OMB No. 0925-0001 and 0925-0002 (Rev. 03/2020 Approved Through 02/28/2023)

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.  
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: Kenneth S. Campbell

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

POSITION TITLE: Professor of Physiology and Cardiovascular Medicine

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 |
| --- | --- | --- | --- |
| University of Oxford, Oxford, UK | BA (Hons) | 09/90 – 06/93 | Physics |
| University of Birmingham, Birmingham, UK | PhD | 09/93 – 04/98 | Muscle physiology |
| University of Wisconsin-Madison, WI, USA | Postdoc | 04/98 – 01/03 | Muscle physiology |

**No variances from ordinary career progression**

1. **Personal Statement**

I lead a research group that integrates biophysical, biochemical, and computational techniques to develop better therapies for human heart failure. We have extensive collaborations with cardiothoracic surgeons and cardiologists and our reseach is motivated by the need to help patients who have severe cardiac disease.

I am excited to support this project (with additional contributions from our postdoc Dr. Sarah Kosta) using our new spatially-explicit framework called FiberSim (PMID 34932957). Our primary goal will be to help Drs. Yengo, Warshaw, and Craig bridge from molecular-level experiments (Aims 1 and 2) to ensemble force-velocity and power (Aim 3). We will use the molecular-level data from the first Aims as inputs to the model and predict myofilament-level function. The predictions can then be tested using in vitro experiments, with modeling and biophysical assays developing in an interative, synergistic process.

Research in my own lab integrates biophysical, biochemical, and computational techniques and aims to develop better therapies for human heart failure. We collaborate with cardiologists and surgeons and our research is motivated by the need to help patients who have severe cardiac disease. We are fortunate to be supported by multiple ongoing grants including three MPI R01s as noted below.

|  |
| --- |
| NIH R01 HL146676  Stelzer / Campbell / Jin (MPIs)  12/18/2018-11/30/2023 |
| Computer modeling of myosin binding protein C and its effects on cardiac contraction |
|  |
| R01 HL149164  Campbell / Tanner (MPIs)  07/01/2020-06/3/2024 |
| Length-dependent activation in human myocardium |
|  |
| NIH R01 HL148785  McDonald / Campbell (MPIs)  07/01/-06/3/2024 |
| Dual filament control of myocardial power and hemodynamics |

Manuscripts (from a total of ~80) that are representative of my work include:

1. **CAMPBELL, K. S.**, Janssen, P.M. & Campbell, S. G. (2018). Force-dependent recruitment from the myosin OFF state contributes to length-dependent activation. *Biophys. J.* 115, 543-553 .[PMC 6084639](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6084639/).
2. **CAMPBELL, K. S.**, Yengo, C. M., Lee, L. C., Kotter, J., Sorrell, V. L., Guglin, M. & Wenk, J. F. (2019). Closing the therapeutic loop. *Arch Biochem Biophys.* 663, 129-131. [PMC6377839](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6377839/).
3. Blair, C. A., Brundage, E. A., Thompson, K. L., Stromberg, A., Guglin, M., Biesiadecki, B. J. & **CAMPBELL, K. S.** (2020). Heart Failure in Humans Reduces Contractile Force in Myocardium From Both Ventricles. *JACC Basic Transl Sci.* 5, 786-798. [PMC7452203](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7452203/).
4. **CAMPBELL, K. S.**, Chrisman, B. S. & Campbell, S. G. (2020). Multiscale Modeling of Cardiovascular Function Predicts That the End-Systolic Pressure Volume Relationship Can Be Targeted via Multiple Therapeutic Strategies. *Front Physiol.* 11, 1043.[PMC7466769](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7466769/).

**B. Positions, Scientific Appointments, and Honors**

**Positions and Scientific Appointments**

|  |  |
| --- | --- |
| 2021 | University of Kentucky College of Medicine Leadership Training |
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| 2020 | Grant review, multiple NIH panels |
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| 2020 | Biophysical Society, Motility Sub-group, Co-leader |
| 2020 - present | Course Director, Medical School Cardiology (100 hours at 3 campuses) |
| 2020 - present | Director, COVID-19 Research Registry and Specimen Bank, University of Kentucky |
| 2019 – 2021 | Guest Editor, Archives of Biochemistry and Biophysics: special issue on muscle modeling |
| 2019 - present | Editorial Board, Scientific Reports |
| 2018 - 2019 | Guest Editor, Biophysical Journal: special issue on cardiac modeling |
| 2018 - present | Grant review, Wellcome Trust, United Kingdom |
| 2018 - present | Professor (Tenured), Department of Physiology and Division of Cardiovascular Medicine, University of Kentucky, Lexington, KY |
| 2017 - present | Principal Investigator, Gill Cardiovascular Biorepository, University of Kentucky |
| 2017 - present | Editorial Board, Life Sciences |
| 2016 - present | Director of Graduate Studies, Department of Physiology, University of Kentucky |
| 2015 | Grant review, American Heart Association Established Investigator Award |
| 2015 - 2018 | Co-founder and Chief Technology Officer, MyoAnalytics, LLC |
| 2015 - 2018 | Associate Professor (Joint Appointment), Division of Cardiovascular Medicine,  University of Kentucky, Lexington, KY |
| 2014 | Symposium Speaker, Biophysical Society Annual Meeting |
| 2014 | Auckland Bioengineering Institute, New Zealand – 4 week visit supported by research grant from the Royal Society of New Zealand, Auckland, New Zealand |
| 2014 - 2020 | Grant review, NIH MTI, K99-R00 panel for NHLBI |
| 2013 | Grant review, NHLBI PPG |
| 2013 - 2014 | Grant review Chair, American Heart Association, Cardiac Biology and Regulation 1 |
| 2013 - present | Core Director, Biospecimens, Kentucky Center for Clinical and Translational Sciences |
| 2012 - 2014 | Grant review, NIH ZHL1 CSR-P (01)1 – Mentored Career Transition Scientist |
| 2011 | Co-Chair, Muscle Mechanics and Ultrastructure, Biophysical Society Annual Meeting |
| 2011 - 2012 | Grant review Co-Chair, American Heart Association, Cardiac Biology and Regulation 1 |
| 2011 | Director, Modeling workshop for trainees in muscle biology, University of Kentucky, Lexington, KY |
| 2010 | Symposium Chair, 6th World Congress on Biomechanics, Singapore |
| 2010 - present | Editorial Board, Frontiers in Cardiac Muscle Physiology |
| 2009 - 2019 | Executive Committee Member, Center for Muscle Biology, University of Kentucky, Lexington, KY |
| 2009 - 2018 | Associate Professor (Tenured), Department of Physiology, University of Kentucky |
| 2008, 2010 | Biophysical Society Annual Meeting Career Workshop Coordinator |
| 2007 | Symposium Chair, Experimental Biology, American Physiological Society Annual Meeting |
| 2007 - 2009 | Grant review, American Heart Association, Cardiac biology and regulation |
| 2007, 2012, 2014 | Grant review, National Science Foundation |
| 2006 - 2012 | Biophysical Society Early Careers Committee |
| 2004 - 2009 | Assistant Professor (Tenure-track), Department of Physiology, University of Kentucky |
| 2004 - present | Member of the American Physiological Society |
| 2003 - 2004 | Assistant Scientist, Department of Physiology, University of Madison-Wisconsin |
| 2001 - present | Member of the American Heart Association |
| 1998 - present | Member of the Biophysical Society |
| 1993 - 2010 | Member of the Physiological Society (United Kingdom) |

**Honors**

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| --- | --- |
| 2006, 2010, 2014 | Holsinger Award for Excellence in Teaching (University of Kentucky, Physiology) |
| 2014 | |  | | --- | | University of Kentucky CTSA Mentor Recognition Award | |
| 2012 | Fellow of the American Heart Association |
| 1993 - 1998 | Wellcome Trust Prize Studentship (United Kingdom) |

**C. Contributions to Science**

**Contribution 1: Quantitative understanding of sarcomere-level function**

Dr. Campbell has published ~30 manuscripts that quantify the mechanical properties of skeletal and cardiac muscles. Important insights from these publications include: (a) bound cross-bridges contribute to diastolic myocardial stiffness, (b) heterogeneity of half-sarcomere responses contributes to residual force enhancement, and (c) myocardial relaxation is independent of afterload but accelerated by end-systolic lengthening.

1. **CAMPBELL, K. S.**, Patel, J. R. & Moss, R. L. (2003). Cycling cross-bridges increase myocardial stiffness at submaximal levels of Ca2+ activation. *Biophys. J.* 84, 3807-3815. [PMC 1302962](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1302962/).
2. **CAMPBELL, K. S.** (2006). Tension recovery in permeabilized rat soleus muscle fibers after rapid shortening and restretch. *Biophys. J.* 90, 1288-1294. [PMC 1367280](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1367280/).
3. Campbell, S. G. & **CAMPBELL, K. S.** (2011). Mechanisms Of Residual Force Enhancement In Skeletal Muscle: Insights From Experiments And Mathematical Models. *Biophysical Reviews.* 3, 199-207. [PMC 3237401](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3237401/)
4. Chung, C. S., Hoopes, C. W. & **CAMPBELL, K. S.** (2017). Myocardial relaxation is accelerated by fast stretch, not reduced afterload. *J Mol Cell Cardiol.* 103, 65-73. [PMC5347980](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC5347980/).

**Contribution 2: Mathematical modeling of striated muscle**

Dr. Campbell has published ~20 manuscripts that integrate mathematical modeling of skeletal and cardiac muscles with experimental data. The earliest manuscripts focused on the short-range mechanical properties of skeletal muscle and continue to influence the field of sensorimotor control. Three manuscripts from 2009 to 2011 showed that interactions between half-sarcomeres could explain residual force enhancement and apparent activation-dependent stiffening of muscle fibers. The latest work focuses on OFF/ON transitions in thick filament structure and their contribution to length-dependent activation in myocardium.

1. **CAMPBELL, K. S.** & Lakie, M. (1998). A cross-bridge mechanism can explain the thixotropic short-range elastic component of relaxed frog skeletal muscle. *J. Physiol.* 510, 941-962. [PMC 2231083](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2231083/).
2. **CAMPBELL, K. S.** (2009). Interactions between connected half-sarcomeres produce emergent mechanical behavior in a mathematical model of muscle. *PLoS Comput Biol.* 5, e1000560. PMC PMC2770126.
3. Campbell, S. G., Hatfield, P. C. & **CAMPBELL, K. S.** (2011). A mathematical model of muscle containing heterogeneous half-sarcomeres exhibits residual force enhancement. *PLoS Computational Biology.* 7, e1002156. [PMC 3182863](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3182863/).
4. **CAMPBELL, K. S.**, Janssen, P.M. & Campbell, S. G. (2018). Force-dependent recruitment from the myosin OFF state contributes to length-dependent activation. *Biophys. J.* 115, 543-553. [PMC 6084639](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6084639/).

**Contribution 3: Open source software for scientific research**

Dr. Campbell has a 16 year track record of creating scientific software and making it freely available to the research community. Major projects include: (a) SLControl, a package for acquiring and analyzing data relating to muscle mechanics, (b) GelBandFitter, a tool for analyzing closely-running bands on gels and immunoblots, (c) MyoSim, software for simulating the mechanical properties of half-sarcomeres, and (d) MyoVision, which automates image analysis for muscle cross-sections.

1. **CAMPBELL, K. S.** & Moss, R. L. (2003). SLControl: PC-based data acquisition and analysis for muscle mechanics. *AJP: Heart.* 285, H2857-2864. PMC not available. [PMID 12907419](http://www.ncbi.nlm.nih.gov/pubmed/12907419).
2. Mitov, M. I., Greaser, M. L. & **CAMPBELL, K. S.** (2009). GelBandFitter--a computer program for analysis of closely spaced electrophoretic and immunoblotted bands. *Electrophoresis.* 30, 848-851. [PMC 2742644](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2742644/).
3. **CAMPBELL, K. S.** (2014). Dynamic coupling of regulated binding sites and cycling myosin heads in striated muscle. *J Gen. Physiol.* 143, 387-399. [PMC 3933939.](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3933939/)
4. Wen, Y., Murach, K. A., Vechetti, I. J., Jr., Fry, C. S., Vickery, C., Peterson, C. A., Mccarthy, J. J. & **CAMPBELL, K. S.** (2018). MyoVision: software for automated high-content analysis of skeletal muscle immunohistochemistry. *J Appl Physiol (1985).* 124, 40-51. [PMC6048460](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC6048460/).

**Contribution 4: Transmural variation in myocardium**

Dr. Campbell’s laboratory has demonstrated that rodent and human hearts exhibit transmural variation in contractile function and that disease changes the normal patterns. These results are important because they may explain changes in cardiac torsion and regional shortening that predict clinical outcomes.

1. Campbell, S. G., Haynes, P., Kelsey Snapp, W., Nava, K. E. & **CAMPBELL, K. S.** (2013). Altered ventricular torsion and transmural patterns of myocyte relaxation precede heart failure in aging F344 rats. *AJP Heart.* 305, H676-686. [PMC 3761331](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3761331/).
2. Chung, C. S. & **CAMPBELL, K. S.** (2013). Temperature and transmural region influence functional measurements in unloaded left ventricular cardiomyocytes. *Physiological Reports.* 1, e00158. [PMC 3871472](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3871472/).
3. Haynes, P., Nava, K. E., Lawson, B. A., Chung, C. S., Mitov, M. I., Campbell, S. G., Stromberg, A. J., Sadayappan, S., Bonnell, M. R., Hoopes, C. W. & **CAMPBELL, K. S.** (2014). Transmural heterogeneity of cellular level power output is reduced in human heart failure. *J Mol Cell Cardiol.* 72, 1-8. [PMC 4037376](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4037376/).
4. Zhang, X., Haynes, P., **CAMPBELL, K. S.**, & Wenk, J. (2015). Numerical evaluation of myofiber orientation and transmural contractile strength on left ventricular function. *J. Biomech. Eng.* 137:044502. PMCID not available. [PMID 25367232](http://www.ncbi.nlm.nih.gov/pubmed/25367232).

**Contribution 5: Biobanking**

Dr. Campbell’s experience with biobanking started in 2008 when he initiated a collaboration with a cardiothoracic surgeon in order to collect samples of human myocardium. The project has now evolved into the Gill Cardiovascular Biorepository which Dr. Campbell leads as PI. The bank has acquired >10,000 myocardial samples from >360 organ donors and patients. The resource supports collaborations with ~30 groups in 5 countries.

Because of his experience, Dr. Campbell was chosen to lead an institution-wide biobanking program for the University of Kentucky CTSA-supported Center for Clinical and Translational Sciences. This program has enrolled ~45,000 patients to date and gives the institution permission to bank any sample that is procured as part of normal clinical care and that would otherwise be discarded. Dr. Campbell is the Director of this program and devotes 15% of his academic effort to the research.

1. Blair, C. A., Haynes, P., Campbell, S. G., Chung, C., Mitov, M. I., Dennis, D., Bonnell, M. R., Hoopes, C. W., Guglin, M. & **CAMPBELL, K. S.** (2016). A protocol for collecting human cardiac tissue for research. *The VAD Journal.* 2, Article 12. [PMC 5199025](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5199025/).
2. Croker, J. A., Patel, R., **CAMPBELL, K. S.**, Barton-Baxter, M., Wallet, S., Firestein, G., Kimberly, R. P., & Elemento, O. (2021). Building biorepositories in the midst of a pandemic. *Journal of Clinical and Translational Science*. 10.1017/cts.2021.6. PMID not available. PMCID not available.

**Complete list of published work in NCBI My Bibliography** (~85 publications, h-index is 33, i10-index is 53).  
<https://www.ncbi.nlm.nih.gov/myncbi/kenneth.campbell.1/bibliography/public/>