BIOGRAPHICAL SKETCH

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NAME: Kenney, Michael

eRA COMMONS USER NAME (credential, e.g., agency login): MICHAELKENNEY

POSITION TITLE: Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Luther College, Decorah, IA	B.A.	1981	Health
University of Iowa, Iowa City, IA	Ph.D.	1988	Exercise Physiology
Michigan State University, East Lansing, MI	Post-doc	1988-1990	Neurophysiology

A. Investigator Statement

The long-term objective of the research in our laboratory is to determine how sympathetic nerve regulation is altered by aging, environmental and immune stress, and pathophysiological conditions. We combine central and peripheral electrophysiological methods with molecular biological techniques to study integrative mechanisms regulating central sympathetic outflow. Central sympathetic neural networks regulate the basal level of activity and the sympathetic nerve discharge (SND) bursting pattern, as well as the acute responsitivity of the sympathetic nervous system. The objective of our current NIH grant is to determine how advancing age alters central mechanisms regulating SND under basal conditions and in response to acute physical stress. The basic approach capitalizes on knowledge of central sympathetic regulatory strategies to probe the fundamental mechanistic interactions between aging and SND regulation using an integrative experimental approach involving electrophysiological, central microinjection, molecular biological, and proteomic approaches. A more complete understanding of central sympathetic neural circuits is critical for determining the role of the sympathetic nervous system in physiological regulation, disease processes, and advancing age.

B. Positions

Positions and Employment

1984-1986 NIH Graduate Research Assistant, Digestive Disease Core Center, College of Medicine, University of Iowa, Iowa City, IA
1986-1988 NIH Graduate Research Assistant, Cardiovascular Research Center, College of Medicine, University of Iowa, Iowa City, IA
1988-1990 Postdoctoral Research Associate, Department of Pharmacology and Toxicology, Michigan State University, East Lansing, MI
1990-1992 Adjunct Assistant Professor, Department of Physiology and Biophysics, College Of Medicine, University of Tennessee, Memphis, TN
1990-1992 Assistant Professor, Department of Biology, Rhodes College, Memphis, TN
1992 -1996 Assistant Professor, Dept. of Anatomy & Physiology, Kansas State University, Manhattan, KS

1996-2002 Associate Professor, Dept. of Anatomy & Physiology, Kansas State University, Manhattan, KS
2002-2015 Professor, Dept. of Anatomy & Physiology, Kansas State University, Manhattan, KS
2011-2013 Interim Head, Dept. of Anatomy & Physiology, Kansas State University, Manhattan, KS
2013-2015 Department Head, Dept. of Anatomy & Physiology, Kansas State University, Manhattan, KS
Dec 2015- Associate Dean for Research in the College of Science and Professor of Biological Sciences, University of Texas at El Paso, El Paso, TX

Other Experience and Professional Memberships

American Physiological Society
American Heart Association

C. Contribution to Science

1. My early line of inquiry focused on understanding mechanisms regulating the pattern and frequency-domain components of sympathetic nerve discharge (SND). The dynamic nature of sympathetic neural circuits during acute physical stress is revealed not only by changes in the level of sympathetic nerve activity but also by alterations in the pattern of sympathetic nerve discharge bursts. The SND bursting pattern represents the signature output of central sympathetic neural circuits. Our publications determined that the paraventricular nucleus of the hypothalamus is an important component of the central neurocircuitry regulating the SND bursting pattern, identified SND pattern transformation as an important strategy for mediating sympathoexcitation in response to acute physical stress, and have contributed to the novel hypothesis that neural rhythmicity is important for coordinating activity in different sympathetic nerves. I served as the primary investigator in these studies.

    a. Kenney MJ. Frequency characteristics of sympathetic nerve discharge in anesthetized rats. *Am. J. Physiol*. 267 (*Regulatory Integrative Comp. Physiol*. 36): R830-R840, 1994.
    b. Kenney MJ, DE Claassen, MR Bishop, and RJ Fels. Regulation of the sympathetic nerve discharge bursting pattern during heat stress. *Am. J. Physiol*. 275 (*Regulatory Integrative Comp. Physiol.* 44): R1992-R2001, 1998.
    c. Kenney MJ, ML Weiss, KP Patel, Y Wang, and RJ Fels. Paraventricular nucleus bicuculline alters frequency components of sympathetic nerve discharge bursts. *Am. J. Physiol.* 281 *(Heart Circ. Physiol.)*: H1233-H1241, 2001.
    d. Barman SM and MJ Kenney. Methods of analysis and physiological relevance of rhythms in sympathetic nerve discharge. *Clin Exp Pharmacol Physiol* 34: 350-355, 2007.

2. The sympathetic nervous system (SNS) plays a critical role in regulating physiological responses to acute stress, and it has generally been considered that the SNS functions independent of other adaptive systems. However, recent lines of inquiry have expanded the functional repertoire of the SNS by establishing an important role for this system in regulating and integrating processes between diverse physiological systems, including the immune system. Understanding mechanisms that mediate physiological relationships between the nervous and immune systems is critical for understanding chronic disease development. Our publications in this burgeoning area of research have demonstrated that central cytokines can contribute to activation of the SNS and have established that splenic sympathoexcitation modulates splenic cytokine gene expression. These findings support the novel hypothesis that activation of central sympathetic neural circuits and subsequent increases in splenic nerve outflow can modulate peripheral immune responses. These studies have contributed to an enhanced understanding of mechanisms mediating neural-immune interactions. I served as the primary investigator in these studies.

    a. Ganta CK, F Blecha, RR Ganta, BG Helwig, S Parimi, N Lu, RJ Fels, TI Musch, and MJ Kenney. Hyperthermia-enhanced splenic cytokine gene expression is mediated by the sympathetic nervous system. *Physiological Genomics* 19: 175-183, 2004.

b. Ganta CK, N Lu, F Blecha, RR Ganta, L Zheng, RJ Fels, and MJ Kenney. Central angiotensin II-enhanced splenic cytokine gene expression is mediated by the sympathetic nervous system. *Am J Physiol Heart Circ Physiol* 289: H1683-H1691, 2005.
c. Helwig BG, RA Craig, RJ Fels, F Blecha, and MJ Kenney. Central nervous system administration of interleukin-6 produces splenic sympathoexcitation. *Autonomic Neuroscience: Basic and Clinical* 141: 104-111, 2008.
d. Kenney MJ and CK Ganta. Autonomic Nervous System and Immune System Interactions. *Comprehensive Physiology* 4(3): 1177-1200, 2014.

3. Accompanying the persistent growth in the world's population is a marked increase in the number of aged persons. The SNS is critically involved in the genesis and modulation of diseases and dysfunction in key organ systems in aged subjects. The incidence of many chronic disease conditions increases with advancing age and many adult Americans between the ages of 60-79 suffer from cardiovascular-related diseases. Understanding age-dependent alterations in mechanisms regulating SND is pertinent for understanding relationships between chronic disease development and age-associated changes in SNS function. Our contributions support the hypothesis that SNS responsiveness to acute stress is attenuated with advancing age, changes associated with altered GABAergic regulation in the rostral ventral lateral medulla. These findings have contributed to understanding the effect of advanced age on mechanisms regulating the SNS. I served as the primary investigator in all of these studies.

    a. Kenney MJ and RJ Fels. Sympathetic nerve regulation to heating is altered in senescent rats. *Am. J. Physiol.* 283 *(Regulatory Integrative Comp. Physiol.)*: R513-R520, 2002.
    b. Kenney MJ and TI Musch. Senescence alters blood flow responses to acute heat stress. *Am J Physiol Heart Circ Physiol* 286: H1480-H1485, 2004.
    c. Kenney MJ. Medullary regulation of visceral sympathetic nerve discharge at peak hyperthermia in aged F344 rats. *Autonomic Neuroscience: Basic and Clinical*. 186: 32-37, 2014.
    d. Kenney MJ. Dexmedetomidine and regulation of splenic sympathetic nerve discharge in Aged F344 rats. *Autonomic Neuroscience: Basic and Clinical*. 190: 53-57, 2015.

4. The acute responsivity of the sympathetic nervous system (SNS) is a primary regulatory feature of this nervous system and plays a key role in maintaining physiological homeostasis in response to episodes of acute physical stress. Hyperthermia is a potent activator of sympathetic nerve outflow, and SNS dysfunction and cardiovascular regulatory alterations contribute to the pathophysiological consequences of heat stroke. Our recent studies have focused on understanding rostral ventral lateral medullary (RVLM) mechanisms mediating visceral sympathetic activation to acute heat stress. These publications demonstrate that maintenance of sympathetic activation during heating is dependent on the integrity of RVLM neural circuits, and highlight the dynamic nature and intrinsic regulatory complexity of RVLM sympathetic neural circuits. These studies provide fundamental information that may contribute to understanding central neural mechanisms mediating altered SND regulation in heart failure patients and aged subjects. I served as the primary investigator in all of these studies.

    a. Hosking KG, RJ Fels, and MJ Kenney. Role of the rostral ventral lateral medulla in mediating visceral sympathoexcitation to acute heat stress. *Autonomic Neuroscience: Basic and Clinical*. 150: 104-110, 2009.
    b. Kenney MJ, CN Meyer, KG Hosking, and RJ Fels. Is visceral sympathoexcitation to heat stress dependent on activation of ionotropic excitatory amino acid receptors in the rostral ventral lateral medulla? *Am J Physiol Regulatory Integrative Comp Physiol* 301(2): R548-R557, 2011.
    c. Kenney MJ, CK Ganta, and RJ Fels. Disinhibition of RVLM Neural Circuits and Regulation of Sympathetic Nerve Discharge at Peak Hyperthermia. *J Appl Physiol* 115: 1297-1303, 2013.
    d. Kenney MJ. Medullary regulation of visceral sympathetic nerve discharge at peak hyperthermia in aged F344 rats. *Autonomic Neuroscience: Basic and Clinical*. 186: 32-37, 2014.

D. Research Support

Ongoing Research Support

5R01AG041948-04 Kenney (PI) 09/15/2012-05/31/2017
NIH/NIA
Sympathetic Neural Regulation and Aging: Medullary Mechanisms and Strategies
The objective of the present Research Plan is to determine how advancing age, and the transition from a healthy aged state to senescence, alters medullary mechanisms regulating SND under basal conditions and in response to acute physical stress.
Role: PI

2R15HL108329-02A1 Poole (PI) 08/01/2015-07/31/2017
NHLBI
Heart Failure & Aging: Mechanistic Bases of Muscle Vascular Dysfunction
The objective of the research is to employ a novel multi-systems approach to address the global hypothesis that, in aged CHF rats, SNS and cardiac dysfunction coalesce within the muscle microcirculation to impair perfusive and diffusive O_2 conductance thereby reducing blood-myocyte O_2 flux and exercise tolerance.
Role: Collaborating Investigator

Active Training Grants: Projects in process of being changed to K-State Personnel

5T35OD010979-18 Kenney & Davis (Co-PIs) 04/01/2010-03/31/2018
NIH/Office of the Director
Short-Term Training in Health Professional Schools
This project attracts veterinary students into biomedical research careers by exposing them hypothesis-driven research activities and ethical issues pertinent to biomedical research.
Role: Co-PI

2T32OD011169-12 Kenney (PI) 09/30/2003-05/31/2020
NIH/Office of the Director
BRITE Veterinary Student Program
The BRITE veterinary student program is designed to expose DVM students to hypothesis-driven research activities, methodologies involved in design and execution of laboratory experiments and ethical issues pertinent to biomedical research, at a formative stage of their veterinary education.
Role: PI

Completed Research Support

R21-HL091342 Kenney (PI) 08/01/2008-05/30/2012
NIH/NHLBI
Aging and Heart Failure are not Similar Syndromes of Sympathetic Dysregulation
The Specific Aim of this project was to determine the effect of advancing age, with and without the imposing pathological condition of congestive HF, on sympathetic nerve responses to acute environmental stress. We tested the hypothesis that aging and HF are not similar syndromes of sympathetic nervous system dysregulation.
Role PI

R21-HL092392 Kenney (PI) 01/01/2009-12/31/2012
NIH/NHLBI
Mechanisms Mediating Hypotension to Anthrax Lethal Toxin
The Specific Aim of this project was to determine the effect of anthrax LeTx infusion on regulation of sympathetic nerve discharge (SND), cardiac function, alpha-adrenergic vasoconstrictor responsiveness, and regional vascular conductance.
Role PI