

# Joseph Webber

Mathematics Institute, Zeeman Building, University of Warwick, Coventry CV4 7AL | [joe.webber@warwick.ac.uk](mailto:joe.webber@warwick.ac.uk)

 [orcid.org/0000-0002-0739-9574](https://orcid.org/0000-0002-0739-9574) |  [researchgate.net/profile/Joseph\\_Webber](https://researchgate.net/profile/Joseph_Webber) |  [jwebber.github.io](https://jwebber.github.io)

**Date of birth:** 1997 | **Nationality:** British citizen | **Last updated** April 9, 2024

## Employment history

Apr 2024- **Mathematical Institute, University of Warwick**  
*Postdoctoral research fellow*  
Working on 'Shape transforming active matter', a 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  
Cambridge Climate, Life and Earth (C-CLEAR) Doctoral Training Partnership (NERC-funded) research entitled *Transpiration through Hydrogels*.

- **Smith-Knight and Rayleigh-Knight Prizes 2022:** awarded Group 1 (highest category).
- **DAMTP Friday Fluids second year talks 2022:** awarded first prize for a 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
- Non-Newtonian Fluid Mechanics
- Fluid Dynamics of Climate
- Slow Viscous Flow
- Perturbation Methods
- 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. **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>
- 📢 "Buckling and swelling instabilities of super-absorbent gels" – *Squishy Journal Club, University of Oxford, 28<sup>th</sup> November 2023*
- 📢 "Wrinkling instability of swelling hydrogels" – *76<sup>th</sup> Annual Meeting of the Division of Fluid Dynamics (APS), Washington DC, USA, 21<sup>st</sup> November 2023*
- 📢 "Linear stability analysis for the formation of wrinkles on confined swelling hydrogels" – *15<sup>th</sup> Annual InterPore Meeting, Edinburgh, 24<sup>th</sup> May 2023*
- 📢 "A linear-elastic-nonlinear-swelling theory for hydrogels: displacements and differential swelling" – *75<sup>th</sup> Annual Meeting of the Division of Fluid Dynamics (APS), Indianapolis, USA, 20<sup>th</sup> November 2022*
- 📢 "Multidirectional gel swelling and drying: a linear-elastic-nonlinear swelling theory for hydrogels" – *14<sup>th</sup> Annual InterPore Meeting, 2<sup>nd</sup> June 2022 (online)*
- 📢 "Dynamics of super-absorbent hydrogels" – *DAMTP Friday Fluids second year talks, 27<sup>th</sup> May 2022 - awarded first prize*
- 📢 "Dynamics of super-absorbent hydrogels" – *C-CLEAR / ARIES Doctoral Alliance Symposium 2022, London, 17<sup>th</sup> 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" – *14<sup>th</sup> 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, 4<sup>th</sup> February 2020*

## Talks & posters

- 📢 "Freezing soft porous gels" – *Warwick-Cambridge Quantitative Cell Biology Symposium 2024, 16<sup>th</sup>-17<sup>th</sup> May 2024*

- 🎧 “Stokes drift through corals” – *Stokes200 Symposium, University of Cambridge, 17<sup>th</sup> 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, 17<sup>th</sup> 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/partiiiivideos>) 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 delivered for Part IA (1<sup>st</sup> year) *Mathematics Introduction to Mechanics*, October 2022 (5/9 lectures in course).
- Supervisor (small group teaching) for Cambridge undergraduate mathematics, over 300 hours of teaching time. Courses taught include
  - Part II (3<sup>rd</sup> year) Fluid Dynamics (2020)
  - Part IB (2<sup>nd</sup> year) Fluid Dynamics + revision (2021, 2022, 2023, 2024)
  - Part IB Variational Principles (2021, 2022+revision, 2023)
  - Part IB Methods (2021, 2022+revision, 2023)

## 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 L<sup>A</sup>T<sub>E</sub>X 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](https://github.com/JWebber/fix-matlab-eps)

---

## Professional experience

- 2022, 2023 **Trinity College, University of Cambridge**  
Undergraduate admissions interviewer.
  - 2022-2024 **Institute of Theoretical Geophysics, University of Cambridge**  
Organised the weekly group seminars and redeveloped the group website.
  - 2018-2020 **Undergraduate summer research (principally Jul-Sep 2018, Jun-Sep 2019, Jun-Sep 2020)**  
Undergraduate summer research under 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.
  - 2017-2019 **DigitalVu software**  
Designed, developed and marketed a bespoke software package, written in C#, for churches to display song words and multimedia using a digital projector.
  - 2014-2016 **Open University, Walton Hall, Milton Keynes**  
Research work with Dr Anthony Lucas-Smith in the Department of Design and Innovation, working on the Intelligent Geometry Compressor concept, a way of improving jet engine efficiency by actively preventing surge and stall.
-