

# Emmet A. Francis

Email: [emmetfranciswebsite@gmail.com](mailto:emmetfranciswebsite@gmail.com) | Website: [emmetfrancis.com](http://emmetfrancis.com)

## Objectives:

- Complete my Ph.D. in Biomedical Engineering at UC Davis focusing on the role of calcium bursts in neutrophil phagocytosis
- Pursue a post-doc to gain more experience in computational modeling of cell mechanics
- Seek a position as a research professor in biophysics

## Education:

- Fourth-year Ph.D. student in Biomedical Engineering at UC Davis, started Fall 2017, Advanced to candidacy in March 2019, estimated graduation Spring 2022. Current GPA: 4.00
- B.S., Biomedical Engineering, UC Davis, 2017, GPA: 3.96

## Research Experience:

### *Graduate Researcher, Heinrich Lab*

*UC Davis, July 2017-present*

- Examine calcium dynamics in human neutrophils during chemotaxis and phagocytosis using dual-micropipette manipulation and fluorescence microscopy
- Developing a finite element model in MATLAB for neutrophil phagocytic spreading and calcium dynamics
- Supplementary techniques include flow cytometry, reflection interference contrast microscopy, confocal microscopy, and automated image analysis in MATLAB
- Have mentored 6 undergraduate students in the lab on independent projects

### *Undergraduate Researcher, Heinrich Lab*

*UC Davis, December 2014-June 2017*

- Learned to use an integrated system which combines dual-micropipette manipulation with fluorescence microscopy, led to two first author publications
- Extensively trained two fellow undergraduates in dual-micropipette manipulation

## Publications:

1. E. A. Francis and V. Heinrich, "Integrative experimental/computational approach establishes cellular protrusion as the primary driving force of phagocytic spreading by immune cells", *In preparation*
2. E. A. Francis, Z. Xiao, L. H. Teng, and V. Heinrich, "Effects of the density of surface-bound IgG on frustrated phagocytic spreading of human neutrophils", *In preparation*
3. E. A. Francis and V. Heinrich, "Mechanistic understanding of single-cell behavior is essential for transformative advances in biomedicine", *The Yale Journal of Biology and Medicine*, Sep 2018, 91(3):279-289.
4. E. A. Francis and V. Heinrich, "Extension of chemotactic pseudopods by nonadherent human neutrophils does not require or cause calcium bursts", *Science Signaling*, Mar 2018, 11(521):eaal4289.
5. V. Heinrich, W.D. Simpson, and E.A. Francis, "Analytical prediction of the spatiotemporal distribution of chemoattractants around their source: theory and application to complement-mediated chemotaxis", *Frontiers of Immunology*, May 2017, 8:578.
6. E. A. Francis and V. Heinrich, "Quantifying the sensitivity of human immune cells to chemoattractant", *Biophysical Journal*, Mar 2017, Vol. 112, Iss. 5, p834-837.

## **Presentations:**

### Biophysical Society (BPS) Annual Meetings

- 2021 virtual poster: *Dependence of neutrophil phagocytosis mechanics on extra- and intracellular calcium*
- 2020 poster in San Diego, CA: *Density of immobilized antibodies modulates human neutrophil biophysical behavior and calcium dynamics during phagocytic spreading*
- 2019 poster in Baltimore, MD: *Effects of opsonin density on phagocytic behavior of human neutrophils*
- 2018 poster in San Francisco, CA: *Single cell analysis of complement-mediated chemotaxis: anaphylatoxic clouds, and neutrophil sensitivity to chemoattractant*
- 2017 poster in New Orleans, CA: *Single-cell investigation of the role of calcium bursts in human immune cells*
- 2016 oral presentation (15 min) in Los Angeles, CA: *Complement-mediated pure chemotaxis of human neutrophils neither requires nor causes bursts in intracellular calcium levels*

### Biomedical Engineering Society (BMES) Annual Meetings

- 2020 virtual poster: *Assessing the roles of adhesion and protrusion in immune cell spreading*
- 2018 poster in Atlanta, GA: *Investigating the mechanistic relationship between biophysical behavior and calcium bursts in human neutrophils*

### UC Systemwide Bioengineering Symposia

- 2019 oral presentation (15 min) in Merced, CA: *Investigating human neutrophil phagocytic spreading dynamics and calcium signaling by varying opsonin density*
- 2018 oral presentation (15 min) in Riverside, CA: *A mechanoregulatory role for calcium bursts in human neutrophils*

### UC Davis Biomedical Engineering Graduate Group Research Symposia

- 2019 poster presentation: *Effects of IgG density on neutrophil phagocytic spreading dynamics and global calcium signaling*
- 2018 poster presentation: *Calcium bursts modulate the mechanical behavior of human neutrophils*

### International conferences:

- Oral presentation at the 2019 European Society for Clinical Investigation Meeting, Phagocytes Symposium in Coimbra, Portugal: *Single-live-cell assessment of the role of calcium bursts in neutrophil chemotaxis and phagocytosis*

### Other:

- Oral presentation (4 min) at the 2019 ARCS Symposium in San Francisco, CA: *The role of calcium bursts in neutrophil chemotaxis and phagocytosis*
- Poster at the 2018 Keystone Symposium C4 – Cells vs. Pathogens: Intrinsic Defenses and Counterdefenses in Monterey, CA: *Single-live-cell/single-pathogen experiments reveal key biophysical mechanisms of chemotaxis and phagocytosis by human neutrophils*
- Poster at the 2017 meeting for Biology and Mathematics in the Bay Area (BaMBA) in San Francisco, CA: *Spatiotemporal model of anaphylatoxic clouds explains key features of complement-mediated chemotaxis by human neutrophils*

## **Outreach and Leadership Experience:**

### *Subcommittee Chair for the Health, Equity, and Wellness Committee*

*UC Davis, September 2018-present*

- Currently the chair of the Department Climate Subcommittee, focusing on diversity, equity and inclusion in the UC Davis BME community
- Scheduled educators from the UCD Diversity, Equity, and Inclusion Office to present at the weekly BME department seminar

### *Co-chair for the 2021 Biomedical Engineering Graduate Group (BMEGG) Recruitment Events*

*UC Davis, September 2018-present*

- Organizing the virtual recruitment events with two co-chairs – organizing virtual information sessions organized by research interest area, virtual lab tours, and other events for early 2021

### *Biomedical Engineering Graduate Group Research Symposium Chair*

*UC Davis, September 2018-June 2020*

- Chair for the 2019 symposium, co-chair for the 2020 symposium (transitioned to virtual)
- Helped contact and coordinate with keynote speakers and industry panel participants (I spearheaded the first industry panel for the 2019 event)
- Led committee meetings, facilitated abstract submission and scheduling, and organized faculty judging for poster and oral presentation awards

### *Biomedical Engineering Student Association (BESA) Publicity Co-chair*

*UC Davis, July 2019-June 2020*

- Together with another chair, I prepare monthly BME Graduate Group (BMEGG) newsletters listing events, announcements, relevant seminars, and publications from the BMEGG
- Helped to re-design the BESA website ([besa.ucdavis.edu](http://besa.ucdavis.edu))

### *Member of BESA Mental Health Group*

*UC Davis, September 2019-June 2020*

- One of the founding members of our grad student mental health group, in which we hold monthly social events or discussions about mental health in graduate school
- Led our first book club discussing *The Book of Joy*

### *Biomedical Engineering Student Association (BESA) Outreach Co-chair*

*UC Davis, September 2018-June 2019*

- Along with 2 other chairs, organized a fundraiser, holiday donation drive, and multiple eMentoring programs with local high schools
- Planned the 3<sup>rd</sup> annual BME Design Challenge, an event where we hosted local community college students and showcased the UC Davis BME department
- Moderated a mixed undergraduate/graduate student panel at a local high school

### *Member of Type 1 Diabetics Club*

*UC Davis, September 2014-June 2017*

- One of the founding members in 2014, took on a leadership role as treasurer from the 2016-2017 school year
- Spoke at a community event for high school diabetics and their parents about adjusting to life in college with diabetes, and helped organize a type 1 diabetes information night on campus

### *Member of the California Aggie Marching Band-uh*

*UC Davis, September 2013-June 2017*

- Represent UC Davis by performing at sports games and other university events
- Support the community through performances at charity and social functions

## **Honors and Awards:**

### *ARCS Foundation Award*

*ARCS Foundation, 2018-2019, 2019-2020, and 2020-2021*

- I have received this ~\$11,000 award for three consecutive years
- Granted by the ARCS Foundation, a national organization dedicated to supporting scholars working in science, engineering, and medical research

### *ESCI Travel Grant*

*European Society for Clinical Investigation (ESCI), June 2019*

- Travel award for the Phagocytes Symposium at the 2019 ESCI Meeting

### *NSF Graduate Research Fellowship*

*National Science Foundation, April 2018*

- Supports 3 years of doctoral graduate studies in the sciences with added stipend
- Highly selective award, applicants are evaluated based on both “intellectual merit” and “broader impacts” criteria

### *UCD & Humanities Graduate Research Award*

*UC Davis, April 2018*

- UC Davis internal fellowship granting \$3,000 for research budget

### *M.S. Ghausi Medal*

*UC Davis College of Engineering, June 2017*

- Highest honor bestowed upon a graduating undergraduate in the College of Engineering
- Selected based upon review of academic record, personal statement, resume, and recommendation letters

### *Outstanding Undergraduate Research Award*

*UC Davis Department of Biomedical Engineering, June 2017*

- Selected from nominated undergraduate researchers by a board of departmental faculty based on a written research summary, CV, and a 10 minute oral presentation

### *Honorable Mention for the Chancellors Award for Excellence in Undergraduate Research*

*UC Davis Undergraduate Research Center, May 2017*

- Selected from an applicant pool across disciplines on campus based on outstanding research, scholarship, or creative activity

### *Undergraduate Travel Award*

*UC Davis Undergraduate Research Center, December 2016*

- \$500 award towards traveling to New Orleans for the 2017 Biophysical Society Meeting

### *Education Committee Travel Award*

*Biophysical Society, November 2016*

- \$400 award towards traveling to New Orleans for the 2017 Biophysical Society Meeting, recipients selected based on scientific merit

### *Provost's Undergraduate Fellowship*

*UC Davis Undergraduate Research Center, May 2016*

- Awarded over \$1,000 in funding for my proposal “A Relationship Between Cytoskeletal Remodeling and Calcium Bursts in Human Neutrophils”, allowed me to purchase a dual bandpass filter set for simultaneous actin and calcium imaging in live neutrophils

### *Regents Scholarship*

*UC Davis, March 2013*

- Most prestigious scholarship offered by UC Davis, based solely on academic and personal achievements