Joseph Webber

Mathematics Institute, Zeeman Building, University of Warwick, Coventry CV4 7AL | joe.webber@warwick.ac.uk
orcid.org/0000-0002-0739-9574 | researchgate.net/profile/Joseph_Webber | jwebber.github.io
Date of birth: 1997 | **Nationality:** British citizen | **Last updated** October 31, 2024

Employment history

Apr 2024- **Mathematical Institute, University of Warwick**
Postdoctoral research fellow
'Shape–Transforming Active Matter', Leverhulme Trust-funded project led by Professor Tom Montenegro-Johnson.

Education

2020-2024 **Department of Applied Mathematics and Theoretical Physics, University of Cambridge**
PhD Fluid Dynamics, supervised by Prof M. Grae Worster
Thesis examiners: Dr Duncan Hewitt (Cambridge), Prof Christopher MacMinn (Oxford). C-CLEAR DTP (NERC-funded) research entitled *Dynamics of super-absorbent hydrogels*.

- **Smith-Knight and Rayleigh-Knight Prizes 2022:** awarded Group 1 (highest category).
- **DAMTP Friday Fluids second year talks 2022:** first prize for talk *Dynamics of super-absorbent hydrogels*.

2019-2020 **Trinity College, University of Cambridge**
Part III Mathematics (MMath), no grade due to COVID-19 pandemic
One-year taught integrated master's course including an essay, *Viscous Fingering Instabilities*, on the Saffman-Taylor Instability. Courses taken:

- Fluid Dynamics of the Solid Earth
- Slow Viscous Flow
- Non-Newtonian Fluid Mechanics
- Perturbation Methods
- Fluid Dynamics of Climate
- Hydrodynamic Stability

2016-2019 **Trinity College, University of Cambridge**
***MA (Cantab.) Mathematics,* 2.i**
Specialised in applied mathematics, specifically fluid mechanics and classical physics.

2009-2016 **Walton High, Milton Keynes**
GCSEs (2014); 'A' levels and STEP (2016)

Papers

- Webber, J.J. & Worster, M.G. **Cryosuction and freezing hydrogels** *Proceedings of the Royal Society A* (2024, submitted)
- Webber, J.J. & Montenegro-Johnson, T.D. **Tubular hydrogel pumps through a responsive LENS** *Journal of Fluid Mechanics* (2024, submitted)
- Webber, J.J. & Worster, M.G. **Wrinkling instabilities of swelling hydrogels** *Phys. Rev. E* 109:044602 (2024) https://doi.org/10.1103/PhysRevE.109.044602
- Webber, J.J., Etzold, M.A. & Worster, M.G. **A linear-elastic-nonlinear-swelling theory for hydrogels. Part 2. Displacement formulation** *Journal of Fluid Mechanics* 960:A38 (2023) https://doi.org/10.1017/jfm.2023.201
- Webber, J.J. & Worster, M.G. **A linear-elastic-nonlinear-swelling theory for hydrogels. Part 1. Modelling of super-absorbent gels** *Journal of Fluid Mechanics* 960:A37 (2023) https://doi.org/10.1017/jfm.2023.200
- Webber, J.J. & Huppert, H.E. **Stokes drift through corals** *Environmental Fluid Mechanics* 21:1119-1135 (2021) https://doi.org/10.1007/s10652-021-09811-8
- Webber, J.J. & Huppert, H.E. **Stokes drift in coral reefs with depth-varying permeability** *Philosophical Transactions of the Royal Society A* 20190531 (2020) https://doi.org/10.1098/rsta.2019.0531
- Webber, J.J. & Huppert, H.E. **Time to approach similarity** *Quarterly Journal of Mechanics and Applied Mathematics* 72:1-23 (2020) https://doi.org/10.1093/qjmam/hbz019

Talks & posters

- "XOXO, Gossip Gel: oscillating chemical reactions facilitate communication between responsive hydrogels" – *77th Annual Meeting of the Division of Fluid Dynamics (APS), Salt Lake City, USA, November 2024*
- "Smart responsive gels: designing the building blocks of squishy bio-inspired devices" – *Mathematical Biology Meeting, University College London, 30th October 2024*
- "Tubular hydrogel pumps through a responsive LENS" – *Soft Matter Lunch, University of Warwick, 30th September 2024*
- "How to make a poster: ...also how you shouldn't, why you should care, and why they matter" – *Warwick Summer Undergraduate Research programme, 28th August 2024*
- "A linear-elastic-nonlinear-swelling model for hydrogels" – *Soft Lab Seminar, University of Bristol / Bristol Robotics Laboratory, 3rd July 2024*
- "Buckling and swelling instabilities of super-absorbent gels" – *UKFN BioActive & Non-Newtonian Fluids SIG Meeting, University College London, 18th June 2024*
- "A linear-elastic-nonlinear-swelling model for hydrogels" – *Physics of Fluids & Soft Matter seminar, University of Manchester, 17th May 2024*
- "Freezing soft porous gels" – *Warwick-Cambridge Quantitative Cell Biology Symposium 2024, 16th May 2024*

- 🔊 "A linear-elastic-nonlinear-swelling model for hydrogels" – *Warwick Applied Maths Seminar, 3rd May 2024*
- 🔊 "Buckling and swelling instabilities of super-absorbent gels" – *Squishy Journal Club, University of Oxford, 28th November 2023*
- 🔊 "Wrinkling instability of swelling hydrogels" – *76th Annual Meeting of the Division of Fluid Dynamics (APS), Washington DC, USA, 21st November 2023*
- 🔊 "Linear stability analysis for the formation of wrinkles on confined swelling hydrogels" – *15th Annual InterPore Meeting, Edinburgh, 24th May 2023*
- 🔊 " A linear-elastic-nonlinear-swelling theory for hydrogels: displacements and differential swelling" – *75th Annual Meeting of the Division of Fluid Dynamics (APS), Indianapolis, USA, 20th November 2022*
- 🔊 "Multidirectional gel swelling and drying: a linear-elastic-nonlinear swelling theory for hydrogels" – *14th Annual InterPore Meeting, 2nd June 2022* (online)
- 🔊 "Dynamics of super-absorbent hydrogels" – *DAMTP Friday Fluids second year talks, 27th May 2022* - awarded first prize
- 🎒 "Dynamics of super-absorbent hydrogels" – *C-CLEAR / ARIES Doctoral Alliance Symposium 2022, London, 17th March 2022*
- 🔊 Various talks at (internal) Institute of Theoretical Geophysics seminars *February, May, October 2021; November 2022; January, November 2023*
- 🔊 "Transport of larvae into and out of porous reefs by waves" – *14th International Coral Reef Symposium, Bremen, Germany, July 2020* (cancelled due to COVID-19 pandemic)
- 🔊 "Stokes drift through coral reefs" – *Open University Pure & Applied Maths Colloquium, Milton Keynes, 4th February 2020*
- 🔊 "Stokes drift through corals" – *Stokes200 Symposium, University of Cambridge, 17th September 2019*
- 🎒 "Stokes drift through corals" – *STEM for Britain 2019, Houses of Parliament, London* (shortlisted finalist)
- 🔊 "An interesting experiment" – *International Conference for Technology Policy and Innovation 2015, Milton Keynes, 17th June 2015*

Teaching

- Preparation and delivery of Part III Preparatory Workshop for Continuum Mechanics, October 2023 (2 hours).
- Produced a series of 10 introductory videos (https://tinyurl.com/partiiivideos) covering key Continuum Mechanics content for incoming Part III students
  - Suffix notation
  - Basics of fluid mechanics
  - Flows in a rotating frame
  - Variational principles
  - Stokes flow
  - Lubrication theory
  - Boundary layers
  - Hydrodynamic instabilities
  - Internal gravity waves
  - Asymptotic expansions
- Cover lectures for University of Warwick MA256 *Introduction to Mathematical Biology*, October 2024 (6/30 lectures in course written by Lukas Eigentler)
- Cover lectures delivered for University of Cambridge Part IA (1st year) Mathematics *Introduction to Mechanics*, October 2022 (5/9 lectures in course).
- "How to make a poster: ...also how you shouldn't, why you should care, and why they matter" talk for summer undergraduate researchers, August 2024

Supervision

- Co-supervisor (with T.D. Montenegro-Johnson) for three students on the Warwick Summer Research Programme for Undergraduates from Underrepresented Groups (August 2024)
- Co-advisor for fourth-year undergraduate R-project (MA4K9) student, 2024-.
- Informal co-advisor for Xietao Wang Lin (MSc+PhD project with T.D. Montenegro-Johnson), 2024-
- Supervisor (small group teaching) for Cambridge undergraduate mathematics, over 300 hours of teaching time. Courses taught include
  - Part II (3rd year) Fluid Dynamics (2020)
  - Part IB (2nd year) Fluid Dynamics + revision (2021, 2022, 2023, 2024)
  - Part IB Variational Principles (2021, 2022+revision, 2023)
  - Part IB Methods (2021, 2022+revision, 2023)

Professional experience

- **Organiser:** *Modelling hydrogels: building networks in the Mathematical Sciences* one-day meeting at the University of Warwick (9th December 2024).
- **Seminar organiser:** Soft Matter Lunches (Warwick, 2024-) Institute of Theoretical Geophysics weekly meetings (Cambridge, 2022-2024).
- **Undergraduate admissions interviewer:** Trinity College Cambridge (Mathematics) (December 2022 & 2023).
- **Undergraduate summer research:** with Prof Herbert Huppert FRS in DAMTP, University of Cambridge. Worked on similarity solutions to equations concerning gravity currents, and wave-induced drifting through porous media (2018-2019).
- **Research work experience:** with Dr Anthony Lucas-Smith in the Department of Design and Innovation, Open University (2014-2016).

Other skills

- **Outreach:** Public outreach video on poroelasticity and coffee makers for the 2021 Cambridge Festival https://www.youtube.com/watch?v=8zcdtzTBDdM
- **Languages:** English (native), French (CEFR level B2 "upper intermediate")
- **Computing:** comfortable in Windows or (Ubuntu) Linux. Proficient in C#, MATLAB, Mathematica, HTML/CSS, XAML. Some experience in FORTRAN 90. Capable user of LaTeX for typesetting.
- **Quiz:** captained Trinity College Cambridge's semi-finalist team on BBC's *University Challenge* for the 2019-20 series.

Open-source tools

- **fix-matlab-eps:** A utility to fix the vector output of MATLAB's contourf, removing white line artefacts by modifying the EPS output.
  github.com/JWebber/fix-matlab-eps