CURRICULUM VITAE

Boyang Qin

Tenure-track Associate Professor
Department of Microbiology
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Professional Experience

2023 - present Tenure-track Associate Professor, Department of Microbiology, Shanghai Jiao Tong University.

2018 - 2023 Post-doctoral Research Fellow, Princeton University. Co-advised by:
Bonnie L. Bassler, Chair, Molecular Biology, Princeton University, Howard Hughes Medical Institute.
Howard A. Stone, Chair, Mechanical & Aerospace Engineering, Princeton University.
Ned S. Wingreen, Molecular Biology, Lewis–Sigler Institute, Princeton University.

Education

2013 - 2018 Ph.D. Mechanical Engineering & Applied Mechanics, University of Pennsylvania.
ADVISOR: Paulo E. Arratia.
DISSERTATION: *Flow behavior and instabilities in viscoelastic fluids: physical and biological systems.*

2009 - 2013 B.S. Mathematics, Lafayette College, *summa cum laude.*
B.S. Mechanical Engineering, Lafayette College, *summa cum laude.*
RESEARCH ADVISORS: Daniel Sabatino & Joshua Smith.
HONOR THESIS: *Direct numerical simulation of heat transfer and fluid flow.*

Publications

1. B. Qin, C. Fei, A.A. Bridges, A.A. Mashruwala, H.A. Stone, N.S. Wingreen, and B.L. Bassler, *Cell position fates and collective fountain flow in bacterial biofilms revealed by light-sheet microscopy*, **Science** 369(6449), 71-77 (2020).
† Featured on perspective: *Tracing cell trajectories in a biofilm*, **Science** 369(6449), 30-31 (2020).
† Featured on research highlights: *How to build a biofilm*, **Nat. Rev. Microbiol.** 18, 476–477 (2020).
† Featured on under the lens: *Illuminating the dynamics of biofilms*, **Nat. Rev. Microbiol.** 18, 544 (2020).

2. B. Qin and B.L. Bassler, *Quorum-sensing control of matrix protein production drives fractal wrinkling and interfacial localization of Vibrio cholerae pellicles*, **Nat. Commun.** 13(1), 6063 (2022).

3. B. Qin* and P.E. Arratia*, *Confinement, chaotic transport, and trapping of active swimmers in time-periodic flows*, **Sci. Adv.** 8(49), eadd6196 (2022). *: co-corresponding author.
† Featured as journal cover image.

4. B. Qin, C. Fei, B. Wang, H.A. Stone, N.S. Wingreen, and B.L. Bassler, *Hierarchical transitions and fractal wrinkling drive bacterial pellicle morphogenesis*, **Proc. Natl. Acad. Sci. U.S.A.** 118(20), e2023504118 (2021).

5. B. Qin*, R. Ran, P.F. Salipante, S.D. Hudson, and P.E. Arratia*, *Three-dimensional structures and symmetry breaking in viscoelastic cross-channel flow*, **Soft Matter** 16(30), 6969-6974 (2020). *: co-corresponding author.
† Featured as journal cover image.

6. B. Qin, P.F. Salipante, S.D. Hudson, and P.E. Arratia, *Flow resistance and structures in viscoelastic channel flows at low Re*, **Phys. Rev. Lett.** 123(19), 194501 (2019).

7. B. Qin*, P.F. Salipante, S.D. Hudson, and P.E. Arratia*, *Upstream vortex and elastic wave in the viscoelastic flow around confined cylinder*, **J. Fluid Mech.** 864, R2 (2019). *: co-corresponding author.
† Featured on "Focus on Fluids" perspective: *Three-dimensional viscoelastic instabilities in microchannels*, **J. Fluid Mech.** 870, 1-4 (2019).

8. B. Qin and P.E. Arratia, *Characterizing elastic turbulence in channel flows at low Reynolds number*, **Phys. Rev. Fluids** 2(8), 083302 (2017).

9. B. Qin, A. Gopinath, J. Yang, J.P. Gollub, and P.E. Arratia, *Flagellar kinematics and swimming of algal cells in viscoelastic fluids*, **Sci. Rep.** 5, 9190 (2015).

10. A.A. Mashruwala, B. Qin, and B.L. Bassler, *Quorum-sensing- and type VI secretion-mediated spatiotemporal cell death drives genetic diversity in V. cholerae*, **Cell** 185(21), 3966-3979 (2022).

11. A. Somasundar, B. Qin, S. Shim, B.L. Bassler, and H.A. Stone, *Diffusiophoretic particle penetration into bacterial biofilms*, **ACS Appl. Mater. Interfaces** 15(28), 33263–33272 (2023).

12. C. Li, B. Qin, A. Gopinath, P.E. Arratia, B. Thomases, R. Guy, *Flagellar swimming in viscoelastic fluids: role of fluid elastic stress revealed by simulations based on experimental data*, **J. R. Soc. Interface** 14(135), 20170289 (2017).

13. R. Ran, Q. Brosseau, B.C. Blackwell, B. Qin, R. Winter, and P.E. Arratia, *Mixing in chaotic flows with swimming bacteria*, **Phys. Rev. Fluids** 7(11), 110511 (2022).

14. R. Ran, Q. Brosseau, B.C. Blackwell, B. Qin, R. Winter, and P.E. Arratia, *Bacteria hinder large-scale transport and enhance small-scale mixing in time-periodic flows*, **Proc. Natl. Acad. Sci. U.S.A.** 118(40), e2108548118 (2021).

15. M.Y. Pack, A. Yang, A. Perazzo, B. Qin, and H.A. Stone, *Role of extensional rheology on droplets bouncing*, **Phys. Rev. Fluids** 4(12), 123603 (2019).

Awards and Grants

2022 - 2027 Burroughs Wellcome Fund, Career Awards at the Scientific Interface, $500,000 over 5 years.

Application funding rate: 6%.

2022 - 2023 Microsoft Azure Cloud Computing Mini Grant, $10,000.

International Journal Referee

- *Physical Review Letters*
- *Physical Review Fluids*
- *Journal of Thermophysics and Heat Transfer*
- *Journal of Non-Newtonian Fluid Mechanics*
- *Soft Matter*
- *European Physical Journal (EPJ)*
- *NPJ Biofilms and Microbiomes*
- *Computational and Structural Biotechnology Journal*
- *Journal of Basic Microbiology*

Invited Talks

9/2020 12th Light-sheet Fluorescence Microscopy Conference 2020, Royal Microscopy Society.
TALK TITLE: *How biofilms form and bacteria cells flow: insights from light-sheet microscopy.*

4/2017 National Institute of Standards and Technology (NIST), Gaithersburg, MD, USA.
TALK TITLE: *Elastic turbulence in channel flows at low Reynolds number.*

1/2017 Beijing University of Technology (BJUT), Beijing, China.
TALK TITLE: *Elastic turbulence & ciliary kinematics in viscoelastic fluids: nonlinearity at low Re.*

Research Conferences

3/2021 The American Physical Society (APS) March Meeting, virtual.
TALK TITLE: *Morphogenesis and fractal dimension of bacterial pellicles.*

11/2018 The 71st Annual Meeting of the APS Division of Fluid Dynamics (DFD), Atlanta, GA.
TALK TITLE: *Flow resistance and structures in viscoelastic channel flows at low Re.*

7/2018 The 13th World Congress in Computational Mechanics (WCCM), New York, NY.
TALK TITLE: *Characterizing elastic turbulence in channel flows at low Reynolds number.*

10/2017 The 89th Annual Meeting of the Society of Rheology (SOR), Denver, CO.
TALK TITLE: *Characterizing elastic turbulence in channel flows at low Reynolds number.*

5/2017 SIAM Conference on Applications of Dynamical Systems, Snowbird, UT.
TALK TITLE: *Active matter in time periodic flows: aggregation & dispersion.*

2/2017 The 88th Annual Meeting of the Society of Rheology (SOR), Tampa, FL.
TALK TITLE: *Elastic turbulence in channel flows at low Reynolds number.*

11/2016 The 69th Annual Meeting of the APS Division of Fluid Dynamics (DFD), Portland, OR.
TALK TITLE: *A purely elastic upstream instability in channel flows.*
TALK TITLE: *Transient aggregation and long-time diffusion of bacterial suspensions in time-periodic flows.*

11/2015 The 68th Annual Meeting of the APS Division of Fluid Dynamics (DFD), Boston, MA.
TALK TITLE: *Elastic turbulence in parallel shear flows at low Reynolds number.*

10/2015 The 87th Annual Meeting of the Society of Rheology (SOR), Baltimore, MD.
TALK TITLE: *Elastic turbulence in parallel shear flows at low Reynolds number.*

10/2014 The 86th Annual Meeting of the Society of Rheology (SOR), Philadelphia, PA.

6/2014 American Chemical Society Colloid & Surface Science Symposium, Philadelphia, PA.

8/2012 The 23rd International Congress of Theoretical and Applied Mechanics(ICTAM), Beijing, China.

Academic Honors

2013 *Lafayette College Carl G. Jr. '67 and Deborah B. Anderson P'01 Mechanical Engineering Prize.*
Awarded to a mechanical engineering major on the strength of high academic achievement and promise for excellence in his or her career.

2013 Tau Beta Pi, P.A. Chapter, national engineering honor society.

2013 Sigma Xi, P.A. Chapter, national research honor society.

2013 Pi Mu Epsilon, P.A. Chapter, national mathematics honor society.

2012 *Excel Scholar*, Lafayette College.

2011, 2010 *Lafayette College Benjamin F. Barge Mathematics Prize.*
Awarded to engineers demonstrating superior mathematics skills.

2011 First place, *Lafayette Annual Cryptography Competition.*
Campus wide competition to solve cryptography ciphers.

2008 - 2013 *Dean's list*, all semesters, Lafayette College.

Teaching Experience

Fall 2015 Teaching assistant, MEAM 302 Fluid Mechanics, University of Pennsylvania.
Junior level course on fluid mechanics.

Spring 2015 Teaching assistant, MEAM 348 Mechanical Engineering Design Lab, University of Pennsylvania.
Junior level course on project design and experimentation.

Fall 2014 Teaching assistant, MEAM 302 Fluid Mechanics, University of Pennsylvania.
Junior level course on fluid mechanics.

Fall 2012 Departmental tutor for MATH 162, Calculus II, Lafayette College.

Student Mentoring

2/2022 - present Michelle H.J. Yoon, undergraduate in Molecular Biology, Princeton University.
PROJECT: *Tracing single-cell gene expression in bacterial biofilms.*

9/2020 - 4/2021 Blessing Jegede, undergraduate in Mechanical Engineering, Princeton University.
PROJECT: *Hierarchical transitions and fractal wrinkling drive bacterial pellicle morphogenesis.*

6/2019 - 8/2019 Alberto Rosado Marin, REU student, Electrical Engineering, University of Puerto Rico.
PROJECT: *Hierarchical transitions and fractal wrinkling drive bacterial pellicle morphogenesis.*

5/2017 - 5/2018 Ran Ranjiangshang, graduate in Mechanical Engineering, University of Pennsylvania.
PROJECT: *Holographic particle velocimetry of elastic instability in cross-slot flows.*

9/2016 - 4/2017 Larkin Johnson, undergraduate in Physics, Haverford College.
PROJECT: *Motility of bacterial cells in viscoelastic fluids under confinement.*
PROJECT: *Pressure measurements of viscoelastic fluids in microfluidic devices.*

6/2016 Faith Taliaferro, undergraduate in Mechanical Engineering, University of Pennsylvania.
PROJECT: *Kinematic reversibility at low Re, Newtonian versus non-Newtonian fluids.*

1/2016 - 5/2016 Minhul Kohari, undergraduate in Mechanical Engineering, University of Pennsylvania.
PROJECT: *Microfluidic diffusor design in lab on chip applications for RNA transvection.*

11/2015 - 3/2016 Misael Cespedes, undergraduate in Physics, Haverford College.
PROJECT: *Bacteria motility and aggregation in shear flow of viscoelastic fluids.*

5/2015 - 9/2015 Bianka Pauli, undergraduate in Mechanical Engineering, Fairleigh Dickinson University.
PROJECT: *Pressure measurements of viscoelastic fluids in microfluidic device.*

9/2014 Tianyu Wang, undergraduate in Physics, Haverford College.
PROJECT: *Impact dynamics of meteor on granular sand beds.*

Service and Outreach

Fall 2016 President of *Mechanical Engineering Graduate Association*, University of Pennsylvania.
The student association responsible for student activities and student-faculty liaison of the mechanical engineering department.

Fall 2016 Director of *Penn Open Labs Science Cafe.*
The science outreach organization that engage graduate students to give science and research talks to high school students in the Philadelphia area.

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