Jonathan Henry Shannahan

Purdue University
School of Health Sciences

EDUCATION

North Carolina State University, Raleigh, North Carolina (2002-2006)
Bachelor of Science Chemistry

University of North Carolina – Chapel Hill, Chapel Hill, North Carolina (2007-2011)
Ph.D, Toxicology
Mentor: Dr. Urmila Kodavanti, Curriculum in Toxicology, U.S. EPA
Dissertation topic: Cardiopulmonary toxicology, susceptible human subpopulations, iron-mediated toxicity

POSITIONS AND EMPLOYMENT

Contractor (July 2006 – June 2007)
U.S. EPA, Cardiopulmonary Immunotoxicology Branch, Research Triangle Park, North Carolina.

Graduate Student (July 2007 – October 2011)
University of North Carolina – Chapel Hill, Chapel Hill, North Carolina
Mentor: Dr. Urmila Kodavanti

Postdoctoral Fellow (November 2011 – June 2013)
East Carolina University, Greenville, North Carolina
Mentor: Dr. Jared Brown

Postdoctoral Fellow (July 2013 – June 2015)
University of Colorado – Anschutz Medical Campus, Aurora, Colorado
Mentor: Dr. Jared Brown

Assistant Research Instructor (July 2015 – June 2016)
University of Colorado – Anschutz Medical Campus, Aurora, Colorado

Assistant Professor (Tenure Track) (July 2016 – Present)
Purdue University, West Lafayette, Indiana

PEER-REVIEWED PUBLICATIONS (chronological order)

1) Wallenborn, J. G., Evansky, P., **Shannahan, J. H.**, Vallanat, B., Ledbetter, A. D., Schladweiler, M. C., Richards, J. H., Gottipolu, R. R., Nyska, A., and Kodavanti, U. P. (2008). Subchronic inhalation of zinc sulfate induces cardiac changes in healthy rats. *Toxicol Appl Pharmacol* **232**(1)

2) Gordon, C. J., Gottipolu, R. R., Kenyon, E. M., Thomas, R., Schladweiler, M. C., Mack, C. M., **Shannahan, J. H.**, Wallenborn, J. G., Nyska, A., MacPhail, R. C., Richards, J. E., Devito, M., and Kodavanti, U. P. (2010). Aging and susceptibility to toluene in rats: a pharmacokinetic, biomarker, and physiological approach. *J Toxicol Environ Health A* **73**(4), 301-18

3) **Shannahan, J. H.**, Schladweiler, M. C., Richards, J. H., Ledbetter, A. D., Ghio, A. J., and Kodavanti, U. P. (2010). Pulmonary oxidative stress, inflammation, and dysregulated iron homeostasis in rat models of cardiovascular disease. *J Toxicol Environ Health A* **73**(10), 641-56

4) Kodavanti, U. P., Thomas, R., Ledbetter, A. D., Schladweiler, M. C., **Shannahan, J. H.**, Wallenborn, J. G., Lund, A. K., Campen, M. J., Butler, E. O., Gottipolu, R. R., Nyska, A., Richards, J. E., Andrews, D., Jaskot, R. H., McKee, J., Kotha, S. R., Patel, R. B., and Parinandi, N. L. (2011). Vascular and cardiac impairments in rats inhaling ozone and diesel exhaust particles. *Environ Health Perspect* **119**(3), 312-8

5) Padilla-Carlin, D. J., Schladweiler, M. C., **Shannahan, J. H.**, Kodavanti, U. P., Nyska, A., Burgoon, L. D., and Gavett, S. H. (2011). Pulmonary inflammatory and fibrotic responses in Fischer 344 rats after intratracheal instillation exposure to Libby amphibole. *J Toxicol Environ Health A* **74**(17), 1111-32

6) **Shannahan, J.**, Schladweiler, M., Padilla-Carlin, D., Nyska, A., Richards, J., Ghio, A., Gavett, S., and Kodavanti, U. (2011). The role of cardiovascular disease-associated iron overload in Libby amphibole-induced acute pulmonary injury and inflammation. *Inhal Toxicol* **23**(3), 129-41

7) **Shannahan, J. H.**, Ghio, A. J., Schladweiler, M. C., McGee, J. K., Richards, J. H., Gavett, S. H., and Kodavanti, U. P. (2011). The role of iron in Libby amphibole-induced acute lung injury and inflammation. *Inhal Toxicol* **23**(6), 313-23

8) Cyphert, J. M., Padilla-Carlin, D. J., Schladweiler, M. C., **Shannahan, J. H.**, Nyska, A., Kodavanti, U. P., and Gavett, S. H. (2012). Long-term response of rats to single intratracheal exposure of Libby amphibole or amosite. *J Toxicol Environ Health A* **75**(3), 183-200

9) **Shannahan, J. H.**, Alzate, O., Winnik, W. M., Andrews, D., Schladweiler, M. C., Ghio, A. J., Gavett, S. H., and Kodavanti, U. P. (2012). Acute phase response, inflammation and metabolic syndrome biomarkers of Libby asbestos exposure. *Toxicol Appl Pharmacol* **260**(2), 105-14

10) **Shannahan, J. H.**, Ghio, A. J., Schladweiler, M. C., Richards, J. H., Andrews, D., Gavett, S. H., and Kodavanti, U. P. (2012). Transcriptional activation of inflammasome components by Libby amphibole and the role of iron. *Inhal Toxicol* **24**(1), 60-9

11) **Shannahan, J. H.**, Nyska, A., Cesta, M., Schladweiler, M. C., Vallant, B. D., Ward, W. O., Ghio, A. J., Gavett, S. H., and Kodavanti, U. P. (2012). Subchronic pulmonary pathology, iron overload, and transcriptional activity after Libby amphibole exposure in rat models of cardiovascular disease. *Environ Health Perspect* **120**(1)

12) **Shannahan, J. H.**, Schladweiler, M. C., Thomas, R. F., Ward, W. O., Ghio, A. J., Gavett, S. H., and Kodavanti, U. P. (2012e). Vascular and thrombogenic effects of pulmonary exposure to Libby amphibole. *J Toxicol Environ Health A* **75**(4), 213-31

13) Wang, X., Podila, R., **Shannahan, J. H.**, Rao, A. M., and Brown, J. M. (2013). Intravenously delivered graphene nanosheets and multiwalled carbon nanotubes induce site-specific Th2 inflammatory responses via the IL-33/ST2 axis. *Int J Nanomedicine* **8**, 1733-48

14) **Shannahan, J. H.**, Brown, J. M., Chen, R., Ke, P. C., Lai, X., Mitra, S., and Witzmann, F. A. (2013). Comparison of nanotube-protein corona composition in cell culture media. *Small* **9**(12), 2171-81

15) **Shannahan, J. H.**, Lai, X., Ke, P. C., Podila, R., Brown, J. M., and Witzmann, F. A. (2013). Silver nanoparticle protein corona composition in cell culture media. *PLoS One* **8**(9), e74001

16) Bhavaraju, L., **Shannahan, J.**, William, A., McCormick, R., McGee, J., Kodavanti, U., and Madden, M. (2014). Diesel and biodiesel exhaust particle effects on rat alveolar macrophages with in vitro exposure. *Chemosphere* **104**, 126-33

17) Wang, X.,* **Shannahan, J. H.**,* and Brown, J. M. (**Authors contributed equally*) (2014). IL-33 modulates chronic airway resistance changes induced by multi-walled carbon nanotubes. *Inhal Toxicol* **26**(4), 240-9

18) Cyphert, J., Carlin, D., Nyska, A., Schladweiler, M., Ledbetter, A., **Shannahan, J.**, Kodavanti, U., and Gavett, S. (2014). Comparative long-term toxicity of Libby amphibole and amosite asbestos in rats after single or multiple intratracheal exposures. *J Toxicol Environ Health* (78(3), 151-65

19) Aldossari, A.,* **Shannahan, J.**,* Podila, R., and Brown, J. (**Authors contributed equally*) (2014). Influence of physicochemical properties of silver nanoparticles on mast cell activation and degranulation. *In Vitro Tox.* 29(1), 195-203

20) **Shannahan, J.**, Podila, R., Aldossari, A., Emerson, A., Powell, B., Ke, P., Rao, A., and Brown, J. (2014). Formation of a protein corona on silver nanoparticles mediates cellular toxicity via scavenger receptors. *Tox. Sci.* 143(1), 136-46

21) Anderson D, Patchin E, Silva R, Sharmah U, Guo T, Das G, Brown J, **Shannahan J**, Gordon T, Chen L, Pinkerton K, Van Winkle L. (2015). Influence of particle size on persistence and clearance of aerosolized silver nanoparticles in the rat lung. *Tox. Sci. 144(2). 366-81*

22) Sumner S, Snyder R, Wingard C, Mortensen N, Holland N, **Shannahan J**, Dhungana S, Pathmasiri W, Lewin A, Fennell T. Distribution and biomarkers of carbon-14 labeled C60 in female rats and mice for up to 30 days after exposure. *J Applied Tox.*

23) Aldossari, A.,* **Shannahan, J.**,* Podila, R., and Brown, J.M. (**Authors contributed equally*) Scavenger receptor B1 facilitates macrophage uptake of silver nanoparticles and cellular activation *J. Nanoparticle Research.*

24) Holland N., Becak D., **Shannahan J.**, Brown J., Carratt S., Van Winkle L., Pinkerton K., Want C., Munusamy P., Baer D., Sumner S., Fennell T., Lust R., and Wingard C. Persistent cardiac ischemia reperfusion injury following instillation of 20 nm citrate-capped nanosilver. *J. of Nanomedicine and Nanotech.*

25) Synder R., Fennell T., Wingard C., Mortenson N., Holland N., **Shannahan J.**, Pathmasiri W., Lewin A., and Sumner S. Distribution and biomarker of carbon-14 labeled fullerene C_{60} ($[^{14}C(U)]C_{60}$) in pregnant and lactating rats and their offspring after maternal intravenous exposure. *J. Applied Toxicology.*

26) **Shannahan J.**, Sowrirajan H., Persaud I., Podila R., and Brown J. Impact of Silver and Iron Nanoparticle Exposure on Cholesterol Uptake by Macrophage. *J. of Nanomaterials.*

27) **Shannahan J.**, Podila R., and Brown, J.M. A hyperspectral and toxicological analysis of protein corona impact on silver nanoparticle properties, intracellular modifications and macrophage activation. *Inter. J. Nanomedicine.*

28) Mallineni S., **Shannahan J.,** Raghavendra A., Rao A., Brown J., and Podila R. Biomolecular interactions and biological responses of emerging two-dimensional materials and aromatic amino acid complexes. *ACS Applied Materials and Interfaces.*

29) **Shannahan J**., Fritz K., Raghavendra A., Podila R., and Brown J. Disease-induced disparities in formation of the nanoparticle-biocorona and the toxicological consequences. *Tox. Sci.*

30) Sendesi S, Ra K, Conkling E, Boor B, Nuruddin M, Howarter J, Youngblood J, Kobos L, **Shannahan J**, Jafvert C, Whelton A. (2017) Worksite chemical air emissions and worker exposure during sanitary sewer and stormwater pipe rehabilitation using cured-in-place-pipe. *Environ. Sci. Technol. Letter.*

31) Raghavendra A, Fritz K, Fu S, Brown J, Podila R, **Shannahan J**. (2017) Variations in biocorona formation related to defects in the structure of single walled carbon nanotubes and the hyperlipidemic disease state. *Sci Reports*

32) Adamson S, Shen X, Jiang W, Lai V, Wang X, **Shannahan J**, Cannon J, Chen J, Zheng W. (2018) Subchronic manganese exposure impairs neurogenesis in the adult rat hippocampus. *Tox. Sci*

33) Adamson, S, Lin Z, Chen R, Kobos L, **Shananhan J.** (2018) Experimental challenges regarding the *in vitro* investigation of the nanoparticle-biocorona in disease states *In Vitro Tox.*

34) Kobos L, Adamson S, Evans S, Gavin T, **Shannahan J.** (2018) Altered formation of the iron oxide nanoparticle-biocorona due to individual variability and exercise. *Environ Toxicol Pharmacol.*

35) Adamson S, Wang R, Wu W, Cooper B, **Shannahan J.** (2018) Metabolomic insights of macrophage responses to graphene nanoplatelets: role of scavenger receptor CD36. *PLOS One*

36) Persaud I., **Shannahan J.**, Raghavendra A., Alsaleh N., Podila R., Brown J. (2019) Biocorona formation contributes to silver nanoparticle induced endoplasmic reticulum stress. *Ecotoxicol Environ Saf*.

37) Thompson L,* **Shannahan J**,* Perez C, Haykal-Coates N, King Charly, Hazari M, Brown J, Farraj A. (* *Authors contributed Equally*) (2019) Early proteome shift and serum bioactivity precede diesel exhaust-induced impairment in cardiovascular recovery in rats. *Sci Reports*

38) Kobos L, Mahboobeh Teimouri Sendesi, S, Whelton A, Boor B, Howarter J, **Shannahan J**.(2019) *In vitro* toxicity assessment of emitted materials collected during the manufacture of water pipe plastic linings. *Inhal Toxicol*

39) Kobos L, Alqatani S, Ferreira C, Aryal U, Hedrick V, Sobreira T, **Shannahan J**. (2019) An integrative proteomic/lipidomic analysis of the gold nanoparticle biocorona in healthy and obese conditions *Applied In Vitro Toxic*

40) Patel S, Yue F, Saw S, Foguth R, Cannon J, **Shannahan J**, Kuang S, Sabbaghi A, Carroll C. (2019) Advanced glycation end-products modulae mitochondrial function and proliferation capacity of achilles tendon-derived fibroblasts. *Sci Reports*

41) Kargl C, Nie Y, Evans S, Stout J, **Shannahan J**, Kuang S, Gavin T. (2019) Factors secreted from high glucose treated endothelial cells impair expansion and differentiation of human skeletal muscle satellite cells. *J. of Physiology*

42) Lawana V, Um S, Rochet J, Turesky R, **Shannahan J**, Cannon J. (2019). Neuromelanin modulates heterocyclic amine-induced dopaminergic neurotoxicity. *Toxicol. Sci.*

43) Shen X, Xia L, Jiang H, **Shannahan J**, Du Y, Zheng W. (2020). Altered clearance of beta-amyloid from the cerebrospinal fluid following subchronic lead exposure in rats: Roles of RAGE and LRP1 in the choroid plexus. *J Trace Elem Med Biol.*

44) Kobos L, Alqahtani S, Xia L, Coltellino V, Kishman R, McIlrath D, Perez-Torres C, **Shannahan J.** (2020). Comparison of silver nanoparticle biodistribution and responses between healthy and metabolic syndrome mouse models. *J Toxic Envir Heal A*

45) Alqahtani S, Kobos L, Xia L, Ferreira C, Marmolejo J, Du X, **Shannahan J**. (2020). Exacerbation of nanoparticle-induced acute pulmonary inflammation in a mouse model of metabolic syndrome. *Frontiers in Immunol*

46) Alqahtani S, Cooper B, Spears C, Wright C, **Shannahan J.** (2020). Electronic nicotine delivery system-induced alterations in oral health via saliva assessment. *Exp Biol Med*

47) Pearce K, Gray N, Guar P, Jeon J, Suarez A, **Shannahan J**, Pappas R, Wright C. (2020) Toxicological analysis of aerosols derived from three popular electronic nicotine delivery systems using normal human bronchial epithelial cells. *Toxicology In Vitro Tox*

48) Kobos L, Ferreira C, Sobreira T, Rajwa B, **Shannahan J.** (2020) A Novel Experimental Workflow to Determine the Impacr of Storage Parameters on the Mass Spectrometric Profiling and Assessment of Representative Phosphatidylethanolamine Lipids in Mouse Tissues. *Analytical and Bioanalytical Chemistry*

49) Hettinger Z, Kargl C, **Shannahan J**, Kuang S, Gavin T. (2021) Extracelular vesicles released from stress-induced premature senescent myoblasts impair endothelial function and proliferation. *Experimental Physiology*

50) Adamson A, Zheng W, Agim Z, Du S, Fleming S, **Shannahan J**, Cannon J. (2021) Systemic copper disorders influence the olfactory function in adulte rats: roles of altered adult neurogenesis and neurochemical imbalance. *Biomolecues*

51) Alqahtani S, Xia L, Jannasch A, Ferreira C, Franco J, Shannahan J. (2021) Disruption of pulmonary resolution mediators contribute to exacerbated silver nanoparticle-induced acute inflammation in a metabolic syndrome mouse model. *Toxicology and Applied Pharmacology*

52) Noh Y, Boor B, **Shannahan J**, Troy C, Jafvert C, Whelton A. (2022) Emergency responder and public health considerations for plastic sewer lining chemical waste exposures in indoor environments. *Journal of Hazardous Materials*

REVIEWS

1) **Shannahan, J. H.**, Kodavanti, U. P., and Brown, J. M. (2012c). Manufactured and airborne nanoparticle cardiopulmonary interactions: a review of mechanisms and the possible contribution of mast cells. *Inhal Toxicol* **24**(5), 320-39

2) Mann, E. E., Thompson, L. C., **Shannahan, J. H.**, and Wingard, C. J. (*all authors contributed equally*)(2012). Changes in cardiopulmonary function induced by nanoparticles. *Wiley Interdiscip Rev Nanomed Nanobiotechnol* **4**(6), 691-702

3) **Shannahan, J. H.**, and Brown, J. M. (2014). Engineered nanomaterial exposure and the risk of allergic disease. *Curr Opin Allergy Clin Immunol* **14**(2), 95-9

4) **Shannahan, J.H.,** and Brown, J.M. (2015). Implications of scavenger receptors on the safe development of nanotherapeutics. *Receptors and Clinical Investigation*

5) **Shannahan, J.H.** (2017). The biocorona: A challenge for the biomedical application of nanoparticles. *Nanotechnology Reviews* 6(4)

6) Kobos L, **Shannahan J.** (2019). Biocorona-induced modifications in engineered nanomaterial-cellular interactions impacting biomedical applications. *WIRES Nanomedicine and Nanobiotechnology*

7) Kobos L, **Shannahan J.** (2020). Particulate Matter Inhalation and the Exacerbation of Cardiopulmonary Toxicity due to Metabolic Disease. *Exp Biol Med*

BOOK CHAPTERS

1) **Shannahan, J.** (2014). Nanoparticle-Biocorona. Encyclopedia of Nanotechnology

2) **Shannahan, J.** Multi-Walled Carbon Nanotube-Induced Pulmonary Fibrous. Biological Effects of Fibrous and Particulate Substances

3) Shannahan, J. and Wright, C. Assessment of Ambient Fine and Ultrafine Particulate Matter Toxicity. Ambient Combustion Ultrafine Particles and Health

HONORS AND AWARDS

2008 UNC-Chapel Hill Certificate in Teaching Science to Undergraduates
2009, 2011 Goldberg Travel Award Recipient (University Travel Award)
2010 Curriculum in Toxicology Poster Award
2010 Society of Toxicology Graduate Student Travel Award
2011 North Carolina Society of Toxicology Poster Award
2011 UNC-Chapel Hill Certificate in Translational Medicine
2012 North Carolina President's Award for Research Competition (2nd Place)
2013 Society of Toxicology Nanotoxicology Specialty Section Outstanding Postdoc Award (3rd Place)
2013 Mountain West Society of Toxicology Best Post-Doctoral Oral Presentation
2014 Colgate-Palmolive Postdoctoral Fellowship Award in *In Vitro* Toxicology
2014 American Thoracic Society Abstract Scholarship Award
2015 Society of Toxicology Nanotoxicology Specialty Section Outstanding Postdoc Award (1st Place)
2018 Purdue Today - Thumbs Up
2019 Experimental Biology and Medicine Journal Outstanding Reviewer Award
2019 Purdue Research Foundation International Travel Award
2019 Outstanding Young Immunotoxioclogist Award, Immunotoxicology Specialty Section, Society of Toxicology
2021 Taylor and Francis Editorial 2021 Award

PROFESSIONAL ACTIVITY

Professional Memberships:

2006-2007 American Chemical Society
2007-2013 North Carolina Society of Toxicology
2009- Society of Toxicology
2009- Inhalation Specialty Section National Society of Toxicology
2010-2013 American Thoracic Society
2012-2013 Sustainable Nanotechnology Organization
2012- Nanotoxicology Specialty Section National Society of Toxicology
2013-2016 Mountain West Society of Toxicology
2014- Immunotoxicology Specialty Section National Society of Toxicology
2016- Ohio Valley Society of Toxicology
2016- Purdue University Birck Nanotechnology Center Faculty Member
2017- Purdue University Interdisciplinary Life Sciences Graduate Program, Biotechnology Training Group Member
2018- Purdue University Center for Cancer Research Member
2019- Purdue University Interdisciplinary Life Sciences Graduate Program, Biotechnology Training Group Chair