Job Description and Selection Criteria

Job title	Postdoctoral Research Assistant in Mathematical Modelling of Cell Therapies for Liver Disease
Division	Mathematical, Physical and Life Sciences
Department	Mathematical Institute
Location	Andrew Wiles Building, Radcliffe Observatory Quarter, Woodstock Road, Oxford, OX2 6GG
Grade and salary	Grade 7: £32,817 - £40,322 per annum
Hours	Full time
Contract type	30 months fixed-term
Reporting to	Professor Sarah Waters
Vacancy reference	145517
Additional information	These are full-time positions that cannot be held concurrently with any other substantive post without the explicit permission of the Head of Department. This position is subject to a 9 month probationary period. This position is funded by the Medical Research Council (MRC). **(PLEASE NOTE: Applicants are responsible for contacting their referees and making sure that their letters are received by the closing date)**

The Role

We invite applications for a Postdoctoral Research Assistant position to work with Professor Sarah Waters at the Mathematical Institute, University of Oxford, on an exciting project to develop new mathematical models for cell therapies for liver disease. The postholder will be based in the group of Sarah Waters, part of the Oxford Centre for Industrial and Applied Mathematics, in the Mathematical Institute.

This post is part of a multi-disciplinary, multi-site MRC-funded collaborative project involving researchers at the Universities of Birmingham (Professor Alicia El Haj and Dr Wei-Yu Lu, Healthcare Technologies Institute) and Edinburgh (Professor Stuart Forbes, Dr Victoria Gadd

and Dr Philip Starkey Lewis, MRC Centre for Regenerative Medicine) with complementary expertise in cell and tissue engineering, liver regeneration, and pre-clinical and clinical liver cell therapy development. Project Partners Dr Daniela Ortiz and Dr Ekaterina Breous-Nystrom (Investigative Safety, Pharmaceutical Sciences) from F. Hoffman-La Roche brings multidisciplinary bioengineering expertise.

Successful clinical translation of regenerative medicine therapies requires robust preclinical tools for safety, immunogenicity and efficacy purposes. In this project we will combine state-of-the-art *in silico*, *in vitro* and *in vivo* approaches and develop a quantitative framework to underpin the translation of preclinical research data into the clinic**.** The foucs will be on stem cell therapies for liver disease. The clinical translational bottleneck in liver cell therapy development concerns safe delivery of the cells to the site of disease; preventing an immunogenic response; and ensuring successful cell engraftment and function at the injury site. To address this bottleneck we will combine mathematical modelling and experimental approaches to determine the impacts of the delivery route (e.g. intrasplenic vs intravenous), together with cell encapsulation with biocompatible and biodegradable immunoprotective micromatrices, on the biomechanical cues experienced by cells during their transit to the injury site. These cues are key as they modulate the cell behaviour, genotype and phenotype. We will develop mathematical models to describe the cross talk between the resulting modulated cells and their biochemical environment at the injury site, accounting for inflammation and host cellular senescence. This preclinical quantitative framework will enable optimisation of the cell therapy protocol to ensure the safe delivery of cells that are able to evade the immune system and successfully engraft and function at the injury site, and therefore facilitate successful clinical translation of next-generation cell therapies for liver disease.

The postholder will develop, analyse and solve two strands of new mechanistic mathematical models. Initial theoretical model development will be guided by analysis of experimental data allowing hypotheses to be made for the causal mechanisms underlying the biological system. Novel multi-scale and multiphysics mathematical models will be developed that incorporate driving processes on a range of spatial and temporal scales. Efficient and accurate computational methods for simulation of multi-scale multiphysics mathematical models will enable full investigation of potential model behaviours, parameter sensitivity analysis and data-driven model calibration. Once calibrated, the mathematical models will be validated via detailed comparison of the model predictions with the quantitative experimental data, and the mathematical models will be refined as necessary. The output will be the development of a quantitative preclinical framework that can be exploited to underpin the clinical translation of cell therapies for liver disease.

The first aim will be to determine the local biomechanical environment experienced by the cells during transit and assess the fraction of injected cells that reach the injury site. A continuum mechanics approach will be exploited, based on conservation of mass and momentum, resulting in coupled systems of nonlinear partial differential equations. The second aim will be to develop a suite of mathematical models to describe the cross talk between the cell source and the biochemical environment, accounting for inflammation and host cellular senescence. This aspect involves a myriad of cell types and molecules which will be described using spatially homogeneous time-dependent ordinary differential equations initially.

Applicants should have expertise in the mathematical modelling of physical systems, ordinary (ODEs) and partial differential equations (PDEs), and skills for solving ODEs and PDEs with either analytical or numerical methods. The post holder will report directly Professor Sarah Waters and be based in the Mathematical Institute. There will be a large amount of interaction between all the team members of this project (at Birmingham, Edinburgh and Roche (Basel)) and the successful candidate will be central to driving these

interactions. This will require some traveling by the postholder to Birmingham and Edinburgh Universities for discussions as well as F. Hoffman La Roche Ltd at Basel. The postholder will also provide guidance to junior members of the research group including doctoral students.

Responsibilities

The successful candidates will perform mathematical research on the project and will be expected to:

- Undertake high-quality, independent research under the leadership of Professor Sarah Waters, in collaboration with Birmingham and Oxford Universities and Project Partners F. Hoffman La Roche Ltd.

- Manage own academic research and administrative activities as well as coordinate research activities with other parts of the interdisciplinary research project. This involves small scale project management, to co-ordinate multiple aspects of work to meet deadlines

- Adapt existing and develop new research methodologies

- Prepare working theories and analyse qualitative and/or quantitative data from a variety of sources, reviewing and refining theories as appropriate

- Contribute ideas for new research projects

- Collaborate in the preparation of research publications, and book chapters

- Present papers at conferences or public meetings

- Act as a source of information and advice to other members of the group on methodologies or procedures

- Represent the research group at external meetings/seminars, particularly the meetings of all researchers on this multidisciplinary, multi-site project

- Carry out collaborative projects with colleagues in Birmingham and Edinburgh Universities, as well as the Project Partners at F. Hoffman La Roche Ltd

It is the policy of the Mathematical Institute to give all PDRAs the opportunity to teach, where the conditions of the grant allow this, and to require teaching if there is a departmental need. Such teaching, if undertaken, will not exceed 3 hours per week for 24 weeks of the year and additional remuneration will be paid. It will normally be delivered as classes, but it might also involve giving lectures or college tutorials.

Pre-employment screening

All offers of employment are made subject to standard pre-employment screening, as applicable to the post.

If you are offered the post, you will be asked to provide proof of your right-to-work and your identity. You will also be asked to complete a health declaration (so that you can tell us about any health conditions or disabilities so that we can discuss appropriate adjustments with you), and a declaration of any unspent criminal convictions.

We advise all applicants to read the candidate notes on the University's pre-employment screening procedures, found at: www.ox.ac.uk/about/jobs/preemploymentscreening/.

Selection criteria

Applicants will be expected to

- have, or be close to completing, a PhD in mathematics or a related discipline;

- have expertise in modelling physical systems using analytical or numerical approaches for solving ODEs and PDEs;

- possess sufficient specialist knowledge in the discipline to work within established research programmes;

- have the ability to work as part of an interdisciplinary team, in particular having the appropriate skills to communicate effectively across disciplines;

- have the ability to manage their own academic research and associated activities;

- have a good track record (for the stage of their career) of publications in leading international journals;

- have the ability to contribute ideas for new research projects;

- have excellent communication skills, including the ability to write for publication, present research proposals and results, and represent the research group at meetings.

Desirable selection criteria

- Experience of modelling problems related to cell biomechanics, fluid mechanics and/or tissue mechanics

- Experience of independently managing a discrete area of a research project

About the University of Oxford

Welcome to the University of Oxford. We aim to lead the world in research and education for the benefit of society both in the UK and globally. Oxford's researchers engage with academic, commercial and cultural partners across the world to stimulate high-quality research and enable innovation through a broad range of social, policy and economic impacts.

We believe our strengths lie both in empowering individuals and teams to address fundamental questions of global significance, while providing all our staff with a welcoming and inclusive workplace that enables everyone to develop and do their best work. Recognising that diversity is our strength, vital for innovation and creativity, we aspire to build a truly diverse community which values and respects every individual's unique contribution.

While we have long traditions of scholarship, we are also forward-looking, creative and cutting-edge. Oxford is one of Europe's most entrepreneurial universities. Income from external research contracts in 2016/17 exceeded £564m and we rank first in the UK for

university spin-outs, with more than 130 companies created to date. We are also recognised as leaders in support for social enterprise.

Join us and you will find a unique, democratic and international community, a great range of staff benefits and access to a vibrant array of cultural activities in the beautiful city of Oxford.

For more information, please visit www.ox.ac.uk/about/organisation.

The Mathematical Institute

The Mathematical Institute, as Oxford's Department of Mathematics is known, is one of the leading mathematics departments in the world. Our mathematical research, impact and environment were all ranked first in the UK in the 2014 Research Excellence Framework exercise, a government review of research in all UK universities. The Mathematical Institute is the focus of research into both fundamental mathematics and its applications, and our inclusive nature and overall size are key factors in the provision of an outstanding research environment for our members. The large number of faculty, postdocs and students in the Mathematical Institute, all supported by excellent facilities, allows us to maintain a critical mass in research groups encompassing a wide spectrum of mathematics, while our integrated nature fosters collaboration between fields. We also host a large number of academic visitors. Our web pages (www.maths.ox.ac.uk) provide comprehensive information about all of our activities.

The research activities of the Institute as a whole can be gauged from the web pages of the research groups and centres within the Institute (www.maths.ox.ac.uk/research). The range of our research interests is well reflected by the profile of our faculty as listed at www.maths.ox.ac.uk/people. Many members of the Institute have received prestigious prizes and other special recognition for their work; some recent examples can be found at www.maths.ox.ac.uk/news/awards-and-prizes.

The Mathematical Institute moved into the purpose-built Andrew Wiles Building in the University's Radcliffe Observatory Quarter in September 2013. As well as providing offices for all staff and graduate students, it houses a range of other facilities available to members of the department, including the Whitehead Library, a large range of meeting rooms, teaching spaces, lecture rooms, and social spaces, and a small facility for carrying out table-top experiments. For more information, see www.maths.ox.ac.uk/about-us.

Teaching is central to the life of the Mathematical Institute and we have around 900 undergraduates on course, some on joint courses with other departments. We teach around 250 students each year across five taught master's degree courses, and have over 250 doctoral students in residence at any one time. Our doctoral programme always attracts the best research students from across the world, and we have a broad mentoring and training programme.

The Mathematical Institute strives to ensure that all staff and students are given the opportunities and support they need to achieve their potential. We are committed to equality of opportunities and to advancing women's careers. We support staff returning from long-term absence and provide flexible arrangements for staff with parental responsibilities. Further information about family support can be found in the Standard Terms and Conditions. Our Good Practice Committee[1] contributes to many aspects of our work, see www.maths.ox.ac.uk/members/good-practice.

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[1] The Mathematical Institute was a founding supporter of the London Mathematical Society's Good Practice Scheme (www.lms.ac.uk/women/good-practice-scheme). We have held an Athena SWAN Bronze Award since 2013, upgraded to Silver in 2017.

As part of the department's commitment to openness, inclusivity and transparency, we strongly encourage applications from all who consider they meet the requirements of the post, and particularly from women and ethnic minorities.

MPLS Division

The University's Division of Mathematical Physical and Life Sciences contains departments that span the full spectrum of the mathematical, computational, physical, engineering and life sciences. Between them, they undertake a huge range of fundamental research and develop application that respond to the great societal and technological challenges of our time. Research across the Division is increasingly interdisciplinary in nature.

MPLS's scientists collaborate closely with colleagues in other Divisions across Oxford, with other universities, research organisations and industrial partners across the globe.

Our senior researchers have been awarded some of the most significant scientific honours (including Nobel prizes and prestigious titles such as FRS and FREng). The Division is equally proud of its tradition of attracting and nurturing the very best early career researchers, many of whom regularly secure prestigious fellowships.

The Division holds ten Athena Swan Awards (three silver and seven bronze) illustrating its commitment to encouraging women in science research and careers.

For more information visit http://www.mpls.ox.ac.uk/about/about-mpls-division

How to apply

Before submitting an application, you may find it helpful to read the 'Tips on applying for a job at the University of Oxford' document here.

If you would like to apply, click on the **Apply Now** button on the 'Job Details' page and follow the on-screen instructions to register as a new user or log-in if you have applied previously.

You will also be required to upload a
- curriculum vitae;
- list of publications;
- statement of research interests and supporting statement;
- two letters of reference.

The supporting statement should describe how you meet the selection criteria outlined in the job description. Please upload all documents **as PDF files** with your name and the document type in the filename.

Applicants should ask three referees to send their letters of reference DIRECTLY to

The Recruitment Co-ordinator (Vacancies)
The Mathematical Institute, Andrew Wiles Building, Radcliffe Observatory Quarter,
Woodstock Road, Oxford, OX2 6GG. Tel: 01865 273518: Email: vacancies@maths.ox.ac.uk

by the closing date (a letter by email is sufficient) **quoting the vacancy reference 145517.** Referees should preferably not, all be from the same institution and whenever possible one should be the applicant's current, or most recent, supervisor. **NOTE: reference letters must be received from your referees by the closing date for your application to be complete.**

All applications must be received by **12:00 noon UK time on Monday 27 April 2020.**

Information for priority candidates

A priority candidate is a University employee who is seeking redeployment because they have been advised that they are at risk of redundancy, or on grounds of ill-health/disability. Priority candidates are issued with a redeployment letter by their employing departments.

If you are a priority candidate, please ensure that you attach your redeployment letter to your application (or email it to the contact address on the advert if the application form used for the vacancy does not allow attachments)

Should you experience any difficulties using the online application system, please email recruitment.support@admin.ox.ac.uk. Further help and support is available from www.ox.ac.uk/about_the_university/jobs/support/. To return to the online application at any stage, please go to: www.recruit.ox.ac.uk.

Please note that you will be notified of the progress of your application by automatic emails from our e-recruitment system. **Please check your spam/junk mail** regularly to ensure that you receive all emails.

Important information for candidates

Data Privacy

Please note that any personal data submitted to the University as part of the job application process will be processed in accordance with the GDPR and related UK data protection legislation. For further information, please see the University's Privacy Notice for Job Applicants at: www.admin.ox.ac.uk/councilsec/compliance/gdpr/privacynotices/job/. The University's Policy on Data Protection is available at: www.admin.ox.ac.uk/councilsec/compliance/gdpr/universitypolicyondataprotection/.

The University's policy on retirement

The University operates an Employer Justified Retirement Age (EJRA) for all academic posts and some academic-related posts. The University has adopted an EJRA of 30 September before the 69th birthday for all academic and academic-related staff in posts at **grade 8 and above**. The justification for this is explained at: www.admin.ox.ac.uk/personnel/end/retirement/acrelretire8+/.

For **existing** employees, any employment beyond the retirement age is subject to approval through the procedures: www.admin.ox.ac.uk/personnel/end/retirement/acrelretire8+/.

There is no normal or fixed age at which staff in posts at **grades 1–7** have to retire. Staff at these grades may elect to retire in accordance with the rules of the applicable pension scheme, as may be amended from time to time.

Equality of Opportunity

Entry into employment with the University and progression within employment will be determined only by personal merit and the application of criteria which are related to the duties of each particular post and the relevant salary structure. In all cases, ability to perform the job will be the primary consideration. No applicant or member of staff shall be discriminated against because of age, disability, gender reassignment, marriage or civil partnership, pregnancy or maternity, race, religion or belief, sex, or sexual orientation.

Benefits of working at the University

Employee benefits

University employees enjoy 38 days' paid holiday, generous pension schemes, travel discounts, and a variety of professional development opportunities. Our range of other employee benefits and discounts also includes free entry to the Botanic Gardens and University colleges, and discounts at University museums. See www.admin.ox.ac.uk/personnel/staffinfo/benefits.

University Club and sports facilities

Membership of the University Club is free for all University staff. The University Club offers social, sporting, and hospitality facilities. Staff can also use the University Sports Centre on Iffley Road at discounted rates, including a fitness centre, powerlifting room, and swimming pool. See www.club.ox.ac.uk and www.sport.ox.ac.uk/oxford-university-sports-facilities.

Information for staff new to Oxford

If you are relocating to Oxfordshire from overseas or elsewhere in the UK, the University's Welcome Service website includes practical information about settling in the area, including advice on relocation, accommodation, and local schools. See www.welcome.ox.ac.uk. There is also a visa loan scheme to cover the costs of UK visa applications for staff and their dependents. See www.admin.ox.ac.uk/personnel/permits/reimburse&loanscheme/.

Family-friendly benefits

With one of the most generous family leave schemes in the Higher Education sector, and a range of flexible working options, Oxford aims to be a family-friendly employer. We also subscribe to My Family Care, a service that provides practical advice and support for employees who have caring responsibilities. The service offers a free telephone advice line, and the ability to book emergency back-up care for children, adult dependents and elderly relatives. See www.admin.ox.ac.uk/personnel/staffinfo/benefits/family/mfc/.

Childcare

The University has excellent childcare services, including five University nurseries as well as University-supported places at many other private nurseries.
For full details, including how to apply and the costs, see www.admin.ox.ac.uk/childcare/.

Disabled staff

We are committed to supporting members of staff with disabilities or long-term health conditions. For further details, including information about how to make contact, in confidence, with the University's Staff Disability Advisor, see www.admin.ox.ac.uk/eop/disab/staff.

Staff networks

The University has a number of staff networks including the Oxford Research Staff Society, BME staff network, LGBT+ staff network and a disabled staff network. You can find more information at www.admin.ox.ac.uk/eop/inpractice/networks/.

The University of Oxford Newcomers' Club

The University of Oxford Newcomers' Club is an organisation run by volunteers that aims to assist the partners of new staff settle into Oxford, and provides them with an opportunity to meet people and make connections in the local area. See www.newcomers.ox.ac.uk.