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*Arthur C. Guyton, Jr.
Distinguished Lecturer*



Gordon Mitchell, PhD

Professor, Department of Physical
Therapy and Neuroscience
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Gordon Mitchell, after 17 years as Chair of the Department of Comparative Biosciences at the University of Wisconsin, recently relocated to the University of Florida where he will start the new Center for Respiratory Biology and Rehabilitation and join the McKnight Brain Institute. He received his PhD in Developmental and Cell Biology from the University of California at Irvine in 1978. He pursued postdoctoral training (1978-80) at the Max-Planck-Institute for Experimental Medicine in Germany where he studied respiratory physiology and neurobiology with Professor Peter Scheid; he then completed one additional year as a postdoctoral fellow at the University of Wisconsin with Professor Jerome Dempsey before the University of Wisconsin opened a new School of Veterinary Medicine. Dr. Mitchell became one of the founding faculty members of that school and remained there until 2014.

Dr. Mitchell has received recognition for his research and teaching accomplishments, including a MERIT Award from the National Institutes of Health, selection as the Steenbock Professor of Behavioral and Neural Science, multiple institutional research and teaching awards, and recognition as a plenary lecturer by the Society for Neuroscience and

American Physiological Society (Comroe Lecture). He served as an APS councilor from 2008-2011.

Dr. Mitchell was among the first to recognize the importance of neuroplasticity in respiratory motor control. Currently, four major research areas are under active investigation in the laboratory. The first area concerns cellular and molecular mechanisms of long-lasting phrenic and hypoglossal motor facilitation induced by intermittent hypoxia. A multidisciplinary approach is used, including neurophysiology, neuropharmacology, ventilation measurements, immunohistochemistry and cell/molecular biology techniques, including flow cytometry and RNA interference in vivo (one of the first laboratories to successfully apply this technology in vivo). To date, at least five distinct cell-signaling cascades giving rise to long-lasting phrenic motor facilitation have been identified. Major questions include: how these pathways interact, when they are used by the animal and for what purpose. A second direction concerns the ability to harness respiratory plasticity to treat respiratory and somatic motor impairment following spinal injury. The fundamental goal is to harness intermittent hypoxia-induced respiratory plasticity to enhance respiratory and somatic motor function in rodents and persons with chronic spinal injury. Striking findings to date include: 1) repetitive acute intermittent hypoxia elicits profound functional recovery of breathing capacity and forelimb function in rodent models of spinal injury, and 2) leg strength and walking ability in humans with incomplete, chronic spinal injuries. A third direction concerns mechanisms of compensatory respiratory plasticity in rodent models of neurodegenerative diseases, including ALS. Compensatory respiratory plasticity preserves ventilatory capacity during motor neuron disease, despite progressive death of respiratory motor neurons; however, phrenic motor output decreases, indicating imminent ventilatory failure (the major cause of death in ALS). Intermittent hypoxia and spinal stem cell implants have been used to promote motor neuron survival and restore breathing capacity. Another major effort concerns the impact of systemic/neuro inflammation on spinal respiratory plasticity; inflammation is prevalent in most clinical disorders that challenge ventilatory control, and undermines the capacity for spontaneous or induced functional recovery.

The Mitchell laboratory collaborates with outstanding scientific groups in Wisconsin with interests in immunology), epigenetics, gene therapy, stem cell biology, and respiratory neurobiology. New collaborations are underway at the Univ. of Florida and Univ. of South Florida. Other, inter-institutional collaborations include: Univ. of Saskatchewan, Emory Univ., Rehabilitation Inst. of Chicago, Cedars Sinai, and Univ. of Texas, Southwestern.

Dr. Mitchell was director of the Respiratory Neurobiology Training Program at the University of Wisconsin from 2002 to 2014. He has supervised 23 graduate students and 26 postdoctoral trainees, with service on 40 additional graduate thesis committees. Dr. Mitchell's trainees have been highly successful as a group: 1) trainees have won >50 awards from national/international organizations for research excellence; 2) many have been invited to give talks in symposia at national/international conferences; 3) many

trainees (>20) successfully competed for fellowships from NIH or medical foundations; and
4) 16 former postdoctoral trainees and 5 former graduate students are now faculty at academic institutions, many with active, extramurally funded research programs. Dr. Mitchell has been active in training clinician scientists and underrepresented minority students.