Pierre Alexandre Haas

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Academic Appointments

2021 –   **Max Planck Research Group Leader**
Max Planck Institutes for the Physics of Complex Systems and of Molecular Cell Biology and Genetics
Center for Systems Biology, Dresden

2020 – 2021   **Hooke Research Fellow**
Mathematical Institute, University of Oxford
Senior Demy of Magdalen College

2017 – 2020   **Nevile Research Fellow in Applied Mathematics**
Department of Applied Mathematics & Theoretical Physics and Magdalene College, University of Cambridge

2016 – 2017   **EPSRC Doctoral Prize Fellow**
Department of Applied Mathematics & Theoretical Physics, University of Cambridge
      (Supervisor: Prof. Raymond E. Goldstein FRS)

Education

2013 – 2017   **PhD in Applied Mathematics**   (Supervisor: Prof. Raymond E. Goldstein FRS)
Department of Applied Mathematics & Theoretical Physics, University of Cambridge

2009 – 2013   **BA & MMath in Mathematics**   (Gonville & Caius College, University of Cambridge)
      2012 – 2013   *Mathematical Tripos*, Part III   Distinction, *Mayhew Prize*
      2009 – 2012   *Mathematical Tripos*, Parts IA, IB, II

2002 – 2009   **Secondary education**   (Lycée de Garçons d'Esch-sur-Alzette, Esch-sur-Alzette, Luxembourg)
      Diplôme de fin d'études secondaires in 2009

Awards and Research Fellowships

Selected Awards

2017   **Award for Outstanding Doctoral Thesis Research in Biological Physics, American Physical Society**
awarded for "*outstanding theoretical work on the description of embryonic inversion in the alga Volvox, incorporating novel generalizations of elasticity theory and applied mathematics*" by the Division of Biological Physics of the American Physical Society (and jointly awarded to David R. Jacobson); the winners share $1500 prize money and are given travel reimbursement to present an invited talk at an APS March Meeting

2013   **Mayhew Prize**
awarded to the "*candidate for Part III of the Mathematical Tripos who has in the judgement of the Examiners shown the greatest distinction in the subjects of Applied Mathematics*"   (en.wikipedia.org/wiki/Mayhew_Prize)

Research Fellowships

2019   **Hooke Research Fellowship, University of Oxford**
two-year fellowship in the Mathematical Institute at the University of Oxford, "*this prestigious Fellowship provides an ideal opportunity for candidates to pursue an independent research programme*"

2017	**Nevile Research Fellowship, Magdalene College, University of Cambridge**

three-year fellowship at Magdalene College in the University of Cambridge; college research fellowships are highly competitive appointments (success rate $\lesssim 1\%$) allowing early-career researchers who have just completed their doctorates to build their own research programme

2016	**Doctoral Prize Fellowship, Engineering and Physical Sciences Research Council**

one-year post-doctoral fellowship; "*the Doctoral Prize helps universities retain and recruit the best PhD students receiving support to increase the impact of their PhD, and to improve retention of the very best students in research careers*"

External research funding

2025 – 2027   "The mechanical basis of the dynamical structure of bile canaliculi in the liver"
DFG Sachbeihilfe HA 10883/1-1, 223 504€

Selected invited talks and seminars

2025   Cell Physics 2025, University of Saarbrücken
2025   "Numerical methods in (nonlinear) algebra" workshop
2024   CASUS Science Day, Görlitz
2024   BPPB (Biological Physics & Physical Biology) seminar
2024   Developmental Biology colloquium, Princeton University
2024   Mathematical Models in Ecology & Evolution 2024 (Vienna, Austria)
mini-symposium on "Population Dynamics Across Interacting Networks or Scales"
2024   Living Matter Seminar, University of Luxembourg
2024   iMOL Winter School, University of Frankfurt
2023   Soft & Living Matter Seminar, Rudolf Peierls Centre for Theoretical Physics, University of Oxford
2023   Society for Mathematical Biology Annual Meeting (Columbus, OH, USA),
mini-symposium on "Mathematical models of community - A journey through the scales"
2023   Theory at EMBL seminar, European Molecular Biology Laboratory, Heidelberg
2022   European Colloid & Interface Society Conference,
keynote talk on "Colloids at Interfaces, Membranes and Biointerfaces, Emulsions and Foams"
2022   Theory group seminar, Institut Curie
2021   Virtual spring meeting of the German Physical Society
mini-symposium on "Cell Adhesion and Migration, Multicellular Systems"
2021   Theory of Living Matter virtual seminar (with S. Höhn)
2020   Colloquium, Department of Physics and Materials Science, University of Luxembourg
2018   APS March Meeting (Los Angeles, CA, USA),

Additional Information

Fellowships of Learned Societies

- Institut Grand-Ducal, Section des Sciences (Luxembourg)
elected *membre correspondant* in 2024

Supervision of Junior Researchers

Students: Maria Gutierrez (2019), Marcin Pruszczyk (2021), Federico Stefanelli (2022),
Marija Krstic (2022), Yuan He (2023), Valens Tribet (2024), Vivek Raj Singh (2024),
Kunjeti Dharanidhar Gupta (2024)
PhD students: Maryam Setoudeh (2021–), Shiheng Zhao (2023–), Chandraniva Guha Ray (2023–)
Postdocs: Matt Bovyn (2021–), Yu Meng (2021–2023), Rahul Gopalan Ramachandran (2022–2024),
Boyi Wang (2024–)

Peer review

- IOP Trusted Reviewer, Institute of Physics (2023)
- Reviewer for Nat. Commun., Phys. Rev. Lett., eLife, Trends Cell Biol., EMBO Rep., J. Phys. Complexity, ...

Service to the Community

- Co-speaker, Workgroup on "physics of the cell", Deutsche Gesellschaft für Zellbiologie
- Contributor to the SciSpaceE White Papers (2021) of the European Space Agency
  Roadmap on Soft Matter and Biophysics, Section 2.7, with Martine Ben Amar and Pasquale Ciarletta
  [associated review paper: M. Ben Amar[#], P. Ciarletta[#], P. A. Haas[#], Commun. Phys. **6**, 150 (2023)]

Conference organisation

2023   Biological Physics Circle Meeting, Dresden (with Steffen Rulands, Frank Jülicher)
        [annual meeting of junior researchers from the main biophysics research nodes in Europe]

Selected institutional responsibilities

2021 – 2023   Scientific Committee, MPI-PKS
               Evaluation of the applications for postdoctoral research and sabbatical visits to the Visitors
               Programme at the Max Planck Institute for the Physics of Complex Systems.

2023 –   PhD Course Committee, MPI-CBG
               Organisation of the annual, Woods-Hole-style course for new doctoral students: one month's
               team research in a lab or research group that is not that of their supervisor.

2023 –   "Thursday Seminar" Committee, MPI-CBG
               Organisation of the institute colloquia (or "Thursday seminars") at the Max Planck Institute of
               Molecular Cell Biology and Genetics.

2023 –   ELBE programme committee, Center for Systems Biology Dresden
               Selection committee for the flagship interdisciplinary postdoctoral research fellowships at the
               Center for Systems Biology Dresden.

Teaching

2023 –   **Lectures at TU Dresden**

               "Pattern formation in biology" (Master Programme in "Physics of Life"): lectures on instabilities
               "Advanced Biological Physics" (Master Programme in "Physics of Life"): lectures on (visco)elasticity

2020   **Undergraduate Classes, University of Oxford**

               class tutor for small group classes for the Part C Solid Mechanics course

2014 – 2020   **Undergraduate Supervisions, University of Cambridge**
               one-on-two tutorials for undergraduates (from Gonville & Caius, Magdalene, Christ's, Trinity, and other
               colleges) reading for the Mathematical Tripos at Cambridge
               Courses: Part IA: Vectors & Matrices, Differential Equations, Dynamics & Relativity, Vector Calculus
                           Part IB: Methods,   Part II: Classical Dynamics, Waves

Outreach

- **Selected lectures to the general public**

2023   "Les chercheurs luxembourgeois à l'étranger"
        Lecture in the series on "Luxembourg researchers abroad" organised by the Institut Grand-Ducal,
        Section des Sciences.
2023   "Lange Nacht der Wissenschaften"
        Lecture within the programme of the Dresden Long Night of the Sciences, including a demonstration
        of the Belousov–Zhabotinsky reaction.

- **Mathematical Olympiads**

2012 – 2021   European Girls' Mathematical Olympiad
This competition aims to encourage diversity in mathematical olympiads.
Team Leader (Luxembourg) in 2012, 2014–2021, member of the *Appeals Committee* (2019)
Member of the *Problem Selection Committee* and *Coordinator* in 2013

2018 –   Benelux Mathematical Olympiad
Problem Selection Committee: member from 2018, chair in 2023
Coordinator in 2018, *Chief coordinator* in 2023

2024   Olympiade Francophone de Mathématiques
Coordinator

2012 –   Problem proposals selected for international mathematical olympiads:

International Mathematical Olympiad, Shortlist	2020/G1, 2021/G1
European Girls' Mathematical Olympiad	2012/5, 2012/7, 2015/1, 2024/6
Benelux Mathematical Olympiad	2018/1, 2019/1, 2022/3, 2023/3, 2024/3, 2025/1, 2025/3
Olympiade Francophone de Mathématiques	2021/3

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Publications

† – joint first authors, # – corresponding author(s)

Preprints and Submitted Manuscripts

[1] **Geometry of T1 transitions in epithelia**
P. A. Haas[#]
arXiv:2504.16765 (2025)

[2] **Euler buckling on curved surfaces**
S. Zhao and P. A. Haas[#]
arXiv:2503.04303 (2025)

[3] **A model for boundary-driven tissue morphogenesis**
D. S. Alber[†], S. Zhao[†], A. Jacinto, E. F. Wieschaus, S. Y. Shvartsman[#], and P. A. Haas[#]
arXiv:2503.03688 (2025)

[4] **Hepatoblast iterative apicobasal polarization is regulated by extracellular matrix remodeling**
J. Delpierre, J. I. Valenzuela, M. J. Bovyn, N. Pimpao Martins, L. Belicova, U. Repnik, M. P. Bebelman, S. Seifert, P. A. Haas, L. Y. Kalaidzidis, and M. Zerial[#]
bioRxiv:2024.01.30.578046 (2024)

[5] **Impossible ecologies: Interaction networks and stability of coexistence in ecological communities**
Y. Meng, Sz. Horvát, C. D. Modes[#], and P. A. Haas[#]
arXiv:2309.16261 (2023)

[6] **A multi-tiered mechanical mechanism shapes the early neural plate**
A. Inman, E. Spiritosanto, B. L. Evans, J. E. Lutton, M. Tada, T. Bretschneider, P. A. Haas[#], and M. Smutny[#]
bioRxiv:2023.06.21.545965 (2023)

Peer-Reviewed Papers

[7] **Mechanics of poking a cyst**
S. Zhao and P. A. Haas[#]
Physical Review Letters **134** (2025, in press) [arXiv:2408.03716]

[8] **Unbuckling mechanics of epithelial monolayers under compression**
C. Guha Ray and P. A. Haas[#],
Physical Review Letters **134**, 118402 (2025)   highlighted as an *Editors' Suggestion*

[9] **Cut it out: Out-of-plane stresses in cell sheet folding of *Volvox* embryos**
P. A. Haas[†#] and S. S. M. H. Höhn[†#]
Physical Review E **111**, 014420 (2025)   highlighted as an *Editors' Suggestion*

[10] **Buckling by disordered growth**
R. G. Ramachandran, R. Alert[#], and P. A. Haas[#]
Physical Review E **110**, 054405 (2024)

[11] **Shaping epithelial lumina under pressure**
M. J. Bovyn[#] and P. A. Haas[#]
Biochemical Society Transactions **52**, 331 (2024)

[12] **Hepatocyte apical bulkheads provide a mechanical means to oppose bile pressure**
M. P. Bebelman[†], M. J. Bovyn[†], C. M. Mayer, R. Naumann, N. P. Martins, A. Honigmann, Y. Kalaidzidis, P. A. Haas[#], and M. Zerial[#]
Journal of Cell Biology **222**, e202208002 (2023)   highlighted in the **Special Collection *"Mechanobiology 2023"***

[13] **Stabilization of microbial communities by responsive phenotypic switching**
P. A. Haas[#], M. A. Gutierrez, N. M. Oliveira[#], and R. E. Goldstein[#]
Physical Review Research **4**, 033224 (2022)

[14] **Comment on** *Faceting and Flattening of Emulsion Droplets: A Mechanical Model*
P. A. Haas[#], R. E. Goldstein[#], D. Cholakova[#], N. Denkov[#], and S. K. Smoukov[#]
Physical Review Letters **126**, 259801 (2021)

[15] **Turing's diffusive threshold in random reaction-diffusion systems**
P. A. Haas[#] and R. E. Goldstein[#]
Physical Review Letters **126**, 238101 (2021)   recommended by the *Journal Club for Condensed Matter Physics*

[16] **Morphoelasticity of large bending deformations of cell sheets during development**
P. A. Haas[#] and R. E. Goldstein[#]
Physical Review E **103**, 022411 (2021)   highlighted as an *Editors' Suggestion*

[17] **Subpopulations and stability in microbial communities**
P. A. Haas[#], N. M. Oliveira[#], and R. E. Goldstein[#]
Physical Review Research: Rapid Communications **2**, 022036(R) (2020)

[18] **Shape-shifting polyhedral droplets**
P. A. Haas[#], D. Cholakova, N. Denkov, R. E. Goldstein, and S. K. Smoukov[#]
Physical Review Research **1**, 023017 (2019)

[19] **Nonlinear and nonlocal elasticity in coarse-grained differential-tension models of epithelia**
P. A. Haas[#] and R. E. Goldstein[#]
Physical Review E **99**, 022411 (2019)

[20] **Embryonic inversion in** *Volvox carteri***: The flipping and peeling of elastic lips**
P. A. Haas[#] and R. E. Goldstein[#]
Physical Review E **98**, 052415 (2018)   highlighted as an *Editors' Suggestion*

[21] **The noisy basis of morphogenesis: mechanics and mechanisms of cell sheet folding inferred from developmental variability**
P. A. Haas[†], S. S. M. H. Höhn[†], A. R. Honerkamp-Smith, J. B. Kirkegaard, and R. E. Goldstein[#]
PLoS Biology **16**, e2005536 (2018)

[22] **Theory of shape-shifting droplets**
P. A. Haas, R. E. Goldstein[#], S. K. Smoukov[#], D. Cholakova, and N. Denkov
Physical Review Letters **118**, 088001 (2017)

[23] **Elasticity and glocality: Initiation of embryonic inversion in** *Volvox*
P. A. Haas and R. E. Goldstein[#]
Journal of the Royal Society Interface **12**, 20150671 (2015)

[24] **Dynamics of a** *Volvox* **embryo turning itself inside out**
S. Höhn, A. R. Honerkamp-Smith, P. A. Haas, P. Khuc Trong, and R. E. Goldstein[#]
Physical Review Letters **114**, 178101 (2015)   highlighted as an *Editors' Suggestion*
selected for a *Viewpoint* in *Physics*: A. Boudaoud, "How to Turn an Embryo Inside Out", *Physics* **8**, 39 (2015)

[25] **Oxfold: Kinetic folding of RNA using stochastic context-free grammars and evolutionary information**
J. W. J. Anderson[#] , P. A. Haas, L.-A. Mathieson, V. Volynkin, R. Lyngsø, P. Tataru, and J. Hein
Bioinformatics **29**, 704 (2013)

Other Publications (peer-reviewed reviews, commentaries)

[26] **Morphogenesis in space offers challenges and opportunities for soft matter and biophysics**
M. Ben Amar[#], P. Ciarletta[#], P. A. Haas[#]
Communications Physics **6**, 150 (2023)

[27] **Morphogenesis: Mathematical Models with Frills**
P. A. Haas[#]
eLife **8**, e48520 (2019)

> *Insight* article highlighting S. A. Montandon, A. Fofonjka, and M. C. Milinkovitch, "Elastic instability during branchial ectoderm development causes folding of the *Chlamydosaurus* erectile frill", *eLife* **8**, e44455 (2019)