Jeremy Binagia

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EDUCATION

Stanford University, Stanford, CA 2016 - Present
Ph.D. Candidate in Chemical Engineering (4.068 GPA)
Advisor: Professor Eric S. G. Shaqfeh

Stanford University, Stanford, CA 2019
M.S. Chemical Engineering (4.068 GPA)
Advisor: Professor Eric S. G. Shaqfeh

The University of Texas at Austin, Austin, TX 2016
B.S. Chemical Engineering with Highest Honors (4.0 GPA)
Advisor: Professor Roger T. Bonnecaze

DISSERTATION

Title*: The role of fluid elasticity on the motility of swimming microorganisms*
Committee members: Prof. Eric S. G. Shaqfeh, Prof. Andrew J. Spakowitz, Prof. Roseanna Zia, Prof. Manu Prakash
Focus areas: biological fluid mechanics, computational modeling, microhydrodynamics, viscoelastic fluids

RESEARCH EXPERIENCE

Graduate Researcher, Stanford University 2016 – Present
Advisor: Professor Eric S. G. Shaqfeh

- Employ computational fluid dynamics and theoretical microhydrodynamics to understand the effect of fluid elasticity on the motility of a wide range of swimming microorganisms (i.e. undulatory, amoeboid, and helical locomotion)
- Currently leading an interdisciplinary effort with researchers in mechanical engineering to create a robotic "swimming rheometer" that can be used to infer the fluid properties of complex biofluids
- Created first fully-resolved 3D simulation of microorganisms swimming in a viscoelastic fluid

High-Energy-Density Physics Intern, Lawrence Livermore National Laboratory 2020
Mentor: Dr. Luc Peterson

- Conducted radiation hydrodynamics simulations to assess the impact of ablator microstructure on seeding fluid instabilities at the National Ignition Facility (NIF)
- Developed an image processing workflow to infer material microstructure from SEM images for use in multiphysics simulations

Undergraduate Researcher, The University of Texas at Austin 2015 – 2016
Advisor: Prof. Roger T. Bonnecaze

- Prototyped a novel nano-patterning method involving selective reduction of a thin metal oxide film using COMSOL simulations
- Utilized molecular simulations to compute rheological properties of soft particle glasses modeled as Herschel-Bulkley fluids

Undergraduate Researcher, Purdue University 2014
Advisor: Prof. Doraiswami Ramkrishna

- Modeled the signaling molecule network that populations of bacteria use to regulate the transfer of antibiotic resistance
- Simulated stochastic chemical systems via a parallel tau-leaping algorithm

Undergraduate Researcher, The University of Texas at Austin 2013 – 2014
Advisor: Prof. Nicholas A. Peppas

- Developed and synthesized pH-responsive polymeric hydrogels for oral drug delivery
- Characterized hydrogels via dynamic & equilibrium swelling, loading & release, and titration studies

PUBLICATIONS

Binagia, J. P., & Shaqfeh, E. S. G. Self-propulsion of a freely suspended swimmer by a swirling tail in a viscoelastic fluid. *Under review.*

Housiadas, K. D., **Binagia, J. P.**, & Shaqfeh, E. S. G. Squirmers with Swirl in Viscoelastic Fluids at Low Weissenberg Number. *Journal of Fluid Mechanics* (2021).

Binagia, J. P., Phoa, A., Housiadas, K. D. & Shaqfeh, E. S. G. Swimming with swirl in a viscoelastic fluid. *Journal of Fluid Mechanics* (2020).

Bonnecaze, R., Chopra, M., Chopra, S., **Binagia, J.**, Ekerdt, J., & Edmondson, B. Patterning metal regions on metal oxide films/metal films by selective reduction/oxidation using localized thermal heating (2020). U.S. Patent App. No. 16/467,927.

Binagia, J. P.*, Guido, C. J.*, Shaqfeh, E. S. G. Three-Dimensional Simulations of Undulatory and Amoeboid Swimmers in Viscoelastic Fluids. *Soft Matter* (2019).

Shu, C.-C., Tran, V., **Binagia, J.**, Ramkrishna, D. On Speeding up Stochastic Simulations by Parallelization of Random Number Generation. *Chemical Engineering Science* (2015).

* *These authors contributed equally*

PRESENTATIONS

Binagia, J. P., Phoa, A., Housiadis, K., & Shaqfeh, E. S. G. "The Impact of Azimuthal Flow on Swimming Dynamics in Elastic Fluids," 2020 AIChE (the American Institute of Chemical Engineers) Virtual Annual Meeting (2020, Nov). Oral presentation.

Binagia, J. P., & Shaqfeh, E. S. G. "Swimming with Swirl in a Viscoelastic Fluid," 2020 AIChE (the American Institute of Chemical Engineers) Virtual Annual Meeting (2020, Nov). Oral presentation.
Video link: https://youtu.be/STR7URrmcPc.

Binagia, J. P., & Shaqfeh, E. S. G. "Swimming with Swirl in a Viscoelastic Fluid," Virtual Technical Meeting 2020 of the Society of Engineering Science (2020, Sep). Oral presentation.

Binagia, J. P., Phoa, A., Housiadis, K., & Shaqfeh, E. S. G. "How Azimuthal Swirl Impacts Swimming Kinematics in a Viscoelastic Fluid," 72nd Annual Meeting of the American Physical Society (APS) Division of Fluid Dynamics, Seattle, WA (2019, Nov). Oral presentation.

Binagia, J. P., Guido, C. J., & Shaqfeh, E. S. G. "Simulating the Swimming Motion of *C. elegans* and Amoeboids in Viscoelastic Fluids via the Immersed Boundary Method," SIAM Conference on Computational Science and Engineering (CSE19), Spokane, WA (2019, Feb). Oral presentation.

Binagia, J. P., Liu, T., Bonnecaze, R. T., "The Role of Viscous Forces in Modeling Soft Particle Glasses," McKetta Department of Chemical Engineering Undergraduate Research Poster Competition, The University of Texas at Austin, Austin, TX (2015, May). Poster presentation.

Binagia, J. P., Tran, V., Shu C.C., & Ramkrishna D. "Population Balance Modeling of Conjugation in Enterococcus faecalis," Summer Undergraduate Research Fellowship (SURF) Symposium, Purdue University, West Lafayette, IN (2014, Aug). Poster presentation.

Binagia, J. P., Horava, S., Peppas, N.A. "Synthesis and Characterization of pH-responsive Hydrogels for Targeted Drug Delivery," McKetta Department of Chemical Engineering Undergraduate Research Poster Competition, The University of Texas at Austin, Austin, TX (2014, May). Poster presentation.

TEACHING & MENTORING EXPERIENCE

Teaching Assistant, Applied Math. in the Chemical and Biological Sciences, Stanford University 2017 – 2018

- Co-lead redesign of course structure including lectures, problem sets, and final projects and transitioned the course to a virtual flipped classroom format
- Planned and led weekly recitation sessions, gave assignment feedback, and provided final project guidance to 30+ students
- Awarded a 2019 Chemical Engineering Outstanding Teaching Assistant Award

Mentor, Stanford Summer Research Amgen Scholars Program 2019

- Taught a visiting undergraduate student the fundamentals of biological fluid dynamics and how to setup, run, and analyze computational fluid dynamics simulations

Tutor, Transport Phenomena, The University of Texas at Austin 2015 – 2016

- Aided 50+ students on weekly problem sets, developing their physical intuition for problem solving

Tutor, Winn Tutoring 2013 - 2014

- Tutored high school students in AP Physics, Chemistry, Calculus

LEADERSHIP, SERVICE & OUTREACH

Program Coordinator, Stanford Science Teaching Through Art (STAR) 2019 – 2021
Developed, organized, and hosted workshops for Stanford PhD students and postdocs centered around how to teach science using art (e.g. infographics, 3D printing, and short videos of science sketches).

Instructor, Stanford Prison Education Project (SPEP) 2019 – 2021
Created and co-taught a lesson on time and length scales in the natural world to a group of Incarcerated individuals at San Francisco County Jail #5 in San Bruno.

Stanford Science Penpals, Member 2016 – 2019
Corresponded bi-weekly via mail with a young student from a rural New Mexico, discussing the life of a scientist and any science questions the student had (e.g. what is a non-Newtonian fluid?).

Member, Stanford CHEMENG Student Faculty Search Committee 2019 – 2021
Met and evaluated potential faculty candidates and discussed our thoughts with the faculty hiring committee.

Member, Graduate Student Action Committee (GSAC) Professional Development Committee 2019 – 2020
Planned and hosted an alumni networking night, data science and biotech panels, and company lunches.

Member, Stanford Graduate Student Action Committee (GSAC) PhD Recruitment Committee 2018
Helped organize and plan events for the annual visit weekend for accepted graduate students.

Vice President Internal, UT Austin Engineering Chamber Orchestra 2014 – 2015
Organized students into small wind and string ensembles and helped coordinate quarterly concerts.

Treasurer, UT Austin Omega Chi Epsilon (OXE) Chemical Engineering Honor Society 2014 – 2015
Set budgetary goals and handled finances associated with company seminars and social and outreach events.

Member, K-12 Outreach Committee for Tau Beta Pi (TBP) Engineering Honor Society 2014 – 2015
Volunteered at outreach events including Explore UT, Girl Day at UT Austin, and Engineer's Week.

FELLOWSHIPS, HONORS & AWARDS

National Science Foundation (NSF) Graduate Research Fellowship (GRFP) 2016 – 2019
National competition with three years of financial support, including annual $34K stipend and $12K tuition.

National Defense Science & Engineering Graduate (NDSEG) Fellowship Awardee 2016
National competition offering three years of financial support, including annual $38K stipend and full tuition coverage. Approximately 6% of applicants receive this award.

Stanford Chemical Engineering Outstanding Teaching Assistant Award 2019
Annual award by the ChemE Undergraduate Committee recognizing teamwork with instructors and assisting with teaching and learning by students as they master the undergraduate curricula.

Stanford Blueprint Datathon Finalist 2019
Annual data science competition focused on the intersection of big data and health.

Rase Brothers Award 2016
Awarded to graduating UT Austin CHE student with the highest GPA. Link to press release.

Unrestricted Endowed Presidential Scholarship 2015 – 2016
Award requiring faculty nomination given to 50 outstanding senior students at UT Austin.

UT Austin Undergraduate Research Fellowship 2014, 2016
$1K award to support academic research projects proposed and written by student applicants.

Welch Foundation Scholarship 2012 – 2016
Competitive four-year scholarship of $14K/year. Awarded to 20 of 700 applicants annually.

Hutchinson International Scholarship 2012 – 2016
Scholarship of $4K awarded to first-generation college students to enable study abroad.

Eagle Scout, Boy Scout Troop 75 – Port Arthur, TX 2012
Highest achievement or rank attainable in the Boy Scouts of America program. Since its inception in 1911, only 4% of Scouts have earned this rank after a lengthy review process.

PROFESSIONAL ASSOCIATIONS

American Institute of Chemical Engineers (AIChE), American Physical Society (APS), Society of Rheology (SoR), Tau Beta Pi (TBP) Engineering Honor Society, Omega Chi Epsilon (OXE) Chemical Engineering Honor Society

INDUSTRY EXPERIENCE

Process Engineering Intern*,* Valero Energy, Port Arthur, TX 2015

- Troubleshot steam header inlet of washwater injection drum to ensure adequate drum pressure when feed nitrogen levels are elevated
- Created and optimized operator pressure safety valve car-seal rounds

SKILLS

Programming:	Python, C++, MATLAB, Fortran, Mathematica, Lua, R
Parallel computing:	MPI, CUDA, OpenMP
Software:	Linux, Git, Pandas, NumPy, COMSOL, Tecplot, PyTorch, TensorFlow, Keras
Theory:	Fluid mechanics, Rheology, Transport phenomena, Machine learning