

Curriculum Vitae

Personal Information

NAME: Heather A. Drummond
ADDRESS: Home: 124 Bridgepointe Blvd
Brandon, MS 39047
Work: Department of Physiology and Biophysics
University of Mississippi Medical Center
Jackson, MS 39216-4505
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Education

<u>Institution</u>	<u>Degree</u>	<u>Year</u>	<u>Major Field</u>
Medical College of Wisconsin	Ph.D.	1995	Physiology
University of Arizona	M.S.	1990	Exercise Science
California State University at Hayward	B.S.	1987	Nutrition and Human Performance

Professional Experience/Post Graduate Training

2008- Present Associate Professor
Department of Physiology and Biophysics
University of Mississippi Medical Center
Jackson, MS 39216

2007 Tenured

2001- 2008 Assistant Professor
Department of Physiology and Biophysics
University of Mississippi Medical Center
Jackson, MS 39216

2000-2001 Assistant Research Scientist
Internal Medicine, College of Medicine
University of Iowa, Iowa City, IA 52242

1996-2000 Postdoctoral Fellow
Co-Advisors: Francois M. Abboud, M.D., Chair Internal Medicine
and Michael J. Welsh M.D., HHMI Investigator
Internal Medicine, College of Medicine
University of Iowa, Iowa City, IA 52242

1995-1996 Postdoctoral Fellow
Advisor: Richard J. Roman, Ph.D.
Department of Physiology
Medical College of Wisconsin, Milwaukee, WI 53226

1995-1996 Mini-Medical School Lab Instructor
Supervisor: Jeffrey L. Osborn, Ph.D.
Medical College of Wisconsin, Milwaukee, WI 53226

1992-1996 Medical Physiology Lab Instructor
 Department of Physiology
 Medical College of Wisconsin, Milwaukee, WI 53226

1988-1990 Research Assistant and Teaching Assistant
 Department of Exercise and Sport Sciences
 University of Arizona, Tucson, AZ 85721

Fellowships, Awards, Honors

1986-1987 Charles Soda Scholarship, California State University at Hayward

1988-1990 Graduate Tuition Scholarship, Department of Exercise and Sport Sciences
 University of Arizona, Tucson, AZ

1992-1993 Pre-Doctoral Fellowship, American Heart Association of Wisconsin
 Title: Mechanisms of acute baroreceptor resetting of carotid baroreceptors.

1993-1994 Pre-Doctoral Fellowship, American Heart Association of Wisconsin
 Title: Differential control of efferent sympathetic and parasympathetic activity by two types of carotid baroreceptors.

1994 Procter and Gamble Professional Opportunity Award
 Neural Control and Autonomic Regulation Section, American Physiological Society

1996-1997 Post-Doctoral Fellowship, Institutional Award

1997-1999 Post-Doctoral Fellowship, Individual National Research Service Award
 Title: Mechanosensitive Baroreceptor Channel Identification

1998 Caroline tum Suden/Frances A. Hellebrandt Professional Opportunity Award.
 American Physiological Society

1998 Young Investigator Travel Award, International Society of Hypertension

2001-2002 American Heart Association, Heartland Affiliate, Beginning Grant in Aid.
 Molecular mechanism of aldosterone inhibition of baroreceptor function.

1999-2000 Post-Doctoral Fellowship, Institutional Award

2002 Bronze Award, University of Mississippi Faculty Achievement Award.

2005 Gold Award, University of Mississippi Faculty Achievement Award

2008 American Society for Hypertension, Young Investigator Award

EFFORT

Research	40%
Teaching	30%
Service	30%

RESEARCH (40% Effort)

Research Grants

Pending:

NIH, NHLBI, PPG

Director: Joey Granger

Title: Preeclampsia: Pathophysiological mechanisms and therapeutic targets

Role: Director of Imaging and Assay Core
Effort: 20%
Direct Costs: \$6,930,050
Indirect Costs: \$3,638,277
Total Direct and Indirect Costs: \$10,568,327

Current:

NIH, NIGMS, P20GM121334 Center of Excellence
Director: Janie Reckelhoff
Title: Mississippi Center of Excellence in Perinatal Research
Role: Services Core Director
Effort: 15%
Direct Costs: \$1,500,000/year
Indirect Costs: \$750,000/year
Total Direct and Indirect Costs: \$11,250,000

NIH, NHLBI, RO1
Multiple Principal Investigator: Michael J. Ryan, Heather A. Drummond, Joey P Granger
Title: Placental ischemia, hypertension and vascular function
Role: Co-PI
April 1, 2017 – March 31, 2022
Effort: 20%
Direct Costs: \$286,398/year
Indirect Costs: \$150,359/year
Total Direct and Indirect Costs: \$2,183,788

American Heart Association, Grant in Aid Award 20410022
Principal Investigator: Heather A. Drummond
Title: ASIC2 forms mechanically gated ion channels and mediates myogenic constriction in renal afferent arterioles.
July 1, 2014 – June 30, 2016; Currently on No-Cost Extension
Effort: 15%
Direct Costs: \$75,000/year
Indirect Costs: \$7,500/year
Total Direct and Indirect Costs: \$165,001

NIH, NHLBI, Program Project Grant
Director: John Hall
Title: Cardiovascular dynamics and their control.
Role: Imaging and Histology Sub-Core Leader
August 1, 2014 – May 31, 2019
Effort: 15%
Total Direct and Indirect Costs: \$10,203,625

NIH, NIGMS, Center of Biomedical Research Excellence Grant
Principal Investigator: John Hall
Title: Cardiorenal and metabolic diseases research center.
Role: Imaging and Histology Sub-Core Leader
September 5, 2013 – April 30, 2018

Effort: 10%

Total Direct and Indirect Costs: \$11,405,051

Past:

NIH Shared Instrumentation Grant, RR031728

Principal Investigator: Heather A. Drummond

Title: TCS SP5 Multiphoton Confocal Microscope

Funded 4/1/2012 – 3/31/2013

Total Direct and Indirect Costs: \$600,000

NIH R01 HL086996-01A1

Principal Investigator: Heather A. Drummond

Title: Vascular Mechanosensor

July 7, 2007 – June 30, 2012

Effort: 20%

Total Direct Costs: \$250,000

Total Indirect Costs: \$1,000,000

Total Direct and Indirect Costs:

American Heart Association, Grant in Aid Award 06553035B

Principal Investigator: Heather A. Drummond

Title: ENaC Proteins Regulate Myogenic Constriction.

July 1, 2006 – June 30, 2008

Effort: 20%

Direct Costs: \$75,000/year

Indirect Costs: \$7,500/year

Total Direct and Indirect Costs: \$165,001

NIH R01 HL071603-01A1

Principal Investigator: Heather A. Drummond

Title: Mechanism of Mechanoreceptor Inhibition by Aldosterone

January 1, 2004 – December 31, 2006

American Heart Association, Scientist Development Award 0235015N,

Principal Investigator: Heather A. Drummond

Title: Molecular Mechanism of Aldosterone Inhibition of Mechanoreceptor Function,

July 1, 2002 – June 30, 2006.

Turned back 1/1/2004 due to overlap with RO1.

Trainee Funding

National Research Service Award, Post-Doctoral Fellowship

Title: Role of DEG/ENaC in the renal myogenic response.

Fellow: Nikki Jernigan, Ph.D.

July 1, 2005 – June 30, 2008

American Heart Association, Post-Doctoral Fellowship 0525323B

Title: DEG/ENaC mediate myogenic constriction

Fellow: Nikki Jernigan, Ph.D.

July 1, 2005 – June 30, 2007

Turned back due to overlap with NRSA

American Heart Association, Post-Doctoral Fellowship 0725322B

Title: Vascular bENaC protein mediates renal blood flow autoregulation.

Fellow: Samira Grifoni, Ph.D.

July 1, 2007 – June 30, 2009

American Heart Association Pre Doctoral Fellowship 0715086B

Title: Beta ENaC mediates myogenic vasoconstriction in mouse renal interlobar arteries.

Student: Kimberly Gannon

July 1, 2007 – June 30, 2009

National Research Service Award, F30 NS061365-11

Title: ASIC2 protein mediates myogenic constriction in mouse cerebral arteries.

Student: Kimberly Gannon (MD/PhD program)

September 14, 2008 – May 1, 2011

Research Interests

- Molecular mechanisms of mechanotransduction in sensory neurons and vascular smooth muscle cells.
- Molecular mechanisms of acid sensing in vascular smooth muscle cells.
- Importance of vascular mechanotransduction in cardiovascular disease.
- Growth factor regulation of degenerin expression.

Publications

Manuscripts

1. Seagard J., F. Hopp, H. Drummond and D. VanWynsberghe. Selective contribution of two types of carotid sinus baroreceptors to the control of blood pressure. *Circulation Research* 72:1011-1022, 1993. PMID 8477517
2. Drummond H. and J. Seagard. Lack of effect of 4-aminopyridine on acute resetting of the type I carotid baroreceptor. *Neuroscience Letters*. 173:94-95, 1994. PMID 7936421
3. Drummond H. and J. Seagard. Acute carotid baroreflex resetting: differential control of blood pressure and renal and thoracic sympathetic nerve activity. *Hypertension*. 27:442-448, 1996. PMID 8698451
4. Zou A., H. Drummond and R. Roman. Role of 20-HETE in elevating loop Cl⁻ reabsorption in Dahl S rats. *Hypertension*. 27:631-635. 1996.
5. Jiang J., D. Stec, H. Drummond, J. Simon, G. Kioke, H. Jacob and R. Roman. Transfer of a salt resistant renin allele raises blood pressure in Dahl salt-sensitive rats. *Hypertension*. 29:619-627. 1997.
6. Alonso-Galacia M., H. Drummond, K. Reddy, J. Falck and Roman R. Inhibition of 20-HETE production contributes to the vascular responses to nitric oxide. *Hypertension*. 29:320-325. 1997.
7. Hoffman M., P. Clifford, A. Snyder, K. O'Hagan, S. Mittelstadt, M. Roberts, H. Drummond and S. Gaskill. Physiological effects of technique and rolling resistance in uphill rolling skiing. *Med Sci Sports Exerc*. 30:311-317. 1998.
8. Drummond H., M. Price, M. Welsh and F. Abboud. A molecular component of the arterial baroreceptor mechanotransducer. *Neuron*. 21:1435-1441. 1998.

9. McDonald F., B. Yang, R. Hrstka, H. Drummond, D. Tarr, P. McCray, J Stokes, M. Welsh and R. Williamson. Disruption of the β subunit of the epithelial Na^+ channel in mice: Hyperkalemia and neonatal death associated with a pseudohypoaldosteronism phenotype. *Proc. Natl. Acad. Sci., USA.* 96:1727-1731. 1999.
10. Fricke B., R. Lints, G. Stewart, H. Drummond, G. Dodt, M. Driscoll and M. Von Doring. ENaC and stomatin are expressed in rat trigeminal and mechanosensory neurons. *Cell and Tissue Res.* 299:326-334. 2000
11. Price, M.P., G.R. Lewin, S.L. McIlwrath, C. Cheng, J. Xie, P.A. Happenstall, C.L. Stucky, A.G. Mannsfeldt, T.J. Brennan, H.A. Drummond, J. Qiao, R.A. Williamson and M.J. Welsh. The mammalian Na^+ channel BNC1 is required for normal touch sensation. *Nature.* 407:1007-1011. 2000.
12. Drummond H., F.M. Abboud and M.J Welsh. Localization of β and γ subunits of ENaC in sensory nerve endings in the rat foot pad. *Brain Research.* 884:1-12. 2000.
13. Drummond H., M.J. Welsh and F.M. Abboud. ENaC subunits are molecular components of the arterial baroreceptor complex. *Neuro-cardiovascular Regulation: From molecules to man.* *Ann NY Acad Sci.* 940:42-47. 2001
14. Sedeek M.H., M. Llinas, H. Drummond, L. Fortepiani, S.R. Abram, B.T. Alexander, J.F. Reckelhoff and J.P. Granger. Role of reactive oxygen species in endothelin-induced hypertension. *Hypertension.* 42(4);806-10. 2003.
15. Drummond H.A., D. Gebremedhin and D.R. Harder, DEG/ENaC Proteins: Components of a Vascular Mechanosensor. *Hypertension.* 44:643-648. 2004.
17. Vera T, J.R. Henegar, H.A. Drummond, J.M. Rimoldi and D.E. Stec. Protective effect of carbon monoxide releasing compounds in ischemia-induced acute renal failure. *Journal American Society of Nephrology.*16(4);950-8. 2005
18. Jernigan N and H.A. Drummond. Vascular ENaC proteins are required for renal myogenic constriction. *Am. J. Physiology – Renal Physiology.* 289(4);F891-901, 2005.
19. Drummond H.A., M Furtado, S. Myers, S Grifoni, K. Parker and D. Stec. ENaC proteins are required for NGF-induced neurite growth. *Am. J. Physiology-Cell Physiology.* 290(2);C404-10, 2006.
20. Ryan MJ, Jernigan NL, Drummond HA, McLemore Jr. GR, Rimoldi JM, Poreddy SR, Gadepalli RSV, Stec DE. Renal Vascular Responses to CORM-A1 in the Mouse. *Pharmacological Research.* 54(1):24-9, 2006.
21. Jernigan NJ and HA Drummond. Myogenic vasoconstriction in mouse renal interlobar arteries: role of endogenous β and γ ENaC. *Am. J. of Physiology-Renal Physiology.* 291(6):F1184-91, 2006.
22. Grifoni SC, Gannon KP, Stec DE and HA Drummond. ENaC proteins contribute to VSMC migration. *Am. J. of Physiology-Heart and Circulatory Physiology.* 291(6):H3076-86, 2006.
23. Drummond HA. ENaC Proteins in Vascular Smooth Muscle Mechanotransduction. In: *Mechanosensitive Ion Channels-Current Topics in Membranes.* Ed. O. Hamill. Elsevier. 59. 2007.
24. Lohmeier, T.E. and H.A. Drummond. The Baroreflex in the Pathogenesis of Hypertension. In: *Comprehensive Hypertension.* Ed. G.Y.H. Lip and J.E. Hall. Elsevier. 2007.
25. Stec DE, Gannon KP, Beaird JS, HA Drummond. 20-Hydroxyeicosatetraenoic Acid (20-HETE) stimulates migration of vascular smooth muscle cells. *Cell Physiol Biochem.* 2007;19(1-4):121-8.
26. Gifroni SC, Jernigan NL, Hamilton G, HA Drummond. ASIC proteins regulate smooth muscle cell migration. *Microvascular Research.* *Microvasc Res.* 2008 Mar;75(2):202-10.

27. Drummond HA, Grifoni SC and NL Jernigan. A new trick for an old dogma: ENaC proteins as mechanotransducers in smooth muscle. *Physiology*. (Invited Review) 2008 Feb;23:23-31.
28. Drummond HA, Jernigan NL, Grifoni SC. Sensing tension: ENaC/ASIC proteins in cardiovascular homeostasis. *Hypertension* (Invited Review). 2008 ;51(5):1265-71.
29. Jernigan NL, LaMarca BB, Speed J, Galmiche L, Granger J, HA Drummond. Dietary salt enhances benzamil sensitive component of myogenic constriction in mesenteric arteries. *American Journal of Physiology-Heart and Circulatory Physiology*. *Am J Physiol Heart Circ Physiol*. 2008 Jan;294(1):H409-20.
30. Grifoni SC, McKey SE, HA Drummond. Hsc70 regulates cell surface ASIC2 expression and vascular smooth muscle cell migration. *Am J Physiol Heart Circ Physiol*. 2008 May;294(5):H2022-30.
31. Gannon KP, Vanlandingham LG, Jernigan NJ, Grifoni SC, HA Drummond. Cerebral myogenic responses are altered in ASIC2 knockout mice. *Am J Physiol Heart Circ Physiol*. 2008 Apr;294(4):H1793-803..
32. Stec DE, Drummond HA, Vera T. Role of Carbon Monoxide in Blood Pressure Regulation. *Hypertension*. 51(3):597-604, 2008.
33. Kelsen S, Patel BJ, Parker LB, Vera T, Rimoldi JM, Gadepalli RS, Drummond HA, Stec DE. Heme oxygenase attenuates angiotensin II-mediated superoxide production in cultured mouse thick ascending loop of Henle cells. *Am J Physiol Renal Physiol*. 2008 Oct;295(4):F1158-65, 2008.
34. Jernigan NJ, Speed J, LaMarca BB, Granger JP, Drummond HA. Angiotensin II regulation of renal vascular ENaC proteins. *Am J Hypertens*. 2009 ;22(6):593-7.
35. Drummond HA. The (f)low down on endothelial ENaC; ENaC as a brake on flow mediated dilation. *Hypertension*. 2009 Jun;53(6):903-4. .
36. VanLandingham LG, Gannon KP, Drummond HA. Pressure-induced constriction is inhibited in a mouse model of reduced β ENaC. *Am J Physiol Regulatory*. 297(3):R723-8, 2009.
37. Drummond H. Yes, no, maybe so: ENaC proteins as mediators of renal myogenic constriction. *Hypertension*. 54(5):962-3, 2009.
38. Grifoni SC, Chiposi R, McKey E, Ryan MJ, Drummond HA. Altered whole kidney blood flow autoregulation in a mouse model of reduced β ENaC. *Am J Physiol Renal Physiol*. 2010 Feb;298(2):F285-92. PMID: PMC2822522
39. Lu Y, Ma X, Sabharwal R, Snitsarev V, Morgan D, Rahmouni K, Drummond HA, Whiteis CA, Costa V, Price M, Benson C, Welsh MJ, Chapleau MW, Abboud FM. The ion channel ASIC2 is required for baroreceptor and autonomic control of the circulation. *Neuron*. 2009 Dec 24;64(6):885-97. PMID: PMC2807410
40. Chung WS, Farley J, Swenson A, Chiposi R, Barnard JM, Drummond HA. Extracellular acidosis activates ASIC-like channels in freshly dissociated cerebral VSMCs. *Am J Physiol Cell Physiol*. 2010 May;298(5):C1198-208. PMID: 20181928 PMC2867380
41. Venegas-Pont M, Manigrasso MB, Grifoni SC, Lamarca BB, Maric C, Racusen LC, Glover PH, Jones AV, Drummond HA, Ryan MJ. Tumor Necrosis Factor- α Antagonist Etanercept Decreases Blood Pressure and Protects the Kidney in a Mouse Model of Systemic Lupus Erythematosus. *Hypertension*. 2010. 56(4):643-9. PMID: 20696988
42. Chung WS, Farley JM, Drummond HA. ASIC-like currents in cerebral artery vascular smooth muscle cells are inhibited by endogenous oxidase activity. *Cellular Physiology and Biochemistry*. 27(2):129-38, 2011.
43. Drummond HA, Grifoni SC, Abu-Zaid A, Gousset M, Chiposi R, Barnard M, Murphey B, Stec DE. Renal inflammation and elevated blood pressure in a mouse model of reduced β ENaC. *American Journal of Physiology Renal Physiology*. *Am J Physiol Renal Physiol*.

2011 Aug;301(2):F443-9

44. Ryan MJ, Gilbert EL, Glover PH, George EM, Masterson CW, McLemore GR Jr, Lamarca B, Granger JP, Drummond HA. Placental ischemia impairs middle cerebral artery myogenic responses in pregnant rat. *Hypertension*. 58(6):1126-31, 2011.
45. Csongradi E, Juncos LA, Drummond HA, Vera T, Stec DE. Role of carbon monoxide in kidney function: Is a little carbon monoxide good for the kidney? *Curr Pharm Biotechnol*. 2012 Sep 1. [Epub ahead of print]. PMID: 22201605
46. Stec DE, Drummond HA, Gousette MU, Storm MV, Abraham NG, Csongradi E. Expression of Heme Oxygenase-1 in Thick Ascending Loop of Henle Attenuates Angiotensin II-Dependent Hypertension. *J Am Soc Nephrol*. 2012 Feb 9. PMID: 22323644.
47. *Ge Y, *Gannon KP, Gousset M, Liu R, Murphey B, and Drummond HA. Impaired myogenic constriction of the renal afferent arteriole in a mouse model of reduced β ENaC expression. *American Journal of Physiology Renal Physiology*. *Am J Physiol Renal Physiol*. 2012 Jun;302(11):F1486-93. *Authors contributed equally. PMID: 22419697
48. Drummond HA. β ENaC is a molecular component of a VSMC mechanotransducer that contributes to renal blood flow regulation, protection from renal injury and hypertension. *Frontiers in Physiology, Membrane Physiology and Biophysics*. 2012 August; volume 3, article 341. Doi: 10.3389/phs.2012.00341.
49. Chung, WS, Weissman, JL, Farley J, and Drummond, HA. β ENaC is required for whole-cell mechanically-gated currents in renal vascular smooth muscle cells. *Am J Physiol Renal Physiol*. 304(12):F1428-37, 2013. PMID: 23552864
50. Stout JM, Gousset MU, Drummond HA, Gray W 3rd, Pruett BE, Stec DE. Sex-specific effects of heme oxygenase-2 deficiency on renovascular hypertension. *J Am Soc Hypertens*. 2013 PMID:23721883
51. Warrington JP, Coleman K, Skaggs C, Hosick PA, George EM, Stec DE, Ryan MJ, Granger JP, Drummond HA. Heme oxygenase-1 promotes migration and beta epithelial Na⁺ channel expression in cytotrophoblasts and ischemic placentas. *Am J Physiol Regul Integr Comp Physiol*. 2014 Feb 19. PMID: 24553299.
52. Warrington JP, Fan F, Murphey SR, Roman RJ, Drummond HA, Granger JP and Ryan MJ. Placental ischemia in pregnant rats impairs cerebral blood flow autoregulation and increases blood-brain barrier permeability. *Physiol Reports*. 2014, Aug 28;2(8). PMID:25168877.
53. Intapad S, Warrington JP, Spradley FT, Palei AC, Drummond HA, Ryan MJ, Granger JP, Alexander BT. Reduced uterine perfusion pressure induces hypertension in the pregnant mouse. *Am J Physiol Regul Integr Comp Physiol*. 307(11):R1353-7, 2014. PMID: 25298513
54. El-Khattouti A, Sheehan NT, Monico J, Drummond HA, Haikel Y, Brodell RT, Megahed M, Hassan M. CD133⁺ melanoma subpopulation acquired resistance to caffeic acid phenethyl ester-induced apoptosis is attributed to the elevated expression of ABCB5: Significance for melanoma treatment. *Cancer Lett*. 2014 Nov 18, S0304-3835(14). PMID: 254497
55. Gannon KP, McKey SE, Stec DE, Drummond HA. Altered myogenic vasoconstriction and regulation of whole kidney blood flow in the ASIC2 knockout mouse. *Am J Physiol Renal Physiol*. Feb 15;308(4):F339-48. 2015. PMID: 25520010
56. Drummond HA. Nontubular Epithelial Na⁺ channel proteins in cardiovascular regulation. *Physiological Reports*, 2015, 3(5):e12404-e12405. doi 10.14814/phy2.12404
57. Drummond HA and Stec DE. β ENaC acts as a mechanosensor in renal vascular smooth muscle cells that contributes to renal myogenic blood flow regulation, protection from renal injury and hypertension. *J Nephrology Res*. 1(1):1-9. 2015.
58. Warrington JP, Drummond HA, Granger JP, Ryan MJ. Placental ischemia-induced increases in brain water content and cerebrovascular permeability: role of TNF- α . *Am J Physiol Regul Integr Comp Physiol*. 2015 Dec 1;309(11):R1425-31. doi:10.1152/ajpregu.00372.2015. Epub 2015 Sep 23. PMID: 26400187

59. Hinds TD Jr, Burns KA, Hosick PA, McBeth L, Nestor-Kalinoski A, **Drummond HA**, AlAmodi AA, Hankins MW, Vanden Heuvel JP, Stec DE. [Biliverdin reductase A attenuates hepatic steatosis by inhibition of glycogen synthase kinase \(GSK\) 3 \$\beta\$ phosphorylation of serine 73 of peroxisome proliferator-activated receptor \(PPAR\) \$\alpha\$.](#) J Biol Chem. 2016 Oct 10. pii: jbc.M116.731703. [Epub ahead of print]. PMID: 27738106
60. Ferrão FM, Cardoso LHD, Drummond HA, Li XC, Zhuo JL, Gomes DS, Lara LS, Vieyra A, Lowe J. Luminal angiotensin II is internalized as a complex with AT₁R/AT₂R heterodimers to target endoplasmic reticulum in LLC-PK₁ cells. Am J Physiol Renal Physiol. 2017 May 3:ajprenal.00261.2016. doi: 10.1152/ajprenal.00261.2016. PMID: 28468964
61. Drummond HA, Xiang L, Chade AR, Hester R. Enhanced maximal exercise capacity, vasodilation to electrical muscle contraction, and hind limb vascular density in ASIC1a null mice. Physiol Rep. 2017 Aug;5(15). pii: e13368. doi: 10.14814/phy2.13368. PMID: 28784852

Abstracts

1. H.A. Drummond, Gebrmedhin, D. and Harder, D. DEG/ENaC Proteins: Components of a Vascular Mechanosensor. Council for High Blood Pressure, 2003,
2. M. Melo-Furtado and H.Drummond. Involvement of the MAPK pathway in aldosterone-induced down-regulation of ENaC proteins in sensory neurons. Gulf Coast Physiological Society, 2004.
3. H. Drummond, M. Melo-Furtado, D. Stec, K. Parker. Mechanosensitive ENaC proteins are involved in vascular smooth muscle migration. Gulf Coast Physiological Society, 2004.
4. H. Drummond, M. Melo-Furtado, D. Stec, K. Parker. Mechanosensitive ENaC proteins are involved in vascular smooth muscle migration. Experimental Biology, 2004.
5. Drummond HA, Parker KP, Stec DE. ENaC proteins are required for vascular smooth muscle cell migration. 58th Council for High Blood Pressure Research., 2005
6. Hall ME and Drummond HA. Mechanical strain regulates beta ENaC expression in vascular smooth muscle cells. Experimental Biology 2005.
7. Grifoni, S and Drummond HA. DEG/ENaC proteins are involved in vascular smooth muscle migration in wound healing. Experimental Biology 2005.
8. Jernigan NL and Drummond HA. DEG/ENaC proteins are required for myogenic constriction in mouse interlobar arteries. Experimental Biology 2005.
9. Furtado MM and Drummond HA. Neuronal expression of mechanosensitive ENaC proteins is regulated by NGF and may be required for neurite formation. Experimental Biology 2005.
10. Golanov EV, Drummond H, Clower B, Chen B. Brainstem epithelial sodium channels participate in cerebral blood flow regulation. Experimental Biology. 2005.
11. Grifoni SC, Drummond HA. ENaC proteins are required for vascular smooth muscle cell migration in wound healing. International Society of Hypertension. 2005
12. Grifoni SC and HA Drummond. ENaC proteins are required for vascular smooth muscle cell migration in wound healing. Council for High Blood Pressure. Washington DC Sept 2005.
13. Hamilton G, NL Jernigan and HA Drummond. Nerve Growth Factor regulation of Acid-Sensing Ion Channel 3 in vascular smooth muscle cells. Mississippi Academy of Sciences, Vicksburg, MS. February 2006.
14. Jernigan NL and HA Drummond. Suppression of endogenous β and γ ENaC abolishes myogenic vasoconstriction in mouse interlobar arteries. Experimental Biology. San Francisco, CA. April 2006.
15. Grifoni SC, NL Jernigan, G Hamilton, A Hoover, T Peters, HA Drummond. ASIC2 and 3 proteins are required for VSMC wound healing. Experimental Biology. San Francisco, CA. April, 2006.

16. NL Jernigan, KL Cockrell, J Speed, JP Granger, HA Drummond. Dietary sodium enhances the benzamil sensitive component of myogenic constriction in mesenteric vessels. Hypertension Society, 2006.
17. Gannon KP, L Galmiche, HA Drummond ASIC2 protein is required for pressure-induced constriction in mouse middle cerebral artery. Experimental Biology, 2007.
18. Grifoni SC and HA Drummond, Enhanced surface expression of ASIC2 inhibits VSMC migration. Experimental Biology, 2007.
19. Grifoni SC and Drummond HA. ASIC2 proteins are a negative regulator of vascular smooth muscle cell migration. Keystone Symposia on Migration. Taos, New Mexico. February 2008.
20. Kim P Gannon, Lauren G VanLandingham, Heather A Drummond. Downregulation of mechanosensitive β ENaC and γ ENaC in VSMCs in ASIC2 +/- mice. Experimental Biology. San Diego, CA. April 2008.
21. HA Drummond and DE Stec. Paradoxical increased blood pressure in a mouse model of reduced β ENaC. Jackson Cardiovascular Renal Meeting, Jackson, Mississippi, October 15-18, 2008
22. KP Gannon, L VanLandingham and HA Drummond., Altered pressure-induced constriction in a mouse model of reduced β ENaC. Jackson Cardiovascular Renal Meeting, Jackson, Mississippi, October 15-18, 2008
23. Grifoni, SC and Drummond, HA, Evidence of renal injury in a mouse model of reduced β ENaC. Jackson Cardiovascular Renal Meeting, Jackson, Mississippi, October 15-18, 2008
24. W.-S. Chung, J. Farley and H. Drummond., Extracellular acidosis activates ASIC-like channels in freshly isolated cerebral artery smooth muscle cells. Jackson Cardiovascular Renal Meeting, Jackson, Mississippi, October 15-18, 2008.
25. S. Elizabeth McKey, Matthew Burford, Kimberly Gannon, Samira Grifoni and Heather Drummond. Regulation of VSMC migration through association of SLP3 and ASIC2. Mechanotransduction in Physiology and Disease. January 18-23, 2009 Taos, NM
26. Kim P Gannon, Rumbidzayi Chiposi, Elizabeth McKey, Heather A Drummond. ASIC2 protein is required for pressure-induced constriction in mouse renal interlobar artery. Mechanotransduction in Physiology and Disease. January 18-23, 2009 Taos, NM
27. Thomas H. Adair and Heather A. Drummond. Benzamil decreases microvessel growth in rat aortic rings in vitro. Experimental Biology, April 18-22, 2009 New Orleans, LA
28. W.-S. Chung, J. Farley and H.A. Drummond. Extracellular acidosis activates ASIC-like channels in freshly isolated cerebral artery smooth muscle cells. Experimental Biology, April 18-22, 2009 New Orleans, LA
29. Samira de Campos Grifoni, Rumbidzayi Chiposi, Heather Drummond. Impaired renal blood flow autoregulation and renal damage in a mouse model of reduced β ENaC. Experimental Biology, April 18-22, 2009 New Orleans, LA
30. Kim Parker Gannon, Rumbidzayi Chiposi, Elizabeth McKey, Heather Drummond. ASIC2 protein is required for pressure-induced constriction in mouse renal interlobar artery. Experimental Biology, April 18-22, 2009 New Orleans, LA
31. Adair T Drummond HA. A role for β ENaC protein in microvessel formation," Experimental Biology, 2010, Anaheim, California. April 24, 2010.
32. Chung WE, Drummond HA. Acid-induced currents in freshly isolated cerebral artery smooth muscle cells are predominately conducted by ASIC1b," Experimental Biology, 2010, Anaheim, California. April 22, 2010.
33. Drummond HA, T Adair. A role for β ENaC protein in microvessel formation," Angiogenesis in Health and Disease, Keystone, Colorado. March 1, 2010.
34. Drummond HA. Role of β ENaC in vascular function. American Physiological Society, International Symposium on Aldosterone and the ENaC/Degenerin Family of Ion Channels. Asilomar, California, September 21, 2011.

35. Drummond HA, Monette Gousset, Ahmed Abu-Zaid, Mohammed Daklallah Jennifer L. Weisman, Beau Murphey and Robert Hester. ASIC1a opposes exercise induced hyperemia and maximal exercise capacity. *Experimental Biology* 2013
36. Warrington JP, George EM, Stec DE, Ryan MJ, Granger JP, Drummond HA. HO-1 induction increases β ENaC in ischemic placentas and cultured cytotrophoblasts. *Council for High Blood Pressure*, September 2013.
37. Coleman KD, Warrington JP, Stec DE, Granger JP, Drummond HA. Hemeoxygenase regulation of cytotrophoblast ENaC mediated migration. *Mississippi Academy of Sciences*, March 2014.
38. Warrington JP, Ryan MJ, Drummond HA, Granger JP. The role of TNF α in placental ischemia induced cerebrovascular abnormalities. *Experimental Biology*, 2014.
39. Intapad S, Warrington JP, Spradley FT, Palei A, Drummond HA, Ryan MJ, Granger JP, Alexander BA. A reduction in uterine perfusion pressures induces hypertension during pregnancy in the mouse. *Experimental Biology*, April 2014.
40. Drummond HA. Mechanisms of kidney injury in hypertension. Is there a role for VSMC β ENaC in protection against pressure-dependent renal injury? *International Society of Nephrology Nexus Symposium*, 2014. Brisbane, Australia, September 26, 2014.
41. AlAmodi AA., Peter A. Hosick, Heather A. Drummond, Terry D. Hinds, Jr and David E. Stec. Liver Specific Knockout of Biliverdin Reductase A (BVRA) Enhances High Fat Diet Induced Hepatic Steatosis and Type II Diabetes in Mice. *Experimental Biology*, Boston MA, 2015
42. Warrington JP, Fan F, LaMarca BB, Dechend R, Wallukat G, Roman RJ, Drummond HA, Granger JP, Ryan MJ Agonistic Autoantibodies to Angiotensin II Type I Receptor Contributes Partly to Placental Ischemia-induced Cerebrovascular Abnormalities. *Experimental Biology*, Boston MA, 2015
43. McLaurin D, Drummond HA. Exposure to urban particulate matter inhibits migration in trophoblasts and vascular smooth muscle cells. *Mississippi Academy of Sciences*, 2016.
44. β ENaC- γ ENaC-ASIC2 are components of a large signaling complex at the VSMC surface that includes stomatin, integrin and Trp proteins". *FASEB Summer Conference on Renal Hemodynamics*, June 2016.

Presentations

Special Presentations

“A molecular component of the arterial baroreceptor mechanotransducer”. *Baroreceptor and Cardiopulmonary Receptor Reflexes*, 2000 APS Conference, Iowa City, IA 52242.

“Mechanotransduction in smooth muscle”. *American Society of Hypertension*. New York, New York, May 16, 2003.

“DEG/ENaC Proteins: Components of a Vascular Mechanosensor.” *Gordon Conference on Mechanotransduction and Gravity Signaling in Biological Systems*, July 2003. H.A. Drummond, Gebremedhin, D. and Harder, D.

“DEG/ENaC Proteins: Components of a Vascular Mechanosensor” *Council for High Blood Pressure Research*, September 2003, Washington D.C. H.A. Drummond, Gebremedhin, D. and Harder, D.

“ENaC Expression and Potential Function in Vascular Smooth Muscle”, Telluride Research Conference, Epithelial Cell Biology and Physiology, Telluride, Colorado, July 26, 2005.

“ENaC Channels: Not Just for Sodium Transport Anymore”, Department of Physiology Seminar, University of Alabama at Birmingham, February, 2007.

“ENaC channels and the myogenic response of the renal vasculature”, FASEB Summer Research Conference, Renal Hemodynamics: Biomolecular Control Mechanisms Integrating Vascular and Tubular Function, Saxtons River, VT, July 10, 2007.

“Role of ENaC as a Mechanosensor”, American Society of Nephrology, November 4, 2007. San Francisco, CA.

“Degenerin Channels in Mechanotransduction. Pennsylvania State University Medical Center, Hershey, PA, February 4, 2008

“ENaC and Mechanotransduction”, Keystone Symposia on Mechanotransduction in Physiology and Disease, Taos, New Mexico, January 23-8, 2009.

“Paradoxical hypertension in a mouse model of reduced β ENaC” Department of Physiology, Emory University, June 4, 2009.

“Vascular degenerin proteins mediate renal myogenic constriction”. FASEB Summer Research Conference, Renal Hemodynamics, Saxtons River, VT, June 23, 2010.

“Degenerin Proteins in VSMC Function”, Dept of Cell Biology, University of Southern Mississippi, Hattiesburg, MS, October 1, 2010.

“Role of β ENaC in vascular smooth muscle function.” British Physiological Society, Durham University, Durham, United Kingdom, December 16, 2010.

“Role of β ENaC in vascular function.” American Physiological Society, International Symposium on Aldosterone and the ENaC/Degenerin Family of Ion Channels. Asilomar, California, September 21, 2011.

“Role of β ENaC in renal vascular function.” Oregon Health Sciences University, Portland, Oregon, Departments of Cardiology and Anesthesiology, January 17, 2012.

“Role of β ENaC in renal vascular function.” Experimental Biology 2013, Symposia on Mechanosensory Mechanisms in the Kidney, Boston, MA, April 22, 2013.

“Degenerin Proteins as Mechanotransducers”. Neurobiology and Anatomical Sciences, University of Mississippi Medical Center, Jackson, MS, September 9, 2014.

“Mechanisms of kidney injury in hypertension. Is there a role for VSMC β ENaC in protection against pressure-dependent renal injury?” International Society of Nephrology Nexus Symposium, 2014. Brisbane, Australia, September 26, 2014.

“Vascular Degenerins contribute to mechanotransduction and the control of renal vascular function and hemodynamics”. Southern Salt and Water Conference, Sarasota, Florida, December

6, 2014.

“ β ENaC- γ ENaC-ASIC2 are components of a large signaling complex at the VSMC surface that includes stomatin, integrin and Trp proteins”. FASEB Summer Conference on Renal Hemodynamics, June 20, 2016.

Other presentations

Department of Physiology Seminars

- 2003, May 7 “Molecules of mechanosensation”
- 2004, July 14 “Degenerins in vascular smooth muscle”
- 2004, April 26 “ENaC proteins in vascular smooth muscle cells”
- 2004, September 2 “Degenerin proteins and mechanotransduction in smooth muscle and sensory neurons”
- 2006, May 4 “Feeling the way through: degenerin proteins in VSMC migration”
- 2007, July 18 “Sensing tension between ENaC and ASIC”
- 2008, February 1 “Epithelial Na⁺ channels: role in ENaC myogenic control of blood vessels”
- 2009, September 2 “Molecular components of a vascular mechanosensor and their role in whole kidney blood flow autoregulation”
- 2010, July 7 “Molecules of mechanotransduction in blood vessels”
- 2011, February 16 “Degenerin proteins in vascular function”
- 2013, June 5 “Importance of bENaC as a mechanosensor in renal VSMCs. The final saga.”
- 2014, September 15 “Degenerin proteins”
- 2015, February 18 “The vascular mechanosome”
- 2016, July 6 “Degenerin Signaling”

Department of Pharmacology

- 2005 “Mechanosensors in smooth muscle and neurons”
- 2012 “Role of β ENaC as a mechanotransducer in renal VSMCs”

Neurobiology and Anatomical Sciences

- 2014 “Degenerin Proteins as Mechanotransducers.”

TEACHING (30% Effort)

Course Director

CONJ 660, 663 Course Director, Medical Scientist Research Program Lab Rotation, Fall 2016 - current

ID 710, Course Co-Director with David Stec, Research Tools in Molecular Biology, Spring 2016 - current

Lecturer

NSCI 703, Neurophysiology, Bodily Senses, 4 hours 2009-013

PHYS 625/725 Dental Physiology, 10 hrs, Respiratory Physiology 2009 – 2016

Mean overall lecture evaluation scores from last 3 years (out of 5.00):

2015- 2016 – 4.76

2014 - 2015 – 4.64

2013 - 2014 – 4.10

2012 - 2013 – 4.10

PHYS 625/725 Dental Physiology, 15 hrs, Cardiovascular Physiology, 2005 - 2008

PHYS 731 Renal and Body Fluid Physiology, 3 hours, ENaC in renal function, 2016

PHYS 717 Circulatory Physiology, 3 hours, Neural Control of the Circulation, 2016

Physiological Applications of Molecular Biology, 2016

- Protein Methodology, 3 hours
- Imaging, 3 hours

PHYS 708 Ethics, Communication and Survival Skills, 2 hours, 2005

ID 714 Professional Skills for Graduate Students and Post-Doctoral Fellows,

- Time Management, 2 hours, 2009, 2010, 2011, 2012, 2013
- Conflict Management, 2 hours, 2012, 2013

BIOCH 724 Research Tools in Molecular Biology, 1.5 hrs, Imaging/Microscopy

ID 727 Current Issues in Biomedical Research, 1.5 hr, Mechanotransducers, Spring 2012

ID 710 Molecular Techniques, 1.5 hr, Microscopy, Spring 2012

Program in Neuroscience, Journal Club, 1 hour, 2008

Program in Neuroscience, Seminar, 1 hour, 2008

Molecular Physiology, Physiology 704, 4 hours, 2004

Pre-doctoral and Post-doctoral Fellows Learning Seminars, 1 hour, 2004

Mentoring

Post-doctoral fellows

Marise Melo-Furtado, PhD. 2004-2005

Nikki Jernigan, Ph.D. 2004-2006

- Caroline Tum Suden Award from the American Physiological Society .Experimental Biology 2005
- August Krogh Young Investigator Award, Microcirculatory Society, Experimental Biology Meeting, 2006
- Porter Minority Fellowship Award from the American Physiological Society, 2004, 2005, 2006
- American Heart Association Post-Doctoral Fellowship Award
- NRSA Post-Doctoral Fellowship Award

Samira deCampos Grifoni, Ph.D. (2005, 2006, 2007, 2008, 2009, 2010)

- Cardiovascular Section Award from the American Physiological Society .Experimental Biology 2008
- Young Investigator Travel Award, Inter-American Society for Hypertension, 2007
- American Heart Association Post-Doctoral Fellowship Award

Wen-Shuo Chung, Ph.D. (2009, 2010, 2011, 2012)

- Caroline Tum Suden Award from the American Physiological Society .Experimental Biology 2011

Jeremy Duncan, Co-mentoring with Michael Ryan and Joey Granger, Post-doctoral fellow, 2016

Cecelia E. Perez, Supervised in development of MC4Rc antibody and sub-cloning of MC4Rc, cDNA into pEGFP-C1.

Junie P. Warrington, Co-mentored with Michael Ryan and Joey Granger, 2013, 2014, 2015, 2016

Graduate Students

Evelyn Ajelabi (First year rotation), 2005

Jeremy Freeman, 2 week Lab Rotation, First year Graduate Student 2009-2010

Kimberly Gannon (MD/PhD) 2005 – 2006, 2010

- Caroline Tum Suden/Frances Hellebrandt Award, American Physiological Society, Experimental Biology 2007
- Zweifach Graduate Student Travel Award, Microcirculatory Society, Experimental Biology, 2007

- American Heart Association, Pre-Doctoral Fellowship
- NIH, NINDS F30 Award (MD/PhD Fellowship) **First award of its kind to UMMC

John Clemmer, Laboratory Rotation, First year Graduate Student 2009

Joy Estes, Laboratory Rotation, First year Graduate Student Physiology, 2011

Victoria Wolf, 1 week Lab Rotation, First year Graduate Student 2014-2015

Gwen Davis, helped prepare for examination at the end of the first year, 2016

Adrian Eddy, 1 week Lab Rotation and month long Lab Rotation, First year Graduate Student 2015-2016

Erika Guise, 1 week Lab Rotation and month long Lab Rotation, First year Graduate Student 2015-2016

Preliminary Exam Committees

John Henry Dassinger, Graduate student, Department of Physiology, served on written and oral preliminary exam committee, 2014

Chunyu Shen, Ruisheng Liu Lab, Department of Physiology,

Ashley Newsome, MD/PhD student, Department of Physiology, 2016

Gwen Davis, PhD student, Department of Physiology, 2016

Dissertation Defense Committees

Dissertation Committee, Iqbal Massodi, Department of Biochemistry, 2008

Dissertation Committee Chair, Kimberly Gannon, Department of Physiology, 2009

Dissertation Committee, Yongfeng Liu, University of Otago, New Zealand, 2011

Medical Students

Michael Hall, M-4, 2004

Matthew Burford, Medical Scholars Research Program, M-1 Student, 2009

Olusola Isikalu, American Heart Association Medical Student Research, M-1 Student 2010

Summer Bailey, Medical Scholars Research Program, M-1 Student, 2010

Ahmed Abu-Ziad, Medical Student Researcher, Alfaisal University College of Medicine, 2011-3

Asma Al Najjar, Medical Student Researcher, Alfasail University, 2013

Faris Raja, Medical Student Researcher, Alfasail University, 2014

“Pre-Clinical Advisor” for M-1 and M-2 students.

2015-2016 - Ashton Walters, Natalie Ethridge, Cathy Chen, George Punecky, Naishal Patel, Matt McGuire

2014-2015 - Talyr Hall, Mary-Katherine Kerce, Bailey Hansen, Ashton Walters, Natalie Ethridge, Cathy Chen

Undergraduate Students

Hinda Ahmed, May 2003 – August 2003, Pharm D. Student, Creighton University

Toni Peters, May 2004 – August 2004, Undergraduate Student, Mississippi State University

Chaz Seyfarth, May 2004 – August 2004, Undergraduate Student, Mississippi State University

Sam Myers, MS State, Department of Physiology Summer Internship Program, 2004

Nancy Salloum, Summer Student, 2007

Toni Peters, Summer Student, 2007

Giana Egiwke, Summer Student 2008

Gina Hamilton, Tougaloo College and Jackson State University, Jackson, MS 2008, 2009

Mohammad Dhaklallah, Summer Undergraduate Research Program, Starkville Mississippi, Summer 2011

Courtney Skaggs, Summer Undergraduate Research Student, Mississippi College, 2013

Kayla Coleman, INBRE Student, Mississippi College, 2013
Skyler Gordon, Summer Undergraduate Research Student, Brown University, 2014
Douglas McLaurin, Summer Student, Inbre Program, Jackson State University, 2015

High School Students

Gina Hamilton, Murrah High School, Jackson, MS, 2004 - 2007
Ryan Hughes, Ridgeland High School, Ridgeland, MS, 2007 - 2010
Alyssa Swenson, Ridgeland High School, Ridgeland, MS, 2008 - 2010

SERVICE (30% Effort)

Professional Service

Institutional/Departmental Service

Director of the Confocal Imaging Core, 2004 - Present
Department of Physiology Seminar Director 2004 – 2006
Reviewer for Institutional Research Project grants, 2014, 2015
Judge of Oral Presentations for School of Medicine Research Day, April 8, 2014, 2015, 2016
Director of the Histology Core, 2014 - Present

Institutional Committees

Faculty Development Committee, 2004-2007
Neuroscience Curriculum Committee, 2008
Committee Member: Medical Scientist Research Program 2009 - 2014,
Member, QEP Assessment Committee for SACS Accreditation, 2011 - 2013
Committee Co-Chair: Medical Scientist Research Program 2015 - 2016

Service on Professional Society Committees

American Heart Association, Council on High Blood Pressure, Membership Committee 2004,
2005, 2006, 2007, 2008, 2009,
American Heart Association, Council on High Blood Pressure, Abstract Scorer, 2006-2008
American Physiological Society, Long Range Planning Committee, 2006, 2007
American Physiological Society, Joint Programming Committee, 2006, 2007
American Physiological Society, Governance Task Force, 2007
Committee Member, Women in Physiology, American Physiological Society, 2011, 2012, 2013
American Physiological Society Women in Physiology Committee, Tum Suden Award Abstract
Scorer, 2010 – 2013
American Physiological Society Women in Physiology Committee, Bodil-Schmidt Neilson
Award Selection Committee, 2011 – 2013
Graduate Women in Medical Sciences Committee, 2013-2014

Scientific Sessions Chaired

Scientific Session Co-chair: Council for High Blood Pressure-2003, Neural Mechanisms of
Hypertension
Chair Featured Topic on Epithelial Ion Channels, Experimental Biology, 2006, San Francisco,
CA. Worked with co-chair to select featured speaker, score abstracts and organize session.
Co-Chair, American Society for Nephrology, Philadelphia, PA 2008
Session Chair, Experimental Biology, American Physiological Society, Inflammatory
Mediators, Autoregulation, and Cardio-renal-Function, Session Chair, April 25,

2010

Editorial Board Member

American Journal of Physiology-Renal Physiology, 2005 - 2016
Frontiers in Renal Physiology, 2011
Hypertension, 2010-2012

Ad Hoc Reviewer for Journals

American Journal of Physiology, Heart and Circulatory Section
American Journal of Physiology, Integrative Section
American Journal of Physiology, Renal Section
Cellular and Molecular Neurobiology
European Journal of Pharmacology
European Journal of Physiology, Pflugers Archives
Faseb Journal
Hypertension
Journal of Applied Physiology
Journal of Diabetes
Journal of Neurophysiology
Journal of Biological Chemistry
Molecular Brain Research
Nature Medicine
Neuroscience
Proceedings of the National Academy of Sciences
Physiological Reports
Physiology
PLOSone

Grant Review Study Sections

American Heart Assoc., Southeastern/Ohio Valley, Peer Review Committee, 2004
Canadian Research Council Grants, 2006
At-large Reviewer for NIH Special Emphasis Panel, NIDDK, 2007
At-large Reviewer for NIH Study Section Neurotransporters, Receptors, and Calcium Signaling, 2007
Ad Hoc Reviewer, NIH, NINDS, 2008
Ad Hoc Reviewer, NIH, NIDDK, 2008
Marsden Grant. Reviewer, 2014
Wellcome Trust, Reviewer, Grant Proposal, December 15, 2009
American Heart Association, Innovative Research Grant Review Committee, 2014, 2015
Israel Science Foundation, 2016

Community Service

- Discovery U, Lab Observation/Rotations (12 hours), Madison Central High School Students, 2014-2015
- Discovery U, Lab Observation/Rotations (12 hours), Madison Central High School Students, 2015-2016
- Mississippi Phun Week, participated in respiratory function, Children's Museum, Nov, 2013.
- Mississippi Phun Week, participated in gastrointestinal function, Children's Museum, Nov, 2015.

- Mississippi Phun Week, Children's Museum, Nov, 2016.