BIOGRAPHICAL SKETCH

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NAME: Caroline A. Rickards

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POSITION TITLE: Assistant Professor

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
The University of Melbourne, Melbourne, Victoria, Australia	B.Sc.	12/1999	Physiology
RMIT University, Melbourne, Victoria, Australia	B.App.Sci (Hons)	12/2000	Cardiovascular Physiology
RMIT University, Melbourne, Victoria, Australia	Ph.D.	04/2005	Cardiovascular Physiology
US Army Institute of Surgical Research, Fort Sam Houston, TX, USA	Postdoctoral	05/2008	Cardiovascular Physiology

A. Personal Statement

I am the Director of the Cerebral & Cardiovascular Physiology Laboratory in the Department of Physiology & Anatomy at UNTHSC. My general research interests encompass understanding the integrated cardiovascular, autonomic, and cerebrovascular responses to environmental and behavioral stressors that challenge vital organ perfusion in humans, with an emphasis on hemorrhage, orthostasis, exercise, and smoking (specifically, electronic cigarettes). A major area of my research focus has been on the early detection of hemorrhagic injury in trauma patients, characterizing physiological differences between individuals with high versus low tolerance to this stress; I received funding from 2008-2015 from the Department of Defense for this work. In addition to investigating these physiological mechanisms, we also collaborate with academic, industry, and government partners to develop and test sensor technologies in the laboratory that may improve the early detection of tissue hypoperfusion in the clinical setting. Furthermore, my laboratory explores potential therapies that may improve cardiovascular and cerebrovascular responsiveness to tissue hypoperfusion, including resistance breathing, oscillatory perfusion therapy, and occlusive exercise. It is anticipated that these studies will have potential clinical applications to hemorrhage, stroke, myocardial infarction, traumatic brain injury, and sepsis. I am also an active member within a number of professional societies, including past-chair of the American Physiological Society (APS) Women in Physiology Committee, current member of the APS Exercise and Environmental Physiology section steering committee, Secretary of the Cerebral Autoregulation Research Network (CARNet), and editorial board member for the *Journal of Physiology* and the *American Journal of Physiology – Regulatory, Integrative and Comparative Physiology*. I have graduated two PhD and two MS students from my laboratory, and I currently supervise one Postdoctoral Fellow, one PhD student, and one MS student. I have also supervised 11 undergraduate research interns at the US Army Institute of Surgical Research and at NASA Kennedy Space Center. The following four publications represent highlights of my scientific career thus far:

- **Rickards CA.** Vive la résistance! The Role of Inspiratory Resistance Breathing on Cerebral Blood Flow. *Resp Physiol & Neurobiol* 2018 (In Press) (PMID: 30340016)

- Sprick JD, **Rickards CA.** Combining Remote Ischemic Preconditioning and Aerobic Exercise: A Novel Adaptation of Blood Flow Restriction Exercise. *Am J Physiol Regul Integr Comp Physiol* 2017; 313:R497-R506 (PMID 28835447)
- Kay VL, **Rickards CA.** The role of cerebral oxygenation and regional cerebral blood flow on tolerance to central hypovolemia. *Am J Physiol Regul Integr Comp Physiol* 2016; 310(4): R375-83 (PMID 26676249).
- **Rickards CA.** Cerebral blood flow regulation during hemorrhage. *Compr Physiol* 2015; 5: 1585-1621 (PMID 26426461).

B. Positions and Honors

Professional Experience

2005 – 2008	National Research Council Postdoctoral Associate, US Army Institute of Surgical Research (USAISR), Fort Sam Houston, TX, USA
2008 – 2012	Research Assistant Professor, Department of Health and Kinesiology, The University of Texas at San Antonio, San Antonio, TX, USA
2012 – 2018	Assistant Professor, Institute for Cardiovascular & Metabolic Diseases, University of North Texas Health Science Center, Fort Worth, TX, USA
2018 – Present	Associate Professor, Department of Physiology & Anatomy, University of North Texas Health Science Center, Fort Worth, TX, USA

Other Experience and Professional Memberships

2000 –	Member, Aerospace Medical Association
2004 – 2005	American Physiological Society Mentoring Program
2006 –	Member, American Physiological Society
2009 –	Member, American Autonomic Society
2010 – 2013	Member, Cardiovascular Section Trainee Committee, American Physiological Society
2011 – 2013	Member, Women in Physiology Committee, American Physiological Society (Coordinator of Mentoring Forum & Facebook page)
2011 –	Member, Cerebral Autoregulation Research Network (CARNet)
2011 –	Review Editor, Frontiers in Exercise Physiology
2013 – 2015	Grant Reviewer, American Heart Association (AHA) - CardioRenal 3 Study Section, CardioRenal Clincial Study Section, Vascular Biology Blood Pressure Clinical Study Section
2013	Chair, Session II: *"New insights into the physiology and pathology of autoregulation*", Cerebral Autoregulation Research Network Meeting, Portugal
2013	Chair, APS Exercise and Environmental Physiology (EEP) Section Featured Topic *"Brain Strain: Challenges to Cerebral Blood Flow Regulation in Humans",* Experimental Biology, Boston, MA
2013 – 2014	Organizing Committee, 2014 Cerebral Autoregulation Research Network Annual Meeting, San Diego, USA
2014	Chair, Scientific Session # 1: *"Cerebrovascular Physiology*", Okanagan Cardiovascular & Respiratory Symposium, Silver Star Ski Resort, Vernon, British Columbia, Canada
2014	Chair, *"Cerebral Autoregulation in Pathological Conditions"*, Cerebral Autoregulation Research Network (CARNet) Meeting (in conjunction with Experimental Biology, 2014), San Diego, CA
2014 –	Cerebral Autoregulation Research Network (CARNet) Steering Committee
2014 – 2015	Organizing Committee, Cerebral Autoregulation Research Network (CARNet) Meeting, Southampton, UK, 2015
2015	Chair, APS Neural Control & Autonomic Regulation (NCAR) Section Featured Topic *"Baroreflex and Chemoreflex Controls of the Human Cerebral Circulation"*, Experimental Biology, Boston, MA
2015	Invited speaker in Featured Topic session *"Cardiovascular Responses to Trauma"* at Experimental Biology Meeting, Boston, MA
2015	Completed advanced statistics course "Analyzing Repeated Measures Data: ANOVA and Mixed Model Approaches" (24 hours), The Analysis Institute Workshop Center

2015 – 2017	Chair, Women in Physiology Committee, American Physiological Society
2015 – 2017	Member, Institutional Review Board, University of North Texas Health Science Center
2016	Chair, Oral Presentation Sessions: *"Cardiovascular Physiology"* and *"Cognitive Function"*, European College of Sports Science Meeting, Vienna, AUSTRIA
2016	Invited Speaker, *"Physical Activity and Brain Vascular Function*" session, European College of Sports Science, Vienna, AUSTRIA
2016	Invited Speaker, *"Cerebrovascular Autoregulation*" session, 6th Annual Meeting of the Cerebral Autoregulation Research Network (in conjunction with the 16th International Symposium on Intracranial Pressure & Neuromonitoring), Massachusetts Institute of Technology (MIT), Cambridge, MA
2016 – 2017	Member, Faculty Mentoring Working Group, Health Institutes, University of North Texas Health Science Center
2017 –	Vice Chair, Institutional Review Board, University of North Texas Health Science Center
2017	Invited Speaker, Pre-Experimental Biology Meeting, University of Illinois at Chicago, Integrative Physiology Laboratory , Chicago, IL
2017	Invited Speaker, "*Control of Cerebral Blood Flow"* session, Oxford Conference on Modeling and Control of Breathing, Oxford, England, UK.
2017	Awards Task Force, American Physiological Society
2017	Social Media/Website/Communications Task Force, American Physiological Society
2017 – 2020	Editorial Board, American Journal of Physiology – Regulatory, Integrative and Comparative Physiology
2018 – 2021	Reviewing Editor, Journal of Physiology
2018 – 2021	Environmental Physiology Councillor, Exercise & Environmental Physiology Section, American Physiological Society
2018 –	Senator, Faculty Senate, University of North Texas Health Science Center
Ad-hoc	Frequent peer reviewer for high impact journals (Journal of Physiology, Journal of Applied Physiology, American Journal of Physiology, The Lancet, Hypertension, Experimental Physiology, Critical Care Medicine)
Ad-hoc	Grant Reviewer, Natural Sciences and Engineering Research Council of Canada (NSERC), Canada Foundation for Innovation (Government of Canada), National Heart Foundation of New Zealand, Wellington Medical Research Foundation (New Zealand), UK Medical Research Council (UK MRC)

Honors and Awards

2001 – 2004	Australian Postgraduate Award, RMIT University
2002	Travel Scholarship, Aerospace Medicine Student and Resident Organization (AMSRO) and Aerospace Medical Association (AsMA)
2003 – 2004	Amelia Earhart Fellowship, Zonta International
2005	Patron's Prize, Australian Military Medicine Association (AMMA)
2005 – 2008	Postdoctoral Associateship, National Research Council (NRC)
2007	Caroline tum Suden/Francis A. Hellebrandt Professional Opportunity Award, American Physiological Society
2010	American Physiological Society Research Career Enhancement Award
2010	Associate Fellow of the Aerospace Medical Association (AsMA)
2013, 2018	Nominated for the UNTHSC Graduate Student Association Outstanding Graduate Faculty Member Award
2018	Best oral presentation, Cerebral Autoregulation Research Network (CARNet) 8th Annual Meeting, Oxford, UK
2018	Granted tenure and promotion to Associate Professor, University of North Texas Health Science Center

C. Contribution to Science

Cerebral Blood Flow Regulation During Hemorrhage

Cerebral hypoperfusion and hypoxia following massive bleeding injuries (from trauma, childbirth, surgery, blood clotting disorders) leads to unconsciousness, neuronal injury, and ultimately death. Understanding these physiological responses, and identifying interventions that could protect cerebral blood flow and oxygenation,

could improve survival from these catastrophic injuries. The central findings from my work using a method of simulated bleeding in healthy human subjects called lower body negative pressure (LBNP), identified that protection of absolute cerebral blood flow may not be as important as the pattern of cerebral blood flow. Specifically, low frequency oscillations in arterial pressure and cerebral blood flow were associated with greater tolerance to simulated hemorrhage. In recognition of my emerging expertise in this field, I was recently invited to write a manuscript "Cerebral blood flow regulation during hemorrhage" for *Comprehensive Physiology*, a publication of the American Physiological Society. I was also invited to present a talk entitled "Cerebral blood flow responses following hemorrhage" in the Featured Topic session "Cardiovascular Responses to Trauma" at Experimental Biology 2015. I have served as the principle and co-investigator on these studies.

- Kay VL, **Rickards CA.** The role of cerebral oxygenation and regional cerebral blood flow on tolerance to central hypovolemia. *Am J Physiol Regul Integr Comp Physiol* 2016; 310(4): R375-83 (PMID 26676249).
- **Rickards CA**, Johnson BD, Convertino VA, Joyner MJ, Barnes JN. Cerebral blood flow regulation during blood loss compared to lower body negative pressure in humans. *J Appl Physiol* 2015; 119(6): 677-85 (PMID 26139213)..
- **Rickards CA.** Cerebral blood flow regulation during hemorrhage. *Comprehensive Physiology* 2015; 5: 1585-1621 (PMID 26426461).
- **Rickards CA**, Ryan KL, Cooke WH, Convertino VA. Tolerance to central hypovolemia: the influence of oscillations in arterial pressure and cerebral blood velocity. *J Appl Physiol* 2011; 111: 1048-1058 (PMID 21799129).

Therapeutic Inspiratory Resistance for Treatment of Hemorrhage

Traumatic hemorrhage is a leading cause of death and disability in both the civilian and military settings. Augmenting the reduction in intrathoracic pressure during inspiration with inspiratory threshold devices improves vital organ perfusion and survival in animal studies of major hemorrhage. In a series of studies in humans breathing through an inspiratory threshold device while subjected to simulated hemorrhage via application of lower body negative pressure (LBNP) and head-up tilt, we demonstrated improved tolerance to this stress through protection of arterial pressure and central blood volume. It is anticipated that resistance breathing therapy will be widely implemented in the clinical setting to treat hypotension (e.g., from hemorrhage, dehydration). I was a post-doctoral fellow on these studies, and now serve as principle investigator on subsequent investigations on the regulation of cerebral blood flow and oxygenation with inspiratory resistance breathing.

- **Rickards CA.** Vive la résistance! The Role of Inspiratory Resistance Breathing on Cerebral Blood Flow. *Resp Physiol & Neurobiol* 2018 (In Press) (PMID: 30340016)
- Ryan KL, Cooke WH, **Rickards CA**, Lurie KG, Convertino VA. Breathing through an inspiratory threshold device improves stroke volume during central hypovolemia in humans. *J Appl Physiol* 2008; 104:1402-1409 (PMID 18309096).
- **Rickards CA**, Ryan KL, Cooke WH, Lurie KG, Convertino VA. Inspiratory resistance delays the reporting of symptoms with central hypovolemia: association with cerebral blood flow. *Am J Physiol Regul Integr Comp Physiol* 2007; 293:R243-R250 (PMID 17507439).
- Convertino VA, Ryan KL, **Rickards CA**, Cooke WH, Idris AH, Metzger A, Holcomb JB, Adams BD, Lurie KG. Inspiratory resistance maintains arterial pressure during central hypovolemia: Implications for treatment of patients with severe hemorrhage. *Crit Care Med* 2007; 35(4):1145-1152 (PMID 17334239).

Novel Vital Signs for Detection of Hemorrhagic Injury

Early and accurate detection of hemorrhagic injury is vital for initiating appropriate interventions in order to improve the chances of survival. Standard vital signs for detection of hemorrhage, such as arterial pressure, arterial oxygen saturation, and radial pulse character, are well regulated by reflex compensatory mechanisms, so only change with substantial loss of blood volume. In collaboration with investigators at the US Army Institute of Surgical Research and other academic and industry partners, we developed novel monitoring technologies for the early detection of blood loss, including muscle near infrared spectroscopy sensors, and machine learning technologies utilizing low-level physiological signals. I was a post-doctoral fellow on these studies, and now serve as principle investigator on subsequent investigations and grants assessing muscle oxygenation and microvascular perfusion as indices for the early detection of hemorrhagic injury.

- **Rickards CA**, Vyas N, Ryan KL, Ward KW, Andre D, Hurst GM, Barrera CR, Convertino VA. Bleeding or active? Validation of a machine-learning algorithm for remote determination of blood volume status. *J Appl Physiol* 2014; 116(5):486-94 (PMID 24408992).
- Convertino VA, Moulton SL, Grudic GZ, **Rickards CA**, Hinojosa-Laborde C, Gerhardt RT, Blackbourne LH, Ryan KL. Use of advanced machine-learning techniques for non-invasive monitoring of hemorrhage. *J Trauma* 2011; 71(1): S25-S32 (PMID 21795890).
- **Rickards CA,** Ryan KL, Ludwig DA, Convertino VA. Is heart period variability associated with the administration of life saving interventions in individual, pre-hospital trauma patients with normal standard vital signs? *Crit Care Med* 2010; 38(8):1666-73 (PMID 20562705).
- Soller BR, Soyemi OO, Yang Y, Ryan KL, **Rickards CA**, Walz JM, Heard SO, Convertino VA. Noninvasively measured muscle PO_2 is an early indicator of central hypovolemia in humans. *J Appl Physiol* 2008; 104:475-481 (PMID 18006869).

Link to Full List of Published Work: http://www.ncbi.nlm.nih.gov/pubmed/?term=rickards+ca

D. Research Support

Ongoing Research Support

Rickards (PI), Rosenberg (Co-I), Romero (Co-I), Yurvati (Co-I) 07/18 - 03/19
Applied Research Program Seed Grant, University of North Texas Health Science Center
Vascular Function Following Blood Flow Restriction Exercise Training
This funding will support completion of Dr. Rosenberg's postdoctoral project. The overall aim of this project is to develop a novel test of cerebral vascular function that can be used to elucidate the relative contributions of neurogenic, myogenic, and endothelial control of cerebral blood flow. Once developed, this test will be used for multiple follow-on studies, to include assessment of individuals with mild cognitive impairment (MCI), and the effect of blood flow restriction exercise on cerebral and systemic vascular function.

Rickards (PI), Yurvati (Co-I) 07/17 - 06/19
American Heart Association (AHA) Association Wide Grant-in-Aid (17GRNT33671110)
A novel approach for improving cerebral tissue blood flow and oxygenation via pulsatile perfusion therapy
The aim of this project is to assess the cerebral blood flow and oxygen responses to pulsatile perfusion under hypovolemic and hypoxic conditions. The long-term goal of this research is to examine whether "pulsatile perfusion therapy" is an effective treatment for conditions that challenge cerebral blood flow and oxygenation, such as hemorrhage, cardiac arrest, stroke, traumatic brain injury, severe dehydration, and hypotension associated with sepsis.

Rickards (Co-PI), Mallet (Co-PI), Yurvati (Co-I) 03/17 - 12/18
William and Ella Owens Medical Research Foundation
Pyruvate-enriched resuscitation to reduce inflammation and free radical production during simulated hemorrhage
The aim of this project is to explore the effects of simulated hemorrhage (via application of lower body negative pressure) on markers of inflammation and oxidative stress, and to assess the efficacy of pyruvate-enriched resuscitation fluid on reducing these markers of tissue injury.

Completed Research Support (Selected)

Rickards (PI) 06/11 – 06/15
Department of Defense, US Army Medical Research and Materiel Command (W81XWH-11-2-0137)
Cerebral blood flow regulation during simulated hemorrhage
The aim of this project was to investigate the effect of hemodynamic oscillations on tolerance to hemorrhage, with a specific focus on the regulation of cerebral perfusion and oxygenation.