

Teaching

BMS 6641 Medical Neuroscience
BMS 6020 Medical Neuroscience (Course Co-Director 1994-1999)
BMS Course 2 Neurological Systems
BMS 6500 Medical Physiology (Course Director 1986-1988)
GMS 6091 Responsible Conduct in Research
GMS 6772 Spinal Cord: Development, Pathology, and Therapy
GMS 6461 Systems Physiology & Pharmacology
GMS 6020 Graduate Neuroscience (1998 - 2000, Chair, Neuroscience Concentration Committee)
GMS 7910 Directed Research
GMS 7980 Doctoral Committees
GMS 7930 Selected Topics: Survival Skills and Ethics for Biomedical Graduate Students; Advanced Concepts in Systems Physiology; Physiology Seminar; Computer Languages

GMS 7939 Graduate Seminar
GMS 6400 Graduate Core Course in Physiology
GMS 6404 Systems Neurophysiology
GMS 6494 Introduction to Physiological Research
GMS 6706 Basic Medical Neuroscience (Course Director, 2011-2013)
 Other courses: Cellular Neurophysiology, Membrane Physiology, Advanced Physiologic Assessment (Nursing), Residency Programs in Neurology and Internal Medicine (Pulmonary and Allergy – Immunology); Medical Honors Program; Service as medical student advisor (2010-2012)

Graduate student dissertation advisor, co-advisor Subsequent or current position

Lauren Segers	Research Associate University of South Florida
Kendall F. Morris	Professor University of South Florida
Zhongzeng Li	Chief Resident in Neurology Medical University of South Carolina
Donald Bolser	Professor University of Florida
David Baekey	Assistant Professor University of Florida
Mackenzie Ott	Postdoctoral Fellow Global Center for Speech and Hearing Research University of South Florida
M. Jason Highsmith	Assistant Professor University of South Florida

Committee member or external examiner for:

Christian Gestreau	Maître de Conférence, CRN2M, Département PNV, MP3-Respiration, Université Aix-Marseille II & III, Marseille, France
Terrence C. Town	Faculty Research Scientist II, Department of Biomedical Science and the Maxine Dunitz Neurosurgical Institute, Cedars-Sinai Medical Center
Charles N. R. Henderson	Associate Professor Palmer College of Chiropractic Medicine
Cristina Jaén	Postdoctoral Fellow Monell Chemical Senses Center

John Canfield
**Visiting students, post-doctoral fellows,
research associates:**

Current graduate student

Subsequent or current position

Charles Brock

Associate Dean of VA Affairs for the USF College
of Medicine

Yvonne M. Hernandez

Associate Professor, Department of
Pharmacology
Georgetown University School of Medicine

Akiko Arata

Division of Physiome, Department of Physiology,
Hyogo College of Medicine, Japan and RIKEN
Brain Science Institute

Sarah Nuding

Senior Research Associate
University of South Florida

Julie A. Jacques

Physician

Jerry Koleski

Physician

Ulysses J. Balis

Professor of Pathology and Director, Division of
Pathology Informatics, University of Michigan

Eugene Chang

Medical student, Baylor College of Medicine

Kimberly Iceman

Assistant Professor, Department of Biology,
Valparaiso University

Thesis Committees

College of Engineering

Chaitanya Damle

College of Engineering

Research

Overview of research

I have a long-standing interest in the analysis of neural circuits and sensory-motor integration. Early work begun as a post-doctoral fellow with George Gerstein described interactions among simultaneously recorded ensembles of sensory and motor neurons in the crayfish. Intracellular recordings and perturbations together with various statistical methods for spike train analysis revealed evidence for roles of spike timing and synchrony in the “ensemble coding” and gain control of parallel proprioceptive input channels and the generation of motor neuron proprioceptive fields.

My subsequent research with students and colleagues since the early 1980s has focused on defining functional connectivity in the mammalian brain stem networks for breathing and airway protective behaviors. We have identified circuit operations that tune that motor pattern during changes in blood pressure and blood gases, with selective perturbations of baroreceptors and peripheral or central chemoreceptors, and following acute challenge-evoked exacerbations that mimic aspects of asthma. To accomplish this work, we developed or enhanced multi-array recording technologies and high-throughput methods for parallel spike train analysis for the identification of functional connectivity and some aspects of its dynamics. Associated computational

models of the network were iteratively informed by our experiments that were, in turn, guided by model-derived predictions and hypotheses.

Our early work, based upon cross-correlation of parallel spike train recordings, identified interactions within and between the ventrolateral medulla and pons. Subsequently, we detected a "rostral-to-caudal polarity" of "I-Driver" neuron excitation from what subsequently came to be called the pre-Bötzinger complex. These results motivated subsequent studies that detected evidence for additional inter-areal connectivity, efference copy of inspiratory drive, and parallel circuits for pontomedullary interactions, including pathways through intervening raphé neurons. This work also informed the development of the first data-driven computational network models composed of discrete spiking "integrate-and-fire" neuronal populations for generation of the motor patterns for breathing and coughing. More recently, we made a stochastic network model linked to a closed-loop deterministic biomechanical model of the lungs and respiratory muscles.

We also detected evidence for circuit mechanism for the modulation of breathing by multiple sensory systems, including the first evidence for baroreceptor-evoked push-pull tuning of inspiratory drive by raphé neurons via tonic expiratory neurons in and around the ventral respiratory column. Gravitational clustering analysis demonstrated respiratory-phase dependent spike synchrony among medullary raphé neurons without respiratory modulation of their individual firing rates. This observation suggested a multiplexing of rate and synchrony "codes" in parallel spike trains. Subsequently, we identified repeated patterns of distributed neuronal spike synchrony and transient neuronal assembly configurations, both during baroreceptor stimulation and with carotid chemoreceptor-evoked induction and expression long-term facilitation of inspiratory drive – a respiratory "memory" associated with repeated transient episodes of hypoxia, as found in sleep disordered breathing.

Time series and frequency domain analyses identified pontine and raphé neuron firing rate modulations with a 0.1-Hz rhythm coherent with blood pressure Mayer waves. These "Mayer wave-related oscillations" (MWROs) were coupled with central respiratory drive and became synchronized with the central respiratory rhythm after vagotomy. Cross-correlation analysis identified functional connectivity between pairs of neurons with MWROs. Collectively, the results suggest that a distributed network participates in the generation of MWROs and in the coordination of respiratory and vasomotor rhythms.

A current goal of our group is to define network-scale operations that tune the motor pattern for breathing during perturbations of blood gases. We have identified functional connectivity supporting multi-path tuning of the respiratory motor pattern by both peripheral and central chemoreceptors and circuit mechanisms for active suppression of breathing during hypocapnic apnea.

Research Fellowships

Post-doctoral F22 NS00220 (1974-76) and F32 NS05650 (1976-77)

NIH Research Grants

Project Title: ***Ensemble Neural Coding NS 14934 (1979-82)***
 Source of Support: NIH/NINDS
 Role: Principal Investigator

Project Title: ***Cutaneous Microvascular and Macrovascular Responses HL 24151 (1980-83)***
 Source of Support: NIH/ NHLBI
 Role: Co-Investigator (C. Baker, PI)

Project Title: **Respiratory Muscle Afferents in Respiratory Control HL 17715 (1980-88)**
Source of Support: NIH/ NHLBI
Role: Co-Investigator (R. Shannon, PI)

Project/Proposal Title: **Adverse Events: Quantitative Risk Assessment Tool 1S07RR018262-01 (2002-2003)**
Source of Support: NIH
Role: Initial Principal Investigator, Office of Research (09/01/02-01/30/03)
Project Location: University of South Florida, Office of Research

The goal of this project was to enhance and strengthen the human subjects protection program at the University of South Florida (USF) through the development and implementation of an electronic submission and tracking system for evaluating and coordinating adverse event (AE) reporting.

Project Title: **Brainstem Neural Networks and Airway Defensive Reflexes 2 R01 HL49813 (1994-2003)**
Source of Support: NIH/ NHLBI
Role: Co-Investigator (R. Shannon, PI)
Project Location: University of South Florida, College of Medicine

The major goal of this project was to define mechanisms of airway defensive reflexes, including cough and the expiratory reflex.

Project Title: **Computational Studies of the Respiratory Brainstem 1 R01 NS46062-02 (2002-2008)**
Source of Support: NIH/NINDS under the NSF-NIH Collaborative Research in Computational Neuroscience Program
Role: Principal Investigator
Project Location: University of South Florida, College of Medicine

This collaborative project brought together researchers from universities in five states to develop a unified model of the brainstem respiratory network. Simulated populations of respiratory neurons with realistic biophysical properties and computationally efficient large-scale simulations were used to integrate current knowledge about complex and nonlinear systems, provide a framework to test and predict the consequences of defined perturbations, and generate testable hypotheses. Associated *in vivo* and *in vitro* experiments tested model-based hypotheses on cellular, network and systems level mechanisms that transform the respiratory network during the transitions between eupnea and hyperventilation apnea, from eupnea to gasping, and during sleep and waking. The project also served as a catalyst for the development and sharing of computational methods, modeling and simulation tools, and large data sets.

Project Title: **US - JAPAN Brain Research Cooperative Program Workshop: The NeuroPhysiome: Bridging computational neuroscience and systems biology (2010)**

Source of Support: NIH/NINDS
Role: Principal Investigator
Meeting location: Okinawa Institute of Science and Technology, Japan

The workshop (October 3-6, 2010) at the Okinawa Institute of Science and Technology) considered the apparent disconnect between computational neuroscience and molecular systems biology. Topics included the commonalities and multi-scale modeling of cellular and molecular processes and neuronal systems physiology and how robust function emerges from complex, plastic processes. The workshop brought together members of the systems biology and computational neuroscience communities with the goal of developing new collaborations between scientists and students from the US and Japan.

Project Title: **Neurogenesis of Cough R33 HL089104-01A1 (2008-2012)**
Source of Support: NIH/NHLBI
Role: Co-Investigator (K. Morris, PI)
Project Location: University of South Florida, Morsani College of Medicine

Cough is an essential component of pulmonary defense and is the most common manifestation of lung disease. Cough is the single most common reason why sick patients visit physicians in the United States. The goal of this research was to delineate the brainstem mechanisms by which cough is produced and regulated.

Project Title: **Central Mechanisms of Airway Protection 1R01HL103415-04 (2010 - 2015)**
Source of Support: NIH/NHLBI
Role: Principal Investigator (Multi-PI) with D. Bolser, (UF, contact), P. Davenport (UF), and K. Morris (USF)
Project Location: University of South Florida Morsani College of Medicine and University of Florida

The long-term goal of this project was to define brainstem mechanisms that control and coordinate cough and swallow.

Project Title: **Mechanisms of Swallow Control of Breathing 1R01HL109025-01A1 (2012-2016)**
Source of Support: NIH/NHLBI
Role: Co-Investigator (Paul Davenport - UF, Kendall Morris- USF, PIs.)
Project Location: University of Florida and University of South Florida Morsani College of Medicine

Dysphagia - difficulty in swallowing - commonly results in penetration and aspiration of bolus material into the lower airways, thereby contributing to a major cause of morbidity and mortality after a stroke or with neuromuscular disease. This project will increase our understanding of the basic neural mechanisms that integrate swallow and breathing and the respiratory-related neural mechanisms of dysphagia rehabilitation.

Project Title: **Brainstem Respiratory Neuron Interactions 2 RO1/R37 NS019814-30 (1984 - 2017)***
Source of Support: NIH/NINDS
Role: Principal Investigator
Project Location: University of South Florida, College of Medicine
* 2004-2011, Javits Neuroscience Investigator (R37 MERIT) Award.

The goal of this project was to define the local and distributed effective connectivity of brainstem respiratory neurons involved in the peripheral and central chemoreceptor modulation of breathing. We will also test model-based predictions on network mechanisms that regulate breathing during hypocapnia and acute challenge-evoked exacerbations in an established sensitized animal model of asthma.

Published articles

1. Lindsey, B. G. and Grant, W. C. Aspects of niche diversification in two hermit crab species. **Bulletin of the Mount Desert Island Biological Laboratory** 10: 39-41, 1970.
2. Lindsey, B. G. Fine structure and distribution of axon terminals from the cochlear nucleus on neurons in the medial superior olivary nucleus of the cat. **Journal of Comparative Neurology** 160: 81-104 1975.
3. Lindsey, B. G. and Gerstein, G. L. Reflex control of crayfish claw motor neuron activity during imposed dactylopodite movements. **Brain Research** 30: 348-353 1977.

4. Lindsey, B. G. and Gerstein, G. L. Proprioceptive fields of crayfish claw motor neurons. **Journal of Neurophysiology** 42: 368-382 1979.
5. Lindsey, B. G. and Gerstein, G. L. Interactions among an ensemble of chordotonal organ receptors and motor neurons of the crayfish claw. **Journal of Neurophysiology** 42: 383-399 1979.
6. Lindsey, B. G. and Brown, H. K. Convergence of parallel sensory channels on crayfish claw motor neurons. Changing firing probabilities and synaptic effects of simultaneously monitored proprioceptors. **Journal of Neurophysiology** 47: 1144-1159, 1982.
7. Lindsey, B. G. Measurement and dissociation of joint influence of action potentials in concurrently active parallel channels on motor neuron activity in crayfish. **Journal of Neurophysiology** 47: 1160-1173, 1982.
8. Shannon, R., Saporta, S. and Lindsey, B. G. Transmission of intercostal muscle proprioceptor afferent information to medullary respiratory areas. **Experimental Neurology** 78: 222-225, 1982.
9. Lindsey, B. G. Suppression of proprioceptor-motor neuron interactions by proprioceptors in crayfish. **Brain Research** 250: 367-372, 1982.
10. Baker, C. H., Davis, D. L. and Lindsey, B. G. Innervation sites of dog hindpaw series and parallel vascular circuits. **Blood Vessels** 20: 135-144, 1983
11. Shannon, R. and Lindsey, B. G. Intercostal and abdominal muscle afferent influence on pneumotaxic center respiratory neurons. **Respiration Physiology** 52: 85-98, 1983.
12. Baker, C. H., Davis, D. L., Lindsey, B. G. and Sutton, E. T. Temperature effects on dog hindpaw series and parallel vascular circuits. **American Journal of Physiology** 245: H159-H166, 1983.
13. Shannon, R., Shear, W. T., Mercak, A. R., Bolser, D.C. and Lindsey, B. G. Non-vagal reflex effects on medullary inspiratory neurons during inspiratory loading. **Respiration Physiology** 60: 193-204, 1985.
14. Segers, L. S., Shannon, R. and Lindsey, B. G. Interactions between rostral pontine and ventral medullary respiratory neurons. **Journal of Neurophysiology**, 54: 318-334, 1985.
15. Bolser, D.C., Lindsey, B. G. and Shannon, R. Medullary inspiratory activity: Influence of intercostal tendon organs and muscle spindle endings. **Journal of Applied Physiology** 62: 1046-1056, 1987.
16. Shannon, R., Bolser, D.C. and Lindsey, B. G. Medullary expiratory activity: Influence of intercostal tendon organs and muscle spindle endings. **Journal of Applied Physiology** 62: 1057-1062, 1987.
17. Segers, L. S., Shannon, R., Saporta, S. and Lindsey, B. G. Functional associations among simultaneously monitored lateral medullary respiratory neurons in the cat. I. Evidence for excitatory and inhibitory actions of inspiratory neurons. **Journal of Neurophysiology** 57: 1078-1100, 1987.
18. Lindsey, B. G., Segers, L. S. and Shannon, R. Functional associations among simultaneously monitored lateral medullary respiratory neurons in the cat. II. Evidence for inhibitory actions of expiratory neurons. **Journal of Neurophysiology** 57: 1101-1117, 1987.

19. Shannon, R. and Lindsey, B. G. Expiratory neurons in the region of the retrofacial nucleus: inhibitory effects of intercostal tendon organs. **Experimental Neurology** 97: 730-734, 1987.
20. Bolser, D.C., Lindsey, B. G. and Shannon, R. Respiratory pattern changes produced by intercostal muscle/rib vibration. **Journal of Applied Physiology** 64: 2458-2462, 1988.
21. Shannon, R., Bolser, D.C. and Lindsey, B. G. Medullary neurons mediating the inhibition of inspiration by intercostal muscle tendon organs? **Journal of Applied Physiology** 65: 2498-2505, 1988.
22. Baker, C. H., Davis, D. L., Sutton, E. T. and Lindsey, B. G. Adrenergic and histaminergic neural interactions in the dog paw. **American Journal of Physiology** 255: H426-H433, 1988.
23. Lindsey, B. G., Shannon, R. and Gerstein, G. L. Gravitational representation of simultaneously recorded brainstem respiratory neuron spike trains. **Brain Research**. 483: 373-378, 1989.
24. Lindsey, B. G., Segers, L. S. and Shannon, R. Discharge patterns of augmenting expiratory neurons in rostral lateral medulla of cat: Regulation by concurrent network processes. **Journal of Neurophysiology** 61: 1185-1196, 1989.
25. Hernandez, Y. M., Lindsey, B. G. and Shannon, R. Inhibitory effects of intercostal muscle tendon organs on medullary expiratory neurons that project to the lumbar spinal cord. **Experimental Brain Research** 78: 219-222, 1989.
26. Lindsey, B. G. Invited review: "Neural control of breathing. Recent advances and hypotheses". **Journal of the Florida Medical Association** 78: 241-243, 1991.
27. Lindsey, B. G., Hernandez, Y. M., Morris, K. F., and Shannon, R. Functional connectivity between brain stem midline neurons with respiratory modulated firing rates. **Journal of Neurophysiology** 67: 890-904, 1992.
28. Lindsey, B. G., Hernandez, Y. M., Morris, K. F., Shannon, R., and Gerstein, G. L. Respiratory related neural assemblies in the brain stem midline. **Journal of Neurophysiology** 67: 905-922, 1992.
29. Lindsey, B. G., Hernandez, Y. M., Morris, K. F., Shannon, R., and Gerstein, G. L. Dynamic reconfiguration of brain stem neural assemblies: Respiratory phase-dependent synchrony versus modulation of firing rates. **Journal of Neurophysiology** 67: 923-930, 1992.
30. Davenport, P. W., Shannon, R., Mercak, A., Reep, R. L., and Lindsey, B. G., Cerebral cortical evoked potentials elicited by cat intercostal muscle mechanoreceptors. **Journal of Applied Physiology** 74: 799-804, 1993.
31. Balis, U. J., Morris, K. F., Koleski, J. and Lindsey, B. G. Simulations of a ventrolateral medullary neural network for respiratory rhythmogenesis inferred from spike train cross-correlation. **Biological Cybernetics** 70: 311-327, 1994.
32. Lindsey, B. G., Segers, L. S., Morris, K. F., Hernandez, Y. M., Saporta, S. and Shannon, R. Distributed actions and dynamic associations in respiratory-related neuronal assemblies of the ventrolateral medulla and brainstem midline: Evidence from spike train analysis. **Journal of Neurophysiology** 72: 1830-1851, 1994.

33. Morris, K. F., Arata, A., Shannon, R., and Lindsey, B. G. Long-term facilitation of phrenic nerve activity in the cat: responses and short-time scale correlations of medullary neurones. **Journal of Physiology** (London) 490: 463-480, 1996.
34. Morris, K. F., Arata, A., Shannon, R., and Lindsey, B. G. Inspiratory drive and phase duration during carotid chemoreceptor stimulation in the cat: medullary neurone correlations. **Journal of Physiology** (London) 491: 241-259, 1996.
35. Shannon, R., Baekey, D. M., Morris, K. F., and Lindsey, B. G. Brainstem respiratory networks and cough. **Pulmonary Pharmacology** 9: 343-347, 1996.
36. Lindsey, B. G., Morris, K. F., Shannon, R., and Gerstein, G. L. Repeated patterns of distributed synchrony in neuronal assemblies. **Journal of Neurophysiology** 78: 1714-1719, 1997.
37. Shannon, R., Baekey, D. M., Morris, K. F., and Lindsey, B. G. Ventrolateral medullary respiratory network and a model of cough motor pattern generation. **Journal of Applied Physiology** 84: 2020-2035, 1998.
38. Lindsey, B. G., Arata, A., Morris, K. F., Hernandez, Y. M., and Shannon, R. Medullary raphe neurones and baroreceptor modulation of the respiratory motor pattern in the cat. **Journal of Physiology** (London) 512: 863-882, 1998.
39. Li, Z., Morris, K. F., Baekey, D. M., Shannon R., and Lindsey, B. G. Responses of simultaneously recorded respiratory-related medullary neurons to stimulation of multiple sensory modalities. **Journal of Neurophysiology** 82: 176-187, 1999.
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41. Morris, K. F., Baekey, D. M., Shannon R., and Lindsey, B. G. Respiratory neural activity during long-term facilitation. **Respiration Physiology** 121: 119-133, 2000.
42. Shannon, R., Baekey, D. M., Morris, K. F., Li, Z. and Lindsey, B. G. Functional connectivity among ventrolateral medullary respiratory neurones and responses during fictive cough in the cat. **Journal of Physiology** (London) 525: 207-224, 2000.
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44. Lindsey, B. G., Morris, K. F., Segers, L. S., and Shannon, R. Invited review: "Respiratory neuronal assemblies". **Respiration Physiology** 122: 183-196, 2000.
45. Chang, E., Morris, K. F., Shannon, R., and Lindsey, B. G. Repeated sequences of interspike intervals in baroresponsive respiratory related neuronal assemblies of the cat brainstem. **Journal of Neurophysiology** 84: 1136-1148, 2000

46. Morris, K. F., Shannon, R., and Lindsey, B. G. Changes in medullary neurone firing rates and synchrony following induction of respiratory long-term facilitation in the cat. **Journal of Physiology** (London) 532: 483-497, 2001.
47. Baekey, D. M., Morris, K. F., Gestreau, C., Li, Z., Lindsey, B. G. and Shannon, R. Medullary respiratory neurones controlling laryngeal motoneurone discharge during eupnoea and fictive cough in the cat. **Journal of Physiology** (London) 534: 565-581, 2001.
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62. Morris K. F., Nuding S. C., Segers L. S., Baekey, D. M., Shannon, R., Lindsey, B. G., Dick, T. E. Respiratory and Mayer wave related discharge patterns of raphé and pontine neurons change with vagotomy. **Journal of Applied Physiology** 109: 189-202, 2010.
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Book chapters

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116. Dunin-Barkowski, W. L. Dick, T. E. Orem, J. M., O'Connor, R., Rybak, I. A., Morris, K. F., and Lindsey, B. G. L-plotting of multidimensional data: consequences for the respiratory pattern generator. *Abstract Viewer/Itinerary Planner* Washington, DC: Society for Neuroscience, 2006.
117. Solomon, I. C., Morris, K. F., Nuding, S. C., Segers, L. S. and Lindsey, B. G. Gasp-synchronous expiratory motor output is observed during gasping and augmented bursts induced by severe hypoxia/re-oxygenation in adult cat *in vivo*. *Abstract Viewer/Itinerary Planner* Washington, DC: Society for Neuroscience, 2006.
118. Morris, K. F., Lindsey, B.G., Baekey, D. M., Nuding, S. C., Segers, L. S., Shannon, R., O'Connor, R. E., and Dick. T. E. Frequency and time series analysis of a 0.1 Hz rhythm in pontine and raphe cardio-respiratory related neurons suggest coherence with blood pressure Mayer waves. *FASEB J.* Abstract, 611.14, 2007.

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123. Morris, K. F., Lindsey, B. G., Baekey, D. M., Nuding, S. C., Segers, L. S., Shannon, R., O'Connor R. E., and Dick, T. E. Cardiorespiratory rhythms in spike trains of caudal raphé and pontine neurons in cats: Insights from computational models of acute vagotomy. Program No. 230.11, *2007 Abstract Viewer/Itinerary Planner* San Diego, CA: Society for Neuroscience, 2007.
124. Ott, M. M., Nuding, S. C., Morris, K. F., and Lindsey, B. G. Correlational linkage maps of rostral medullary neurons and the ventral respiratory column suggest multiple network sites for motor pattern modulation. Program No. 476.4, *2008 Abstract Viewer/Itinerary Planner* San Diego, CA: Society for Neuroscience, 2008.
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126. Morris, K. F., Davenport, P. W., Baekey, D. M., Nuding, S. C., Lindsey, B. G., Russell O'Connor, R., Segers, L. S., Shannon, R., and Bolser, D. C. In vivo functional interactions and computational models of a distributed ponto-medullary cough network. *FASEB J.* 23: 1010.7, 2009.
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129. Morris, K. F., Dick, T. E., Davenport, P. W., Baekey, D. M., Nuding, S. C., Lindsey, B. G., O'Connor, R., Segers, L. S., Shannon, R. and Bolser, D. C.² Brainstem Multi-Neuron Recording, Modeling and Simulation. Abstract, XIth Oxford Conference on Modeling and Control of Breathing, Nara Japan, 2009.
130. *Lindsey, B. G., Nuding, S. C., Segers, L. S., O'Connor, R., Ott, M. M., and Morris, K. F. Central chemoreceptor stimulation enhances synchrony in groups of ventral respiratory column inspiratory

neurons. Program No. 668.3, 2009 Abstract Viewer/Itinerary Planner Chicago, IL: Society for Neuroscience, 2009.

131. *Lindsey, B. G., Ott, M. M., Nuding, S. C., Segers, L. S., O'Connor, R., and Morris, K. F. Central chemoreceptors modulate breathing via multipath tuning in ventrolateral respiratory column (VRC) circuits. *FASEB J* 25:847.27, 2011.

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135. Wu, M. A., Casali, K. R., Tobaldini, E., Morris, K. F., Ott, M.M., Lindsey, B. G., Segers, L. S., Nuding, S. C., Montano, N. Mayer wave related oscillations are present in the vagal outflow during chemoreceptor challenge. *FASEB J* 25: Abstract 1076.12, 2011.

136. Davenport, P. W., Sapienza, C. M., Morris, K. F., Lindsey, B. G., Pitts, T. E., and Bolser, D. C. Multielectrode recording of brainstem central respiratory pattern generator neurons during swallow control of respiration. Dysphagia Research Society, Abstract, 2011.

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141. Davenport, P. W., Bolser, D. C., Pitts, T. E., Poliacek, I., Lindsey, B. G., and Morris, K. F. Swallow reconfiguration of respiratory neural pattern, Abstract, *XIIth Oxford Conference on Breathing*, Almelo, Netherlands, 2012.

142. *Lindsey, B. G., Nuding, S. C., Segers, L. S., Dean, J. B., Bolser, D. C., Morris, K. F. Ventral respiratory column tonic expiratory neurons and inspiratory drive modulation, Abstract, *XIIth Oxford Conference on Breathing*, Almelo, Netherlands, 2012.
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144. Morris, K. F., O'Connor, R., Pitts, T. E., Bolser, D. C., Segers, L. S., Nuding, S. C., Lindsey, B. G., Recent advances in simulations of brainstem respiratory networks modeled from multi-neuron recordings, Abstract, *XIIth Oxford Conference on Breathing*, Almelo, Netherlands, 2012.
145. Segers LS, Nuding SC, Ott MM, Dean JB, Bolser DC, O'Connor R, Morris KF, Lindsey BG. Ventral respiratory column tonic expiratory neurons: Nodes for convergent afferent modulation of inspiratory drive, *FASEB J*, 27: Abstract 1214.2, 2013.
146. O'Connor RE, Nuding SC, Segers LS, Ott MM, Lindsey BG, Morris KF. Ventral respiratory column neuron interactions and discharge patterns during expression of low-frequency or very low frequency brainstem network oscillations, *FASEB J*, 27: Abstract 1214.3, 2013.
147. Nuding SC, Segers LS, O'Connor R, Dean JB, Bolser DC, Morris KF, Lindsey BG. Persistent activity and interactions in the brainstem respiratory network during hyperventilatory apnea, *FASEB J*, 27: Abstract 931.3, 2013.
148. Bolser DC, Pitts T, O'Connor R, Segers LS, Sapienza CM, Davenport PW, Morris KF, and Lindsey BG. Prediction of inverse relationship between compression phase duration and expulsive airflow during voluntary cough in humans by a joint neural network biomechanical computational model, *FASEB J*, 27: Abstract, 930.16, 2013.
149. Rose MJ, Pitts T, Davenport PW, Morris KF, Lindsey BG, and Bolser DC. Laparotomy disrupts respiratory phase preference for swallow, *FASEB J*, 27: Abstract, 930.13, 2013.
150. Held HE, Dean JB, Lindsey BG, Teresa C. Pitts T, Rose MJ, Mortensen A, Nicholas JN, Baekey D, Davenport P, Bolser DC. Cats that successfully vent gastric-derived CO₂ exhibit different muscle activation than those that do not. *FASEB J*, Abstract 2014.
151. Pitts T, Gestreau C, Morris KF, Lindsey BG, Davenport PW, Bolser DC. Coordination of swallow and breathing: *in vivo* and computational model simulations *FASEB J*, Abstract, 2014.
152. *Lindsey BG, Nuding SC, Iceman KE, Segers LS, O'Connor R, Dean JB, Bolser DC, Morris KF. Persistent and evoked activities during the dissolution and reemergence of brainstem respiratory network rhythms with hyperventilatory apnea. Abstract, *The XIIIth Oxford Breathing Meeting: Respiratory and Cardiovascular*, Sydney, Australia, 2014.
153. Tsai, H-W, Zhou G, Morris KF, Gestreau C, Nuding SC, Segers LS, Lindsey BG, and Davenport P. Multielectrode recording of brainstem neurons: swallow control of the respiratory neural network. Abstract *Viewer/Itinerary Planner Society for Neuroscience*, 2014.

154. Zhou G, Tsai HW, Horton K-K, Morris KF, Nuding SC, Segers LS, Lindsey BG, Bolser DC, Davenport PW. Ventral respiratory column expiratory neuron activity is altered during fictive swallow in the decerebrated cat. *FASEB J*, Abstract 1012.12, 2015.
155. Tsai HW, Zhou G, Morris KF, Gestreau C, Nuding SC, Segers LS, Lindsey BG, Bolser DC, Davenport PW. Swallowing-related activities of respiratory and non-respiratory neurons in the nucleus tractus solitarius (NTS) in cats. *FASEB J*, Abstract 1012.13, 2015.
156. Iceman KE, Nuding SC, Segers LS, Lindsey BG, and Morris KF. Medullary raphé neuron responses during central chemoreceptor perturbations and functional connectivity within the respiratory brain stem. *Abstract Viewer/Itinerary Planner Society for Neuroscience*, 2015.
157. Tabitha Y. Shen TY, Gestreau C, Musselwhite MN, Rose MJ, Pitts TE, Morris KF, Lindsey BG, Davenport PW Bolser DC. Frequency dependent inhibitory mechanisms controlling the laryngeal adductor response (LAR). *FASEB J*, 30: Abstract 1261.8, 2016.
158. Zhou G, Tsai H-W, Samuel I, Morris K, Nuding S, Segers L, Gestreau C, Lindsey B, Bolser D, Davenport P. Synchrony between ventral respiratory column expiratory neurons is altered during fictive swallow in cat. *FASEB J*, 30: Abstract 1261.2, 2016.
159. * Lindsey B, Nuding S, Segers L, Iceman K, O'Connor R, Dean JB, Taylor-Clark T, Alencar P, Shuman D, Horton K, Bolser D, Morris, K. Carotid chemoreceptors tune breathing via a multipath brain stem network modulated by coordinated groups of tegmental field-parafacial neurons. *Physiology 2016*, Abstract PCA276, Joint Meeting of the American Physiological Society and The Physiological Society, Dublin, Ireland, 2016.

Participant/speaker at national and international symposia, meetings and workshops

1. *Central Neural Production of Periodic Respiratory Movements*. Lake Bluff, Illinois, 1982.
2. *Neurogenesis of Central Respiratory Rhythm* CNRS International Symposium, Bandol, France, 1984.
3. *Respiratory Muscles and their Neuromotor Control*. Satellite Symposium of the XXX International Congress of IUPS, Los Angeles, 1986.
4. *Cardiorespiratory and Motor Coordination*. Satellite Symposium of the XXXI International Congress of IUPS, Helsinki, 1989.
5. *"Multineuron recordings and the analysis of state dependent network configurations in respiratory neuron assemblies"*, International Joint Conference on Neural Networks, San Diego, CA 1990.
6. *Central Integration of Cardio-respiratory Control*. Symposium of the XXXII International Congress of IUPS, Glasgow, 1993.
7. *American Physiological Society Conference on the Control of Breathing*. Madison, Wisconsin, 1996.
8. *"Neuronal Assembly Dynamics: Cellular and Network Mechanisms in Cardiorespiratory Control"*, American Physiological Society Symposium at Experimental Biology, San Francisco '98 (organizer and co-chair), 1998.
9. Invited speaker, Featured Topics: *The medullary raphé: Such an obvious role in respiratory control, but what exactly is it?* Experimental Biology, 1999.

10. Invited speaker, *"Neuronal Assemblies and Dynamical Systems: A Conference Honoring George Gerstein"*. University of Pennsylvania, 2003.
11. *"Functional Connections among Ponto-medullary Respiratory Neurons"*, American Physiological Society Symposium at Experimental Biology 2004.
12. Invited participant, *Principal Investigators meeting of the Collaborative Research in Computational Neuroscience Program*, National Science Foundation, 2005.
13. Invited participant, *Principal Investigators meeting of the Collaborative Research in Computational Neuroscience Program*, National Science Foundation, 2006.
14. Symposium speaker: "Network dynamics in the reconfiguring and re-emerging respiratory network" presented at the *First International Congress of Respiratory Biology*, Bonn Germany, 2006.
15. Participant in the *"UK Spike Train Analysis Workshop- An international neuroscience workshop on spike train analysis"*, Institute of Neuroscience, Newcastle University, England, 2006.
16. Theme Leader and symposium speaker on *"Multifunctional- reconfiguring networks. Overview: network reconfiguration over different time scales"* for the *Xth Oxford Conference on Modeling and Control of Breathing*, Canada, 2006.
17. Invited speaker, Featured Topics: *"Emerging properties and concepts in respiratory rhythm generation"*, Experimental Biology 2007, Washington, D. C., 2007.
18. Invited participant, *Principal Investigators meeting of the Collaborative Research in Computational Neuroscience Program*, University of Maryland, 2007.
19. Invited speaker at the Royal Society Discussion Meeting, *"Brainstem: neural networks vital for life"*, London, UK, 2008.
20. Invited speaker at Virginia Commonwealth University/Center for the Study of Biological Complexity NHLBI Workshop on *"Modeling Neuromuscular Control of the Cardiovascular and Cardiopulmonary Systems"*, 2010.
21. Invited speaker at the *US - JAPAN Brain Research Cooperative Program Workshop "The NeuroPhysiome: Bridging computational neuroscience and systems biology"*, Okinawa Institute of Science and Technology, Japan, 2010.
22. Invited speaker in Featured Topic: *"Multiscale neuronal control of respiratory function: Bridging gene networks to neural networks"*, Experimental Biology 2011, Washington, D. C., 2011.
23. Invited participant, 2011 Multi-scale Modeling Consortium/NHLBI Systems Biology Meeting, The Interagency Modeling and Analysis Group, NIH Bethesda, MD, 2011.
24. Invited Speaker, Symposium: *"Computational modeling in central respiratory control and CO₂ chemoreception"*, Experimental Biology 2012, San Diego, CA, 2012.
25. Invited participant, *The XIIth Oxford Conference on Breathing: Breathing, emotion and evolution*, Almelo, Netherlands, 2012.
26. Invited participant/speaker, *"Persistent and evoked activities during the dissolution and reemergence of brainstem respiratory network rhythms with hyperventilatory apnea"*, *The XIIIth Oxford Conference on Breathing*, Sydney Australia, 2014.

Invited Research Seminars

Department of Physiology, Royal Free Hospital, London

Institute of Neurology, London
Brain Research Institute, UCLA
Neural Computation Group, E. I. DuPont de Nemours
Department of Medicine, Robert Wood Johnson Medical School
Department of Physiology, Northwestern University Medical School
David Mahoney Institute of Neurological Sciences, University of Pennsylvania
Department of Anesthesia, Medical College of Wisconsin
Department of Pharmacology, University of South Florida
Department of Physiological Sciences, University of Florida
University of Wisconsin, Madison
Neuroscience Program, Michigan State University
Department of Physiology, Texas Tech University
Department of Physiology, Stritch School of Medicine, Loyola University
Department of Medicine, Case Western Reserve University School of Medicine
Department of Molecular Medicine, Morsani College of Medicine, USF
Department of Molecular and Systems Biology, Geisel School of Medicine, Dartmouth

Professional Societies

1971-present American Association for the Advancement of Science
1981-2016 American Physiological Society
1976-2016 Society for Neuroscience
1992-2010 Association of Chairs of Departments of Physiology

Service

National and professional service

American Physiological Society Committee Service: Central Nervous System Section Steering Committee (1994-1999; 2001-2002; 2005-2007; Chair, 1996-1999); Committee on Committees (1996-1997); Section Advisory Committee (1996-1999); Nominating Committee (1996-1998); Awards Committee (2000-2002); Long-Range Planning Committee (2005-2007); Task Force on Governance (2006-2007).

Research host: Frontiers in Physiology Program for high school teachers, American Physiological Society: 2004, 2007.

External reviewer of the Department of Cellular and Integrative Physiology, University of Nebraska Medical School (2005).

Young Investigator Awards Selection Committee, the Xth Oxford Conference on Modeling and Control of Breathing, (2006).

International program committee for the Joint Meeting of the International Society for Autonomic Neuroscience (ISAN) and the American Autonomic Society (AAS), Brazil, 2011.

<p>Reviewer for:</p> <p><i>American Journal of Physiology</i> <i>Anesthesiology</i> <i>Autonomic Neuroscience</i> <i>Brain Research</i> <i>Experimental Brain Research</i> <i>Experimental Neurology</i> <i>Experimental Physiology</i> <i>Journal of Applied Physiology</i> <i>Journal of Computational Neuroscience</i> <i>Journal of Neurophysiology</i> <i>Journal of Neuroscience</i> <i>Journal of Neuroscience Methods</i> <i>Journal of Physiology (London)</i> <i>Neuroscience</i> <i>Neuroscience Letters</i> <i>Pediatric Research</i> <i>Respiration Physiology Science</i></p> <p>Editorial Board, <i>Journal of Neurophysiology</i> (July, 2014 – present)</p>	<p>Grant reviewer for:</p> <p><i>American Heart Association; National Institutes of Health; National Science Foundation; The Wellcome Trust; United States Civilian Research and Development Foundation; Veterans Administration, Biotechnology and Biological Sciences Research Council, UK; Canada Foundation for Innovation.</i></p> <p>Service since 2003 - NSF review panel CRCNS-2 for the joint NSF-NIH Collaborative Research in Computational Neuroscience Program (2003-2004) NIH Special Emphasis Panel ZRG1 MDCN-C Neuro-Bioengineering (Chair) (2003-2004) NIH Special Emphasis Panel ZRG1 IFCN-E Respiration (2003-2004) NIH Special Emphasis Panel ZRG1 RES-D (03) (2003-2004) NIH Special Emphasis Panel ZRG1 MDCN-G July 27, 2004 NIH Special Emphasis Panel ZRG1 MDCN-C Neuro-Bioengineering (Chair) August 10, 2004 NIH Special Emphasis Panel ZRG1 MDCN-C Neural-Engineering (Chair) March 14, 2005 NIH Special Emphasis Panel ZRG1 MDCN-K Neurotech/Engineering (Chair) July 27, 2005 NSF review panel CRCNS, March 2-3, 2006. Biotechnology and Biological Sciences Research Council David Phillips Fellowship, U.K., 2011 NSF grant reviewer 2007, 2012 NIH Sensorimotor Integration Study Section (<i>ad hoc</i> 2005, 2007, 2013; regular member, 2007-2012. NIH Special Emphasis Panel ZGM1-TWD-6(SC) National Institute of General Medical Sciences, November 15, 2013 NIH Special Emphasis Panel/Scientific Review Group 2014/10 ZRG1 IFCN-T (02) M June 10-11, 2014 NIH Respiratory Integrative Biology and Translational Research: RIBT study section June 26-27, 2014 Canada Foundation for Innovation, 2014 NIH Respiratory Integrative Biology and Translational Research: RIBT study section February 12-13, 2015 NIH Institute of Biomedical Imaging and Engineering MSM Program Review Special emphasis panel ZEB1 November 18, 2015 NIH Sensorimotor Integration Study Section, June 7, 2016</p>
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University of South Florida

1980-1995	Institutional Review Board (Human Subjects)
1987	Search Committee, Director of Sponsored Research
1990	Provost's University Task Force on Scientific and Technical Computing
1996	Cost Accounting Standards Workgroup
1998	Task Force on Health and Allied Health
2000	Steering Committee, USF Bioengineering Institute
2001-2002	Reviewer for Florida High Tech Corridor matching grant program

2001-2003	University Compliance Task Force
2001-2003	President's Cabinet
2001-2003	Leadership Council
2001-2003	Executive Budget Committee
2001-2003	Strategic Committee for Research
2001-2003	USF Board of Trustees Work Group on Research & Scholarship
2001-2003	USF Compliance Task Force
2001-2003	Financial Management Information Services Sponsors Group
2001-2003	Research Council, ex officio
2001-2003	Research Incentives Subcommittee
2001-2003	Faculty Salaries on Grants Subcommittee
2001-2003	Radiation Safety Committee, ex officio
2001-2003	Biosafety Committee, ex officio
2003-2004	President's Advisory Committee for the Search for the Vice-President for Health Sciences and Dean of Medicine
2004-2006	Advisory Board, NSF IGERT (Integrative Graduate Education Research and Training) Program at USF
2004-2006	USF College of Engineering Advisory Board
2004	<i>Ad hoc</i> discipline committee for Distinguished University Professor nominees
2005- 2007	Faculty Liaison for the USF Board of Trustees Workgroup on Health Sciences.
2006	Search committee for new College of Engineering Associate Dean for Research
2011	Reviewer for Internal Research Assistant Professor Awards Program – USF Office of Research
2015	Biomedical Engineering Initiative Working Group

USF College of Medicine Service

1985-1986	Vice-president, College of Medicine Faculty Association
1986-1987	President, College of Medicine Faculty Association
1977-1985	Electron Microscope Committee
1979-1980	Faculty Seminar Committee
1979-1980	Third and Fourth Year Curriculum Subcommittee
1980-1981	Learning Resources Committee
1980-1985	Computer Council
1981-1983	Rules, Policies, Procedures
1982-1983	Safety Committee
1988-1990	Committee for Institutional Grant Administration
1988-1990	Committee for Capital Expenditure Recommendations
1988	Committee to Draft College of Medicine Bylaws
1988	Task Force on Faculty Development
1988	Chair of Faculty Development Section, Faculty Retreat
1990	Search Committee, Neurophysiology position in Surgery
1990	Committee on Graduate Medical Sciences Education and Graduate Affairs
1991	Task Force on Faculty Development
1991	Task Force on Research
1991	Task Force on Graduate Education
1992	Ad Hoc Committee on Development of Neuroscience Course
1992-	Executive Council
1993	Ad hoc committee on Attitudes and Principles of Conduct for Faculty and Students
1993-1995	Curriculum Committee

1994 Participant in Curriculum Retreat
 1994-1995 Dean's Implementation Committee on Curriculum Reform
 1996-1997 Strategic Planning Committee, College of Medicine
 1997- 2000 Committee on Space, College of Medicine
 1997 Workgroup for Clinical Investigator/Basic Science Pathway for Subspecialty Residents
 1997 Search Committee for American Heart Association Professorship in Surgery
 1998 Member of LCME Committee I: Objectives
 1997 Elected representative of Basic Science Chairs on LCME Overview Committee
 1998-2000 Chair, Neuroscience Concentration Committee
 1998-2001 Chair, Committee on Space, College of Medicine
 1997 Chair, Year 4 Curriculum Work Group
 2000 Search Committee, Chair of Pediatrics
 2002-2003 Search Committee, Chair of Neurology
 2003-2004 Chair, Neuroscience Research Work Group
 2003-2004 Chair, COM Administrative Efficiencies Steering Committee
 2004-2005 Chair, Search Advisory Committee for Assoc. V. P. and Vice-Dean for Research, HSC
 2004-2005 Research Strategic Workgroup
 2004-2005 Financial Management Strategic Workgroup
 2004-2005 Faculty Development Strategic Workgroup
 2004-2005 HSC Cardiovascular Initiative Workgroup
 2005 M.D. - Ph.D. Program Implementation Workgroup
 2005-2007 Co- Chair AIMS Council
 2005-2006 Chair LCME Committee Two: Research/Graduate Programs/Basic Science
 2006 Dean's Strategic Advisory Committee
 2006-2007 Member, Search Committee for Rothman Endowed Chair in Pediatrics
 2006-2007 COM Research Bridge Funding Committee
 2006-2008 Leadership Development Advisory Council
 2006-2008 Mentor, the Leadership Institute at USF Health
 2006-2007 College of Medicine Space Committee
 2007-2008 Search Advisory Committee for Vice-Dean for Education
 2007-2009 Chair, College of Medicine Financial Oversight Committee
 2012- Department of Molecular Pharmacology and Physiology Faculty Development Committee
 2013- Department of Molecular Pharmacology and Physiology Executive Committee

USF Health Service

2002-2003 Health Sciences Center Conflict of Interest Task Group
 2003-2004 Chair, Professional Integrity Advisory Council, Health Sciences Center
 2004-2005 Health Sciences Center Conflict of Interest Committee
 2004-2005 Health Sciences Center HIPPA Security Rule Implementation Team
 2004-2005 Research Strategic Workgroup
 2004-2005 Financial Management Strategic Workgroup
 2004-2005 Faculty Development Strategic Workgroup
 2004-2005 Chair, Search Advisory Committee for the Vice-Dean and Associate VP for Research, HSC
 2005-2006 Engineering-HSC Steering Committee
 2007 Executive Assistant to the Vice-President Search Committee
 2009-2011 USF Health Byrd Alzheimer's Institute Scientific Advisory Board
 2011-2015 *Ad hoc* committee for Distinguished University Health Professor nominees