

Name: **Hammack, Sayamwong Emwill “Jom”**

2006 - present **Assistant Professor**
University of Vermont, Burlington, VT
2002 **Postdoctoral Fellow, Center for Behavioral Neuroscience**
Emory University, Atlanta, GA
2001 **Ph.D., Psychology**
University of Colorado, Boulder, CO
1998 **M.A., Psychology**
University of Colorado, Boulder, CO
1995 **B.S., Psychology**
Florida State University, Tallahassee, FL

TEACHING EXPERIENCE

University of Vermont: **Instructor**
PSYC 121, Biopsychology (3X)
PSYC 223, Psychopharmacology (2X)
PSYC 380, Neuropsychopharmacology
PSYC 295, Psychopharmacology laboratory
Oglethorpe University: **Instructor**
Survey of Physiological Psychology
University of Colorado: **Laboratory instructor and teaching assistant**
Psychology of Learning and Motivation
Biopsychology I
Psychology of Perception
Physiological Psychology (2X)

INVITED PRESENTATIONS

Oct. 5, 2009 **“A role for pituitary adenylate cyclase-activating peptide (PACAP) expression and signaling in the bed nucleus of the stria terminalis (BNST) in stress-induced anxiety-like behavior”**
Plenary Lecture, The 9th International Symposium on VIP, PACAP and Related Peptides
Kagoshima, Japan
June 18, 2009 **“The response of neurons in the bed nucleus of the stria terminalis to serotonin: Implications for anxiety”**
Vermont Summer Summit
Burlington, Vermont
March 10, 2009 **“Serotonin and Anxiety: The Role of the Bed Nucleus of the Stria Terminalis”**
Department of Psychology
Binghamton University, State University of New York
March 19, 2008 **“The Helpless Brain”**
Newport/Derby/Stanstead Osher Lifelong Learning Institute
Newport, Vermont
Feb. 21, 2008 **“The response of neurons in the bed nucleus of the stria terminalis to serotonin: Implications for anxiety”**
Department of Pharmacology Seminar
University of Vermont
Feb. 11, 2008 **“Serotonin, Anxiety, and the Bed Nucleus of the Stria Terminalis”**

Department of Biology Seminar Program
University of Vermont

- July 20, 2007 **“Serotonin, Anxiety, and the Bed Nucleus of the Stria Terminalis”**
Vermont Summer Summit Meeting
Burlington, Vermont
- April 30, 2007 **“The Behavioral Neuroscience of Drug Addiction”**
Public Lecture
University of Vermont
- Fall, 2002 **“The Role of Corticotropin Releasing Hormone in Learned Helplessness”**
Center for Behavioral Neuroscience
Emory University (video-conference with Georgia State University)
Atlanta, Georgia

STUDENT MENTORSHIP

Masters Degree

- 2008 Kimberly Rhodes
2009 Joe Cheung

Undergraduate Honors Thesis

- 2009 Steven Babbitt
2009 Rachel Sugarman

SPECIAL AWARDS AND HONORS

- 2008 Young Investigator Award, National Alliance for Research on Schizophrenia and
Depression (NARSAD)
- 2004 Completion of grant proposal writing workshop, The Grant Institute
- 2001 Nomination for 2002 Society for Neuroscience Donald B. Lindsley Prize in Behavioral
Neuroscience
- 1997 *Graduate School Fellowship Award*
University of Colorado, Boulder, CO
- 1996 *Graduate School Fellowship Award*
University of Colorado, Boulder, CO
- 1994 Florida State University Dean’s Honor List
- 1993 Florida State University Dean’s Honor List

PROFESSIONAL AFFILIATIONS

- 2007 – 2008 Eastern Psychological Association, member
2007 – 2009 American Psychological Association, member
2002 – 2006 Center for Behavioral Neuroscience, Atlanta, GA, member
1998 – 1999 PsychoNeuroImmunology Research Society, member
1995 – Present Society for Neuroscience, member

Ad hoc reviewer for the following journals:

Behavioural Brain Research
Brain Research Bulletin
Journal of Comparative Neurology
Journal of Neurophysiology
Neuroscience
Neuroscience Research
Pharmacology, Biochemistry and Behavior

Psychoneuroendocrinology
Yonsei Medical Journal

Grants reviewed for:

National Science Foundation
Neurological Foundation of New Zealand

FUNDING

“Exercise, Serotonin and Anxiety”

Principal Investigator

Direct costs: \$275,000; Total cost: \$403,775

National Institutes of Health Exploratory/Developmental Research Grant Award (Parent R21)

National Institutes of Health, Bethesda, MD

2009-2010

“Development of PACAP receptor antagonists for stress-related behavioral, endocrine and metabolic disorders”

Co-Investigator

Direct costs: \$30,000; total cost: \$30,000

Research Opportunities Grant Program

University of Vermont

2009-2010

“The role of 5-HT₇ receptors in the bed nucleus of the stria terminalis in mediating learned helplessness”

Principal Investigator

Direct costs: \$57,121; Total cost: \$57,121

2008 Young Investigator Award, National Alliance for Research on Schizophrenia and Depression (NARSAD)

2008-2010

“Modulation of BNST 5-HT responses by corticosterone”

Postdoctoral Fellowship Recipient

Direct costs: 147,372; Total cost: 147,372

Ruth L. Kirschstein National Research Service Award

National Institutes of Health, Bethesda, MD

2004-2007

PUBLICATIONS: SCIENCE COMMUNICATION

Books

Toufexis, D., **Hammack, S.E.** “Anti-Anxiety Drugs.” Drugs, The Straight Facts (High School Book Series). Ed. David J. Triggle. Philadelphia, PA: Chelsea House Publishers.

PUBLICATIONS: BASIC RESEARCH

Research Articles

Guo, J., **Hammack, S.E.**, Hazra, R., Levita, L., Rainnie, D.G. (2009) Bi-directional modulation of BNST neurons by 5-HT: Molecular expression and functional properties of excitatory 5-HT receptor subtypes, *Neuroscience, in press.*

Hammack, S.E., Guo, J., Hazra, R., Dabrowska, J., Myers, K.M., Rainnie, D.G. (2009) The response of neurons in the bed nucleus of the stria terminalis to serotonin: Implications for anxiety, *Progress in Neuro-Psychopharmacology & Biological Psychiatry, in press.*

- Hammack, S.E.**, Cheung, J., Rhodes, K.M., Schutz, K.C., Falls, W.A., Braas, K.M., May, V. (2009) Chronic stress increases pituitary adenylate cyclase-activating peptide (PACAP) and brain-derived neurotrophic factor (BDNF) mRNA expression in the bed nucleus of the stria terminalis (BNST): roles for PACAP in anxiety-like behavior, *Psychoneuroendocrinology*, 34(6), 833-43.
- Jasnow, A.M., Ressler, K.J., **Hammack, S.E.**, Chhatwal, J.P., Rainnie, D.G. (2009) Characterization of cholecystokinin-containing interneurons of the basolateral amygdala using a CCK-promotor specific lentivirus, *Journal of Neurophysiology*, 101(3),1494-506.
- Fox, J.H., **Hammack, S.E.**, Falls, W.A. (2008) Exercise is associated with reduction in the anxiogenic effect of mCPP on acoustic startle, *Behavioral Neuroscience* 122(4), 943-8.
- Hammack, S.E.**, Mania, I., Rainnie, D.G. (2007) Differential expression of intrinsic membrane currents in defined cell types of the anterolateral bed nucleus of the stria terminalis, *Journal of Neurophysiology* 98(2), 638-56.
- Chhatwal, J.P., **Hammack, S.E.**, Jasnow, A., Rainnie, D.G., Ressler, K.J. (2007) Identification of cell-type specific promoters within the brain using lentiviral vectors, *Gene Therapy* 14(7), 575-583.
- Milligan, E.D., Sloane, E.M., Langer, S.J., Cruz, P.E., Chacur, M., Spataro, L. **Hammack, S.E.**, Maier, S.F., Flotte, T.R., Forsayeth, J.R., Leinwand, L.A., Chavez, R., Watkins, L.R. (2005) Controlling neuropathic pain by adeno-associated virus driven production of the anti-inflammatory cytokine, interleukin-10, *Molecular Pain* 1-9.
- Levita, L., **Hammack, S.E.**, Mania, I., Li, X-Y, Davis, M., Rainnie, D.G. (2004) 5-hydroxytryptamine(1a)-like receptor activation in the bed nucleus of the stria terminalis: Electrophysiological and behavioral studies, *Neuroscience* 128, 583-596.
- Hammack, S.E.**, Richey, K.J., Watkins, L.R., Maier, S.F. (2004) Chemical lesion of the bed nucleus of the stria terminalis blocks the behavioral consequences of uncontrollable stress, *Behavioral Neuroscience* 118(2), 443-448.
- Day, H.E.W., Greenwood, B.N., **Hammack, S.E.**, Watkins, L.R., Fleshner, M., Maier, S.F., Campeau, S. (2004) Differential expression of 5-HT1A, alpha1b adrenergic, CRH-R1 and CRH-R2 receptor mRNA in serotonergic, GABAergic and catecholaminergic cells of the rat dorsal raphe nucleus, *Journal of Comparative Neurology* 474(3), 364-378.
- Will, M.J., Der-Avakian, A., Bland, S.T., Grahn, R.E., **Hammack, S.E.**, Sparks, P.D., Pepin, J.L., Watkins, L.R., Maier, S.F. (2004) Electrolytic lesions and pharmacological inhibition of the dorsal raphe nucleus prevent stressor potentiation of morphine conditioned place preference in rats, *Psychopharmacology (Berl)* 171(2), 191-198.
- Hammack, S.E.**, Pepin, J.L., DesMarteau, J.S., Watkins, L.R., Maier, S.F. (2003) Low doses of corticotropin-releasing hormone injected into the dorsal raphe nucleus block the behavioral consequences of uncontrollable stress, *Behavioural Brain Research* 147(1-2), 55-64.
- Hammack, S.E.**, Schmid, M.J., LoPresti, M.L., Foster, A., Watkins, L.R., Maier, S.F. (2003) Corticotropin releasing hormone type 2 receptors in the dorsal raphe nucleus mediate the behavioral consequences of uncontrollable stress, *Journal of Neuroscience* 23(3), 1019-1025.
- Greenwood, B.N., Foley, T.E., Day, H.E.W., Campisi, J., **Hammack, S.E.**, Campeau, S., Maier, S.F., Fleshner, M. (2003) Freewheel running prevents learned helplessness/behavioral depression: Role of dorsal raphe serotonergic neurons, *Journal of Neuroscience* 23(7), 2889-2898.
- O'Connor, K.A., Johnson, J.D., **Hammack, S.E.**, Brooks, L.M., Spencer, R.L., Watkins, L.R., Maier, S.F. (2003) Inescapable shock induces resistance to the effects of dexamethasone, *Psychoneuroendocrinology*

28, 481-500.

Hammack, S.E., Richey, K.J., Schmid, M.J., LoPresti, M.L., Watkins, L.R., Maier, S.F. (2002) The role of corticotropin releasing hormone in the dorsal raphe nucleus in mediating the behavioral consequences of uncontrollable stress, *Journal of Neuroscience* 22(3), 1020-1026.

Grahn, R.E., **Hammack, S.E.**, Will, M.J., O'Connor, K. A., Deak, T., Sparks, P.D., Watkins, L.R., Maier, S.F. (2002) Blockade of alpha1 adrenoreceptors in the dorsal raphe nucleus prevents enhanced conditioned fear and impaired escape performance following uncontrollable stressor exposure in rats, *Behavioral Brain Research* 134(1-2), 387-392.

Hammack, S.E., Sutton, L.C., Hartley, C.E., Lea, S.E., Maier, S.F., Watkins, L.R. (1999) Inescapable shock-induced potentiation of morphine analgesia in rats: sites of action, *Behavioral Neuroscience* 113(4), 795-803.

Grahn, R.E., Will, M.J., **Hammack, S.E.**, Maswood, S., McQueen, M.B., Watkins, L.R., Maier, S.F. (1999) Activation of serotonin-immunoreactive cells in the dorsal raphe nucleus in rats exposed to an uncontrollable stressor, *Brain Research* 826, 35-43.

Goehler, L.E., Gaykema, R.P.A., **Hammack, S.E.**, Maier, S.F., Watkins, L.R. (1998) Interleukin-1 induces c-fos immunoreactivity in primary afferent neurons of the vagus nerve, *Brain Research* 804, 306-310.

Minear, M.M., **Hammack, S.E.**, Lundy, R.F., Contreras, R.J. (1996) Amiloride inhibits taste nerve responses to NaCl and KCl in sprague-dawley and fischer 344 rats. *Physiology and Behavior*, 60(2), 507-516.

Selected Abstracts

Hammack S.E., Roman, C., Cheung, J., Falls, W.A., Schutz, K.C., Braas, K.M., Sugarman, R.A., Rhodes, K.M., May, V., Chronic stress increases PACAP/PAC1 receptor signaling in the bed nucleus of the stria terminalis (BNST) and facilitates anxiety-like behavior, *Annual Meeting of the Pavlovian Society*, (2009).

Fox, J.H., **Hammack, S.**, Falls, W.A., Exercise dose dependently reduces the anxiogenic effect of intra-bed nucleus of the stria terminalis injections of mCPP, *Proc. Soc. Neurosci.* 35 (2009).

Falls, W.A., Macaulay, C.M., Fox, J.H., **Hammack, S.E.**, Green, J.T., Voluntary Exercise enhances learning and consolidation but not the retrieval of cued conditioned fear in mice, *Proc. Soc. Neurosci.* 35 (2009).

May, V., Roman, C.W., Schutz, K.C., Braas, K.M., Falls, W.A., **Hammack, S.E.**, Chronic variate stress alters the expression of transcript for several stress-related peptides in the anterolateral bed nucleus of the stria terminalis (BNST), *Proc. Soc. Neurosci.* 35 (2009).

Roman, C.W., May, V., Kocho-Schellenberg, M., Grimmig, B., Sugarman, R., Falls, W.A., Braas, K.M., **Hammack, S.E.**, Activation of pituitary adenylate cyclase-activating peptide (PACAP) in the bed nucleus of the stria terminalis (BNST) mediates increases in anxiety-like behavior following chronic stressor exposure, *Proc. Soc. Neurosci.* 35 (2009).

Babbin, S.F., Phillips, E.M., **Hammack, S.E.**, C-Fos expression in the bed nucleus of the stria terminalis (BNST) and amygdala following a pharmacological treatment that induces learned helplessness, *Proc. Soc. Neurosci.* 35 (2009).

Lieberman, G., **Hammack, S.E.**, Bouton, M.E., Changes in c-Fos expression in the bed nucleus of the stria terminalis and the central nucleus of the amygdala in response to short- and long-duration conditioned fear stimuli, *Vermont Chapter SFN 4th Annual Neuroscience Research Forum* (2009).

Cheung, J., Babbin, S.F., Phillips, E.M., Rhodes, K.M., **Hammack, S.E.**, Pharmacological activation of the dorsal raphe nucleus (DRN) increases anxiety-like behavior and c-fos expression in the bed nucleus of the stria terminalis, Vermont Chapter SFN 4th Annual Neuroscience Research Forum (2009).

Rhodes, K.M., Grimmig, B.A., Kocho-Schellenberg, M., Wilner, N.J., Sugarman, R.A., Williams, M.R., **Hammack, S.E.**, The 5-HT1A receptor antagonist WAY 100635 dose-dependently decreases social interaction when infused into the bed nucleus of the stria terminalis (BNST), Vermont Chapter SFN 4th Annual Neuroscience Research Forum (2009).

Hammack S.E., Cheung, J., Falls, W.A., Sugarman, R.A., Rhodes, K.M., Schutz, K.C., Braas, K.M., May, V., Chronic stress increases PACAP/PAC1 receptor signaling in the bed nucleus of the stria terminalis (BNST) and facilitates anxiety-like behavior, Vermont Chapter SFN 4th Annual Neuroscience Research Forum (2009).

Fox, J.H., **Hammack, S.E.**, Falls, W., Exercise reduces the anxiogenic effect of intra-bed nucleus of the stria terminalis injections of mCPP, Proc. Soc. Neurosci. 34 (2008).

Cheung, J., Babbin, S.F., Phillips, E.M., Rhodes, K.M., **Hammack, S.E.**, Pharmacological activation of the dorsal raphe nucleus (DRN) increases anxiety-like behavior and c-fos expression in the bed nucleus of the stria terminalis, Proc. Soc. Neurosci. 34 (2008).

Rhodes, K.M., Grimmig, B.A., Kocho-Schellenberg, M., Wilner, N.J., Sugarman, R.A., Williams, M.R., **Hammack, S.E.**, The 5-HT1A receptor antagonist WAY 100635 dose-dependently decreases social interaction when infused into the bed nucleus of the stria terminalis (BNST), Proc. Soc. Neurosci. 34 (2008).

Hammack S.E., Cheung, J., Falls, W.A., Sugarman, R.A., Rhodes, K.M., Schutz, K.C., Braas, K.M., May, V., Chronic stress increases PACAP/PAC1 receptor signaling in the bed nucleus of the stria terminalis (BNST) and facilitates anxiety-like behavior, Proc. Soc. Neurosci. 34 (2008).

Guo, J., Hazra, R., **Hammack, S.E.**, Rainnie, D.G., Serotonin receptors in the BNST: correlation of pharmacology profile and single cell mRNA expression, Proc. Soc. Neurosci. 34 (2008).

Rhodes, K.M., **Hammack, S.E.**, Grimmig, B.A., Kocho-Schellenberg, M., Williams, M.R., 5-HT1A receptor antagonist within the bed nucleus of the stria terminalis modulates anxiety-like behavior in rats, Proc. Eastern Psychological Association. 79 (2008).

Cheung, J., Rhodes, K.M., Babbin, S.F., **Hammack, S.E.**, Pharmacological activation of the dorsal raphe nucleus is associated with anxiety-like behavior and fos expression in the bed nucleus of the stria terminalis, Proc. Eastern Psychological Association. 79 (2008).

Ressler, K.J., Jasnow, A.M., Maguschak, K.A., **Hammack, S.E.**, Chhatwal, J.P., Rainnie, D.G., Construction of cell-type specific promoter lentiviruses for optically guiding electrophysiological recordings of distinct interneuron populations within the basolateral amygdala of rats, Proc. Soc. Neurosci. 33 (2007).

Jasnow, A.M., **Hammack, S.E.**, Chhatwal, J.P., Ressler, K.J., Rainnie, D.G., Identification of three distinct subtypes of cholecystochinin-containing interneurons in the basolateral amygdala of rats, Proc. Soc. Neurosci. 33 (2007).

Hammack, S.E., Guo, J., Hazra, R., Rainnie, D.G., Subthreshold intrinsic membrane currents actively modulate the firing properties of neurons in the anterolateral group of the bed nucleus of the stria terminalis (BNST), Proc. Soc. Neurosci. 32 (2006).

Hammack, S.E., Haensly, J.W., Rainnie, D.G., Activation of 5-HT₇ receptors mediate a depolarizing response in a subset of neurons in the anterolateral cell group of the bed nucleus of the stria terminalis, *Proc. Soc. Neurosci.* 31 (2005).

Hammack, S.E., Mania, I., Levita, L., Rainnie, D.G., Neurons in the bed nucleus of the stria terminalis respond differently to serotonin after exposure to corticotropin releasing factor or isolation housing, *Proc. Soc. Neurosci.* 30 (2004).

Levita, L. **Hammack, S.E.**, Mania, I., Davis, M., Rainnie, D.G., Functional modulation of the bed nucleus of the stria terminalis by serotonin: An electrophysiological and a behavioral study using acoustic startle, *CBN Learning and Behavior Symposium* (2004).

Hammack, S.E., Mania, I., Levita, L., Rainnie, D.R., Physiological properties of neurons in the anterolateral bed nucleus of the stria terminalis, *Proc. Soc. Neurosci.* 29 (2003).

Levita, L. **Hammack, S.E.**, Mania, I., Davis, M., Rainnie, D.G., Functional modulation of the bed nucleus of the stria terminalis by serotonin: An electrophysiological and a behavioral study using acoustic startle, *Proc. Soc. Neurosci.* 29 (2003).

Day, H.E., Greenwood, B.N., **Hammack, S.E.**, Fleshner, M., Watkins, L.R., Maier, S.F., Campeau, S., Differential expression of 5-HT_{1A}, 1B, adrenergic, CRH-R1 and CRH-R2 receptor mRNA in serotonergic, gabaergic and catecholaminergic cells of the rat dorsal raphe nucleus, *Proc. Soc. Neurosci.* 29 (2003).

Hammack, S.E., Pepin, J., DesMarteau, J.S., Watkins, L.R., Maier, S.F., Low, but not high, doses of corticotropin releasing hormone block the behavioral effects caused by urocortin II administered into the dorsal raphe nucleus and those caused by uncontrollable shock, *Proc. Soc. Neurosci.* 28 (2002).

Hammack S.E., Richey K.J., Schmid, M.J., LoPresti, M.L., Watkins L.R., Maier S.F., Corticotropin releasing hormone in the dorsal raphe nucleus is necessary and sufficient for the development of learned helplessness, *Proc. Soc. Neurosci.* 27 (2001).

Maier S.F., **Hammack S.E.**, Pelleycounter M.A., Richey K.J., Schmid M.J., LoPresti, M.L., Watkins L.R., Corticotropin releasing hormone type 2 receptors in the dorsal raphe nucleus are necessary for the development of learned helplessness, *Proc. Soc. Neurosci.* 27 (2001).

Sparks, P.D., Amat, J., Matus-Amat, P., **Hammack, S.E.**, Griggs, J.B., Hinde, J.L., Watkins, L.R., Maier, S.F., Bupivacaine injections into medial prefrontal cortex (mPFC) in the rat disinhibit the release of serotonin in the dorsal raphe (DRN) nucleus in response to controllable tailshock, *Proc. Soc. Neurosci.* 26 (2000).

Will, M.J., Pepin, J.L., **Hammack, S.E.**, Grahn, R.E., Watkins, L.R., Maier, S.F., Dorsal raphe nucleus lesion blocks stressor-potentiated morphine place preference, *Proc. Soc. Neurosci.* 25 (1999).

Grahn, R.E., **Hammack, S.E.**, Will, M.J., O'Connor, K.A., Deak, T., Sparks, P.D., Watkins, L.R., Maier, S.F., The noradrenergic alpha 1 antagonist benoxathian microinjected into the dorsal raphe nucleus prevents enhanced conditioned fear and escape failure produced by inescapable tailshock in rats, *Proc. Soc. Neurosci.* 25 (1999).

Hinde, J.L., **Hammack, S.E.**, Gaykema, R.P.A., Goehler, L.E., Maier, S.F., Watkins, L.R., Intraperitoneal injections of interleukin-1b induce c-fos immunoreactivity in vagal sensory neurons, *Proc. Soc. Neurosci.* 24 (1998).

Hammack, S.E., Grahn, R.E., Will, M.J., McQueen, M.B., Goehler, L.E., Gaykema, R.P.A., Watkins, L.R., Maier, S.F., C-fos expression in the dorsal raphe nucleus and projection regions 24 hours after inescapable shock, *Proc. Soc. Neurosci.* 23 (1997).

Grahn, R.E., **Hammack, S.E.**, Will, M.J., Karimzad, F., McQueen, M.B., Gaykema, R.P.A., Goehler, L.E., Watkins, L.R., Maier, S.F., C-fos expression in the dorsal raphe nucleus in rats after escapable or inescapable tailshock, *Proc. Soc. Neurosci*, 23 (1997).

Hartley, C.E., **Hammack, S.E.**, Sutton, L.C., Maier, S.F., Watkins, L.R., Inescapable shock (IS) potentiates morphine analgesia 24 hrs later: the role of the mu opioid receptors in the lumbosacral spinal cord, *Proc. Soc. Neurosci*, 22 (1996).