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**EDUCATION**      **University of Washington, Seattle, Washington**  
 Doctor of Philosophy in Mechanical Engineering      December 2018  
 Advisor: Alberto Aliseda  
 Master of Science in Mechanical Engineering      June 2013

**Lafayette College, Easton, Pennsylvania**  
 Bachelor of Science in Mechanical Engineering, Minor: Bioengineering      May 2011  
*Magna Cum Laude*, with Thesis Honors

## RESEARCH EXPERIENCE

- **Postdoctoral Fellow – Bioengineering, Seattle, Washington**      **Winter 2019-Present**

**Microbubble Enhanced Heating Using Ultrasound Contrast Agents and High-Intensity Focused Ultrasound**

Developed experiments to explore heating due to high-intensity focused ultrasound (HIFU) in tissue-mimicking phantoms for the treatment of essential tremors and brain lesions. Extended these experiments to explore using ultrasound contrast agents (micron-sized bubbles) to enhance the heating from HIFU. Implemented simultaneous measurements of microbubble activity, through ultrasound imaging, and of temperature elevation using fine-wire thermocouples.

- **Research Assistant – Mechanical Engineering, Seattle, Washington**      **Fall 2011-Fall 2018**

**Steering Ultrasound Contrast Agents with Ultrasound in Physiologically Realistic Flows**

Developed and conducted laboratory tests to explore the forces acting on microbubbles due to ultrasound in both a uniform and pulsatile flow system using index-matched flow phantoms. Set up a high temporal and spatial resolution measurement system to detect individual microbubble positions and wrote a Particle Tracking Velocimetry (PTV) code to obtain their trajectories (and thus the forces acting on the microbubbles). Extended the method to measure the microbubble trajectories using a clinical ultrasound imaging system (Philips iU22).

**SciSheets: Delivering the Power of Programming with the Simplicity of Spreadsheets**

Collaborated with Dr. Joseph Hellerstein (Senior Data Science Fellow at the eScience Institute and Affiliate Professor at the University of Washington Department of Computer Science and Engineering) to work on the development of the open-source python package, SciSheets, which aims to make spreadsheets more reproducible and to make python more accessible to non-programmers.

**Using the RAVEN II Surgical Robot as a Training Tool for the da Vinci Surgical Robot**

Collaborated with the University of Washington BioRobotics lab to analyze performance data taken from both the RAVEN II surgical robot and the da Vinci surgical robot.

**Droplet Size Distribution from a Surface Acoustic Wave Nebulization (SAWN) Device**

Collaborated with the University of Washington Medicinal Chemistry Department to determine the aerosol distribution created from a Surface Acoustic Wave (SAW) nebulization device using a Phase Doppler Particle Analyzer (PDPA) and high-speed imaging.

**Senior Honors Thesis**, Easton, Pennsylvania

**Fall 2010- Spring 2011**

Investigated the role of asymmetry in lung dynamics using a progressively complex lung model with variable features under the guidance of Dr. Jenn Stroud Rossmann (Lafayette College). Determined how lung morphological parameters (such as branching angle and degree of diameter reduction in each daughter vessel) relate to loss coefficients. Results compared with benchmark studies of respiratory flow dynamics in healthy lungs (Philips and Kaye 1997).

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## SCIENTIFIC PUBLICATIONS

### Google Scholar

#### Peer-Reviewed Journal Proceedings

1. **A. Clark**, N. Machicoane, A. Aliseda (2019) A quantitative study of track initialization of the four-frame best estimate algorithm for three-dimensional Lagrangian particle tracking. *Measurement Science and Technology*, 30 (4): 045302, doi:10.1088/1361-6501/ab0786.
2. V.K. Chivukula, M.R. Levitt, **A. Clark**, M.C. Barbour, K. Sansom, L. Johnson, C.M. Kelly, C. Geindreau, S.R. du Roscoat, L.J. Kim, A. Aliseda (2019) Reconstructing patient-specific cerebral aneurysm vasculature for in vitro investigations and treatment efficacy assessments. *Journal of Clinical Neuroscience*, 61: 153-159, doi:10.1016/j.jocn.2018.10.103.
3. Y. Huang, S.R. Heron, **A. Clark**, J.S. Edgar, S.H. Yoon, D.P.A Kilgour, F. Turecek, A. Aliseda, D.R. Goodlett (2016) Surface acoustic wave nebulization device with dual interdigitated transducers improves SAWN-MS performance. *Journal of Mass Spectrometry*, 51 (6): 424-429, doi:10.1002/jms.3766.
4. M.C. Barbour, P.M. McGah, C.H. Ng, **A.M. Clark**, K.W. Gow, A. Aliseda (2015) Convective leakage makes heparin locking of central venous catheters ineffective within seconds: Experimental measurements in a model superior vena cava. *ASAIO Journal*, 61 (6): 701-709, doi:10.1097/MAT.0000000000000280.
5. **A. Clark**, J.S. Rossmann, I.M. Katz, A.R. Martin, G. Caillibotte (2015) Pressure loss coefficients for asymmetric bifurcations of pulmonary airways with predetermined flow distributions. *Journal of Bioengineering & Biomedical Science*, 5 (1): 148, doi:10.4172/2155-9538.1000148.

#### In-Preparation Journal Articles

1. **A. Clark**, A. Aliseda, Dynamics of microbubbles under ultrasound excitation in a physiologically realistic flow: measurements of the Bjerknes force from optical imaging experiments (in preparation, 2019).
2. **A. Clark**, A. Aliseda, M. Averkiou, Exploring the ultrasound-induced Bjerknes force using clinical ultrasound imaging in quiescent, steady, and pulsatile flows (in preparation, 2019).
3. **A. Clark**, S. Bonilla, M. Averkiou, Enhanced heating with microbubbles in high intensity focused ultrasound applications (in preparation, 2019).

#### Peer-Reviewed Conference Proceedings

1. **A. Clark**, J. Hellerstein (2017) SciSheets: Providing the power of programming with the simplicity of spreadsheets, *SciPy*, Austin, TX.

## Chapters in Edited Books

1. N. Machicoane, P. Huck, **A. Clark**, A. Aliseda, R. Volk, M. Bourgoïn, “Recent developments in particle tracking diagnostics for turbulence research,” in *Flowing Matter*, F. Toschi, M. Sega, eds. (Springer, Cham), 177-209, 2019, [doi:10.1007/978-3-030-23370-9\\_6](https://doi.org/10.1007/978-3-030-23370-9_6).
  2. D. Glassman, T.S. Lendvay, L. White, A. Lewis, H. King, **A. Clark**, T. Glassman, B. Comstock, “Raven surgical robot training in preparation for da Vinci® use: A randomized prospective trial,” in *Medicine Meets Virtual Reality 21*, J.D. Westwood, S.W. Westwood, L. Fellander-Tsai, C.M. Fidopiastis, R.S. Haluck, R.A. Robb, S. Senger, K.G. Vosburgh, eds. (IOS Press) 135-141, 2014, [doi:10.3233/978-1-61499-375-9-135](https://doi.org/10.3233/978-1-61499-375-9-135).
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## CONFERENCES

### Contributed Talks

(Names of mentored students are underlined)

1. **A. Clark**, S. Bonilla, D. Suo, M. Averkiou (2020) Enhanced Heating with Microbubbles in High Intensity Focused Ultrasound Applications, *The 25<sup>th</sup> European Symposium on Ultrasound Contrast Imaging*, Rotterdam, The Netherlands.
2. **A. Clark**, M. Averkiou, A. Aliseda (2019) Experimental characterization of the Bjerknes force on microbubbles in physiologically realistic flows, *APS Division of Fluid Dynamics*, Seattle, WA.
3. D. Suo, **A. Clark**, S. Bonilla, S. Keller, M. Averkiou (2019) Controlled bubble-enhanced heating with added microbubbles, *International Society for Therapeutic Ultrasound*, Barcelona, Spain.
4. **A. Clark**, A. Aliseda (2018) Manipulating microbubbles in physiologically realistic flows using the ultrasound-induced Bjerknes force, *APS Division of Fluid Dynamics*, Atlanta, GA.
5. **A. Clark**, A. Aliseda (2018) Microbubble dynamics under ultrasound steering: Bjerknes, drag, and lift forces in the microcirculation, *World Congress of Biomechanics*, Dublin, Ireland.
6. **A. Clark**, A. Aliseda (2017) Steering microbubbles in physiologically realistic flows using the Bjerknes force, *APS Division of Fluid Dynamics*, Denver, CO.
7. **A. Clark**, J. Hellerstein (2017) SciSheets: Providing the power of programming with the simplicity of spreadsheets, *SciPy*, Austin, TX.
8. **A. Clark**, A. Aliseda (2016) The hydrodynamic and ultrasound-induced forces on microbubbles under high Reynolds number flow representative of the human systemic circulation, *APS Division of Fluid Dynamics*, Portland, OR.
9. **A. Clark**, A. Aliseda (2016) Steering ultrasound contrast agents with ultrasound using the primary Bjerknes force, *International Conference of Multiphase Flows*, Florence, Italy.
10. **A. Clark**, A. Aliseda (2014) Hydrodynamic forces on microbubbles under ultrasound excitation, *APS Division of Fluid Dynamics*, San Francisco, CA.
11. M. Barbour, P. McGah, **A. Clark**, C.H. Ng, K. Gow, A. Aliseda (2013) Hemodynamics of Central Venous Catheters: experiments and simulations, *APS Division of Fluid Dynamics*, Pittsburgh, PA.
12. **A. Clark**, A. Aliseda (2013) Using ultrasound to steer ultrasound contrast agents: Implications for targeted drug delivery, *APS Division of Fluid Dynamics*, Pittsburgh, PA.

13. **A. Clark, A. Aliseda** (2012) Characterization of Surface Acoustic Wave Nebulization: Atomization dynamics and resulting droplet size distribution (poster), *APS Division of Fluid Dynamics*, San Diego, CA.
  14. **A. Clark, A. Aliseda** (2012) Microbubbles as drug-delivery vectors: steering ultrasound contrast agents in arterial flow using the Bjerknes force, *APS Division of Fluid Dynamics*, San Diego, CA.
  15. **A. Clark, J.S. Rossmann** (2012) Effect of asymmetric branching on respiratory flow and pressure losses: implications for asthma, *ASME Summer Bioengineering Conference Proceedings*, Fajardo, Puerto Rico.
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## TEACHING EXPERIENCE

- **Science Teaching Experience Program (STEP) Instructor** **Winter 2020**  
Selected to participate in the STEP program to learn research-based science and technology teaching methods. As part of the program, I developed and taught three two hour classes on cell identification and tracking to 24 senior biology students.
  - **Instructor** **Summer 2018**  
Developed and taught an undergraduate level heat transfer course (ME 331: Introduction to Heat Transfer) to a class of 24 students.  
-Teaching Evaluations 4.7/5
  - **Software Carpentry Instructor**, Seattle, Washington **2017-present**  
Instructed graduate students, professors, and industry professionals on basic data science skills (python, unix/linux, Git). Certified to teach at Software Carpentry workshops.
  - **Teaching Assistant**, Seattle, Washington  
**Spring 2012, Fall 2015, Spring 2017, Fall 2017, Winter 2018, Spring 2018**  
Developed and led recitation sessions for 70-80 undergraduate students at the University of Washington for ME 333: Fluid Dynamics and CEE 347: Introduction to Fluid Mechanics. Met twice a week with students for office hours to answer questions and help them with current homework assignments. Led students in lab sections to further demonstrate fundamental fluid concepts.
  - **Tutor**, Seattle, Washington **Summer 2014**  
Instructed student in Fluid Dynamics and Heat Transfer to help prepare them for graduate school. Developed lesson plans and homework assignments for each subject.
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## HONORS AND AWARDS

- **National Science Foundation Graduate Student Research Fellowship**
- World Congress of Biomechanics Student Travel Bursary
- College of Engineering Graduate Student Conference Travel Grant, University of Washington
- Graduate and Professional Student Senate (GPSS) Travel Grant, University of Washington
- American Physical Society Division of Fluid Dynamics Travel Grant
- Selected as Project Lead for eScience Data Science Incubator, University of Washington
- Society of Women Engineers Outstanding Female Engineer Award, University of Washington
- Mechanical Engineering Endowed Students First Fellowship, University of Washington
- Mechanical Engineering Faculty Award, Lafayette College
- Marquis Scholarship, Lafayette College's highest academic scholarship

## MENTORING ACTIVITIES

- High Performance Computing Club Mentor** **2016-2018**
- Introduced undergraduate students to high performance computing. Trained students to use linux, python, and parallelization tools to run computing jobs on clusters to answer basic data science problems
- Mechanical Engineering Graduate Student Association (MEGA), Cofounder** **2013-2018**
- Facilitated integration of new graduate students into the department by one-on-one mentoring about course and advisor selection
  - Developed seminars for students to share their research and learn professional development skills
- Graduate and Professional Student Senate Grads Guiding Grads Mentoring Program** **2015-2016**
- Mentored female graduate students from throughout the university in succeeding in graduate school
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## COMMUNITY OUTREACH

- MindSET (Tau Beta Pi)** **2015-2016**
- Conducted science and engineering experiments with underrepresented female elementary school students at a local elementary school
- Time to Invent (Society of Women Engineers)** **2014-2015**
- Conducted science and engineering experiments with underrepresented female elementary school students at a local elementary school
- University of Washington's Engineering Discovery Days Volunteer** **2012-Present**
- Introduced engineering to local elementary and middle school students
- Lafayette College Marquis Scholar Steering Committee** **2010-2011**
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## PROFESSIONAL EXPERIENCE

- Air Liquide Centre de Recherche Claude-Delorme, Jouy-en-Josas, France** **Summer 2011**
- Continued work on senior honors thesis and expanded respiratory models to three-dimensions
  - Developed scripts to run CFD simulations using GAMBIT and FLUENT
  - Collaborated with engineers and medical doctors in an international environment
- BBraun Medical, Bethlehem, Pennsylvania** **Summer 2010**
- Developed an algorithm to automatically determine the best package size for given sets of IV components
  - Ran laboratory tests and collected data on bubble formation in an IV set using two different infusion pumping systems
- Armour Technologies, Inc., Swarthmore, Pennsylvania** **Summers 2008/2009**
- Trained to run tests and collect data on intravascular medical devices, mainly introducers and catheters
  - Designed and constructed a pressure/vacuum machine, a heating machine, and prototyped methods to curve catheters
  - Researched types of catheter curves and started the construction of a catheter database from this information