental Health (NIMH) Academic Research Enhancement Award (AREA)  
(6/1/2016-5/31/2019)

Title: Modulation of fear conditioning by extended amygdala circuits

Total award amount: \$410,845

Barnard Minigrant (Elizabeth Bauer PI)

2016-2018

Total award amount: \$8,000

#### *Prior Awards Now Terminated*

Grant # 1R15MH095032-01 (Elizabeth Bauer PI)  
National Institutes of Mental Health (NIMH) Academic Research Enhancement Award (AREA)  
(7/1/2011-6/30/2014)

Title: Modulation of fear memory by corticotropin-releasing factor in the amygdala  
Total award amount: \$392,415

Barnard SAPL Minigrant (Elizabeth Bauer PI)  
2013-2014  
Total award amount: \$8,000

Grant #: 5F32MH076640 (Elizabeth Bauer PI)  
NIMH National Research Service Award (NRSA) Postdoctoral Fellowship (6/01/06-5/31/08)  
Title: Amygdala and Prefrontal Control of the Rhinal Cortices  
Amount of Award: \$99,224

Grant #: 1F31NS043899 (Elizabeth Bauer PI)  
NIMH National Research Service Award (NRSA) Predoctoral Fellowship (9/1/02-8/31/04)  
Title: mGluRs and Synaptic Plasticity in the Lateral Amygdala  
Amount of Award \$70,260

NSF Predoctoral Fellowship (1998-2001)  
Amount of Award: \$60,000

### **Service to the College**

AMGEN Scholars Summer Research Program Section Leader; (2010-2014)

- Served on admissions committee
- Lead weekly classes for summer AMGEN students (10 weeks)
- Accompanied students to AMGEN Scholars National Symposium

Barnard College Center for Research on Women. Advisory Board. 2008-present.

Organized the Roslyn Silver Science Lecture; Speaker: Elisabeth Murray, NIH (October 2010)

#BarnardReads Moderator (2016)

Committee on Petitions and Academic Standing (Fall 2015-present)

Committee on Honors (Fall 2014-Spring 2016)

Committee on Faculty Governance and Procedures, member (Elected Spring 2011; 2011-2012 academic year, spring 2013)

Member of Grievance Committee (Spring 2013)

Member of the search committee for a Microbiologist (Biology); Spring 2009

Outside Member of the search committee for a Developmental Psychologist (Psychology); Spring 2009

2008-2009 5 Major and First-year advisees

2009-2010 18 Major and First-year advisees

2010-2011 21 Major and First-year advisees

2011-2012 23 Major and First-year advisees

2012-2013 3 Major and First-year advisees (on leave this year)

2013-2014 12 Major and First-year advisees (on leave this year)

2014-2015 16 Major and First-year advisees

2015-2016 32 Major and First-year advisees

2016-2017 36 Major and First-year advisees

### **Service to the Profession**

Peer Review:

Behavioral Brain Research

Biological Psychiatry

European Journal of Neuroscience

Experimental Brain Research  
Journal of Neurophysiology  
Journal of Psychopharmacology  
Neuroscience Letters  
Neuropharmacology  
Neuropsychopharmacology  
Physiology and Behavior  
PlosONE  
Progress in Neuro-Psychopharmacology and Biological Psychiatry  
Psychoneuroendocrinology

Biotechnology and Biological Sciences Research Council (United Kingdom)  
Human Frontier Science Program  
National Science Foundation (ad hoc reviewer)  
Elizabeth Bauer 2017