

Biographical Sketch

NAME: TODD ERIK RASMUSSEN		POSITION TITLE: PROFESSOR OF SURGERY	
EDUCATION/TRAINING:	DEGREE	YEAR(S)	FIELD OF STUDY
University of Kansas, Lawrence, Kansas	Bachelor of Science	1984-1989	Pharmacy
Mayo Medical School, Rochester, Minnesota	Medical Doctor	1989-1993	Medicine
Wilford Hall U.S. Air Force Medical Center, San Antonio, Texas	Surgical Internship	1993-1994	General Surgery
Wilford Hall U.S. Air Force Medical Center, San Antonio, Texas	Surgical Residency	1995-1999	General Surgery
Mayo Clinic, Rochester, Minnesota	Fellowship Training	1999-2001	Vascular Surgery

A. PERSONAL STATEMENT:
 I am a Professor of Surgery and Vice Chair of Education in the Department of Surgery at Mayo Clinic and Senior Associate Consultant in the Division of Vascular Surgery. I am a retired Air Force Colonel with leadership experience in clinical and academic medicine, device innovation and translation, and the intricacies of federal research funding and interagency collaboration. During my military career, I led programs accountable to highest levels of the Federal Government, and had experience managing vertically within a large, global bureaucracy and leading teams in diverse missions around the world. I am now a full-time vascular surgeon but also a strategic thinker who creates relationships, teams, and synergy. I have remained flexible and innovative throughout my career, maintaining a surgery practice, research and innovation programs, and a track record of patenting and delivering products to the market.

B. PROFESSIONAL EXPERIENCE AND HONORS:

Current Academic & Positions:

- Professor of Surgery and Vice Chair of Education, Department of Surgery, Mayo Clinic College of Medicine and Science, Rochester, Minnesota
- Senior Associate Consultant, Division of Vascular and Endovascular Surgery, Mayo Clinic, Rochester, Minnesota

Honors & Lectureships:

- Air Force Medical Service 2007 United State Air Force Surgical Excellence Award. January 2007.
- 17th Annual Gold Headed Cane Award for excellence in patient care, academic achievement & deployed medicine. Wilford Hall Medical Center, Lackland Air Force Base, Texas. November 2008.
- Mike Wertheimer Memorial Lecture of the Royal Australian College of Surgeons May 2010.
- 2011 Baron Dominique Jean Larrey Award for Excellence in Military Surgery. Uniformed Services University of the Health Sciences Surgical Associates, Bethesda, Maryland. March 2011.
- 2011 Kern Memorial Lectureship, The Association of Military Surgeons of the United States (AMSUS), San Antonio, Texas, November, 2011
- 2013 Alpha Omega Alpha (AOA) Visiting Professorship, F. Edward Hebert School of Medicine The Uniformed Services University of the Health Sciences, Bethesda, Maryland, May 2013.

- Tom Deal Memorial Lectureship. Special Operations Medical Association. December 2014.
- *National Hero of Military Medicine*. Center for Public Private Partnerships, Washington DC. 2015.
- Charles C. Wolferth, Jr. Lecture. American College of Surgeons Committee on Trauma. May 2019.
- Council of Deans Fellow, Association of American Medical Colleges (AAMC). 2019-present.
- United States Department of Defense, Defense Superior Service Medal presented June 30, 2021.
- Mayo Clinic Fellows Association, Department of Surgery Educator of the Year 2021-2022.

National Academic Service

- Associate Examiner: American Board of Surgery, September 2014 - Present
- Editorial Review: Journal of Vascular Surgery, Journal of Trauma & Acute Care Surgery, JAMA Surgery, New England Journal of Medicine
- Invited panelist and contributor to National Academy of Medicine study panels (2015 and 2019)
- Food and Drug Association (FDA) Regulatory Consultant, Circulatory System Devices Panel (2018 to present) Medical Devices Advisory Committee, Center for Devices and Radiologic Health

C. CONTRIBUTIONS TO SCIENCE, POLICY AND PEER REVIEWED PUBLICATIONS:

A combination of rigorous medical and scientific expertise and extensive clinical experience as a surgeon-scientist (wartime and in the U.S.) has allowed me to lead ground-breaking research and innovation in the areas of life and limb-threatening injury, vascular trauma and hemorrhage control and resuscitation. My research has built strong interpersonal dynamics within my programs and with collaborators around the world. My research and innovation programs have a record of academic success, including delivery of impactful knowledge and materiel products. I have led large research institutes and programs in strategic planning, programming, budgeting, and execution of federal appropriations. My experience in the highest levels of the government has allowed me to participate in policy initiatives with the National Academies, the White House, and interagency partners such as the National Institutes of Health (NIH) and Food and Drug Administration (FDA).

For complete bibliometric/publication record see: ORCID: <https://orcid.org/0000-0003-1120-4116>;
Web of Science: Y-2122-2019: Source [Publons](#): publications, 300, citations 10,000, h-index 60

- 1. Vascular trauma** is a leading cause of shock, mortality, and morbidity in civilian and military situations. The wars in Iraq and Afghanistan provided extraordinary conditions in which to study the complexities of controlling and repairing vascular injury and resuscitating and rehabilitating affected patients. Our research defined modern rates of wartime vascular injury, and developed translational, applied models with which to study new approaches to the management of vascular injury and shock. Our program delivered knowledge and materiel products to mitigate the effects of ischemia/reperfusion, improve long-term statistical and functional limb salvage of the mangled extremity. The results of this research have improved survival and recovery of service members and those injured in accidents and acts of violence in the civilian setting.
 - a. White JM, Stannard A, Burkhardt GE, Eastridge BJ, Blackbourne LH, **Rasmussen TE**. The epidemiology of vascular injury in the wars in Iraq and Afghanistan. *Ann Surg*. 2011;253(6):1184-9.
 - b. Hancock HM, Stannard A, Burkhardt GE, Williams K, Dixon P, Cowart J, Spencer JR, **Rasmussen TE**. Hemorrhagic shock worsens neuromuscular recovery in a porcine model of hind limb vascular injury and ischemia/ reperfusion. *J Vasc Surg* 2011;53(4):1052-62.
 - c. Percival TJ, **Rasmussen TE**. Reperfusion strategies in the setting of extremity vascular injury with ischemia. *Brit J Surg* 2012;99(Suppl 1):66-74.
 - d. Perkins ZB, Yet B, Glasgow S, Marsh W, Tai NRM, **Rasmussen TE**. Long-term, patient-centered

- outcomes of Extremity Vascular Trauma. *J Trauma Acute Care Surg.* 2018;85(1S Suppl 2):S104-S111.
- e. Alarhayem AQ, Cohn SM, Cantu-Nunez O, Eastridge BJ, **Rasmussen TE**. Impact of time to repair on outcomes in patients with lower extremity arterial injuries. *J Vasc Surg.* 2019;69(5):1519-1523.
 - f. Sharrock AE, Tai N, Perkins Z, White JM, Remick KN, Rickard RF, **Rasmussen TE**. Management and outcome of 597 wartime penetrating lower extremity arterial injuries from an international military cohort. *J Vasc Surg.* 2019;70(1):224-232.
 - g. Patel JA, White JM, White PW, Rich NM, **Rasmussen TE**. A contemporary, 7-year analysis of vascular injury from the war in Afghanistan. *J Vasc Surg.* 2018;68(6):1872-1879.
 - h. Textbook: **Rasmussen TE** & Tai NR (eds). *3rd Edition Rich's Vascular Trauma*. Philadelphia: Elsevier Publishers Copyright 2016. ISBN: 978-1-4557-1261-8.
 - i. Perkins ZB, Kersey AJ, White JM, Lauria AL, Propper BW, Tai NRM, **Rasmussen TE**. Impact of Ischemia Duration on Limb Salvage in Combat Casualties. *Ann Surg.* 2022 Sep 1;276(3):532-538.

- 2. Medical device innovation:** In response to my clinical experience in war and emerging data on the causes of bleeding and death in U.S. service members, I co-invented (with Eliason JL) the Fluoroscopy-independent, endovascular aortic occlusion system (US Patent # 20,130,102,926) in 2009. This innovation defined the term Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA), and through refinement of device prototypes and creation of private/public partnerships, evolved into the ER-REBOA™ catheter. A decade after the patent, the ER-REBOA™ has now been used in more than 5,000 patients worldwide, including U.S. and allied surgical teams in deployed locations. The USU Shock and Organ Support Research Program is currently supporting the development and testing of next-generation REBOA technologies, and the study of REBOA in the management of post-partum bleeding, and as an adjunct to CPR in the setting of cardiac arrest.
- a. Stannard A, Eliason JE, **Rasmussen TE**. Resuscitative endovascular balloon occlusion of the aorta (REBOA) as an adjunct for hemorrhagic shock. *J Trauma* 2011;71(6):1869-72.
 - b. Morrison JJ, **Rasmussen TE**. Noncompressible torso hemorrhage: a review with contemporary definitions and management strategies. *Surg Clin North Am* 2012;92(4):843-58.
 - c. Scott DJ, Eliason JL, Villamaria C, Morrison JJ, Houston R, Spencer JR, **Rasmussen TE**. A novel fluoroscopy-free, resuscitative endovascular aortic balloon occlusion system in a model of hemorrhagic shock. *J Trauma Acute Care Surg* 2013;75:122-128.
 - d. Morrison JJ, Percival TJ, Markov NP, Villamaria C, Scott D, Saches KA, Spencer JR, **Rasmussen TE**. Aortic balloon occlusion is effective in controlling pelvic hemorrhage. *J Surg Res* 2012;177(2):341-347.
 - e. **Rasmussen TE**, Franklin CJ, Eliason JL. Surgical Innovation: Resuscitative endovascular balloon occlusion of the aorta for hemorrhagic shock. *JAMA Surg.* 2017;152(11):1072-1073.
 - f. **Rasmussen TE**, Eliason JL. Military-civilian partnership in device innovation: development, commercialization and application of Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA). *J Trauma Acute Care Surg.* 2017;84(4):732-735.
 - g. Borger van der Burg BLS, Van Schaik J, Brouwers JJWM, Wong CY, **Rasmussen TE**, Hamming JF, Hoencamp R. Migration of Aortic Occlusion Balloons in an in vitro model of the human circulation. *Injury.* 2019 Feb;50(2):286-291.
 - h. Eliason JL, Myers DD, Ghosh A, Morrison JJ, Mathues AR, Durham L, Dunivant V, Gonzalez AA, **Rasmussen TE**. Resuscitative Endovascular Balloon Occlusion of the Aorta: Zone I Occlusion Time Affects Spinal Cord Injury in a Nonhuman Primate Model. *Ann Surg.* 2021 Jul 1;271(1):e54-e61.
 - i. Lauria AL, Sen I, Rasmussen TE. The Human Acellular Vessel for Vascular Reconstruction or Bypass: A Novel Biologic Conduit for Vascular Bypass and Repair. *JAMA Surg.* 2022 Aug 1;157(8):731-732.
 - j. Polcz JE, Ronaldi AE, Madurska M, Bedocs P, Leung LY, Burmeister DM, White PW, **Rasmussen TE**, White JM. Next-Generation REBOA (Resuscitative Endovascular Balloon Occlusion of the Aorta) Device Precisely Achieves Targeted Regional Optimization in a Porcine Model of Hemorrhagic Shock. *J Surg Res.* 2022 Aug 5;280:1-9. doi: 10.1016/j.jss.2022.06.007. Epub ahead of print.

- 3. Military medicine's experience during wars in Afghanistan and Iraq** has influenced civilian medicine and public policy relating to homeland security and national preparedness. I have worked as part of interagency teams, in the translation of wartime lessons into a national plans, policy and legislation. These efforts have resulted in a framework for a *national trauma system*, a *national trauma research investment* and *integrated DoD-civilian partnerships* in high-acuity care to achieve military readiness and improve homeland response to mass casualty events. I supported a National Academy of Medicine study on the impact of the wars on medicine, and played a role in the White House initiative to develop and launch the *Stop the Bleed* campaign. I have also led interagency projects with NIH and FDA to improve the awareness of, and investment in, trauma/critical care innovations as well as a more effective evaluation of their regulatory (FDA) requirements.
- Propper BW, **Rasmussen TE**, Davidson S, Vandenberg S, Gunst MA, Clouse WD, Burkhardt GE, Gifford SM, Johannigman JA. Surgical response to multiple casualty incidents in the modern era. *Ann Surg* 2009;250(2):311-315.
 - Elster EA, Butler FK, **Rasmussen TE**. Implications of combat casualty care for mass casualty events. *JAMA* 2013;310(5):475-76.
 - Rasmussen TE**, Kellermann AL. Wartime Lessons – Shaping a National Trauma Action Plan. *N Engl J Med* 2016;357(17):1612-1615.
 - Bulger EM, **Rasmussen TE**, Jurkovich GJ, Fabian TC, Kozar RA, Coimbra R, Costantini TW, Ficke J, Malhotra AK, Price MA, Smith SL, Cioffi WG, Stewart RM. Implementation of a National Trauma Research Action Plan (NTRAP). *J Trauma Acute Care Surg*. 2018;84(6):1012-16.
 - Pusateri AE, Homer MJ, **Rasmussen TE**, Kupferer KR, Hoots WK. The interagency strategic plan for research and development of blood products and related technologies for trauma care and emergency preparedness 2015-2020. *Am J Disaster Med*. 2018 Summer;13(3):181-194.
 - Rasmussen TE**, Baer DG, Goolsby C. The Giving Back – Battlefield Lesson to National Preparedness. *J Trauma Acute Care Surg* 2016;80(1):116-7.
 - Rasmussen TE**, Martin MJ. Tragedies of 2017 showed how military medical partners can help at home. USA TODAY Opinion on-line publication December 28th, 2017: <https://www.usatoday.com/story/opinion/2017/12/28/2017-tragedies-military-medical-partners-helped-civilians-home-rasmussen-martin-column/984694001/>

D. RESEARCH SUPPORT

Active:

2021 – Present. (Primary Investigator). Project costs \$394,912. Prospective observational study to assess use and outcomes of Human Acellular Vessel (HAV) as a vascular prosthesis (bypass conduit) for arterial reconstruction in patients with limb threatening peripheral artery disease. An industry funded, FDA-supported clinical trial of a biologic vascular conduit under FDA issued expanded access Investigational New Drug (IND).

2021 – Present. (Primary Investigator). Project costs \$107,865. Automated partial resuscitative endovascular balloon occlusion of the aorta (REBOA) controller to enable management of noncompressible hemorrhage during delayed medical evacuation. Department of Defense (DOD) funded industry collaboration on a preclinical, applied device development effort to advance miniaturized endovascular devices with on-board sensing and therapeutic capabilities.

2022 – Present. (Primary Investigator). Project costs \$200,729. Phase 2 clinical study for the evaluation of safety and efficacy of Humacyte' Human Acellular Vessel (HAV) for vascular replacement or reconstruction in patients with life or limb threatening vascular trauma. An industry funded; FDA-

supported regulatory trial of a biologic conduit used for vascular repair in setting of severe injury.

Completed (selected):

2018 – 2021. “Uniformed Services University (USU) Transforming Technologies for the Warfighter (TTW)”. Department of Defense, Defense Health Program (DHP) \$20M RDT&E award to form and lead strategic partnerships with civilian academia drive medical innovation and the applied study of emerging technologies for all phases of trauma and critical care.

2018 – 2021 (Co-Primary Investigator). “Uniformed Services University Battlefield Shock and Organ Support Research Program”. Department of Defense, Defense Health Program \$8M award for study of technologies for vascular injury, hemorrhage control, resuscitation and extra-corporeal organ support.

08/01/13 – 07/01/15 (Co-Investigator, 5%/ Extramural Collaborator: University of Michigan). “Validation of Endovascular Skills for Trauma and Resuscitative Surgery (ESTARS™)”. Defense Health Program (DHP)/ Joint Program Committee (JPC-6) Merit Award. Award amount: \$250,000.

09/01/10 – 07/01/13 (Co-Investigator, 10%/ Extramural Collaborator: University of Michigan). “Joint operational training for use of vascular shunts in the management of vascular injury.” Defense Health Program (DHP)/ Joint Program Committee (JPC-6) Merit Award. Award amount: \$612,000.

09/01/07 – 07/01/2013 (Primary Investigator, 5%). “Global War on Terror (GWOT) Vascular Initiative: Outcomes following vascular trauma”. Defense Health Program (DHP)/ Joint Program Committee (JPC-6) Merit Award. Award amount: \$2,100,000

09/01/11-07/01/13 (Primary Investigator, 10%). “Impact of Clinical Practice Guidelines on Outcomes of Combat Casualties”. Defense Health Program/ Joint Program Committee (JPC-6) Merit Award. Award amount: \$749,000.

09/01/10 – 07/01/13 (Co-Investigator, 10%/ extramural collaborator: University of Michigan). “Treatment of non-compressible hemorrhage with thoracic aortic balloon occlusion system”. U.S. Air Force Medical Service Broad Agency Announcement (BAA) Merit Award. Award amount: \$850,000.

04/01/09 – 09/30/10 (Primary Investigator 10%). “Impact of porcine hind limb ischemia on outcomes: functional assessment of ischemic intervals”. Air Force Medical Service Clinical Investigation Facility (CIF) Merit Award. Award amount: \$35,000.00,

07/01/09 – 07/01/10 (Primary Investigator 10%). “Fasciotomy to reduce ischemia reperfusion injury in porcine model of hind limb vascular injury” Air Force Medical Service Clinical Investigation Facility (CIF) Young Investigator Award. Award amount: \$94,000.

11/01/08 – 09/30/09 (Primary Investigator 10%) “Impact of temporary shunts in setting of extremity vascular injury and shock in swine”. Air Force Medical Service Clinical Investigation Facility (CIF) Young Investigator Award. Award amount: \$136,000.00

11/01/08 – 06/30/09 (Primary Investigator 10%). “Impact of venous effluent diversion in porcine model of tourniquet application and release. Air Force Medical Service Clinical Investigation Facility (CIF) Young Investigator Award. Award amount: \$186,798.00

