Barclay Morrison III, Ph.D.

Professor of Biomedical Engineering

Curriculum Vitae

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A. Field of Specialization

Traumatic Brain Injury Biomechanics, Prevention, and Treatment

Traumatic brain injury results in approximately 50,000 deaths and 85,000 permanently disable persons per year in the United States with an estimated primary care cost of $76 billion per year. The clinical situation is quite dire as there are no drug treatments which target the underlying pathobiology of TBI. This profound need for improvements in the prevention and treatment of TBI is the driving force behind my research. My long term goal is to understand the consequences of mechanical forces on the most complex system of the human body, the brain, and to develop strategies to mitigate and perhaps reverse these injurious effects. My research explores the specific cellular, molecular, and metabolic effects of injury on brain cells in response to precisely controlled biomechanical stimuli. My research program has three main focus areas:

1) Improvement of prevention strategies through development of critical biomechanical data for the living brain
2) Identification of novel treatment options by understanding the post-traumatic pathobiology in greater detail
3) Engineering new research tools to enhance studies in the first two areas

B. Academic Training

B.1 Educational Background

1988 -1992 Johns Hopkins University, Baltimore, MD
B.S., Biomedical Engineering

1992-1994 University of Pennsylvania, Philadelphia, PA
M.S.E., Bioengineering

1994-1999 University of Pennsylvania, Philadelphia, PA
Ph.D., Bioengineering

Dissertation: "Differential Genomic Expression after Mechanical Injury of Organotypic Brain Slice Cultures: An *In Vitro* Model of Traumatic Brain Injury" (Published)

Sponsor: Tracy K. McIntosh, Ph.D.

B.2 Academic Honors and Fellowships

1993-1997 Ashton Fellowship, University of Pennsylvania, Philadelphia, PA

1999 The S.R. Pollack Award for Excellence in Graduate Bioengineering Research, University of Pennsylvania, Philadelphia, PA

1999 Biomedical Engineering Society Graduate Student Research Award

1999 First Place, National Neurotrauma Society Student Competition

2006 The Kim Award for Student-Faculty Involvement, Fu Foundation School of Engineering and Applied Science, Columbia University, New York, NY

C. Positions Held since Final Degree

1999-1999	Post-doctoral Fellow, Department of Neurosurgery, University of Pennsylvania, Philadelphia, PA **Mentor**: Tracy K. McIntosh, Ph.D.
2000-2002	Post-doctoral Fellow, Clinical Neurosciences Department, Southampton University, UK **Mentor**: Lars E. Sundstrom, Ph.D.
2003-2008	Assistant Professor of Biomedical Engineering, Columbia University, NY
2004-	Director, Neurotrauma and Repair Laboratory, Columbia University, NY
2008-2012	Associate Professor (untenured),Biomedical Engineering, Columbia University, NY
2012-2016	Associate Professor, Biomedical Engineering, Columbia University, NY
2012-2014	Vice Chair, Biomedical Engineering, Columbia University, NY
2014-	Vice Dean of Undergraduate Programs, Fu Foundation School of Engineering and Applied Science, Columbia University, NY
2016-	Professor, Biomedical Engineering, Columbia University, NY

D. Publications

(indicates Morrison as corresponding author; underline indicates Morrison's mentees; **bold number** indicates published while at Columbia; in Morrison's field, the senior author is either first or last; T publication derived from thesis; R undergone stringent editorial review by peers; I invited and carries special prestige and recognition; S published with a student; P published with a post-doc; C published with faculty colleagues; as of April 24, 2018, ISI citation metrics: total citations 2676, h index 26; Google Scholar citation metrics: total citations 4373, h index 33)*

D.1 Doctoral Thesis

"Differential Genomic Expression after Mechanical Injury of Organotypic Brain Slice Cultures: An *In Vitro* Model of Traumatic Brain Injury", (1999), *University of Pennsylvania*

D.2 Full-length, Peer Reviewed Publications

1. (TR) **Morrison III, B.**, Meaney, D.F., and McIntosh, T.K., *Mechanical characterization of an in vitro device to quantitatively injure living brain tissue.* Ann.Biomed.Eng., 1998. **26**: p. 381-90.
2. (TR) **Morrison III, B.**, Saatman, K.E., Meaney, D.F., and McIntosh, T.K., *In vitro central nervous system models of mechanically induced trauma: A review.* J.Neurotrauma, 1998. **15**: p. 911-28.
3. (TR) O'Dell, D.M., Raghupathi, R., Crino, P.B., **Morrison III, B.**, Eberwine, J.H., and McIntosh, T.K., *Amplification of mRNAs from single, fixed, TUNEL-positive cells.* BioTechniques, 1998. **25**: p. 566-8.

4. (TR) **Morrison III, B.**, Eberwine, J.H., Meaney, D.F., and McIntosh, T.K., *Traumatic injury induces differential expression of cell death genes in organotypic brain slice cultures determined by complementary DNA array hybridization.* Neurosci., 2000. **96**: p. 131-9.
5. (TR) **Morrison III, B.**, Meaney, D.F., Margulies, S.S., and McIntosh, T.K., *Dynamic mechanical stretch of organotypic brain slice cultures induces differential genomic expression: Relationship to mechanical parameters.* J.Biomech.Eng., 2000. **122**: p. 224-30. (*Best Paper Award in the journal for that year*)
6. (R) **Morrison III, B.**, Pringle, A.K., McManus, T., Ellard, J., Bradley, M., Signorelli, F., Iannotti, F., and Sundstrom, L.E., *L-arginyl-3,4-spermidine is neuroprotective in several in vitro models of neurodegeneration and in vivo ischaemia without suppressing synaptic transmission.* Brit.J.Pharm., 2002. **137**: p. 1255-68.
7. (R) Cater, H.L., Chandratheva, A., Benham, C.D., **Morrison III, B.**, and Sundstrom, L.E., *Lactate and glucose as energy substrates during, and after, oxygen deprivation in rat hippocampal acute and cultured slices.* J.Neurochem., 2003. **87**: p. 1381-90.
8. (RC) ***Morrison III, B.**, Cater, H.L., Wang, C.B., Thomas, F.C., Hung, C.T., Ateshian, G.A., and Sundstrom, L.E., *A tissue level tolerance criteria for living brain developed with an in vitro model of traumatic mechanical loading.* Stapp Car Crash J., 2003. **47**: p. 93-105. (*Best paper award in the journal for that year*)
9. (R) Pringle, A.K., **Morrison III, B.**, Bradley, M., Iannotti, F., and Sundstrom, L.E., *Characterisation of a novel class of polyamine-based neuroprotective compounds* Naunyn-Schmiedeberg's Arch.Pharm., 2003. **368**: p. 216-24.
10. (R) Sundstrom, L., **Morrison III, B.**, Bradley, M., and Pringle, A., *Organotypic cultures as tools for functional screening in the CNS.* Drug Discov.Today, 2005. **10**: p. 993-1000.
11. (R) *Cater, H.L., Sundstrom, L.E., and **Morrison III, B.**, *Temporal development of hippocampal cell death is dependent on tissue strain but not strain rate.* J.Biomech., 2006. **39**: p. 2810-8.
12. (R) ***Morrison III, B.**, Cater, H.L., Benham, C.D., and Sundstrom, L.E., *An in vitro model of traumatic brain injury utilising two-dimensional stretch of organotypic hippocampal slice cultures.* J.Neurosci.Meth., 2006. **150**: p. 192-201.
13. (RC) Cater, H.L., Gitterman, D.P., Davis, S.M., Benham, C.D., **Morrison III, B.**, and Sundstrom, L.E., *Stretch-induced injury in organotypic hippocampal slice cultures reproduces in vivo post-traumatic neurodegeneration: Role of glutamate receptors and voltage-dependent calcium channels.* J.Neurochem., 2007. **101**: p. 434-47.
14. (RSC) *Elkin, B.S., Azeloglu, E.U., Costa, K.D., and **Morrison III, B.**, *Mechanical heterogeneity of the rat hippocampus measured by AFM indentation.* J.Neurotrauma, 2007. **24**: p. 812-22.
15. (RS) *Elkin, B.S. and **Morrison III, B.**, *Region-specific tolerance criteria for the living brain.* Stapp Car Crash J., 2007. **51**: p. 127-38.
16. (RS) *Yu, Z., McKnight, T.E., Ericson, M.N., Melechko, A.V., Simpson, M.L., and **Morrison III, B.**, *Vertically aligned carbon nanofiber arrays record electrophysiological signals from hippocampal slices.* Nano Lett., 2007. **7**: p. 2188-95.
17. (RC) Ateshian, G.A., Costa, K.D., Azeloglu, E.U., **Morrison III, B.**, and Hung, C.T., *Continuum modeling of biological tissue growth by cell division, and alteration of intracellular osmolytes and extracellular fixed charge density.* J.Biomech.Eng., 2009. **131**: p. 101001.

18. (RSC) Gao, S., Simon, M.J., **Morrison III, B.**, and Banta, S., *Bifunctional chimeric fusion proteins engineered for DNA delivery: Optimization of the protein to DNA ratio.* Biochim.Biophys.Acta, 2009. **1790**: p. 198-207.

19. (RSC) Graudejus, O., Yu, Z., Jones, J., **Morrison III, B.**, and Wagner, S., *Characterization and application of an elastically stretchable microelectrode array to neural field potential recordings.* J.Electrochem.Soc., 2009. **156**: p. P85-P94.

20. (R) Margulies, S.S., Hicks, R.R., Ansel, B., Bullock, R., Clifford, D., Clifton, G., Conwit, R., Dash, P., Diaz-Arrastia, R., Dietrich, W.D., et al., *Combination therapies for traumatic brain injury - prospective considerations.* J.Neurotrauma, 2009. **26**: p. 925-39.

21. (RSC) *Simon, M.J., Gao, S., Banta, S., and **Morrison III, B.**, *TAT-mediated intracellular protein delivery to primary brain cells is dependent on glycosaminoglycan expression.* Biotechnology and Bioengineering, 2009. **104**: p. 10-9.

22. (RSC) *Yu, Z., Graudejus, O., Tsay, C., Lacour, S.P., Wagner, S., and **Morrison III, B.**, *Monitoring electrical activity from hippocampal tissue during large electrode deformation.* J.Neurotrauma, 2009. **26**: p. 1135-45.

23. (RC) Ateshian, G.A., **Morrison III, B.**, and Hung, C.T., *Modeling of active transmembrane transport in a mixture theory framework.* Ann.Biomed.Eng., 2010. **38**: p. 1801-14.

24. (RC) Choi, J.J., Wang, S., Tung, Y.S., **Morrison III, B.**, and Konofagou, E.E., *Molecules of various pharmacologically-relevant sizes can cross the ultrasound-induced blood-brain barrier opening in vivo.* Ultrasound Med.Biol., 2010. **36**: p. 58-67.

25. (RS) *Elkin, B.S., Ilankovan, A., and **Morrison III, B.**, *Age-dependent regional mechanical properties of the rat hippocampus and cortex.* J.Biomech.Eng., 2010. **132**.

26. (RS) *Elkin, B.S., Shaik, M.A., and **Morrison III, B.**, *Fixed negative charge and the Donnan effect: A description of the driving forces associated with brain tissue swelling and edema.* Phil.Trans.Royal Soc.London A, 2010. **368**: p. 585-603.

27. (RSC) Gao, S., Simon, M.J., **Morrison III, B.**, and Banta, S., *A plasmid display platform for the selection of peptides exhibiting a functional cell penetrating phenotype.* Biotech.Prog., 2010. **26**: p. 1796-1800.

28. (RSC) Lacour, S.P., Benmerah, S., Tarte, E., FitzGerald, J., Serra, J., McMahon, S., Fawcett, J.W., Graudejus, O., Yu, Z., and **Morrison III, B.**, *Flexible and stretchable micro-electrodes for in vitro and in vivo neural interfaces.* Med.Biol.Eng.Comp., 2010. **48**: p. 945-954.

29. (RSC) Li, G., Simon, M.J., Cancel, L., Shi, Z., Ji, X., Tarbell, J.M., **Morrison III, B.**, and Fu, B.M., *Permeability of endothelial and astrocyte cocultures: In vitro blood-brain barrier models for drug delivery studies.* Ann.Biomed.Eng., 2010. **38**: p. 2499-511.

30. (RSC) *Simon, M.J., Kang, W.H., Gao, S., Banta, S., and **Morrison III, B.**, *Increased delivery of TAT across an endothelial monolayer folowing ischemic injury.* Neurosci.Lett., 2010, **486**: 1-4.

31. (RS) *Yu, Z. and **Morrison III, B.**, *Experimental mild traumatic brain injury induces functional alteration of the developing hippocampus.* J.Neurophysiol, 2010. **103**: p. 499-510.

32. (RSC) *Simon, M.J., Kang, W.H., Gao, S., Banta, S., and **Morrison III, B.**, *TAT is not capable of transcellular delivery across an intact endothelial monolayer in vitro.* Ann.Biomed.Eng., 2011 **39**: p.394-401.

33. (RS) *Elkin, B.S., Ilankovan, A., and **Morrison III, B.**, *A detailed viscoelastic characterization of the P17 and adult rat brain.* J.Neurotrauma, 2011, **28**: p.2235-2244.

34. (RS) *Elkin, B.S., Shaik, M.A., and **Morrison III, B.**, *Chondroitinase ABC reduces brain tissue swelling in vitro.* J.Neurotrauma, 2011, **28**: p.2277-2285.

35. (RSC) Gao, S., Simon, M.J., **Morrison III, B.**, and Banta, S., *An unusual cell penetrating peptide identified using a plasmid display-based functional selection platform.* ACS Chem.Bio., 2011 **6**: p.484-91.

36. (RSCI) ***Morrison III, B.**, Elkin, B.S., Dolle, J.P., Yarmush, M.L., *In vitro models of traumatic brain injury.* Ann.Rev.Biomed.Engin., 2011, **13**: p.91-126.

37. (RSC) *Kang, W.H., Simon, M.J., Gao, S., Banta, S., and **Morrison III, B.**, *Attenuation of astrocyte activation by TAT delivery of a peptide JNK inhibitor.* J.Neurotrauma, 2011, **28**: 1219-1228.

38. (RS) *Elkin, B.S., Ilankovan, I., **Morrison III, B.**, *Dynamic, regional mechanical properties of the porcine brain: Indentation in the coronal plane*. J.Biomech.Eng., 2011, **133**: 071009.

39. (RSP) *Finan, J.D., Elkin, B.S., Pearson, E.M., Kalbian I.L., **Morrison III, B.**, *Viscoelastic properties of the rat brain in the sagittal plane: effects of anatomical structure and age.* Ann.Biomed.Eng., 2012, **40**: 70-78..

40. (RSC) Graudejus, O., Goletiani, C., Yu, Z., **Morrison III, B.**, and Wagner, S., *Encapsulating elastically stretchable neural interfaces: yield, resolution,and recording/stimulation of neural activity.* Advanced Functional Materials, 2012, **22**: 640-651.

41. (RC) Saggu, R., **Morrison III, B.**, Lowe, J.P., Pringle, A.K., *Interleukin-1b does not affect the energy metabolism of rat organotypic hippocampal-slice cultures.* Neuroecience Letters, 2012, **508**: 114-118.

42. (RCI) Ateshian, G.A., **Morrison III, B.**, Holmes, J.W., and Hung, C.T., *Mechanics of cell growth.* Mechanics Research Communications, 2012, **42**: 118-125.

43. (RC) Baseri, B., Choi, J.J., Deffieux, T., Samiotaki, M., Tung, Y., Small, S.A., **Morrison III, B.**, and Konofagou, E.E., *Activation of signaling pathways following localized delivery of systemically administered neurotrophic factors across the blood–brain barrier using focused ultrasound and microbubbles.* Phys.Med.Biol., 2012, **57**: N65-N81.

44. (RSC) *Effgen, G.B., Hue, C.D., Vogel, E.W., Panzer, M.B., Meaney, D.F., Bass, C.R., **Morrison III, B.**, A *multiscale approach to blast neurotrauma modeling: Part II: Methodology for inducing blast injury to in vitro models*, Frontiers in Neurology, 2012, **3**: 10.3389/fneur.2012.00023.

45. (RSC) Yu, Z., McKnight, T.E., Ericson, M.N., Melechko, A.V., Simpson, M.L., **Morrison III, B.**, *Vertically aligned carbon nanofiber as nano-neuron interface for monitoring neural function*, Nanomedicine: Nanotechnology, Biology, and Medicine, 2012, **8**: 419-423.

46. (RC) Panzer, M.B., Matthews, K.A., Yu, A.W., **Morrison III, B.**, Meaney, D.F., Bass, C.R., A *multiscale approach to blast neurotrauma modeling: Part I: Development of novel test devices for in vivo and in vitro blast injury models,* Frontiers in Neurology, 2012, **3**:46. doi: 10.3389/fneur.2012.00046.

47. (RSC) Dixon, S.J., Lemberg, K.M., Lamprecht, M.R., Skouta, R., Zaitsev, E., Gleason, C.E., Patel, D., Bauer, A.J., Cantley, A., Yang, W.S., **Morrison III, B.**, Stockwell, B.R., *Ferroptosis: an iron-dependent oncogenic-RAS-selective form of cell death*, Cell, 2012, **149**:1060-1072.

48. (RPC) Choo, A.M., Miller, W.J., Chen, Y., Nibley, P., Goletiani, C., **Morrison III, B.**, Kutzing, M.K., Firestein, B.L., Sul, J.Y., Haydon, P.G., Meaney, D.F., *Antagonism of*

astroglial purinergic signaling improves recovery from traumatic brain injury, Brain, 2013, **136**: 65-80.

49. (RPC) Chen, C., Wu, S., Finan, J.D., **Morrison III, B.**, and Konofagou, E.E., *An experimental study on the stiffness of size-isolated microbubbles using atomic force microscopy*, IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control, 2013, **60**: 524-534.

50. (RC) Dolle, J.P., **Morrison III, B.**, Schloss, R.S., and Yarmush, M.L., *An organotypic uniaxial strain model using microfluidics,* Lab Chip, 2013, **13**: 432-42.

51. (RSC) Mao, H., Elkin, B.S., Genthikatti, V.V., **Morrison III, B.**, Yang, K.H., *Why is CA3 more vulnerable than CA1 in experimental models of controlled cortical impact-induced brain injury?*, J. Neurotrauma, 2013, **30**: 1521-1530.

52. (RSC) *Hue, C.D., Cao, S., Haider, S.F., Vo, K. V., Effgen, G.B., Vogel, E.W., Panzer, M.B., Bass, C.R., Meaney, D.F., **Morrison III, B.**, *Blood-brain barrier dysfunction after primary blast injury in vitro*, J. Neurotrauma, 2013, **30**: 1652-1663.

53. (RS) *Elkin, B.S., **Morrison III, B.**, *Viscoelastic properties of the P17 and adult rat brain in the coronal plane*, J.Biomech.Eng., 2013, **135**: 114507.

54. (RC) Dolle, J.P., **Morrison III, B.**, Schloss, R.S., and Yarmush, M.L., *Brain-on-a-chip microsystem for investigating traumatic brain injury: Axon diameter and mitochondrial membrane changes play a significant role in axonal response to strain injuries.* Technology (Singapore), 2014. **2**: 106.

55. (RSC) *Effgen, G.B., Vogel, E.W., Lynch, K.A., Lobel, A., Hue, C.D., Meaney, D.F., Bass, C.R., and **Morrison III, B.**, *Isolated primary blast alters electrophysiological function with minimal cell death in organotypic hippocampal slice cultures*, *J.Neurotrauma*, 2014 **31**: 1202-10.

56. (RSP) *Finan, J.D., Fox, P.M., **Morrison III, B.**, *Non-ideal effects in indentation testing of soft tissues*, Biomech. Model. Mechanobiol., 2014, **13**: 573-84.

57. (RC) Gullotti, D., Panzer, M., Beamer, M., Chen, Y.C., Patel, T., Yu, A., Jaumard, N., Winkelstein, B., Bass, C.R., **Morrison III, B.**, and Meaney, D.F., *Significant head accelerations can influence immediate neurological impairments in a murine model of blast-induced traumatic brain injury*. J.Biomech.Eng. 2014, **136**: 091004.

58. (RSC) *Hue, C.D., Cao, S., Bass, C.R., Meaney, D.F., and **Morrison III, B.**, *Repeated primary blast injury causes delayed recovery, but not additive disruption, in an in vitro blood-brain barrier model*. J.Neurotrauma, 2014, **31**: 951-60.

59. (RSC) *Hughes, R.H., Silva, V.A., Ahmed, I., Shreiber, D.I., **Morrison III, B.**, *Neuroprotection by genipin against reactive oxygen and reactive nitrogen species-mediated injury in organotypic hippocampal slice cultures*, Brain Res., 2014, **1543**: 308-314.

60. (RS) *Lamprecht, M.R. and **Morrison III, B.**, *GPR30 activation is neither necessary nor sufficient for acute neuroprotection by 17β-estradiol after an ischemic injury in organotypic hippocampal slice cultures*, Brain Res., 2014, **1563**: 131-7.

61. (RCI) Meaney, D.F., **Morrison III, B.**, and Bass, C.R., *The mechanics of traumatic brain injury: A review of what we know, and what we need to know, for reducing its societal burden*. J.Biomechanical Eng., 2014, **136**: 021008.

62. (RC) Patel, T.P., Gullotti, D.M., Hernandez, P., O'Brien, W.T., Capehart, B.P., **Morrison III, B.**, Bass, C.R., Eberwine, J.E., Abel, T., and Meaney, D.F., *An open-source toolbox for automated phenotyping of mice in behavioral tasks*, Front.Behav.Neurosci., 2014, **8**: 349, doi: 10.3389/fnbeh.2014.00349.

63. (RS) *Kang, W.H. and **Morrison III, B.**, *Functional tolerance to mechanical deformation developed from organotypic hippocampal slice cultures*, Biomech.Model.Mechanobiol., 2015, **14**: 561-75.

64. (RSC) *Kang, W.H., Cao, W., Graudejus, O., Patel, T.P., Wagner, S., Meaney, D.F., and **Morrison III, B.**, *Alterations in hippocampal network activity after in vitro traumatic brain injury*, J.Neurotrauma., 2015, **32**: 1011-9.

65. (RSC) *Kang, W.H. and **Morrison III, B.**, Predicting changes in cortical electrophysiological function after in vitro traumatic brain injury, Biomech.Model.Mechanobiol., 2015, **14**: 1033-44.

66. (RS) *Lamprecht, M.R. and **Morrison III, B.**, *A combination therapy of 17β-estradiol and memantine is more neuroprotective than monotherapies in an organotypic brain slice culture model of traumatic brain injury*, in J.Neurotrauma, 2015, **32**: 1361-8.

67. (RSC) *Hue, C.D., Cho, F.S., Cao, S., Bass, C.R., Meaney, D.F., and **Morrison III, B.**, *Dexamethasone potentiates in vitro blood-brain barrier recovery after primary blast injury by glucocorticoid receptor-mediated upregulation of ZO-1 tight junction protein*. J.Cerebral Blood Flow & Metab., 2015, **35**: 1191-8.

68. (RC) Beamer, M., Tummala, S., Gullotti, D., Kopil, K., Gorka, S., Abel, T., Bass, C.R., **Morrison III, B.**, Cohen, A.S., and Meaney, D.F., *Primary blast injury causes cognitive impairments and hippocampal circuit alterations.* Experimental Neurology, 2016, 283: (Pt.A), 16-28.

69. (RSPC) *Finan, J.D., Cho, F.S., Kernie, S.G., **Morrison III, B.** *Intracerebroventricular administration of chondroitinase ABC reduces acute edema after traumatic brain injury*. BMC Research Notes, 2016, **9**: 160.

70. (RSC) *Effgen, G.B., Ong, T., Nammalwar, S., Ortuno, A.I., Meaney, D.F., Bass, C.R., **Morrison III, B.** *Primary blast exposure increases hippocampal vulnerability to subsequent exposure reducing long-term potentiation*. J.Neurotrauma, 2016, **33**: 1901-12.

71. (RSC) *Hue, C.D., Cho, F.S., Cao, S., Nicholls, R.E., Vogel III, E.W., Sibindi C., Arancio O., Bass C.R., Meaney D.F., **Morrison III B.** *Time course and size of blood-brain barrier opening in a mouse model of blast-induced traumatic brain injury.* J.Neurotrauma, 2016, **33**: 1202-11.

72. (RSC) *Vogel III, E.W., Effgen, G.B., Patel, T.P., Meaney, D.F., Bass, C.R., **Morrison III, B.** *Isolated primary blast inhibits long-term potentiation in organotypic hippocampal slice cultures.* J.Neurotrauma, 2016, 33:652-61.

73. (RS) *Effgen, G.B. and **Morrison III, B.**, *Electrophysiological and pathological characterization of the period of heightened vulnerability to repetitive injury in an in vitro stretch model.* J.Neurotrauma., 2017, **34**: 914-24.

74. (RS) *Effgen, G.B. and **Morrison III, B.**, *Memantine reduced cell death, astrogliosis, and functional deficits in an in vitro model of repetitive mild traumatic brain injury*. J.Neurotrauma, 2017, **34**: 934-42.

75. (RSC) Hu, F., Lamprecht, M.R., Wei, L., **Morrison III, B.**, and Min, W., *Bioorthogonal chemical imaging of metabolic activities in live mammalian hippocampal tissues with stimulated raman scattering.* Scientific Reports, 2016, **6**: p. 39660.

76. (RSC) *Lamprecht, M.R., Elkin, B.S., Kesavabhotla, K., Crary, J.F., Raghupathi, R., **Morrison III, B.** Strong c*orrelation of genome-wide expression after traumatic brain injury in vitro and in vivo implicates a role for SORLA*. J.Neurotrauma, 2017, **34**: 97-108.

77. (RSC) *Vogel III, E.W., Morales, F.N., Meaney, D.F., Bass, C.R., and **Morrison III, B.**, *Phosphodiesterase-4 inhibition restored hippocampal long term potentiation after primary blast*. Experimental Neurology, 2017, **293**: p. 91-100.

78. (RSC) *Vogel III, E.W., Rwema, S.H., Meaney, D.F., Bass, C.R., **Morrison III, B.** *Primary blast injury depressed hippocampal long-term potentiation through disruption of synaptic proteins.* J. Neurotrauma, 2017, **34**: 1063-73.

79. (RSPC) *Finan, J.D., Sundaresh, S., Elkin, B.S., McKhann 2nd, G.M., and **Morrison III, B.**, *Mechanical properties of living, human cortical grey and white matter*. Acta Biomaterialia, 2017, **55**: 333-9.

80. (RSC) Evans, B.S., Newell, E., Mahajan, M., Tsang, S.H., Ferguson, P.J., Mahoney, J., Hue, C.D., Vogel III, E.W., **Morrison III, B.**, Arancio, O., Nicholls, R.E., Bassuk, A.G., and Manajan, V.B., *Acute vitreoretinal trauma and inflammation after traumatic brain injury in mice*. Annals of Clinical and Translational Neurology, 2017, **5**: 240-51

D.3 Refereed Conference Proceedings

1. (RC) ***Morrison III, B.**, Cater, H.L., and Sundstrom, L.E., *Development of universal injury tolerance criteria for living brain tissue.* NATO-RTO Specialists' Meeting on Personal Protection, 2003.

2. (RC) Lacour, S.P., **Morrison III, B.**, Tsay, C., and Wagner, S., *Stretchable microelectrode arrays for dynamic neural recording of in vitro mechanically injured brain.* Proc.IEEE Sensors, 2005: p. 617-20.

3. (RC) Tsay, C., Lacour, S.P., Wagner, S., and **Morrison III, B.**, *Architecture, fabrication, and properties of stretchable microelectrode arrays.* Proc.IEEE Sensors, 2005: p. 1169-72.

4. (RSC) *Yu, Z., Tsay, C., Lacour, S.P., Wagner, S., and **Morrison III, B.**, *Stretchable mircoelectrode arrays: A tool for discovering mechanisms of functional deficits underlying traumatic brain injury and interfacing neurons with neuroprosthetics.* IEEE Proc.EMBC, 2006: p. 6732-5.

5. (RSC) Choi, J.J., Wang, S., **Morrison III, B.**, and Konofagou, E.E., *Focused ultrasound-induced molecular delivery through the blood-brain barrier.* IEEE International Ultrasonics Symposium, 2007.

6. (RC) Wang, S., Choi, J.J., Tung, Y.S., **Morrison III, B.**, and Konofagou, E.E., *Delivery of fluorescent dextrans through the ultrasound-induced blood-brain barrier opening in mice.* IEEE International Ultrasonics Symposium, 2008: p. 1702-5.

7. (RC) Garmarnik, V., Pan, S., Malke, J., Chiu, C., Koo, B., Montes, J., Yeager, K., Marra, J., Dunaway, S., Montgomery, M., et al., *An integrated motion capture system for evaluation of spinal muscular atrophy patients.* IEEE Proc.EMBC, 2009: p. 218-21.

8. (RC) Koo, B., Montes, J., Garmarnik, V., Yeager, K., Marra, J., Dunaway, S., Montgomery, A.M., De Vivo, D., Strauss, N.E., Konofagou, E.E., et al., *Design and evaluation of a hybrid passive and active gravity neutral orthosis.* IEEE Proc.EMBC, 2009: p. 1573-6.

9. (RS) ***Morrison III, B.**, Yu, Z., and Elkin, B.S., *Progress on tissue-level, functional tolerance criteria and material properties of the living brain with anatomical resolution.* IRCOBI Proceedings, 2009.

10. (RSC) Muratore, R., LaManna, J.K., Lamprecht, M.R., and **Morrison III, B.**, *Bioeffects of low dose ultrasound on neuronal cell function.* Proceedings of the Ultrasonic Industry Association, 2009.

11. (RS) *Yu, Z., Elkin, B.S., and **Morrison III, B.**, *Modeling traumatic brain injury in vitro : Functional changes in the absence of cell death.* Biomedical Science and Engineering Conferences, 2009.

12. (RS) *Yu, Z., Elkin, B.S., and **Morrison III, B.**, *Quantification of functional alterations after in vitro traumatic brain injury.* IEEE Proc.EMBC, 2009.

13. (RSC) *Yu, Z., Graudejus, O., Lacour, S.P., Wagner, S., and **Morrison III, B.**, *Neural sensing of electrical activity with stretchable microelectrode arrays.* IEEE Proc.EMBC, 2009.
14. (RS) *Elkin, B.S. and **Morrison III, B.**, *Mechanical properties of the rat brain: Effect of age and anatomical region.* ASME Summer Bioengineering Division, 2010.
15. (RS) *Elkin, B.S. and **Morrison III, B.**, *Age-dependent mechanical properties of the rat brain measured with the atomic force microscope.* US National Congress on Theoretical and Applied Mechanics, 2010.
16. (RS) *Elkin, B.S. and **Morrison III, B.**, *High-rate, regional mechanical properties of the porcine brain cross-validated with two methods of indentation.* IRCOBI Proceedings, 2010.
17. (RS) *Elkin, B.S., Shaik, M.A., and **Morrison III, B.**, *Chondroitin sulfate proteoglycans contribute to brain tissue swelling behavior.* Northeastern Bioengineering Conference, 2010.
18. (RP) *Goletiani, C. and **Morrison III, B.**, *Uric acid prevents traumatic cell death and neuronal dysfunction in organotypic hippocampal slice cultures.* Northeastern Bioengineering Conference, 2010.
19. (RS) *Kang, W.H. and **Morrison III, B.**, *Activated astrocytes and TAT transduction after in vitro traumatic mechanical injury.* Northeaster Bioengineering Conference, 2010.
20. (RS) *Lamprecht, M.R., McKnight, T.E., Ericson, M.N., and **Morrison III, B.**, *VACNF arrays for recording dopamine concentrations in the brain.* Northeastern Bioengineering Conference, 2010.
21. (RSC) *Simon, M.J., Kang, W.H., Gao, S., Banta, S., and **Morrison III, B.**, *Evaluation of the cell-penetrating peptide TAT as a trans-blood-brain barrier delivery vehicle.* Northeastern Bioengineering Conference, 2010.
22. (RS) *Yu, Z., Kang, W.H., and **Morrison III, B.**, *Toward a functional tolerance criterion for the hippocampus developed from orgnaotypic slice cultures.* ASME Summer Bioengineering Division, 2010.
23. (RS) *Yu, Z., Kang, W.H., and **Morrison III, B.**, *Changes in electrophysiological function after controlled deformation of slice cultures of the hippocampus.* US National Congress on Theoretical and Applied Mechanics, 2010.
24. (RS) *Effgen, G.B., Gill, E., and **Morrison III, B.**, *A model of repetitive, mild traumatic brain injury and a novel pharmacological intervention to block repetitive injury synergy.* IRCOBI Proceedings, 2012.
25. (RSP) *Finan, J.D., Pearson, E.M., and **Morrison III, B.**, *Viscoelastic properties of the rat brain in the horizontal plane.* IRCOBI Proceedings, 2012.
26. (RSC) *Hue, C.D., Vo, K.V., Effgen, G.B., Vogel, E.W., Panzer, M.B., Bass, C.R., Meaney, D.F., and **Morrison III, B.**, *Integrity disruption of an in vitro blood-brain barrier model following exposure to blast overpressure.* IRCOBI Proceedings, 2012.

D.4 Book Chapters

1. (RCI) ***Morrison III, B.**, Cullen, D.K., and LaPlaca, M.C., *In vitro models for biomechanical studies of neural tissues*, in Neural Tissue Mechanics, L.E. Bilston, ed. 2011, Springer-Verlag: Berlin.
2. (RSCI) *Kang, W.H., Cao, W., Wagner, S., **Morrison III, B.**, *Stretchable Neural Interfaces*, in Stretchable Electronics, T. Someya, ed. 2012, Wiley-VCH: Weinheim.
3. (ISC) Vogel, E.W., **Morrison III, B.**, Evilsizor, M.N., Griffiths, D.R., Thomas, T.C., Lifshitz, J., Sutton, R.L., Long, J.B., Ritzel, D., Ling, G.S.F., Huh, J., Raghupathi, R., McIntosh,

T.K., *Experimental models of TBI: Clinical Relevance and Shortcomings*, in Cellular Therapy for Neurological Injury, Cox, C., Atala, T., eds. 2016, CRC Press.

E. Other Honors and Awards

1999 Biomedical Engineering Society Travel Award

1999 National Neurotrauma Society Travel Award

2001 Richard Skalak Best Paper Award in the *Journal of Biomechanical Engineering* for 2000, Bioengineering Division of the American Society of Mechanical Engineers:

> **Morrison III, B.**, Meaney, D.F., Margulies, S.S., and McIntosh, T.K., *Dynamic mechanical stretch of organotypic brain slice cultures induces differential genomic expression: Relationship to mechanical parameters.* J.Biomech.Eng., 2000. **122**: p. 224-30.

2004 John Paul Stapp Best Paper Award in the *Stapp Car Crash Journal* for 2003:

> **Morrison III, B.**, Cater, H.L., Wang, C.B., Thomas, F.C., Hung, C.T., Ateshian, G.A., and Sundstrom, L.E., *A tissue level tolerance criteria for living brain developed with an in vitro model of traumatic mechanical loading.* Stapp Car Crash J., 2003. **47**: p. 93-105.

2006 The Kim Award for Student-Faculty Involvement, Fu Foundation School of Engineering and Applied Science, Columbia University, New York, NY

2006 Invited speaker, annual National Neurotrauma Symposium

2009 Keynote speaker, annual meeting of the International Research Council on Biomechanics of Injury

2010 Invited speaker, annual National Neurotrauma Symposium

2013 Cover image, Journal of Neurotrauma for Hue, C.D., Cao, S., Haider, S.F., Vo, K. V., Effgen, G.B., Vogel, E.W., Panzer, M.B., Bass, C.R., Meaney, D.F., **Morrison III, B.**, *Blood-brain barrier dysfunction after primary blast injury in vitro*, J. Neurotrauma, 2013, **30**: 1652-1663.

2015 Elected Vice President of the *International Research Council on Biomechanics of Injury*

2018 Elected Fellow of the *American Institute for Medical and Biological Engineering*

E.1 Honors and Awards won by Morrison Research Group

2005 **Student Travel Grant (Z. Yu)** from the NINDS Neural Interfaces Workshop 2005; “Highly compliant electrode arrays for improved modulus matching”, Advisor: **B. Morrison III**

2006 **Student Travel Grant (Z. Yu)** from the 24th Annual National Neurotrauma Symposium; “A new tool to study post-traumatic neuronal dysfunction: stretchable microelectrode arrays”, Advisor: **B. Morrison III**

2006 Extraordinary Teaching Assistant Award (B.S. Elkin), from the Fu Foundation School of Engineering and Applied Science, Columbia University, Advisor: **B. Morrison III**

2007 **National Science Foundation Graduate Research Fellowship (M.J. Simon)**; "Discovery of Protein Engineering Design Principles for Cell-Specific, Cell-Penetrating Peptides", Advisor: **B. Morrison III**

2007 **Stapp Student Award (B.S. Elkin)** from the 51st Stapp Car Crash Conference; "Region-specific tolerance criteria for the living brain", Second Place, Advisor: **B. Morrison III**

2008 **Natural Sciences and Engineering Research Council of Canada Postgraduate Scholarship (B.S. Elkin)** "Mechanical Properties of Brain Tissue: Implications for Traumatic Brain Injury" Advisor: **B. Morrison III**

2008 **Student Travel Grant (M.J. Simon)** from the 26th Annual National Neurotrauma Symposium; "TAT-mediated intracellular delivery is dependent upon cell-type and phenotype: implications for delivery to activated astrocytes following injury" Advisor: **B. Morrison III**

2009 **National Science Foundation Graduate Research Fellowship (M.R. Lamprecht)**; "Utilizing Dual Sensing Electrode Arrays to Delineate the Role of Astrocytes in Spike-Timing-Dependent Plasticity after Traumatic Brain Injury", Advisor: **B. Morrison III**

2010 **Student Award (B.S. Elkin)** from the 36th Northeast Bioengineering Conference "Chondroitin Sulfate Proteoglycans Contribute to Brain Tissue Swelling Behavior", Advisor: **B. Morrison III**

2010 **Student Travel Grant (B.S. Elkin)** from the 28th Annual National Neurotrauma Symposium, "The effect of chondroitinase ABC on brain tissue swelling *in vitro*", Advisor: **B. Morrison III**

2010 **Ph.D. Student Poster Competition Finalist (B.S. Elkin)** from the Summer Bioengineering Conference of ASME, "Mechanical properties of the rat brain: effect of age and anatomical region", Advisor: **B. Morrison III**

2011 **Student Travel Grant (M.R. Lamprecht)** from the Annual National Neurotrauma Symposium, "Combinational Drug Therapies as Treatment for Traumatic Brain Injury", Advisor: **B. Morrison III**

2011 **Student Travel Grant (C.D. Hue)** from the Annual National Neurotrauma Symposium, "Blast overpressure induces disruption of brain endothelial monolayer integrity", Advisor: **B. Morrison III**

2011 **Student Poster Competition Finalist (M.R. Lamprecht)** from the Annual National Neurotrauma Symposium, "Combinational Drug Therapies as Treatment for Traumatic Brain Injury", Advisor: **B. Morrison III**

2012 **The Murray Mackay Young Researcher Award (C.D. Hue)** from the International Research Council on Biomechanics of Injury, "Blast-induced disruption of an in vitro blood-brain barrier model", Advisor: **B. Morrison III**

2012 **Oral Presentation Award in Engineering, Mathematics and Physics (S.F. Haider)** from the Annual Biomedical Research Conference for Minority Students, "Increased solute permeability of an in vitro blood-brain barrier model exposed to blast overpressure", Advisor **B. Morrison III**

2012 **Student Poster Competition Finalist (G.B. Effgen)** from the Annual National Neurotrauma Symposium, "A combination of 17β-estradiol and memantine after repetitive, mild traumatic brain injury reduces injury synergy", Advisor: **B. Morrison III**

2013 **Columbia University Presidential Award for Outstanding Teaching by Graduate Students - Finalist (C.D. Hue)**, Advisor **B. Morrison III**

2014 **Acorda Scientific Excellence Award from Acorda Therapeutics** (A. Huang), Advisor **B. Morrison III**

2014 **Student Travel Grant (C.D. Hue)** from the Annual National Neurotrauma Symposium, "Dexamethasone potentiates recovery of the blood-brain barrier after primary blast injury in vitro", Advisor: **B. Morrison III**

F. Patents

1. Spermidine derivatives for the treatment of chronic neurodegenerative diseases (European patent #EP2003704764; US patent application #20050124554)
2. Treatment of chronic neurodegenerative and related diseases (European patent #EP1471901)
3. Enzyme combinations to reduce brain tissue swelling (US9040040 B2)
4. Systems and methods for real-time concussion diagnosis by electroencephalogram activity monitoring (PCT application filed 6/17)
    i. Licensed to NoMo Diagnostics Inc. (12/17)
5. Hyaluronidase for the treatment of cerebral edema (PCT application filed 12/17)

G. Professional Service

G.1 Editorial Positions

2010 – 2013 Associated Editor, *BMC Neuroscience*

2011 2012 Review Editor, *Frontiers in Neurotrauma*

2012 – Associate Editor, *Journal of Biomechanical Engineering*

2016 – Associate Editor, *Journal of Neurotrauma*

G.2 Professional Board Positions

2006 –2013 Engineering Conferences International, Advisory Board Member

2012 – International Research Council on Biomechanics of Injury, Council Member

2012 – 2015 International Research Council on Biomechanics of Injury, Publications Committee

2014 – 2016 International Research Council on Biomechanics of Injury, Membership & Awards Committee

2015 – Scientific Advisory Board, Center for Injury Epidemiology and Prevention at Columbia University Medical Center, NY

2015 – Vice President, International Research Council on Biomechanics of Injury

2016 – Board of Directors, Football Research, Inc., NY

G.3 Membership in Professional Societies

1. Biomedical Engineering Society (BMES, 1995 – present
2. Engineering in Medicine and Biology Society (IEEE EMBS, 1995 – present)
3. National Neurotrauma Society (1995 - present)
4. Society for Neuroscience (1995 - 2010)
5. Material Research Society (2004 – 2012, 2015)
6. American Society of Mechanical Engineers (2013 – present)
7. American Institute for Medical and Biological Engineering, Fellow (2018 – present)

G.4 Invited Presentations

1. April 7, 1997 "*In vitro* mechanical injury of organotypic brain slice cultures" for the Head Injury Research Center of the *University of Pennsylvania*
2. June 19, 1998 "An *in vitro* model of brain trauma: A combination of engineering and molecular biology" for the Institute for Medicine and Engineering of the *University of Pennsylvania*
3. July 15, 1999 "Mechanisms of cell death after traumatic brain injury: implications for therapeutic strategies" for the Department of Clinical Neurological Sciences, *University of Southampton*, UK
4. July 16, 1999 "Mechanisms of cell death after traumatic brain injury: implications for therapeutic strategies" for the Department of Neurosurgery, *King's College Hospital*, UK
5. October 13, 1999 "Differential genomic expression after *in vitro* mechanical injury of organotypic brain slice cultures" for the joint BMES EMBS Annual Conference, Atlanta, GA
6. October 27, 1999 "Differential gene expression after mechanical injury of organotypic brain slice cultures" for the 29th Annual Meeting of the Society for Neuroscience, Miami, FL
7. October 16, 2000 "*In vitro* traumatic brain injury affects the expression of both cell death and cell survival genes" for the International Workshop on Medical and Engineering Aspects of Dynamic Head and Neck Injuries, Cranfield, UK
8. February 15, 2001 "Re-engineering *in vitro* models of traumatic brain injury" for the Neuroscience Research Department, Glaxo SmithKline, Harlow, UK
9. February 23, 2001 "Can animal models of traumatic brain injury be reproduced in tissue culture?" for the CNS Seminar Series, *Southampton University*, UK
10. December 14, 2001 "Molecular Consequences of *In vitro* Traumatic Brain Injury of Organotypic Slice Cultures" for the Department of Bioengineering, *University of Toledo*
11. March 14, 2002 "Molecular consequences of *in vitro* traumatic brain injury of organotypic slice cultures" for the Department of Bioengineering, *University of Pittsburgh*
12. April 19, 2002 "Molecular consequences of *in vitro* traumatic brain injury of organotypic slice cultures" for the Department of Bioengineering, *Wayne State University*

13. April 22, 2002 “Utilizing *in vitro* models to study traumatic brain injury” for the Biomechanics Division of the National Highway Traffic Safety Administration, Washington, D.C.
14. April 23, 2002 “Utilizing *in vitro* models to study traumatic brain injury” for the Division of Neurosciences, Walter Reed Army Institute of Research, Silver Spring, MD
15. April 25, 2002 “Molecular consequences of *in vitro* traumatic brain injury of organotypic slice cultures” for the Department of Biomedical Engineering, *City College of New York*
16. April 29, 2002 “Molecular consequences of *in vitro* traumatic brain injury of organotypic slice cultures” for the Department of Biomedical Engineering, *Columbia University*
17. May 21, 2003 “Development of universal injury criteria for living brain tissue” for the NATO sponsored Personal Protection joint AVT-HFM Meeting, Koblenz, Germany.
18. October 27, 2003 “A tissue level tolerance criteria for living brain developed with an in vitro model of traumatic mechanical loading”, Stapp Car Crash Conference, San Diego, CA.
19. July 21, 2005 “Quantitative Tolerance Criteria for SIMon: Cell Death and Dysfunction” Southern Consortium for Injury Biomechanics, *University of Alabama*, Birmingham, AL.
20. October 6, 2005 “Brain constitutive properties measured with atomic force microscopy: implications for head injury” for the Department of Biomedical Engineering, *Georgia Technical Institute*
21. November 17, 2005 “Are sub-regions of the hippocampus more vulnerable to post-traumatic cell death? Insights from atomic force microscopy and an *in vitro* model” for the Virginia Tech - Wake Forest Center for Injury Biomechanics, *Virginia Technical Institute*
22. November 30, 2005 “*In vitro* approaches can increase our understanding of head injury biomechanics using atomic force microscopy and an organotypic slice culture model of traumatic brain injury” for the Department of Biomedical Engineering, *City College of New York*
23. December 1, 2005 “Heterogeneous constitutive properties of the hippocampus measured by atomic force microscopy may explain trauma-induced, regional patterns of cell death” for the Departments of Biomedical Engineering and Mechanical and Aerospace Engineering, *University of Virginia*
24. December 12, 2005 “Hippocampal mechanical properties determined with the atomic force microscope: implications for head injury” for the Department of Biomedical Engineering, *Wayne State University*
25. February 20, 2006 “Regional brain material properties and injury tolerance criteria” for the Department of Neurosurgery, *University of Pennsylvania*
26. March 30, 2006 “Structural properties of the hippocampus and injury tolerance criteria” for the Department of Biomedical Engineering, *Duke University*
27. June 19, 2006 “Understanding the biomechanics of head injury” for the Summer Undergraduate Research Fellowship program, *Columbia University*
28. July 8, 2006 “Flexible microelectrode arrays” for the 24th Annual National Neurotrauma Society Conference, St. Louis, MO
29. November 3, 2006 “Is post-traumatic, intra-hippocampal regional vulnerability a function of biomechanical heterogeneity?” for the Spinal Cord and Brain Injury Research Center, *University of Kentucky*

30. December 13, 2006 “Quantitative tolerance criteria for SIMon: Cell death and dysfunction” for the Southern Consortium of Injury Biomechanics, *University of Alabama*
31. February 26, 2007 “Advances in cellular brain injury biomechanics” for the Brain Injury Symposium, National Highway Traffic Safety Administration
32. March 6, 2007 “Flexible electronics and stretchable microelectrode arrays” for the Center for Biomaterials & Advanced Technologies, Medical Devices Group, Ethicon, Inc. (J&J)
33. March 12, 2007 “Reducing the societal cost of traumatic brain injury”, for the Virginia Tech - Wake Forest Center for Injury Biomechanics, *Virginia Technical Institute*
34. April 27, 2007 “Toward understanding regional vulnerability in traumatic brain injury” for the Department of Biomedical Engineering, *New Jersey Institute of Technology*
35. May16, 2007 “Softening the impact of traumatic brain injury” for the Spinal Cord and Brain Injury Research Center, *University of Kentucky*
36. December 6, 2007 “Quantitative tolerance criteria for SIMon: Cell death and dysfunction” for the Southern Consortium of Injury Biomechanics, *University of Alabama*
37. January 27, 2008 “Biomechanics and modeling of mild traumatic brain injury” for the *Winter Conference on Brain Research*, Snowbird, UT
38. February 11, 2008 “Mind storm: Traumatic brain injury… a silent epidemic” for Café Science, *Columbia University*
39. May 8, 2008 “Development of methods to enable the directed evolution of cell penetrating peptides for targeted brain cell delivery” *Wyeth Research*, NJ
40. October 3, 2008 “The Neurotrauma and Repair Laboratory” for the Graduate Student Seminar Series, *Columbia University*, NY.
41. October 15, 2008 “Modeling traumatic brain injury: lessons learned and critical data” for the Man Vehicle Laboratory, *Massachusetts Institute of Technology*, MA.
42. November 14, 2008 “Enabling data for modeling traumatic brain injury” for the Biomechanics & Injury Mitigation Systems, *Johns Hopkins University Applied Physics Laboratory*, MD.
43. March 19, 2009 “Modeling traumatic brain injury *in vitro*: functional changes in the absence of cell death” for the Biomedical Science and Engineering Conference, *Oak Ridge National Laboratory*, TN.
44. April 6, 2009 “Vertically aligned carbon nanofiber arrays for neuroscience” for the CTSA Nanotechnology Seminar Series, *Columbia University Medical Center*, NY.
45. June 5, 2009 “Brain tissue heterogeneity and implications for traumatic brain injury” for Grand Rounds in the Department of Neurosurgery, *Medical College of Wisconsin*, WI.
46. June 17, 2009 “Vertically aligned carbon nanofiber arrays for electrophysiological and electrochemical recordings from brain slices” for the Nanotechnology for the Study of Cellular and Molecular Interactions Conference, *Engineering Conferences International*, Barga, Italy.
47. September 3, 2009 “Quantification of functional alterations after in vitro traumatic brain injury” for the “Neural Injury” session at the *Engineering in Medicine and Biology Conference*, MN.
48. September 4, 2009 “Neural sensing of electrical activity with stretchable microelectrode arrays” for the “Neural Sensing and Applications” session at the *Engineering in Medicine and Biology Conference*, MN.

49. September 9, 2009 “Advances in the study of brain injury biomechanics”, **Keynote lecture** for the *International Research Council on Biomechanics of Injury* conference, UK.
50. November 12, 2009 “Studying traumatic brain injury through a combination of biomechanics and cell biology”, for Grand Rounds, Department of Neurosurgery, *Columbia University Medical Center*, NY.
51. February 11, 2010 “Compliant tissue/electronics interfaces for biomedical studies”, for the Electrical Engineering Department, *Princeton University*.
52. March 18, 2010 “Brain material properties and tolerance criteria: critical ingredients for computational models of brain injury” for the Mechanical Engineering department, *City College of New York*.
53. March 28, 2010 “Mechanical properties of anatomical structures of the rat brain” for the *Northeast Bioengineering Conference*, NY.
54. May 5, 2010 “Material properties and failure criteria for brain: understanding brain injury biomechanics” for the Department of Chemistry, Chemical Biology, and Biomedical Engineering, *Stevens Institute of Technology*.
55. June 15, 2010 “Outcome measures in *in vitro* modeling of TBI / validation of *in vitro* models” for the *National Neurotrauma Symposium*, NV.
56. August 3, 2010 “Determining a mechanical tolerance criterion for neuron function within the hippocampus” for the *6th World Congress on Biomechanics*, Singapore.
57. August 12, 2010 “Heterogeneous material properties and tolerance criteria for brain injury models” for the DoD Brain Injury Computational Modeling Expert Panel, FL.
58. October 20, 2011 “Region and mechanism-specific tolerance criteria for traumatic brain injury” for the Columbia University Seminar on Injury Prevention, NY.
59. November 9, 2011 “Traumatic Brain Injury Tolerances: *In Vitro* Insights” for the Safar Center, University of Pittsburgh Medical Center, PA.
60. January 12, 2012 "Biomechanical insight to traumatic brain injury from brain slice models" for the Center for Neuroscience & Regenerative Medicine, Uniformed Services University of the Health Sciences, MD.
61. November 14, 2012 "Brain trauma: Biomechanical Insights" for First Year Seminars in Modern Biology, *Columbia University*, NY
62. March 21, 2013 “Traumatic Brain Injury: Inertia- and Blast-Injuries and an Edema Therapy” for Grand Rounds, Department of Neurosurgery, *Columbia University Medical Center*, NY
63. August 10, 2013 “Better Strategies to Prevent Brain Injuries”, for *Aspen BrainLab*, Aspen, CO
64. October 2, 2013 "Brain trauma from Blast" for First Year Seminars in Modern Biology, *Columbia University*, NY
65. December 10, 2013 “From biomechanics to cerebral edema after traumatic brain injury” for Visiting Professor Research Seminar, Department of Anesthesiology, *Columbia University Medical Center*, NY
66. March 3, 2014 “Traumatic brain injury: at the intersection of neuroscience and biomechanics” for the Current Issues in Neuroscience seminar series, *Teacher College, Columbia University*, NY

67. September 23, 2014 “Biomechanics at the mesoscopic scale: Knowledge and tools to define tolerance” for Army Research Laboratory, Aberdeen Proving Grounds, MD
68. October 14, 2014 “Traumatic brain injury alters electrophysiological function in organotypic brain slice cultures” for The Head Injury Center CNS Injury Seminar Series, *University of Pennsylvania*, PA
69. November 12, 2014 "Mild traumatic brain injury – in a dish!?" for First Year Seminars in Modern Biology, *Columbia University*, NY
70. December 4, 2014 “Neuronal network function is altered after in vitro traumatic brain injury” for the Neuroscience Seminar, *Tulane University*, LA
71. February 6, 2015 “Learning deficits in hippocampal slice cultures after traumatic brain injury” for the Biomedical Engineering Seminar Series, *New Jersey Institute of Technology*, NJ
72. June 23, 2015 “Traumatic brain injury”, for the GEM4 2015 Summer Institute, *Carnegie Mellon University*, PA
73. September 17, 2015 “Heading Off Damage: New insights in traumatic brain injury”, for Columbia University’s Mortimer B. Zuckerman Mind Brain Behavior Institute, Stavros Niarchos Foundation – Brain Insight Lecture Series, *Columbia University*, NY.
74. November 5, 2015 Kavli Salon on Neurodegeneration III, Roundtable discussion, *Rockefeller University*, NY.
75. December 4, 2015 “Reproducing mild traumatic brain injury in a slice culture model”, for the Columbia Translational Neuroscience Initiative, *Columbia University*, NY.
76. May 6, 2016 “Comparing primary and tertiary phases of blast traumatic brain injury with an in vitro model”, for Department of Anatomy & Neurobiology, *Virginia Commonwealth University*, VA.
77. June 16, 2016 “Studying repetitive TBI in a culture dish”, for the Center for Injury Epidemiology and Prevention, *Columbia University*, NY.
78. July 13, 2016 “Biomechanics for Prevention: Preventing synergy of repetitive mTBI” for the Big Ten–Ivy League Traumatic Brain Injury Research Collaboration, Philadelphia, PA.
79. October 12, 2016 “Mild TBI and Learning Impairments in an Organotypic Slice Culture Mode” for *Burke Medical Research Institute*, White Plains, NY.
80. December 14, 2016 “Synaptic Disruption after Mild Traumatic Brain Injury in an Engineered Organotypic Slice Culture System” for Department of Biomedical Engineering, *Southern University of Science and Technology*, Shenzhen, China.
81. February 16, 2017 “Mechanobiology of Traumatic Brain Injury: Applications to Prevention and Treatment” for Columbia Engineering in Medicine Symposium, *Columbia University*, NY.
82. March 13, 2017 “In Pursuit of Treatments for Traumatic Brain Injury” for Institute of Engineering in Biology and Medicine, *Pontificia Universidad Catolica de Chile*, Santiago, Chile.
83. March 14, 2017 “Columbia Engineering: An Undergraduate Snapshot” for Institute of Engineering in Biology and Medicine, *Pontificia Universidad Catolica de Chile*, Santiago, Chile.
84. April 2, 2017 “Primary Blast Injury Decreases Neuronal Plasticity” for Northeastern Bioengineering Conference, *New Jersey Institute of Technology*, NJ.

85. April 14, 2017 “Continuing Efforts to Reduce the Societal Costs of Brain Injury: Material Properties, Mild Injury, and Interventions”, for Department of Biomedical Engineering, *University of Virginia*, VA.
86. April 22, 2017 “Traumatic Brain Injury from a Biomedical Engineering Perspective” for Days on Campus, *Columbia University*, NY.
87. April 28, 2017 “Rescuing Deficits in Neuronal Plasticity after Mild Traumatic Brain Injury” for Faculty of Basic and Biomedical Sciences, *Paris Descartes University*, Paris, France.
88. May 11, 2017 “Investigating Traumatic Brain Injury: Engineering and Neuroscience Collide” for the Neuroscience Education, University Research and Outreach Group, *University of Chicago*, IL.
89. October 10, 2017 “Thinking about concussion” for Columbia University Scholars Program, *Columbia University*, NY.
90. November 19, 2017 “NoMo Diagnostics, Concussion Detection Technology” for New York Angels, NY.

H. Academic Service

H.1 University Committees

2007 – 2013 University Institutional Animal Care and Use Committee (Morningside)
2013 – University Financial Conflict of Interest Committee (Morningside), Co-chair 2018-
2013 – University Committee on Animal Welfare
2014 Promotions and Tenure Committee, School of Arts and Sciences (*ad hoc*, external reader)
2014 – Committee on Instruction, Columbia College and General Studies, SEAS representative
2014 – Educational Policy and Planning Committee, Columbia College and General Studies, SEAS representative
2014 – 2016 Provost’s Middle States Commission on Higher Education Accreditation Subcommittee
2015 – 2017 Chandler Classroom Steering Committee
2015 – 2016 Educational Policy and Planning Committee, Columbia College and General Studies, working group for course numbering
2016 – 2017 University Travel Policy Committee
2017 – JED Foundation Assessment Steering Committee
2017 – Center for Teaching and Learning Advisory Board

H.2 School of Engineering and Applied Science Committees and Duties

2012 – 2014 SEAS Committee on Instruction
2012 – 2014 SEAS Advisory Committee on Undergraduate Curriculum
2013 Chair, SEAS-level Tenure Review Committee (*ad hoc*)
2014 – Vice Dean for Undergraduate Programs, SEAS

2014 – Co-Chair, SEAS Committee on Instruction
2015 Facilitator, SEAS Strategic Forum Discussion on Undergraduate Education
2016 Presenter, SEAS Strategic Forum Discussion on Graduate Education
2016 SEAS Website Redesign Review Committee
2016 – Academic Integrity Task Force
2016 – ABET Coordination Team for Reaccreditation
2016 – 2017 Initiated the Johnson and Johnsons Scholars Program
2016 – 2017 Initiated Engineering Summer Scholarship for students on financial aid
2017 – Interschool Committee to institute new timing for Course Evaluations
2018 – Provost's Academic Review Preparation Committee

H.3 Departmental Committees and Duties

2003 – Undergraduate Student Advisor
2003 – Graduate Student Advisor
2003 – 2005 Chair of the International Student Exchange Program Committee
2003 – 2007 Chair of the Industrial Liaison Committee
2004 – 2005 Chair of the Departmental Holiday Reception Committee
2004 – 2006 Member of the ABET Committee
2004 – 2014 Member of the Undergraduate Curriculum Committee
2004 – 2014 Member of the Undergraduate Laboratory Committee
2004 – 2006 Member of the BME New Science Building Space Proposal Committee
2004 – 2008 Member of the Biomechanics Track Faculty Search Committee
2005 Member of the Coulter Foundation Partnership Preliminary Application Committee
2006 – 2007 Chair of the Biomechanics Track Faculty Search Committee: Hired Drs. Chris Jacobs and Hayden Huang
2006 – 2012 Member of the Undergraduate Teaching Laboratory Committee
2006 Chair of the Undergraduate Teaching Laboratory Committee
2007 – 2008 Chair of the Biomechanics Track Faculty Search Committee: Hired Dr. Henry Hess
2007 – 2010 Chair of the Undergraduate Curriculum Committee
2007 – 2010 3-2 Program (Transfer Student) Advisor
2008 – 2009 Instituted an Online Undergraduate Advising and Academic Tracking System
2009 Member of the Search Committee for Instructor in Biomedical Engineering: Hired Dr. Aaron Kyle
2010 Instituted a totally revised Online Undergraduate Advising and Academic Tracking System
2011 – 2013 Member of the ABET Renewal Committee
2012 – 2014 Vice-chair, Department of Biomedical Engineering
2012 – Administrative Committee, Department of Biomedical Engineering

2013 – 2014 Member of the Biomedical Engineering Instructor Search Committee: Hired Dr. Katherine Reuther

2013 – 2014 Chair, Biomedical Engineering Neural Engineering Faculty Search Committee: Hired Dr. Josh Jacobs

H.4 Department, School, and University Outreach

2003 Organized the BME-Center for Career Education Orientation

2004 Engineering Invitational Presentation on BME Senior Design

2004 Parents' Weekend Open House

2004 Organized the BME-Center for Career Education Orientation

2005 Days on Campus Luncheon and Laboratory Tours

2005 Organized Engineering Open House for Rising Sophomores

2005 Organized Sophomore Group Advising Session

2005 Departmental Participant in Days on Campus Luncheon and Laboratory Tours

2005 Hosted Katherine Jernberg, Dean of Admissions, Keck Graduate Institute

2006 Departmental Gateway Lecture

2006 Participant in Collegiate School Laboratory Tours

2006 SURF lecture, "Understanding the biomechanics of head injury"

2006 Departmental Coordinator for Summer Engineering Invitational

2006 Academic Resources Fair Departmental Representative

2006 Prospective Student Host: Brandon Boston

2006 Prospective Student Host: Nicholas Fountoulakis

2007 Departmental Gateway Lecture

2007 Prospective Student Host: Janelle Geddes

2007 BMES Career Panel Member during Engineering Week

2007 Faculty Representative at Summer Engineering Invitational

2007 3-2 Program Student Orientation

2007 Organized two Faculty Academic Advising Training Sessions

2007 Conducted the Town Hall Meeting for Junior BME Students

2008 Café Science, Featured Scientist

2008 Departmental Gateway Lecture

2008 Departmental Representative for Days on Campus

2008 Prospective student host: Colin Hoffman

2008 Departmental Representative at the Engineering Invitational Parent Student Reception

2008 Prospective student host: Nabil Mehta

2008 Departmental Representative for SEAS Major Night

2008 3-2 Program Student Orientation

2008 Conducted the Town Hall Meeting for Junior BME Students

2008 Met with Diversified Search Ray & Berndston to inform the search for Dean of Division of Student Affairs

2009 Untenured Faculty Focus Group Leader
2009 Facilitator of a meeting between Junior Faculty and Dean Feniosky Pena-Mora
2009 Presented to the SEAS Committee on Instruction the BME system for undergraduate advising and tracking
2009 Days on Campus Biomedical Engineering Department Representative
2009 Participant in Collegiate School Laboratory Tours
2009 Prospective student host: Natasha Satya
2009 Engineering Invitational Biomedical Engineering Lecture
2009 New Student Orientation Program Biomedical Engineering Representative
2009 SEAS Parents Weekend Lecture
2009 Conducted the Town Hall Meeting for Junior BME Students
2010 Departmental Gateway Lecture
2010 Addressed the President's Council, Cold Spring Harbor Laboratory
2011 Participant in Collegiate School Laboratory Tours
2012 Science Expo, The School at Columbia
2012 First Year Seminars in Modern Biology BIOL C2908, "Brain Trauma: Biomechanical Insights"
2012 Participant in Collegiate School Laboratory Tours
2013 Alumni Weekend Departmental Lunch representative
2013 Participant in Collegiate School Laboratory Tours
2013 First Year Seminars in Modern Biology BIOL C2908, "Brain Trauma: Biomechanical Insights"
2013 – 2014 Organizing Committee, Science Expo, The School at Columbia University
2014 ResInc, introductions at fall kickoff speaker series
2014 Just Desserts, Dean's office representative
2014 Student Leadership Dinner, Dean's office representative
2014 First Year Seminars in Modern Biology BIOL C2908, "Mild traumatic brain injury – in a dish!?"
2014 Engineering Career Fair Dinner, Dean's office representative
2014 Faculty Excellence Celebration dinner with donors, Dean's office representative
2015 Columbia Engineering Scholarship Dinner, Dean's office representative
2015 Columbia Engineering Alumni Association Dinner, speaker
2015 Columbia Engineering Days on Campus, speaker
2015 Davis Scholars lunch for prospective families
2015 Perspectives on Diversity Alumni Brunch
2015 SEAS Awards of Distinction Dinner, speaker
2015 Archimedes Dinner
2015 Carleton Commons Dedication lunch
2015 SWE dinner, speaker
2015 Academic Success Program lunch
2015 SEAS Senior Dinner

2015 Columbia Engineering Class Day
2015 Prospective Egleston Scholars reception
2015 Alumni Reception and Dinner
2015 Convocation
2015 Egleston Family welcome reception
2015 Academic Assembly
2015 SEAS Manhattanville brainstorming session, participant
2015 Just Desserts, speaker
2015 SEAS Strategy meeting on undergraduate education, chaired & presented
2015 Race, Ethnicity and University Life: Next Steps from Office of University Life
2015 Chairs' Meeting, presentation on advising
2015 SEAS Faculty Meeting, presentation on advising
2015 Columbia Engineering Alumni Association Cruise
2015 Summer Engineering Research Invitational, speaker
2015 – 2016 Organizing Committee, Science Expo, The School at Columbia University
2016 SEAS strategy meeting on graduate education, presented
2016 Egleston Scholar enhanced advising
2016 Scholarship Dinner
2016 Columbia Engineering Young Alumni dinner, speaker
2016 Lynn Conway Lunch on Diversity in STEM
2016 Magill Lecture by Lynn Conway
2016 Engineering Strategic Discussion Dinner
2016 Senior Toast
2016 Egleston Recruitment dinner
2016 Days on Campus Reception, speaker
2016 Davis Scholars Lunch for prospective families
2016 Diversity brunch
2016 Deans in Halls, named guest
2016 Awards of Distinction dinner
2016 Senior Dinner
2016 Academic Success Program lunch, speaker
2016 Egleston Scholars Graduation Reception, speaker
2016 Rio Innovation Hub Design Challenge, chaperone
2016 New Faculty Orientation, speaker
2016 First in Family Orientation, speaker
2016 Transfer Student Welcome Reception
2016 Academic Resource Fair
2016 ResInc Welcome Reception, speaker
2016 Just Desserts Networking Reception, speaker
2016 American Council of Engineering Companies of New York Annual Engineering Excellence Awards, judge

2016	Work-Life Balance in Academia Panelist, SEAS Path to Professorship Workshop
2017	Met with Boeing representatives for recruiting students
2017	Senior Toast
2017	American Council of Engineering Companies of New York Engineering Excellence Awards Gala
2017	Columbia Engineering Scholarship Dinner
2017	Johnson and Johnson Scholars meeting, presenter
2017	Student Leadership Lunch
2017	Davis Scholars Lunch, Days on Campus
2017	Diversity Brunch, Days on Campus
2017	Columbia Engineering Awards of Distinction Dinner, speaker
2017	Columbia Engineering Senior Dinner
2017	Academic Success Program Senior Banquet, speaker
2017	Alumni Dinner
2017	Oversaw renovations of CEPSR 414
2017 – 2018	Oversaw implementation of APMA E2000 Multivariable Calculus of Engineers
2017 – 2018	Oversaw implementation of ORCA E2500 Foundations in Data Science
2017	Egleston Scholars Welcome Reception, speaker
2017	New Family Orientation, panelist
2017	New Faculty Orientation, speaker
2017	Academic Assembly
2017	Visiting Student Reception
2017	Transfer and Combined Plan Student Reception
2017	SCOOPS activity for first year students
2017	Family Weekend Welcome Reception
2017	Just Desserts Student-Alumni Networking Reception, speaker
2017	Tree Lighting Ceremony, speaker
2018	Pi-Day Student Reception, speaker
2018	Columbia Engineering Scholarship Dinner
2018	Columbia Engineering Awards of Distinction Dinner, speaker
2018	Columbia Engineering Senior Dinner
2018	Academic Success Program Senior Banquet, speaker