Ryan Walker Barrs, PhD

68 President St. Bioengineering BE313
Charleston, SC 29403
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EDUCATION

Doctor of Philosophy, Bioengineering **December 2023**
Dissertation: Engineering Next-Generation Cardiovascular Therapies Charleston, SC
Advisor: Ying Mei, PhD
Clemson University (Clemson/MUSC Joint Bioengineering Program)

Bachelor of Science, Biomedical Engineering **May 2016**
University of South Carolina Columbia, SC
Honors: Cum Laude

RESEARCH EXPERIENCE

NIH T32 Postdoctoral Research Fellow **May 2024 – Present**
Medical University of South Carolina Charleston, SC
Advisor: Michael Kern, PhD
Project: Engineering skeletal muscle organoids for craniofacial regenerative therapy

- Advanced extracellular vesicle therapeutic platform in heart repair using large animal model (porcine) model of acute myocardial infarction towards clinical translation
- Developed hiPSC-derived skeletal muscle cell lines to fabricate human skeletal muscle organoids for craniofacial tissue engineering applications
- Filed provisional patent "Engineering Human Skeletal Muscle Organoids for Craniofacial Repair and Drug Screening" with the Zucker Institute for Innovation Commercialization at the Medical University of South Carolina

NIH F31 Predoctoral Research Fellow **August 2020 – November 2023**
Clemson University Charleston, SC
Project: Leveraging the HIF-alpha pathway to improve the engraftment and therapeutic efficacy of human nanowired cardiac organoids

- Independently funded PhD research to develop human cardiac microtissues embedded with conductive silicon nanowires for improving cell therapy and functional engraftment in preclinical rodent models of cardiac ischemia-reperfusion injury

Graduate Research Assistant **August 2017 – November 2023**
Clemson University Charleston, SC
Advisor: Ying Mei, PhD
Dissertation Title: Engineering Next-Generation Cardiovascular Therapies

- Developed novel bioink for modular bioprinting of vascularized tissue replacements
- Investigated nanowired human cardiac organoid transplantation for heart repair
- Established therapeutic extracellular vesicle platform with human cardiac organoids

Research Specialist I **October 2016 – August 2017**
Medical University of South Carolina Charleston, SC
Advisor: Jeffrey Jones, PhD

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Project: IL-6 mediated pathogenesis mechanisms of abdominal aortic dilation

- Developed expertise in core molecular biology experiments (e.g. western blot, qPCR, ELISA, mammalian cell culture, animal research)

Undergraduate Research Assistant **January 2015 – May 2016**
University of South Carolina Columbia, SC
Advisor: Esmaiel Jabbari, PhD
Project: Synthesis of peptide-functionalized biomaterials for bone tissue engineering

APPOINTMENTS

T32 Ruth L. Kirschstein Postdoctoral Fellow **January 2024 – Present**
Clemson University Charleston, SC
Advisor: Michael Kern, PhD
Project: Skeletal muscle tissue engineering for reconstructive oral surgery

F31 Ruth L. Kirschstein Predoctoral Fellow **August 2021 – December 2023**
National Institutes of Health (National Heart, Lung, and Blood Institute)
Grant Number: 5F31HL156541
Project: Leveraging the HIF-alpha pathway to improve the engraftment and therapeutic efficacy of human nanowired cardiac organoids

MADE in SC Fellow **February 2018 – August 2021**
South Carolina Established Program to Stimulate Competitive Research (SC EPSCoR)
Project: Materials genomics-guided development of proangiogenic biomaterials

Graduate Research Assistant **August 2017 – February 2018**
Clemson/MUSC Joint Bioengineering Program
Advisor: Ying Mei, PhD

RELATED EXPERIENCE

Science Communications Intern **August 2019 – December 2023**
Medical University of South Carolina

- Prepared lay summaries of research on campus for MUSC Catalyst News and EurekAlert
- Wrote feature article for MUSC's literary magazine Progressnotes Fall 2019 issue
- Writing samples can be found at www.clippings.me/ryanbarrs

Student Researcher **June 2015 – August 2015 and**
Medical University of South Carolina **June 2016 – August 2016**
MUSC Summer Undergraduate Research Program (SURP)
Advisor: Ying Mei, PhD

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Staff Editor **August 2018 – August 2019**
Humanitas
- Promoted and published annual arts and humanities magazine at MUSC

Clemson Bioengineering Organization (CBO) Representative **August 2020 – August 2021**
Medical University of South Carolina
- Liaised between bioengineering students at Clemson and MUSC campus
- Planned events for Clemson and MUSC bioengineering students
- Kept students on the MUSC campus informed of CBO affairs

PUBLICATIONS

Y Tan*, RC Coyle*, **RW Barrs*,** *et al.* Nanowired human cardiac organoid transplantation enables highly efficient and effective recovery of infarcted hearts. *Science Advances*. (2023).
***Co-first author**

RW Barrs, J Jia, M Ward, *et al.* Engineering a chemically defined hydrogel bioink for direct bioprinting of microvasculature. *Biomacromolecules.* (2020).

RW Barrs, J Jia, SE Silver, M Yost, Y Mei. Biomaterials for bioprinting microvasculature. ***Chemical Reviews****.* (2020). **First-authored authoritative review in top Chemistry journal.**

RC Coyle, **RW Barrs**, DJ Richards, *et al.* Targeting HIF-α for robust prevascularization of human cardiac organoids. *Journal of Tissue Engineering and Regenerative Medicine.* (2021).

JD Bain, **RW Barrs**, Y Mei. Progress and challenges in transplantation of human pluripotent stem cell derived cardiomyocytes for cardiac therapy. *npj Biomedical Innovations.* (2025).

SE Silver, **RW Barrs**, Y Mei. Transplantation of Human Pluripotent Stem Cell-Derived Cardiomyocytes for Cardiac Regenerative Therapy. *Frontiers in Cardiovascular Medicine.* (2021).

J Jia, EJ Jeon, M Li, DJ Richards, S Lee, Y Jung, **RW Barrs**, *et al.* Evolutionarily conserved sequence motif analysis guides development of chemically defined hydrogels for therapeutic vascularization. *Science Advances.* (2020).

SE Silver, AR Howells, DC Arhontoulis, LN Randolph, NA Hyams, **RW Barrs**, Mei Li, CM Kerr, RA Robino, JE Morningstar, JD Bain, ME Floy, RA Norris, X Bao, JM Ruddy, SP Palecek, LMR Ferreira, XL Lian, Y Mei. Hypoimmunogenic hPSC-derived cardiac organoids for immune evasion and heart repair. ***Nature Biomedical Engineering****.* (2026).

L Schroeder, J Buckley, R Martin, RE Stroud, EK Nadeau, **RW Barrs**, *et al.* Plasma neutrophil gelatinase-associated lipocalin is associated with acute kidney injury and clinical outcomes in neonates undergoing cardiopulmonary bypass. *Pediatric Critical Care Medicine.* (2019).

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AW Akerman, RE Stroud, **RW Barrs**, *et al.* Elevated wall tension initiates interleukin-6 expression and abdominal aortic dilation. *Annals of Vascular Surgery.* (2018).

J Jia, RC Coyle, DJ Richards, CL Berry, **RW Barrs**, *et al.* Development of peptide-functionalized synthetic hydrogel microarrays for stem cell and tissue engineering applications. *Acta Biomaterialia.* (2016).

PRESENTATIONS

National IDeA Symposium of Biomedical Research Excellence **June 2018**
Poster presentation Washington, DC
"Development of a vasculogenic bioink to support bioprinted tissue constructs"

Regenerative Medicine Workshop **March 2019**
Oral presentation and poster presentation Isle of Palms, SC
"Development of a vasculogenic bioink for direct bioprinting of vascularized tissues"

SC EPSCoR/MADE in SC State Conference **April 2019**
Poster presentation Columbia, SC
"Development of vascular inductive alginate bioinks with defined chemistry for vascularized tissue unit fabrication"

Biomedical Engineering Society (BMES) Annual Meeting **October 2019**
Oral presentation Philadelphia, PA
"Development of vascular inductive bioinks with defined chemistry for vascularized tissue unit fabrication"

MADE in SC Fellows/Faculty Conference **April 2022**
Poster presentation Columbia, SC
"Materials genomics-guided development of proangiogenic biomaterials"

Gordon Research Conference **July 2024**
Signal Transduction by Engineered Extracellular Matrices Manchester, NH
Poster presentation
"Nanowired human cardiac organoids for heart repair"

American Association of Extracellular Vesicles Annual Conference **November 2024**
Poster presentation Houston, TX
"Silicon nanowires augment therapeutic extracellular vesicle production from human cardiac organoids"

Society for Biomaterials Annual Conference **April 2025**
Oral Presentation Chicago, IL

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"Silicon nanowires augment therapeutic extracellular vesicle production from human cardiac organoids"

American Association of Extracellular Vesicles Annual Conference **November 2024**
Poster presentation Houston, TX
"Conductive silicon biointerfaces augment EV-driven heart repair from cardiac organoids"

American Association of Extracellular Vesicles Annual Conference **November 2025**
Poster Presentation Salt Lake City, UT
"Conductive silicon biointerfaces augment EV-driven heart repair from cardiac organoids"

MENTORING EXPERIENCE

Michael Ward **June – August 2018**
Undergraduate student (Clemson University)
- Clemson Research Experience for Undergraduates (REU)
- Helped develop bioink for bioprinting vascularized tissues, resulting in authorship on a peer-reviewed publication
- Earned his Master of Science in Bioengineering from Clemson University in 2021

Masi Sundara **June – August 2019**
High school student (Academic Magnet High School)
- Nicotine e-liquid effects on cardiac fibroblast spheroids
- Invited to present work at Lowcountry Regional Science and Engineering Fair at College of Charleston
- Pursuing a Bachelor of Science in Neuroscience at University of Western Ontario

Blessing Agho **June – August 2021**
Undergraduate student (University of South Carolina)
- MUSC Summer Undergraduate Research Program (SURP)
- Hypoxia inducible factor activating nanoparticle synthesis
- Earned her Bachelor of Science in Biological Sciences from USC in 2022

Karen Deguzman **June – August 2022**
Undergraduate student (Clemson University)
- Bioengineering Research and Clinical Summer Immersion at Charleston (BEACH)
- Engineering decellularized human amnion/chorion membranes for wound healing
- Participated in Summer Undergraduate Research in Japan after mentorship
- Senior project won Clemson pitch contest
- Earned Bachelor of Science in Bioengineering at Clemson University in Spring 2024

Mohammed Ismaiel **July 2023 – August 2024**
Undergraduate student (Clemson University)
- Bioengineering Research and Clinical Summer Immersion at Charleston (BEACH)

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- Decellularized human amnion/chorion membrane engineering for wound healing
- Earned Bachelor of Science in Bioengineering at Clemson University in Spring 2025
- Post-baccalaureate intern at the National Institutes of Health

PROFESSIONAL ASSOCIATIONS

Biomedical Engineering Society (BMES)	**2017 - Present**
Society for Biomaterials (SFB)	**2017 - Present**
American Medical Writers Association (AMWA)	**2019 - Present**
American Association of Extracellular Vesicles (AAEV)	**2024 - Present**