



Academic Curriculum Vitae

Section 1: Personal Summary

Name	Meurig Gallagher
Current Post	Assistant Professor
Institute	Institute of Metabolism and Systems Research (IMSR) School of Mathematics School of Computer Science
College	College of Engineering and Physical Sciences (EPS) College of Medical and Dental Sciences (MDS)

Section 2: Career to date

Education & Professional Qualifications

Year	Degree and subject, awarding body/University
2015	PhD Applied Mathematics, University of Birmingham
2011	MMath Applied Mathematics, University of Nottingham

Employment History

Year(s)	Type of post, location
2022 – DATE	Assistant Professor, IMSR, UoB
2020 – 2022	Centre Fellow, IMSR, UoB
2016 – 2019	Research Fellow, School of Mathematics, UoB
2015 – 2016	Teaching Fellow, School of Mathematics, UoB

Membership in Professional Societies

Year(s)	Role, name of specialist society/professional body
2016 – DATE	Ordinary Member, European Society of Human Reproduction and Embryology
2021 – DATE	Full Member, Association of Reproductive and Clinical Scientists
2020 – DATE	Member, Society of Research Software Engineering
2020 – 2021	Early Career Member, American Physical Society

Section 3: Education

Principal education-related achievements	
1	<p>MSc Reproductive Science</p> <p>Together with Professor Jackson Kirkman-Brown (Lead) and Dr Linda Lefièvre, I am designing a new MSc in Reproductive Science to be led across the University of Birmingham and Birmingham Women's Hospital. My role in this is to develop and deliver content that will drive greater quantitative skills in the sector, enabling better analysis and assessment, and providing a pathway for the next generation of Embryologists and Andrologists to have a better understanding of research.</p>
2	<p>(Software) Carpentry Instructor</p> <p>I undertook training to become an accredited (Software) Carpentry Instructor (www.carpentries.org). This certifies me to teach courses in software (R, Python, MATLAB etc) and data (Image processing, data management, visualisation, etc). Working with the BEAR (Birmingham Environment for Academic Research) Training Team, I run several training events a year to introduce practical and directed programming skills for researchers.</p>
3	<p>Development of technology in the teaching of mathematics.</p> <p>The use of technology forms a significant part of both my education and research. As such I have always been keen to not only bring technology into my teaching, but also to help others enhance their own teaching and learning using suitable technological advances. In 2016 I developed the use of gapped-notes, tablet delivery, and lecture capture in my teaching, leading to my recording of a HEFI MicroCPD on lecture capture.</p>
4	<p>Outstanding Teaching Award nomination (2016)</p> <p>I have received continually excellent feedback regarding my teaching style from both staff and students. My interpersonal skills allow me to develop an excellent rapport with my students, resulting in a nomination for a College of EPS Outstanding Teaching Award.</p>

Teaching design & delivery		
Programme	Role	Details
BSc Biomedical Science	Lecturer	Neuroscience, Endocrinology and Reproduction Year 2, 2023 – 2024 4 groups, 1 hours of SGT delivery in Reproduction and Infertility
MSci Mathematics, BSc Mathematics	Co-Module convener	Advanced Mathematical Modelling (3AMM) Year 3/4, 2023 – 2024 75 students Wrote and delivered material for 25% of course (5 credits), comprising 12 lectures, 3 guided study sessions with problem sheets, 1 assessed coursework and 1 exam question (out of 4 for the course).
MSci Mathematics, BSc Mathematics	Co-Module convener	Advanced Mathematical Modelling (3AMM) Year 3/4, 2022 – 2023 92 students Wrote and delivered material for 25% of course (5 credits), comprising 12 lectures, 3 guided study sessions with problem sheets, 1 assessed coursework and 1 exam question (out of 4 for the course).
BSc Biomedical Science	Lecturer	Neuroscience, Endocrinology and Reproduction Year 2, 2022 – 2023 3 groups, 8 hours of SGT delivery in Reproduction and Infertility
MBChB Medicine and Surgery	Lecturer	Reproduction, Endocrinology and Development Year 2, 2021 – 2022 2 groups, 2 hours of SGT delivery in Infertility
MBChB Medicine and Surgery	Lecturer	Reproduction, Endocrinology and Development Year 2, 2020 – 2021 2 groups, 2 hours of SGT delivery in Infertility

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PGT Mathematics	Module convener	2017/18 Research Frontiers in Applied Mathematics
MSc Mathematics, BSc Mathematics	Contributor	Curriculum review and development: Mathematical Biology 4 th year Undergraduate course. 2017
MSc Mathematics, BSc Mathematics	Module convener	Perturbation theory and asymptotics. Year 3/4, 2015 – 2016 ~90 students. Wrote course, delivered 22 hrs lectures + 5 problems classes, wrote & marked exam and coursework.
MSc Mathematics, BSc Mathematics	Module convener	Nonlinear Dynamical Systems. Year 2/3, 2015 – 2016 ~250 students. Wrote course, delivered 22 hrs lectures + 5 problems classes, wrote & marked exam and coursework.

Innovation and enhancement		
Programme	Role	Details
Talking about Teaching	Workshop Delivery	Delivered pedagogical workshop on lecture capture to colleagues within the School of Mathematics. 2017
N/A	Workshop Delivery	Delivered pedagogical workshop 'Creating (electronic) learning resources in mathematics' to colleagues in the School of Mathematics 2017.
MSc Mathematics, BSc Mathematics	Innovator	Developed the use of lecture capture and other technology for the teaching of mathematics. 2016

Teaching leadership		
Programme	Role	Details
MSc Reproductive Science	Leadership	A key member of the team (comprising myself, Prof. Jackson Kirkman-Brown [lead] and Dr Linda Levièvre) developing a new Master's course in Reproductive Science. In particular, I am developing content to raise the quantitative understanding in the field through provision of content including novel data analysis and assessment.
MSc Biomedical Science	Leadership	Providing leadership to develop a novel module for MSc Biomedical Science students to learn quantitative skills and appreciate mathematical approaches to biomedical problems. This would be a highly-novel and exciting addition to existing provision. Anticipated course start date 2024/25.
MSc Mathematics, BSc Mathematics	Leadership	Provided insight and input for the redesign of the second year module Numerical Methods & Programming (2NP).

Supervision of Programmes			
Type of Teaching Activity	Topic/Title	Degree course	Year(s) of Course
Practical	Software Carpentry - MATLAB	N/A	2022

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SGT	Reproduction, Endocrinology & Development	MBChB Yr 2	2021
Practical	Software Carpentry - MATLAB	N/A	2021b
Practical	Software Carpentry - MATLAB	N/A	2021a
Lectures	Research Frontiers in Applied Mathematics	MSc Applied Mathematics Yr 1	2018
Lectures	Foundation Year Mathematics	FY Mathematics Yr 0	2016
Practical	C++ Assessment	MSc Financial Engineering Yr 1	2016
SGT	Academic tutorials	BSc/MSci Mathematics Yr 1, 2 & 3	2016
SGT	Academic tutorials	BSc/MSci Mathematics Yr 1 & 2	2015
SGT	Multivariate analysis	BSc/MSci Mathematics Yr 2	2015
Assessment	Multivariate analysis	BSc/MSci Mathematics Yr 2	2015
Assessment	Dissertation	MSc Financial Engineering Yr 1	2015
SGT	Mathematics in Industry Project Supervision	BSc/MSci Mathematics Yr 3	2015
SGT	Mathematical Modelling and Problem Solving Project Supervision	BSc/MSci Mathematics Yr 1	2015

Supervision of students

BSc Biomedical Science – 6 laboratory projects supervised 2022-2023

MSci Mathematics – 5 theses supervised, 2016-2018

BSc Mathematics – 27 student projects supervised 2016-2018

Section 4: Research

Research vision

Current research interests, activities and brief summary of vision for the next 5 years

As an interdisciplinary researcher I have strong expertise in, and a passion for, integrating challenging theoretical, quantitative, and experimental methods to drive transformational innovation in healthcare. The primary focus of my research is to make a meaningful difference by creating new diagnostics and therapies for male subfertility. I aim to do this by integrating mathematical (biological fluid dynamics, modelling, data science) and experimental (semen handling, advanced microscopy) approaches with clinical data.

My work to-date demonstrates a strong upwards trajectory through:

- £1.98M of funding as PI or key Co-I.
- Being examined and appointed as Human Fertilisation & Embryology Authority (HFEA) Research Person Responsible for the UoB HFEA Licence, becoming just 1 of just 17 Research PRs in the UK.
- Election to the Association of Reproductive & Clinical Scientists (professional body for the field) Scientific Advisory Board to provide scientific insight into policy and practice.
- My position as Mechanistic Lead for a major clinical trial (NIHR135258), providing novel methodology for sperm assessment to understand unexplained infertility.
- Invitations to give talks worldwide including at The International Human Embryology Research Academy (India), University of California, Berkeley, and industrial visits to Hamilton Thorne Inc. (Boston, USA).
- An invitation to Chair a session at the European Society of Human Reproduction and Embryology Meeting 2022.
- An invitation to contribute to a section of the World Health Organisation laboratory manual for the examination and processing of human semen 6th Edition on Computer-Assisted Sperm Analysis.
- The release of 2 software packages: FAST (Flagellar Analysis and Sperm Tracking) – the world's first high-throughput flagellar analysis software for swimming sperm, available free from www.flagellarcapture.com; and NEAREST (Nearest-Neighbours for Easy Application of Regularised STokeslets) – Open source computation for Stokes flow www.gitlab.com/nearest_code
- A patent submission for a microchannel device for sperm sorting (Patent Application Number 2116389.4).
- 21 publications in internationally leading journals across disciplines including mathematics, medicine, biological sciences, and engineering (286 citations, Google Scholar); with each of my top-5 cited publications have myself as either first (performing the bulk of the work) or last (leading the research) author.

My vision for the next 5 years is to establish myself as an international leader in evidenced-based andrology. I will do this by leading an interdisciplinary team with expertise clinical reproduction, mathematical modelling and social sciences. My aim is to fund this group from a combination of income streams, including: a personal Fellowship for myself, individual grant funding; and industry partnership – building on my existing relationships with the leading worldwide companies Hamilton Thorne Inc, Cooper Surgical, and Vitrolife. Through the work of my group and collaborators I will strive to realise the translational potential of my research and bring a product to market, thereby

changing treatment practice for male subfertility. It is believed that this work has strong potential for a 4* impact case study for UoA10 in REF2028.

Staff members of your research group			
Name	Post	Year (from – to)	Source of funding
Ingrida Krasauskaite	Pre-doctoral clinical scientist	2023 – 2024	BHP
Dr Hisham Al-Ahwany	Post-doctoral scientist	2023 –	NHS
Adrian Garcia	Research Software Engineer	2022 – 2023	MRC CiC
Simon Hartley	Senior Research Software Engineer	2022 – 2023	MRC CiC
Venkata Balantrapu	Research Associate	2021 – 2022	UoB DIF
Chris Lam	Research Associate	2021 – 2022	UoB DIF
Claudia Roman-Montanana	NHS Research Associate	2021 – 2022	NHS
Research grants and awards received and submitted			
Live Grants			
Funder & Scheme, PI/Cols, academic credit	Dates	Total to UoB	
NIHR HTA (NIHR135258 / 1738587) “The UNexplained Infertility treatment Trial (UNITY trial)” Co-I (20%)	10/2022 – 03/2028	£1,801,805.97	
MRC Confidence in Concept 8.2 (2127622) “Flagellar Dynamics – Enabling the next-generation of sperm diagnostics and treatment” PI (80%)	10/2022 – 03/2023	£50,435.23	
MRC Confidence in Concept 8.2 (2127764) “Magna muros – Rapid clean sperm preparation using walls” Co-PI (50%)	10/2022 – 03/2023	£59,683.48	
Completed Grants			
ãWT ISSF “Determining the role of lipid droplet formation as a protective mechanism against lipotoxicity in human beta cells during the development of type 2 diabetes” Co-I	09/2021 – 09/2022	£24,537	
Innovate UK SETSquared ICURe Programme “Flagellar Analysis and Sperm Tracking” PI (100%)	11/2021 – 04/2022	£35,000	
UoB Dynamic Investment Fund “Automation and statistical refinement of an unsupervised analysis pipeline for measurable residual disease testing in acute myeloid leukemia.” Co-I	11/2021 – 04/2022	£10,000	
EPSRC Centre for Predictive Modelling in Healthcare Seed Corn Funding “Precision Antithyroid Therapy” Co-I	02/2020 – 07/2020	£10,000	
LMS Undergraduate Research Bursary “Mathematically modelling the effect of a non-Newtonian viscosity on the blood flow through coupled arterial anastomoses” PI (100%)	07/2018 – 09/2018	£1440	

Principal research publications (Author order convention: First author performed the bulk of the work, last author led the work, * denotes corresponding author)	
1	<p>Gallagher, M.T.*, Cupples, G., Ooi, E.H., Kirkman-Brown, J.C. and Smith, D.J., 2019. Rapid sperm capture: high-throughput flagellar waveform analysis. <i>Human Reproduction</i>, 34(7), pp.1173-1185.</p> <p>63 citations (Google Scholar), in the top 5% of publications scored by Altmetric.</p> <p>National press coverage: <i>The Independent</i> – ‘Sperm tail-tracking technique could improve male fertility testing’ 2019. www.independent.co.uk/life-style/sperm-testing-tail-male-fertility-research-birmingham-university-a8947301.html</p> <p>BBC – ‘How AI may be a powerful tool in treating male infertility’ - https://www.bbc.com/news/business-66608073</p> <p>The paper that accompanied the release of the world’s first software package for automatically tracking sperm tails in microscopy videos FAST. The largest investigation of sperm flagellar (tail) beating to-date, this work is both highly cited and the basis for further investigations I am doing on the recently awarded clinical trial NIHR135258. There is strong potential for the commercialisation of this work, as evidenced by my InnovateUK ICURe Fellowship and ongoing discussions with industry.</p> <p>As First and Corresponding Author I performed and designed the work, including designing and implementing the algorithms, and collecting and analysing sperm data.</p>
2	<p>Neal, C.V., Hall-McNair, A.L., Kirkman-Brown, J., Smith, D.J. and Gallagher, M.T., 2020. Doing more with less: the flagellar end piece enhances the propulsive effectiveness of human spermatozoa. <i>Physical Review Fluids</i>, 5(7), p.073101.</p> <p>15 citations (Google Scholar).</p> <p>National press coverage: <i>New Scientist</i> – ‘Sperm swim up to 70 per cent faster when they have a lazy tail’ 2020. https://www.newscientist.com/article/2248614-sperm-swim-up-to-70-per-cent-faster-when-they-have-a-lazy-tail/</p> <p>International press coverage: <i>BNR Nieuwsradio</i>: ‘Sperm with a lazy tail swims 60 percent faster’ 2020. https://www.bnr.nl/podcast/wetenschap-vandaag/10415359/sperma-met-ee-luie-staart-zwemt-70-procent-snelter</p> <p>The final few microns of the sperm tail have been historically ignored in studies due to the loss of internal structures that mean it is unlikely to actively bend and contribute to propulsion. In this study led by myself and conducted by my former PhD student, we show that the inclusion of this inactive end piece in an elasto-hydrodynamic model of sperm has a significant effect on both swimming speed and efficiency compared to a sperm with a fully active tail.</p>
3	<p>Hall-McNair, A.L., Montenegro-Johnson, T.D., Gadêlha, H., Smith, D.J. and Gallagher, M.T.*, 2019. Efficient implementation of elasto-hydrodynamics via integral operators. <i>Physical Review Fluids</i>, 4(11), p.113101.</p> <p>29 citations (Google Scholar).</p> <p>In this widely cited study led by myself and conducted by my former PhD student, we developed an efficient modelling framework for microscopic flexible fibres interacting through viscous flow. This work takes into account non-local interactions and is demonstrated with application to sedimenting and shear flows with multiple fibres, as well as flagellar propulsion.</p>
4	<p>Gallagher, M.T.* and Smith, D.J., 2018. Meshfree and efficient modeling of swimming cells. <i>Physical Review Fluids</i>, 3(5), p.053101.</p> <p>21 citations (Google Scholar).</p> <p>The paper that accompanied the release of the open-source software package NEAREST. In this work I developed a new meshfree approach for modelling three-dimensional locomotion in Stokes flow. Designed with ease-of-implementation in mind, this method enables researchers from a wide-range of fields to use this method to solve previously intractable problems. Forms the basis for the NEAREST package and further work by myself as first author (9, 10, 12-14, 16-17 in my full publication list below).</p>

Other significant completed research outputs (in no particular order)	
Prizes & Awards	
1	Iwan Lewis-Jones Young Scientist Prize, British Andrology Society 2018
2	STEM4Britain Finalist 2018
Selected invited lectures and conference presentations	
3	Manipal Reproductive Science Summit 2023, Manipal India 03/2023
4	ARCS 365, 02/2023
5	World Congress of Biomechanics 07/2022
6	International Human Embryology Research Academy 02/2022
Conference organisation	
7	Association of Reproductive and Clinical Scientists Symposium Lead Local Organiser 09/2022 & 09/2023
8	Biologically Active Fluids SIG, Flagellar Capture and Sperm Tracking Workshop 10/2019
Involvement in guideline and consensus groups	
9	ARCS Policy & Practice Committee
10	WHO Laboratory Manual for the Examination and Processing of Human Semen 6 th Edition 2021 – Contributions to sections on Sperm Motility and Computer-Aided Semen Analysis
Software development and release	
11	FAST (Flagellar Analysis and Sperm Tracking) 2019 – The world's first high-throughput flagellar analysis software for swimming sperm, available free from www.flagellarcapture.com FAST is currently being used in South Africa, Australia, France, Brazil, Argentina, India, and the United States of America.
12	2018 NEAREST (Nearest-Neighbours for Easy Application of Regularised STokeslets) – Open Source computation for Stokes flow. www.gitlab.com/nearest_code
Peer review for funding bodies (membership of funding panels, review of grants)	
National Institute for Health and Care Research (NIHR) – NIHR Research for Patient Benefit	
Committee membership – national/international bodies and societies	
Association of Reproductive and Clinical Scientists (ARCS) Executive Committee. As the Professional Body and Learned Society for Reproductive Science in the UK, ARCS strives to promote high standards of practice and to support the professional interests of those working the UK and internationally. I sit both as the Academic Member on the ARCS Executive Committee, and on the Communication Committee, where I contribute by ensuring clear cross-community dissemination of all the work ARCS do, along with related research and events.	
Membership of Editorial Boards and Peer Review for Scientific Journals	
Journal Peer Review for: Nature Scientific Reports; Proceedings of the National Academy of Sciences of the United States of America; Journal of the Royal Society Interface; Journal of Fluid Mechanics; FLOW; Physical Review Fluids; Reproduction Fertility and Development; Andrology; Animals; Reproduction in Domestic Animals; Journal of Assisted Reproduction and Genetics; Human Fertility; MDPI Fluids; Public Library of Science (PLoS) Biology; Public Library of Science (PLoS) ONE	
Contributions to improving research integrity and research culture	
2022 – DATE: Research Computing Management Committee, UoB	
2022 – DATE: School of Mathematics Research Committee Member (Ex Officio)	
2021 – DATE: MATLAB SIG Chair, UoB	
2021 – DATE: Carpentries Instructor Accreditation (Software)	

2021 – DATE: Open Research Working Group, College of Engineering and Physical Sciences

2018 – DATE: Open Research Champion, School of Mathematics, UoB

Experimental laboratory skills


Both European Society of Human Reproduction & Embryology, and American Society of Andrology accredited for diagnostic semen analysis.

Semen handling: sperm washing, direct swim-up, density gradients, cell counting, motility assessment, morphology assessment

Advanced microscopy: live, motile and fixed cells, fluorescence, calcium imaging, super-resolution and analysis.

Experimental techniques: flow cytometry, cell culture, experimental optimisation.

Research Metrics (Google Scholar, accessed 01/07/2023)

No. of peer-reviewed original research articles	19
No. of peer-reviewed review articles	2
Normalised citation impact (InCites)	Obstetrics & Gynecology: 5.75 Reproductive Biology: 3.32 Zoology 1.85
Citation count	286
Citation Map (Publons) My work has been cited across the globe:	

Research publications that have attracted a high Altmetrics Score (webpages accessed 22/11/2022)

Publication	Altmetrics Score	Percentile of all research outputs scored by Altmetrics	Attention Score compared to outputs of the same age	Attention Score compared to outputs of the same age and source
Gallagher, M.T. , Cupples, G., Ooi, E.H., Kirkman-Brown, J.C. and Smith, D.J., 2019. Rapid sperm capture: high-throughput flagellar waveform analysis. <i>Human Reproduction</i> , 34(7), pp.1173-1185.	85	Top 5%	High (97 th Centile)	High (93 rd Centile)

Postgraduate research student supervision

Degree	Year completed / due to complete	1 st / 2 nd Supervisor	Source of support	Name of the Student Title of Thesis Current post
PhD	2024	1 st	EPSRC	Rosemary Evans Mathematical Modelling for Personalising Healthcare PGR Student – UoB

PhD	2022	2 nd	EPSRC	Dr Atticus Hall-McNair Elastohydrodynamics of actuated slender bodies in Stokes flows: methods, tools, and simulations of microscale motility. Senior Mathematical Modeller, DSTL
PhD	2022	2 nd	EPSRC	Dr Cara Neal Hybrid computational approaches for flagellar waveform development in complex fluids with application to human sperm propulsion. PDRA – University of Liverpool
MSc by Research	2022	2 nd	UoB	Christina Clavelo-Farrow An investigation into how long-chain fatty acids translocate the membrane of pancreatic beta-cells
MRes (UCLAN)	2022	2 nd	UCLAN	Jamie Mann Predictive Rheological Haematology
MRes	2018	1 st	UoB	Katie Hoar Microvascular anastomoses: The effect of sutures on blood flow
MSc Mathematical Modelling	2017	1 st	UoB	Harry Reynolds Modelling pulsatile blood flow in coupled arterial anastomoses
MSc Mathematical Modelling	2016	1 st	UoB	Gurpejh Sharma Investigating the stability of Newtonian fluids under a Poiseuille flow

Section 5: Enterprise, Engagement and Impact (EEI)

Statement on current EEI activities and brief summary of vision for the next 5 years

Project managing the release of FAST gave me first-hand experience of providing expert advice to a wide range of users internationally. FAST is being used in South Africa, Australia, France, Brazil, Argentina, India and the United States of America; and has been highlighted as an emerging technology by the World Health Organisation, who noted that “flagellar tracking can enable an abundant array of diagnostic, toxicological and therapeutic possibilities in human sperm research” (WHO laboratory manual for the examination and processing of human semen 6th edition 2021).

I was recently awarded £35k (Innovate UK) as part of the SETsquared ICURe Programme to facilitate my exploration of the Innovation to Commercialisation pathway for both FAST and a microchannel device (MCD) for sperm sorting (International Patent Application Number PCT/GB2022/052873), and validation of the market for the next stages of translation, whether this be through spin-out or licensing – these two options were highlighted as the recommended next steps by the InnovateUK panel.

I am currently building and leading a cross-disciplinary, multi-country, multi-centre team to quantify the links between sperm motility parameters (using FAST) and successful outcomes of fertility treatments. So far 16,000 cells from 70 couples have been analysed. As an additional application, FAST can provide insight into animal reproductive health; FAST is being used internationally by leading teams including those of Prof. Gerhard van der Horst (South Africa), Prof. Simon de Graaf (Sydney), Dr Polina Lishko (USA) amongst others.

My work with FAST, and other methods for sperm preparation and analysis has led to me developing close links with the three industry leaders in fertility: Vitrolife (\$26Bn market cap), Cooper Surgical (\$15Bn market cap) and Hamilton Thorne Inc (\$130M market cap). I am currently in discussion with each of these companies to fund projects (including potential postgraduate students) and research leading to the creation of novel technologies in the field.

My EEI work has led to both Cooper Surgical and Merck commissioning me to give international seminars for the Nordic Fertility Innovation summit (Merck, Feb 2023), and in both Münster and London for Cooper Surgical. Following the success of the Cooper Surgical events, they have invited me to provide input on future events.

Principal EEI or EEI-related achievements

1	<p>ThinkTank Futures Gallery Exhibition: Microbots! The future of medicine. Launched 10/2019</p> <p>A key achievement was leading the creation of a permanent exhibit in Birmingham Thinktank science museum (220k annual visitors). This exhibit uses techniques from my core research, utilising bespoke real-time image tracking software with linked game development, highlighting the use of mathematics in addressing antimicrobial resistance, and, more widely, imaging and modelling for healthcare applications.</p>
2	<p>Innovate UK SETSquared ICURe Cohort 38</p> <p>I secured £35k of competitive funding from Innovate UK for their Innovation-to-Commercialisation of University Research (ICURe) fellowship scheme. This allowed me to conduct market research for my FAST software – travelling across the United States and Europe to have 86 conversations with existing market leaders to examine the early-stage commercialisation potential of my work.</p> <p>As part of this scheme I had media engagement and communication training, with which I developed a significant online presence – my ICURe LinkedIn posts had 12k impressions.</p>
3	<p>Microchannel device for sperm sorting, International Patent Application PCT/GB2022/052873</p> <p>I am an inventor of a microchannel device for sperm sorting, and have just filed an International Patent Application (Nov. 2022) in conjunction with UoB Enterprise. The key feature of our design is to exploit the hydrodynamic properties of sperm which induce natural boundary-following navigation – thereby providing a strong link between the physiological environment and the technology. This device, which more closely mimics the female reproductive tract than competitor devices, obtain a better separation of the strongest swimming sperm with good shape and DNA quality.</p> <p>Work on this device (which includes an MRC Confidence in Concept award – see above) has been developed after several in-depth discussion with the two industry leaders Vtirolife and Cooper Surgical. Each of these companies are already excited by the potential licencing opportunities of this technology. The aim is for one of these partners to take the device to market.</p>
4	<p>Our fluid nation - the impact of fluid dynamics in the UK. UK Fluids Network Report 2019</p> <p>My work with FAST has been highlighted by the UK Fluids Network as a Reproductive Case Study for the UK Fluids Network, who highlight how “<i>Fluid dynamics is enabling essential new insights to support advances in reproductive medicine</i>”.</p>

Enterprise / Knowledge transfer and exchange – networking/collaboration activities

01/2023	Sponsored by Merck (travel & accommodation) to attend the <i>Nordic Fertility Innovation 2023</i> conference (Helsinki, Finland).
10/2022	Sponsored by Merck (travel & accommodation) to attend the <i>SmART Masterclass</i> knowledge exchange seminar in assisted reproductive technologies (Newcastle, UK).
01/2022	Sponsored by Planer Ltd (a leading IVF technology company) to attend the <i>Fertility 2022</i> conference (Online).

Influence and Impact

07/2021: The WHO laboratory manual for the examination and processing of human semen 6th edition is the latest edition of the worldwide reference text for semen analysis. My profile in computational semen analysis led to an invitation to contribute to writing sections on both Sperm Motility and Computer-Assisted Sperm Analysis.

06/2021: Workshop attendance – Parliament for Researchers – How to engage with developed legislatures.

Selected Outreach and Widening Participation

03/2021: Liberal Arts and Natural Sciences Cultural Programme. Communicating Science Panel Discussion.

01/2020: School of Mathematics Popular Maths Lecture – A long and winding tail: How maths is helping unlock the secrets of male fertility.

10/2019: ThinkTank Lates – Microbots! The future of medicine.

Selected public engagement and patient involvement

09/2022: Building on our artist-in-residence scheme, SMQB launched the Lore + (Dis)order sciart exhibition. Here I engaged with the public through the art that was co-created alongside two of my SMQB-funded Seedcorn projects.

09/2022: As part of the Lore + (Dis)order exhibition series I took part in an 'In conversation' panel event where I gave my perspective of working collaboratively across science, maths, and art to address pressing healthcare need.

11/2021: In designing NIHR135258, we worked with a patient co-applicant to co-create the research. This approach ensured we took on wider views around the treatment plans. In addition, we incorporated an independent patient support consultant within the bid to represent the quieter patient voices – this ensured that our planned approach has engagement from under-served groups, and was designed to be appropriate for the ethnically, socially, and economically diverse participants of our trial.

03/2021: At the INTERFACE of science + art + health. SMQB Artists in Residence exhibition launch.

05/2018: Pint of Science talk – A sperm's tail

Impact Case Development

REF 2028: It is hoped that my work with FAST and sperm preparation will form a strong candidate 4* impact case study for UoA10. The aim is to change the way sperm are assessed and selected for assisted reproduction (e.g. IVF) by integrating rational, evidenced based approaches underpinned by modelling to gain greater insight through non-invasive imaging of sperm.

Section 6: Leadership and Management

National Leadership roles

I sit as the Academic Member on the Association of Reproductive and Clinical Scientists (ARCS) Executive Committee. ARCS is the professional body and learned society supporting the needs and research interests of those involved in reproductive sciences in the UK and worldwide.

Leadership roles – Institute/College/University

University level:

- Research Computing Management Committee

College level (EPS):

- Open Research Working Group Member (2021 – DATE)

Institute level:

- SMQB Theme Lead – Endocrinology, Metabolism and Reproduction
- Open Research Champion, School of Mathematics

University level	<p>Research Computing Management Committee</p> <p>The University's Research Computing Management Committee (RCMC) advises Advanced Research Computing and advocates BEAR services within the University. RCMC Advises on all research computing to the highest levels within the university, including on the Digital Research Committee chaired by the PVC for Research.</p>
College level (EPS)	<p>Open Research Working Group</p> <p>As Open Research Champion for the School of Mathematics I also sit on the College of EPS Open Research Working Group (ORWG). The aim of the ORWG is to identify and share 'best practice' across the College and University on Open Access publishing, particularly relating to the emerging Plan S provisions, and to explore ways in which Data, Tools and Research Practice can be 'opened'.</p>
Institute level (Mathematics)	<p>Open Research Champion</p> <p>The position of Open Research Champion in the School of Mathematics was created for me to provide leadership and support to colleagues, highlighting my commitment to the principles of Open Research.</p>
Institute level (SMQB)	<p>SMQB Theme Lead – Endocrinology, Metabolism and Reproduction</p> <p>As SMQB Theme Lead I lead a team of 8+ people. I have a responsibility to effectively assess and organise the theme budget to drive collaborations and visibility of SMQB, both internally and internationally. As part of this role, I provide mentorship to the theme members to enable and enhance their personal and academic development and research profiles; as well as providing strategic direction for the theme.</p> <p>I have responsibility for the SMQB Strategic Pillar: Impact and Knowledge Exchange, as well as contributing to the overarching strategy of the SMQB as a whole, ensuring a Centre whose purpose fits our internal ambitions and those of the wider University.</p>

Leadership Training	
2022 – 2023	<p>MDS SUSTAIN</p> <p>I was successful in applying for, and completing, the competitively awarded UoB MDS SUSTAIN Leadership Programme. The aim of the programme is to develop skills and confidence in aspiring leaders and takes inspiration from the Academy of Medical Sciences SUSTAIN programme.</p>

Section 7: Citizenship

<ul style="list-style-type: none"> • Regular supporter of School of Mathematics Open Days, including running sessions based around our ThinkTank Science Museum exhibition • I frequently process at graduations, and acted as Procession Manager Summer 2022 • I have a strong commitment to mentorship: <ul style="list-style-type: none"> ○ Mentor for School of Mathematics Postdoctoral Mentorship Scheme ○ Mentor for Rosemary Evans for the UoB Introduction to Academic Practice for Doctoral Researchers (IAPDR) Scheme ○ Mentor in mathematics for an SMQB MRC-funded Skills Development Fellow ○ Mentor for SMQB Theme 3 members to enable and enhance their personal and academic development and research profiles

- Having been an active member of the School of Mathematics since 2011, I proactively aim to identify wellbeing issues within the department and provide support to colleagues in times of challenge
- I am University First-Aid trained to ensure safe lab access for all members of the team and wider community
- I am a frequent attendee at school events to widen participation and support university life.

Section 8: Equality, Diversity and Inclusion

My passion and drive to ensure equality, diversity, and inclusion throughout all aspects of my life is driven by my late father. In running a charity supporting those with learning disabilities, he spent his life championing people of all backgrounds to enable them to reach their full potentials. Having worked in this sector as a support worker myself, I strive to live these ideals with everything I do.

I believe that it is imperative to integrate these values into all aspects of my work, including research. In the UNiTY clinical trial bid, I included the need to encapsulate voices from all patients and particularly men (who have long been able to avoid being part of the fertility conversation, leading to a significant gender imbalance in women having to carry the physical and emotional burden of fertility treatment). This approach was specifically highlighted by the Patient and Public Involvement (PPI) reviewer, who stated 'I was particularly impressed with the detailed 'Patient view' as this was very comprehensive'.

I served on the School of Mathematics Equality, Diversity and Inclusion (EDI) Committee 2016-2019, where I provided an early career researcher perspective, and developed procedures and events that make Birmingham a welcoming and inviting place for people of all backgrounds. During this time, I contributed to the School's Athena Swan application, which was subsequently awarded. My role in the application was leading the data team, involving monitoring, and evaluating the extent to which EDI policies and procedures had been applied, including managing secure data and providing analysis for the written report. These experiences gave me an ability to identify and address issues with the potential to impact on protected groups, and the opportunity to take appropriate action, ensuring legislation is followed and, importantly, enabling all people to succeed to the best of their abilities.

I strive to be fair and support a diverse team of people as I believe this is best for my research outcomes and to ensure a thriving community. This is evidenced by the gender diversity in my present and former team members including postgraduate research students (50% male / 50% female) and staff members (3/2). In the recent ARCS Symposium (September 2023) for which I was lead Organiser, the session chairs were 60% female, while the speakers had a 33% male / 67% female and 33% non-white / 67% white splits.

APPENDIX

Full list of publications

Reverse chronological order – most recent first.

Author order convention: first author performed the bulk of the work, last author led the work.

* denotes corresponding author, † denotes joint first author.

- 21*** Newman-Sanders A., Kirkman-Brown, J.C. and **Gallagher, M.T.** 2023. Gym lifestyle factors and male reproductive health: a study into young adult usage and perceptions. *Reproductive BioMedicine Online*. *In press*.
- 20*** **Gallagher, M.T.**, Kirkman-Brown, J.C. and Smith, D.J., 2023. Axonemal regulation by curvature explains sperm flagellar waveform modulation. *PNAS nexus* 2(3)
- 19** Bisconti, M., Leroy, B., **Gallagher, M.T.**, Senet, C., Martinet, B., Arcolia, V., Wattiez, R., Kirkman-Brown, J., Simon, J.F. and Hennebert, E., 2022. The ribosome inhibitor chloramphenicol induces motility deficits in human spermatozoa: a proteomic approach identifies potentially involved proteins. *Frontiers in cell and developmental biology*, p.1654.
- 18** Baldi, E., **Gallagher, M.T.**, Krasnyak, S., Kirkman-Brown, J., Apolikhin, O., Barratt, C.L., Festin, M.P., Kiarie, J., Lamb, D.J., Mbizvo, M. and Schlatt, S., 2022. Extended semen

- examinations in the sixth edition of the WHO Laboratory Manual for the Examination and Processing of Human Semen: contributing to the understanding of the function of the male reproductive system. *Fertility and Sterility*, 117(2), pp.252-257.
- 17 Smith, D.J., **Gallagher, M.T.**, Schuech, R. and Montenegro-Johnson, T.D., 2021. The role of the double-layer potential in regularised stokeslet models of self-propulsion. *Fluids*, 6(11), p.411
 - 16 **Gallagher, M.T.** and Smith, D.J., 2021. The art of coarse Stokes: Richardson extrapolation improves the accuracy and efficiency of the method of regularized stokeslets. *Royal Society open science*, 8(5), p.210108.
 - 15* Cupples[†], G., **Gallagher[†], M.T.**, Smith, D.J. and Kirkman-Brown, J.C., 2021. Heads and tails: requirements for informative and robust computational measures of sperm motility. In *XIIIth International Symposium on Spermatology* (pp. 135-150). Springer, Cham.
 - 14* **Gallagher, M.T.** and Smith, D.J., 2020. Passively parallel regularized stokeslets. *Philosophical Transactions of the Royal Society A*, 378(2179), p.20190528.
 - 13 Neal, C.V., Hall-McNair, A.L., Kirkman-Brown, J., Smith, D.J. and **Gallagher, M.T.**, 2020. Doing more with less: the flagellar end piece enhances the propulsive effectiveness of human spermatozoa. *Physical Review Fluids*, 5(7), p.073101.
 - 12* **Gallagher, M.T.**, Montenegro-Johnson, T.D. and Smith, D.J., 2020. Simulations of particle tracking in the oligociliated mouse node and implications for left–right symmetry-breaking mechanics. *Philosophical Transactions of the Royal Society B*, 375(1792), p.20190161.
 - 11* **Gallagher, M.T.**, Cupples, G., Ooi, E.H., Kirkman-Brown, J.C. and Smith, D.J., 2019. Rapid sperm capture: high-throughput flagellar waveform analysis. *Human Reproduction*, 34(7), pp.1173-1185.
 - 10* Hall-McNair, A.L., Montenegro-Johnson, T.D., Gadêlha, H., Smith, D.J. and **Gallagher, M.T.**, 2019. Efficient implementation of elasto-hydrodynamics via integral operators. *Physical Review Fluids*, 4(11), p.113101.
 - 9* **Gallagher, M.T.**, Choudhuri, D. and Smith, D.J., 2019. Sharp quadrature error bounds for the nearest-neighbor discretization of the regularized stokeslet boundary integral equation. *SIAM Journal on Scientific Computing*, 41(1), pp.B139-B152.
 - 8* **Gallagher, M.T.**, Wain, R.A., Dari, S., Whitty, J.P. and Smith, D.J., 2019. Non-identifiability of parameters for a class of shear-thinning rheological models, with implications for haematological fluid dynamics. *Journal of Biomechanics*, 85, pp.230-238.
 - 7 Kavanagh, D.P.J., **Gallagher, M.T.** and Kalia, N., 2019. Tify: a quality-based frame selection tool for improving the output of unstable biomedical imaging. *PloS one*, 14(3), p.e0213162.
 - 6 **Gallagher, M.T.**, Smith, D.J. and Kirkman-Brown, J.C., 2018. CASA: tracking the past and plotting the future. *Reproduction, Fertility and Development*, 30(6), pp.867-874.
 - 5* **Gallagher, M.T.** and Smith, D.J., 2018. Meshfree and efficient modeling of swimming cells. *Physical Review Fluids*, 3(5), p.053101.
 - 4 **Gallagher, M.T.**, Needham, D.J. and Billingham, J., 2018. The initial development of a jet caused by fluid, body and free surface interaction with a uniformly accelerated advancing or retreating plate. Part 2. Well-posedness and stability of the principal flow. *Journal of Fluid Mechanics*, 841, pp.146-166.
 - 3 **Gallagher, M.T.**, Needham, D.J. and Billingham, J., 2018. The initial development of a jet caused by fluid, body and free surface interaction with a uniformly accelerated advancing or retreating plate. Part 1. The principal flow. *Journal of Fluid Mechanics*, 841, pp.109-145.
 - 2* **Gallagher, M.T.**, Neal, C.V., Arkill, K.P. and Smith, D.J., 2017. Model-based image analysis of a tethered Brownian fibre for shear stress sensing. *Journal of the Royal Society Interface*, 14(137), p.20170564.
 - 1 Griffiths, P.T., **Gallagher, M.T.** and Stephen, S.O., 2016. The effect of non-Newtonian viscosity on the stability of the Blasius boundary layer. *Physics of Fluids*, 28(7), p.074107.

1	2021 WHO Laboratory Manual for the Examination and Processing of Human Semen
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