

UNIVERSITY OF PENNSYLVANIA -SCHOOL OF MEDICINE
Curriculum Vitae

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William M. Armstead, Ph.D.

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Education:

1975-1979	B.A.	University of Pennsylvania (Biochemistry)
1980-1983	M.S.	Tulane University (Pharmacology)
1983-1985	Ph.D.	Tulane University (Pharmacology)

Postgraduate Training and Fellowship Appointments:

1985-1986	Postdoctoral Fellow/Instructor, Department of Pharmacology, Tulane University
1986-1988	Postdoctoral Fellow, Department of Physiology and Biophysics, University of Tennessee, Memphis, TN

Faculty Appointments:

1988-1990	Instructor, Department of Physiology and Biophysics, University of Tennessee, Memphis, TN
1990-1992	Assistant Professor, Department of Physiology and Biophysics, University of Tennessee, Memphis, TN
1992-1999	Assistant Professor, Departments of Anesthesia and Pharmacology, University of Pennsylvania; Department of Anesthesiology and Critical Care Medicine, The Children's Hospital of Philadelphia
1999-2009	Research Associate Professor, Departments of Anesthesia and Pharmacology, University of Pennsylvania
2009-present	Research Professor, Departments of Anesthesiology and Critical Care and Pharmacology, University of Pennsylvania
2014-present	Research Professor, Department of Systems Pharmacology and Translational Therapeutics

Administrative Appointments:

1997-1999	Director, Basic Science Research Department of Anesthesia The Children's Hospital of Philadelphia
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Awards, Honors and Membership in Honorary Societies:

1979	Phi Lambda Upsilon
1987	Sigma Xi
1994	Established Investigator Award of the American Heart Association
2003	Fellow, Cardiovascular Section of the American Physiological Society
2003	Fellow, Stroke Council of the American Heart Association

Memberships in Professional and Scientific Societies:

National Societies:

American Physiological Society
American Society of Pharmacology and Experimental Therapeutics
International Society of Cerebral Blood Flow and Metabolism
The Microcirculatory Society
The Neurotrauma Society
American Society of Anesthesiologists
Society of Neuroscience
Society for Neuroscience in Anesthesiology and Critical Care
Stroke Council, American Heart Association

International Scientific Grant Review Committees:

Neuron, Network for European Funding for Neuroscience Research: External Insights to the nervous system. Study Section member 2016 in Madrid
Catalan Agency for Health Technology Assessment and Research and the TV3 Marato Foundation of Catalonia, Spain, Study Section Member 2006

National Scientific Grant Review Committees:

Member, NIH ZRG1 ETTN-C (10) Small business: Clinical Neurophysiology Panel
Member, NINDS Special Emphasis Panel ZNS1 SRB-M (02) 2017-
Member, JPC-6/ CCCRP PTCRA Combat Casualty Care and TBI panel 2017-
Chair, AHA Brain I Study Section 2014-2016
Co-chair, AHA Brain I Study Section, 2012-2014
AHA-National Strategically Focused Prevention Research Network study section, 2014
NIH Special Emphasis Panel "US-China Collaborative Research", 2013
VA Neurobiology C Study Section, Permanent member 2007-2011, Ad Hoc 1998-2006
AHA Region II Brain Study Section, Permanent member 2008
AHA Region I Brain Study Section, Permanent member 2009-2017
NIH Acute Neural Injury and Epilepsy (ANIE), Ad Hoc member 2008-2009
NIH Developmental Brain Disorders Study Section Ad Hoc member 2005-2007
AHA– National, Brain 2 Study Section, Permanent Member 2001-2005

National Scientific Committees:

Member, Board of Directors of SNACC, 2014-present
Chair, Research Committee of Board of Directors of SNACC, 2014-present
Adjunct Member of the ASA Committee on Neuroanesthesia, 2014-2016
AHA/ASA International Stroke Conference Planning Committee; Chair, Experimental Methods section, 2009-2013
ASPET Cardiovascular Division Executive Board Member, 2002-2013
ASPET Co-Chair of Program Committee for Cardiovascular Division 2010-2013
Microcirculatory Society, Awards Committee, 2009-present
ASPET Cardiovascular Division Student/Post Doctoral Fellow Competition/Award Committee Member 2002-2010
National Neurotrauma Society, Abstract Review Committee Member 2002-present

Editorial Positions:

Editorial Board

2006-2012 American Journal of Physiology: Heart and Circulatory Physiology
 1998-2009 Microcirculation

Ad Hoc Reviewer for:

1987-present American Journal of Physiology
 1988-present Journal of Pharmacology and Experimental Therapeutics
 1989-present Journal of Cerebral Blood Flow and Metabolism
 1994-present Anesthesiology
 1994-present Brain Research
 1995-present Journal of Neurotrauma
 1995-present Stroke
 2002-present Molecular Psychiatry
 2002-present Journal of Neuroscience
 2003-present Pediatric Critical Care Medicine
 2004-present Neurocritical Care
 2004-present Neurosurgical Anesthesiology

Academic Committees at the University of Pennsylvania and Affiliated Hospitals:

1994-1999 Member, Admission Committee, Dept. of Anesthesiology, The Children's Hospital of Philadelphia
 1993-1999 Member, Research Committee, Dept. of Anesthesiology, The Children's Hospital of Philadelphia
 1992-present Member, The Graduate Group in Pharmacological Sciences, University of Pennsylvania
 1997-2000 Member, Institutional Animal Care and Use Committee, University of Pennsylvania
 1999-2000 Member, Search Committee seeking veterinarian for the University Laboratory Animal Resources Division, University of Pennsylvania
 2000-present Member, Institute of Neurological Sciences, University of Pennsylvania
 2006-present Member, Cardiovascular Institute, University of Pennsylvania
 2012-2015 Member, Post-Doctoral Committee for Rebecca Orndorff in IFEM, Univ of Penn
 2013-2016 Member, Thesis Committee for John O'Donnell, Pharmacology, Univ of Penn

Major Teaching at the University of Pennsylvania and Affiliated Hospitals:

Presented lectures in the Pharmacology Graduate Courses: Neuropharmacology
 Neurochemistry 510 and Pharmacology 570 Principles of Cardiovascular Pharmacology

Students Trained:**Undergraduate:**

1. Stacy Rebich
 2. Michael Wilderman
 3. Andrew Venteicher
 4. Galia Ben-Haim
 5. Alana Salvucci
 6. Amanda Jagolino
- Recipient of the Louis H. Castor Undergraduate Research Grant
 Recipient of the Rose Award

Students Trained: (Continued)

7. Shaji Philip
8. Jonathan Ford
9. John Willis Kiessling
Recipient of the Rose Award
10. Sarah Goldberg
11. Heather Kaczynski
12. Victor Curvello

Graduate

1. Jo El Schultz
Pharmacology Dept. Medical College of Wisconsin
Member, Doctoral Dissertation Committee

Medical:

1. David Furman, a Temple University student who spent the 1995 summer in the lab.
2. Miriam Kulkarni, a UMDNJ-New Brunswick student did research in the 2001 summer
3. Jennifer Kosty

Residents:

1. Leif-Erik Bohman, MD (Neurosurgery)

Critical Care Fellows:

1. Michael Thorogood, M.D.
2. Venkatramanan Shankar, M.D.
3. Thivakorn Kasemsri, M.D.
4. Abdullah Al-Turki, M.D.

Junior Faculty:

1. Mark I Rossberg, M.D.
2. Dimitry Baranov, M.D.
3. Mioara D. Manole, M.D.
Pediatric Emergency Medicine
Children's Hospital of Pittsburgh/University of Pittsburgh
Member, Advisory Committee for K08HD58798

Visiting Scholars from China

1. Su, Diansan, MD, Ph.D
2. Fang Ji, MD, Ph.D
3. Zhenhong Wang, MD, Ph.D

Lectures by Invitation (Previous 5 years)

2016 “Pressor choice to increase arterial pressure influences outcome in pediatric brain injury.” Department of Anesthesia, UTMB-Galveston

Bibliography:**Research Publications, Peer Reviewed:**

1. Voet, D., G. Bunick, and W.M. Armstead. The structure of model compounds for the association of tryptophan with nucleic acid bases in structural aspects of recognition and assembly in biological macromolecules. Ed., M. Balaban, J.L. Sussman, W. Traub, and A. Yonath. Balaban ISS, Rehobot and Philadelphia pp.559-566, 1981.
2. Armstead, W.M., H.L. Lipton, A.L. Hyman, and P.J. Kadowitz. Analysis of adrenergic responses in the mesenteric vascular bed of the cat. Evidence that vascular beta-2 adrenoceptors are innervated. *Can. J. Physiol. Pharmacol.* 62: 1470-1478, 1984.
3. Lipton, H.L., W.M. Armstead, A.L. Hyman and P.J. Kadowitz. Vasoconstrictor effects of leukotrienes C₄ and D₄ in the feline mesenteric vascular bed. *Prostaglandins* 27:233-243, 1984.
4. Armstead, W.M., H.L. Lipton, A.L. Hyman, and P.J. Kadowitz. Influence of nisoldipine on vascular resistance and vasoconstrictor responses in cats. *Am. J. Physiol.* 252:H816-H825, 1987.
5. Lipton, H.L., W.M. Armstead, A.L. Hyman, and P.J. Kadowitz. Characterization of the vasoconstrictor activity of indomethacin in the mesenteric vascular bed of the cat. *Prost. Leukotr. Med.* 27:81-91, 1987.
6. Lipton, H.L., W.M. Armstead, A.L. Hyman, and P.J. Kadowitz. Influence of calcium entry blockade on vasoconstrictor responses in feline mesenteric vascular bed. *Circ. Res.* 61:570-580, 1987.
7. Kadowitz, P.J., W.M. Armstead, H.L. Lipton, and A.L. Hyman. Inhibitory effects of diltiazem on mesenteric vasoconstrictor responses in the cat. *J. Pharmacol. Exp. Ther.* 244:84-90, 1988.
8. Mirro, R., W.M. Armstead, D.W. Busija, R. Green, and C.W. Leffler. Increasing ventilation pressure increases cortical subarachnoid CSF prostanoids in newborn pigs. *Ped Res.* 22:647-650, 1987.
9. Armstead, W.M., M. Pourcyrous, R. Mirro, C.W. Leffler, and D.W. Busija. Platelet activating factor: a potent constrictor of cerebral arterioles in newborn pigs. *Circ. Res.* 62: 1-7, 1988.
10. Armstead, W.M., R. Mirro, C.W. Leffler, and D.W. Busija. The role of prostanoids in the mediation of responses to KC404, a novel cerebrovasodilator. *J. Pharmacol. Exp. Ther.* 244:138-143, 1988.

Bibliography: (Continued)**Research Publications, Peer Reviewed:** (Continued)

11. Armstead, W.M. C.W.Leffler, D.W. Busija, DG. Beasley, and R. Mirro. Adrenergic and prostanoid mechanisms in the control of cerebral blood flow in hypotensive newborn pigs. *Am. J. Physiol.* 254: H671-677, 1988.
12. Armstead, W.M., R. Mirro, D.W. Busija, and C.W. Leffler. Postischemic generation of superoxide anion by newborn pig brain. *Am. J. Physiol.* 255: H401-H403, 1988.
13. Mirro, R., D.W. Busija, W.M. Armstead, and C.W. Leffler. Histamine dilates pial arterioles of newborn pigs through prostanoid production. *Am. J. Physiol.* 254: H1023-H1026, 1988.
14. Mirro, R., C.W. Leffler, W.M. Armstead, D.G. Beasley, and D.W. Busija. Indomethacin restricts cerebral blood flow during pressure ventilation of newborn pigs. *Ped. Res.* 24: 59-62, 1988.
15. Lovelady, G.K., R. Mirro, W.M. Armstead, D.W. Busija, and C.W. Leffler. Effect of 15-HETE on cerebral arterioles of newborn pigs. *Prostaglandins* 36: 507-513, 1988.
16. Armstead, W.M., R. Mirro, C.W. Leffler, and D.W. Busija. Acetylcholine produces cerebrovascular constriction through activation of muscarinic-1 receptors in the newborn pig. *J. Pharmacol. Exp. Ther.* 247: 926-933, 1988.
17. Armstead, W.M., R. Mirro, D.W. Busija, and C.W. Leffler. Vascular responses to vasopressin are tone dependent in the cerebral circulation of the newborn pig. *Circ. Res.* 64: 136-144, 1989.
18. Busija, D.W., W.M. Armstead, C.W. Leffler, and R. Mirro. Lipoxins A₄ and B₄ dilate cerebral arterioles of newborn pigs. *Am. J. Physiol.* 256: H468-H471, 1989.
19. Leffler, C.W., D.W. Busija, W.M. Armstead, R. Mirro, and D.G. Beasley. Ischemia alters cerebral vascular responses to hypercapnia and acetylcholine in piglets. *Ped. Res.* 25: 180-183, 1989.
20. Armstead, W.M., R. Mirro, C.W. Leffler, and D.W. Busija. Cerebral superoxide anion generation during seizures in newborn pigs. *J. Cereb. Blood Flow Metab.* 9: 175-179, 1989.
21. Leffler, C.W., D.W. Busija, D.G. Beasley, W.M. Armstead, and R. Mirro. Postischemic microvascular cerebral responses to norepinephrine and hypotension in newborn pigs. *Stroke* 20:541-546, 1989.
22. Mirro, R., W.M. Armstead, D.G. Beasley, and C.W. Leffler. Lumbar CSF eicosanoids in neonates. *Prostaglandins, Leukotrienes, and Essential Fatty Acids* 36:77-79, 1989.

Bibliography: (Continued)**Research Publications, Peer Reviewed:** (Continued)

23. Rogers, A.H., W.M. Armstead, R. Mirro, D.W. Busija, and C.W. Leffler. Influence of intraarterial norepinephrine on cerebral hemodynamics of newborn pigs. *Proc Soc. Exp. Biol. Med.* 191: 174-178, 1989.
24. Armstead, W.M., R. Mirro, C.W. Leffler, and D.W. Busija. Influence of endothelin on piglet cerebral microcirculation. *Am. J. Physiol.* 257:H707-710, 1989.
25. Mirro, R., W.M. Armstead, J. Mirro, Jr., D.W. Busija, and C.W. Leffler. Blood induced superoxide anion generation on the cerebral cortex of newborn pigs. *Am. J. Physiol.* 257: H1560-1564, 1989.
26. Leffler, C.W., D.W. Busija, R. Mirro, W.M. Armstead, and D.G. Beasley. Effects of ischemia on brain blood flow and oxygen consumption of newborn pigs. *Am. J. Physiol.* 257: H1917-1926, 1989.
27. Armstead, W.M., R. Mirro, D.W. Busija, and C.W. Leffler. Permissive role of prostanoids in acetylcholine-induced cerebral vasoconstriction. *J. Pharmacol. Exp. Ther.* 251:1012-1019, 1989.
28. Armstead, W.M., C.W. Leffler, D.W. Busija, and R. Mirro. Vasopressin and prostanoid mechanisms in the control of cerebral blood flow in hypotensive newborn pigs. *Am. J. Physiol.* 258: H408-H413, 1990.
29. Mirro, R., C.W. Leffler, W.M. Armstead, and D.G. Beasley. Increased airway leukotriene levels in infants with severe bronchopulmonary dysplasia. *AJDC* 144:160-161, 1990.
30. Minkes, R.K., H.L. Lipton, W.M. Armstead, K.A. Lepak, T.R. Higuera, D.B. McNamara, and P.J. Kadowitz. Influence of SQ29, 548 on vasoconstrictor responses in the mesenteric vascular bed of the cat. *European J. Pharmacol.* 179: 119-127, 1990.
31. Leffler, C.W., R. Mirro, W.M. Armstead, and R. Mirro. H₂O₂ effects on cerebral prostanoids and pial arteriolar diameter in piglets. *Am. J. Physiol.* 258:H1382-H1387, 1990.
32. Leffler, C.W., R. Mirro, W.M. Armstead, and D.W. Busija. Prostanoid synthesis and vascular responses to exogenous arachidonic acid following cerebral ischemia in piglets. *Prostaglandins* 40:241-248, 1990.
33. Leffler, C.W., D.W. Busija, W.M. Armstead, D.R. Shanklin, R. Mirro and O. Thelin. Activated oxygen and arachidonate effects on newborn cerebral arterioles. *Am. J. Physiol.* 259: H1230-H1238, 1990.
34. Mirro, R., C.W. Leffler, W.M. Armstead, and D.W. Busija. Pressure ventilation increases brain vascular prostacyclin production in newborn pigs. *Ped. Res.* 28: 609-612, 1990.

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35. Armstead, W.M., R. Mirro, D.W. Busija, and C.W. Leffler. Prostanoids modulate opioid cerebrovascular responses in newborn pigs. *J. Pharmacol. Exp. Ther.* 255: 1083-1089, 1990.
36. Mirro, R., C.W. Leffler, W.M. Armstead, and D.W. Busija. Positive pressure ventilation alters blood to brain and blood to CSF transport in neonatal pigs. *J. Appl. Physiol.* 70: 584-589, 1991.
37. Armstead, W.M., R. Mirro, D.W. Busija, D.M. Desiderio, and C.W. Leffler. Opioids in cerebrospinal fluid in hypotensive newborn pigs. *Circ. Res.* 68:922-929, 1991.
38. Armstead, W.M., R. Mirro, D.W. Busija, and C.W. Leffler. Opioid and prostanoid mechanisms in the control of cerebral blood flow in hypotensive newborn pigs. *J. Cereb. Blood Flow Metab.* 11:380-387, 1991.
39. Mirro, R., W.M. Armstead, D.W. Busija, and C.W. Leffler. Blood to brain transport after newborn cerebral ischemia/reperfusion injury. *Proc. Soc. Exp. Biol. Med.* 197:268-272, 1991.
40. Leffler, C.W., R. Mirro, C. Thompson, M. Shibata, W.M. Armstead, M. Pourcyrus, and O. Thelin. Activated oxygen species do not mediate hypercapnia-induced cerebral vasodilation in newborn pigs. *Am. J. Physiol.* 261:H335-H342, 1991.
41. Hsu, P., S. Zuckerman, R. Mirro, W.M. Armstead, and C.W. Leffler. Effects of ischemia/reperfusion on brain tissue prostanoids and leukotrienes in newborn pigs. *Prostaglandins* 42:557-569, 1991.
42. Armstead W.M., R. Mirro. S. Zuckerman, D.W. Busija, and C.W. Leffler. The influence of opioids on local cerebral glucose utilization in the newborn pig. *Brain Res.* 571: 97-102, 1992.
43. Armstead, W.M., .T. Crofton, L. Share, R. Mirro, S.L. Zuckerman, and C.W. Leffler. The influence of opioids on CSF vasopressin concentration in the newborn pig. *Am. J. Physiol.* 262:862-867, 1992.
44. Armstead, W.M., R. Mirro, S.L. Zuckerman, and C.W. Leffler. Vasopressin modulates cerebrovascular responses to opioids in newborn pigs. *J. Pharmacol. Exp. Ther.* 260: 1107-1112, 1992.
45. Armstead, W.M., R. Mirro, O.P. Thelin, M. Shibata, S.L. Zuckerman, D.R. Shanklin, D.W. Busija, and C.W. Leffler. Polyethylene glycol-superoxide dismutase and catalase attenuate the increased blood-brain barrier permeability that follows ischemia/reperfusion in the piglet. *Stroke*, 23:755-762, 1992.
46. Mirro, R., S. Karanth, W.M. Armstead, M. Shibata, and C.W. Leffler. Alterations in cerebrovascular reactivity after positive pressure ventilation. *Ped. Res.* 32:114-117, 1992.

Bibliography: (Continued)**Research Publications, Peer Reviewed:** (Continued)

47. Leffler, C.W., R. Mirro, W.M. Armstead, and M. Shibata. Topical arachidonic acid restores pial arteriolar dilation to hypercapnia of postischemic newborn pig brain. *Am. J. Physiol.* 263: H746-H751, 1992.
48. Mirro, R., L. Lowery-Smith, W.M. Armstead, M. Shibata, S.L. Zuckerman, and C.W. Leffler. Cerebral vasoconstriction in response to hypocapnia is maintained after ischemia/reperfusion injury in newborn pigs. *Stroke.* 23:1613 -1616, 1992.
49. Armstead, W.M., R. Mirro, M. Shibata, and C.W. Leffler. Prostanoids modulate opioid-induced increases in CSF vasopressin concentration. *Am. J. Physiol.* 263: H1670-H1674, 1992.
50. Armstead, W.M., R. Mirro, S. L. Zuckerman, M. Shibata, D. R. Shanklin, and C. W. Leffler. Transforming growth factor β attenuates ischemia-induced alterations in cerebrovascular responses. *Am. J. Physiol.* 264: H381-H385, 1993.
51. Leffler, C.W., C. Thompson, W.M. Armstead, R. Mirro, M. Shibata, D.W. Busija, and D.R. Shanklin. Superoxide scavengers do not prevent ischemia-induced alteration of cerebral vasodilation in piglets. *Ped. Res.* 33:164-170, 1993.
52. Leffler, C.W., R. Mirro, M. Shibata, H. Parfenova, W.M. Armstead, and S. Zuckerman. Effects of indomethacin on cerebral vasodilation to arachidonic acid and hypercapnia correlate in newborn pigs. *Ped. Res.* 33: 609-614, 1993.
53. Tong, S.H., Parfenova, M. Shibata, S. Zuckerman, W.M. Armstead, and C.W. Leffler. Pituitary adenylate cyclase activating polypeptide dilates piglet cerebral arterioles. *Proc. Soc. Exp. Biol. Med.* 203: 343-347, 1993.
54. Mirro, R., L.J. Pharris, W.M. Armstead, M. Shibata, and C.W. Leffler. Effects of indomethacin on newborn pig pial arteriolar response to PCO_2 . *J. Appl. Physiol.* 75: 1300-1305, 1993.
55. Shibata, M., R. Mirro, W.M. Armstead, and C.W. Leffler. Actinomycin D blocks interleukin- 1α -induced pial arteriolar dilation and increased prostanoid production in newborn pigs. *Brain Res. Bull* 33 (4) 404-409, 1994.
56. Leffler, C.W., R. Mirro, W.M. Armstead, and M. Shibata. Light/dye microvascular injury selectively eliminates hypercapnia-induced pial arteriolar dilation in newborn pigs. *Am. J. Physiol.* 266: H623-H630, 1994.
57. Zuckerman, S.L., R. Mirro, W.M. Armstead, M. Shibata and C.W. Leffler. Indomethacin reduces ischemia-induced alteration of blood-brain barrier transport in piglets. *Am. J. Physiol.* 266: H2198-2203, 1994.

Bibliography: (Continued)**Research Publications, Peer Reviewed:** (Continued)

58. Armstead, WM, SL Zuckerman, M. Shibata, H Parfenova, and CW Leffler. Different pial arteriolar responses to acetylcholine in the newborn and juvenile pig. *J Cereb Blood Flow Metab*, 14: 1088-1095, 1994.
59. Armstead, W.M., CD Kurth. The role of opioids in newborn pig fluid percussion brain injury. *Brain Res* 660: 19-26, 1994.
60. Armstead, W.M., C.D. Kurth. Different cerebral hemodynamic responses following fluid percussion brain injury in the newborn and juvenile pig. *J. Neurotrauma*, 11: 487-497, 1994.
61. Armstead, W.M. Opioids and nitric oxide contribute to hypoxia-induced pial artery vasodilation in the newborn pig. *Am. J. Physiol.*, 268: H226-H232, 1995.
62. Rebich, S., J. Devine, and W.M. Armstead. The role of nitric oxide and cAMP in β adrenoceptor-induced pial artery vasodilation. *Am. J. Physiol.*, 268: H1071-H1076, 1995.
63. Devine, J., and W.M. Armstead. The role of nitric oxide in opioid-induced pial artery vasodilation. *Brain Res.* 675:257-263, 1995.
64. Armstead, W.M. The role of nitric oxide and cyclic AMP in prostaglandin-induced pial artery vasodilation. *Am. J. Physiol.* 268: H1436-H1440, 1995.
65. Armstead, W.M. The contribution of delta₁ and delta₂ opioid receptors to hypoxia-induced pial artery dilation in the newborn pig. *J Cereb Blood Flow and Metab.* 15: 539-546, 1995.
66. Armstead, W.M. Relationship between opioids and activation of phospholipase C and protein Kinase C in brain injury induced pial artery vasoconstriction. *Brain Res.* 689: 183-188, 1995.
67. Shankar, V., and W.M. Armstead. Opioids contribute to hypoxia-induced pial artery dilation through activation of ATP-sensitive K⁺ channels. *Am. J. Physiol.* 269: H997-H1002, 1995.
68. Thorogood, M., and W.M. Armstead. Influence of brain injury on opioid-induced pial artery vasodilation. *Am. J. Physiol.*, 269:H1776-H1783, 1995.
69. Armstead, W.M. The role of ATP-sensitive K⁺ channels in cGMP-mediated pial artery vasodilation. *Am. J. Physiol.*, 270:H423-H426, 1996.
70. Wilderman, M.J., W.M. Armstead: Relationship between nitric oxide and opioids in hypoxia-induced pial artery vasodilation. *Am. J. Physiol.*, 270: H860-H874, 1996.
71. Thorogood, M. and W.M. Armstead. Influence of PEG-SOD/catalase on altered opioid-induced pial artery dilation following brain injury. *Anesthesiology*, 84:614-625, 1996.

Bibliography: (Continued)**Research Publications, Peer Reviewed:** (Continued)

72. Armstead, W.M. Role of vasopressin in altered pial artery responses to dynorphin and β endorphin following brain injury. *J. Neurotrauma*, 13:115-123, 1996.
73. Armstead, W.M. Influence of brain injury on vasopressin induced pial artery vasodilation: role of superoxide anion. *Am. J. Physiol.*, 70:H1272-H1278, 1996.
74. Armstead, W.M. Relationship between opioids and prostaglandins in hypoxia-induced vasodilation of pial arteries in the newborn pig. *Proc. Soc. Exp. Biol and Med.*, 212:135-141, 1996.
75. Armstead, W.M. cGMP and cAMP in prostaglandin induced pial artery dilation and increased CSF opioid concentration. *Am. J. Physiol.*, 271:H166-H172, 1996.
76. Rossberg, M.I., and W.M. Armstead. Relationship between vasopressin and opioids in hypoxia induced pial artery vasodilation. *Am. J. Physiol.*, 271:H521-H527, 1996.
77. Zuckerman S. L., W. M. Armstead, P. Hsu, M. Shibata, and C. W. Leffler. Age dependence of cerebrovascular response mechanisms in domestic pigs. *Am J. Physiol* 271:H535-H540, 1996.
78. Wilderman, M.J. and W.M. Armstead. Influence of cAMP on CSF opioid concentration: Role in cAMP-induced pial artery dilation. *Eur. J. of Pharmacol*, 309:243-249, 1996.
79. Armstead, W.M. Role of endothelin in pial artery vasoconstriction and altered responses to vasopressin following brain injury. *J Neurosurg.*, 85:901-907, 1996.
80. Armstead, W.M. Role of nitric oxide, cyclic nucleotides, and the activation of ATP-sensitive K^+ channels in the contribution of adenosine to hypoxia-induced pial artery dilation. *J. Cerebral Blood Flow and Metabolism*, 17:100-108, 1997.
81. Kasemsri T. and WM Armstead. Endothelin production links superoxide generation to altered opioid-induced pial artery vasodilation following brain injury. *Stroke*, 28:190-197, 1997.
82. Armstead W.M. Role of activation of calcium sensitive K^+ channels and cAMP in opioid-induced pial artery dilation. *Brain Research*, 747:252-258, 1997.
83. Wilderman, M.J., and WM Armstead. Role of PACAP in the relationship between cAMP and opioids in hypoxia-induced pial artery vasodilation. *Am J Physiol*, 272:H1350-H1358, 1997.
84. Rossberg, M.I., and WM Armstead. Role of cyclic nucleotides in vasopressin-induced piglet pial artery dilation and opioid release. *Pediatric Res*, 41:498-504, 1997.

Bibliography: (Continued)**Research Publications, Peer Reviewed:** (Continued)

85. Armstead W.M. Role of activation of calcium sensitive K^+ channels in nitric oxide and hypoxia induced pial artery vasodilation. *Am J Physiol*, 272:H1785-H1790, 1997.
86. Armstead W.M. Role of impaired cAMP and calcium sensitive K^+ channel function in altered cerebral hemodynamics following brain injury. *Brain Res.*, 768:177-184, 1997.
87. Wilderman M.J. and W.M. Armstead. Role of neuronal nitric oxide synthase in the relationship between nitric oxide and opioids in hypoxia induced pial artery dilation. *Am J. Physiol*, 273:H1807-H1815, 1997.
88. Armstead W.M. Brain injury impairs ATP-sensitive K^+ channel function in piglet cerebral arteries. *Stroke*, 28:2273-2280, 1997.
89. Kasemsri T. and W.M. Armstead. Endothelin impairs ATP sensitive K^+ channel function after brain injury. *Am J. Physiol*, 273:H2639-H2647, 1997.
90. Wilderman M.J. and W.M. Armstead. Role of endothelial nitric oxide synthase in hypoxia induced pial artery dilation. *J Cereb Blood Flow and Metab*, 18:531-538, 1998.
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None

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16. Armstead WM, Vavilala, MS. Age and Sex Differences In Hemodynamics In a Large Animal Model of Brain Trauma. Book chapter in "Vascular Mechanisms in CNS Trauma" Eng Lo editor ,pp 269-284, 2013.
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PAST GRANT SUPPORT

NAME **William M. Armstead, Ph.D.**

DEPARTMENT **Anesthesia**

DATE May 2018

<u>Name of Grant</u>	<u>Period of Award</u>	<u>Grant Category</u>	<u>Role in Grant**</u>	<u>% Effort</u>	<u>Funding Source</u> <u>Direct Cost</u>	<u>Current Annual</u>	<u>Additional Comments</u>
1. Opioids and Cerebral Hemodynamics	1989-1994	FG	PI	80%	NIH R29 HL42939	\$70,000	First Award
2. Cellular Aspects of Opioid Induced Influence on Cerebral Hemodynamics	1993-1994	PG	PI	Contributed	Research Foundation of University of Pennsylvania	\$14,000	
3. Opioids and Cerebral Hemodynamics in Traumatic Brain Injury	1993-1995	PG	PI	Contributed	Foerderer Fund for Excellence	\$36,400	
4. Role of opioids in Fluid Percussion Brain Injury	1994-1995	PG	PI	Contributed	American Heart Association – SEPA Affiliate Grant-in-Aid	\$36,190	
5. Cellular Aspects of Opioid-Induced Influences on the Cerebral Circulation	1994-1999	PG	PI	70%	American Heart Association Established Investigator Award	\$55,000	

*For **Grant Category**, use code in bold from the following menu:

- | | | | |
|------------|---|-----------|--|
| R01 | NIH R01 | CT | Clinical Trials |
| PP | NIH Program Project, Center or Core Grants | TG | Training Grants |
| FG | Federal Grants - Other (including other individual NIH grants and grants from VA, NSF, Dept. of Energy, etc.) | IG | Industrial Grants (including pharmaceutical) |
| | | PG | Private Foundation Grants (including internal Penn grants) |
| | | O | Other |

** For program projects, specify whether PI, co-leader or project leader. For center, core and training grants, similarly specify your role.

*** Include any additional, brief information. For clinical trials, for example, specify if multicenter or single center and indicate role of Penn site. Explain any grants in **Other** category.

If space is needed for more entries, use an additional sheet.

PAST GRANT SUPPORT

NAME William M. Armstead, Ph.D.

DEPARTMENT Anesthesia

DATE May 2018

<u>Name of Grant</u>	<u>Period of Award</u>	<u>Grant Category*</u>	<u>Role in Grant**</u>	<u>% Effort</u>	<u>Funding Source</u>	<u>Current Annual Direct Cost</u>	<u>Additional Comments***</u>
6. Opioids and Hypoxic Pial Artery Dilation	1999-2000	PG	PI	Contributed	Research Foundation of University of PA	\$31,500	
7. K Channels and Cerebral Hemodynamics After Brain Injury	1999-2000	PG	PI	4%	Grant-in-Aid American Heart Assoc PA, DE Affiliate	\$40,706	
8. Role of Opioids in Fluid Percussion Brain Injury	1995-2000	RO1	PI	20%	NIH RO1 NS34932	\$106,914	
9. Opioids and fluid Percussion brain injury	2001-2003	PG	PI	20%	AHA-PA, DE Affiliate Grant-in-Aid	\$ 45,455	
10.K Channels and Cerebral Hemodynamics After Brain Injury	2000-2005	RO1	PI	40%	NIH RO1 NS36983	\$175,000	
	2005-2006	Supplement	PI	32%		\$ 45,00	

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- | | | | |
|-----|---|----|--|
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PAST GRANT SUPPORT

NAME **William M. Armstead, Ph.D.**

DEPARTMENT **Anesthesia**

DATE **May 2018**-----

<u>Name of Grant</u> <u>Comments</u>	<u>Period of Award</u>	<u>Grant Category</u>	<u>Role in Grant**</u>	<u>% Effort</u>	<u>Funding Source</u>	<u>Current Annual</u> <u>Direct Cost</u>	<u>Additional</u>
11. tPA and hypoxic/ischemic brain injury	2005-2006	PG	PI	contributed	Research Foundation, Univ of Pennsylvania	\$36,592	
12. Animal model testing of Shunt Check diagnostic device	2007-2008	O	PI	2%	NeuroDiagnostic Devices	\$5,951	
13. Plasminogen activators and cerebral ischemic injury	2007-2009	RO1	PI	Contributed	NIH RO1 NS53410 Administrative Supplement	\$50,000	
14. tPA in traumatic Brain Injury	2006-2011	RO1	Co-Investigator	5%	NIH HL77760	\$225,000	

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- | | |
|---|--|
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| | O Other |

** For program projects, specify whether PI, co-leader or project leader. For center, core and training grants, similarly specify your role.

*** Include any additional, brief information. For clinical trials, for example, specify if multicenter or single center and indicate role of Penn site. Explain any grants in **Other** category.

If space is needed for more entries, use an additional

PAST GRANT SUPPORT

NAME **William M. Armstead, Ph.D.** DEPARTMENT **Anesthesia** DATE **February 2018**-----

<u>Name of Grant</u>	<u>Period of Award</u>	<u>Grant Category</u>	<u>Role in Grant**</u>	<u>% Effort</u>	<u>Funding Source</u>	<u>Current Annual</u>	<u>AdditionalComments</u>
15. Plasminogen activators and cerebral ischemic injury	2006-2011, no cost extension 2011-2012	FG	PI	40	NIH RO1 NS53410	\$218,745	
16. Plasminogen activators and NMDA after brain injury	2008-2013 no cost extension 2013-2014	FG	PI	40	NIH RO1 HD57355	\$201,960	
17. Developmental endothelial locus-1 (Del-1) is a hemostatic factor in thrombotic stroke (Bdeir)	3/1/2015-2/28/2017	FG	Co-Investigator	5	NIH R21NS091793	<u>Direct Cost</u> \$150,000	
18. The Moody Project for Brain Injury (DeWitt)	7/1/2014-12/31/16	PG	Consultant	20	Moody Foundation	\$42,031	

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		PG	Private Foundation Grants (including internal Penn grants)
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If space is needed for more entries, use an additional

PAST GRANT SUPPORT

NAME William M. Armstead, Ph.D. DEPARTMENT Anesthesia DATE May 2018-----

<u>Name of Grant</u>	<u>Period of Award</u>	<u>Grant Category</u>	<u>Role in Grant**</u>	<u>% Effort</u>	<u>Funding Source</u>	<u>Current Annual</u>	<u>AdditionalComments</u>
19. The Moody Project for Brain Injury (DeWitt)	1/1/17-12/31/17	PG	Co-Investigator	20%	Moody Foundation	\$240,184	
20. Drug Delivery by carrier erythrocytes (Muzykantov)	1/1/14-12/31/17	FG	Co-Investigator	10%	NIH HL121134	\$346,846	

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- | | |
|---|--|
| R01 NIH R01 | CT Clinical Trials |
| PP NIH Program Project, Center or Core Grants | TG Training Grants |
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| | PG Private Foundation Grants (including internal Penn grants) |
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*** Include any additional, brief information. For clinical trials, for example, specify if multicenter or single center and indicate role of Penn site. Explain any grants in **Other** category.

If space is needed for more entries, use an additional

CURRENT GRANT SUPPORT

NAME OF FACULTY MEMBER **William M. Armstead, Ph.D.** DEPARTMENT **Anesthesia** DATE **May 2018**

<u>Name of Grant</u>	<u>Period of Award</u>	<u>Grant Category</u>	<u>Role in Grant**</u>	<u>% Effort</u>	<u>Funding Source</u>	<u>Current Annual Direct Cost</u>	<u>Additional Comments</u>
1. Pressor choice influences protection of autoregulation in brain injury (Armstead)	9/1/15-8/31/20	R01	PI	40%	NIH RO1NS090998	\$229,476	
2. Vasoactive agents and cerebral outcomes in brain injury (Vavilala)	9/1/15-9/20/18 (NCE)	FG	Co-Investigator	10%	NIH R21NS095321	\$20,184	
3. Inhaled nitric oxide and brain outcomes after pediatric traumatic brain injury (Armstead)	3/13/17-3/12/18 (NCE 6/30/18)	IG	PI	15%	Mallinckrodt Pharmaceuticals	\$159,596	
4. Astroglial glutamate transporters calcium and mitochondria (Robinson)	7/1/17-6/30/18	FG	Co-Investigator	5%	NIH 2R56NS077773-05A1 subcontract	\$14,809	
5. The Moody Project for Brain Injury (DeWitt)	1/1/18-12/31/19	PG	Co-Investigator	30%	Moody Foundation	\$244,911	

PENDING GRANT SUPPORT

NAME OF FACULTY MEMBER	William M. Armstead, Ph.D.		DEPARTMENT	<u>Anesthesia</u>		DATE	May 2018
<u>Name of Grant</u>	<u>Period of Award</u>	<u>Grant Category*</u>	<u>Role in Grant**</u>	<u>% Effort</u>	<u>Funding Source</u>	<u>Current Annual Direct Cost</u>	<u>Additional Comments***</u>
1. Pressor choice influences protection of autoregulation in brain injury (Armstead)	6/1/18-5/31/19	FG	PI	10%	RO1NS107283 RFA Admini-Strative Supplement	\$62,112	
2. Vascular delivery of nanocarriers by erythrocytes (Muzykantov)	7/1/18-6/30/23	FG	Co-Investigator	10%	RO1HL143806	\$508,690 percentile: 9	
3) Astroglial glutamate transporters, calcium and mitochondria	9/1/18-8/31/23	FG	Co-Investigator	5%	RO1NS106693	\$14,809	

*For Grant Category, use code in bold from the following menu:20

R01	NIH R01	CT	Clinical Trials
PP	NIH Program Project, Center or Core Grants	TG	Training Grants
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		PG	Private Foundation Grants (including internal Penn grants)
		O	Other

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Other Contributions to Clinical Research

Name William M. Armstead

Department Anesthesia

<u>Name of Trial</u>	<u>Sponsor</u>	<u>Status</u> active/ complete	<u>Role</u> Local P.I., patient recruiter	<u>Name of National PI and</u> <u>Affiliation</u>	<u>No. Patients</u> recruited by candidate	<u>Total N of</u> <u>study</u>
N/A						