## BIG DATA INSTITUTE

<table>
<thead>
<tr>
<th>Job title</th>
<th>Senior Postdoctoral Research Scientist in Malaria Vector Genomics and Modelling</th>
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<tbody>
<tr>
<td>Division</td>
<td>Medical Sciences</td>
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<tr>
<td>Department</td>
<td>Nuffield Department of Medicine</td>
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<tr>
<td>Location</td>
<td>Big Data Institute Building, Li Ka Shing Centre for Health Information and Discovery, Old Road Campus, Oxford, OX3 7LF</td>
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<tr>
<td>Grade and salary</td>
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<tr>
<td>Hours</td>
<td>Full time</td>
</tr>
<tr>
<td>Contract type</td>
<td>Fixed term until October 2020</td>
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<tr>
<td>Reporting to</td>
<td>Dominic Kwiatkowski Group Head and Alistair Miles Head of Epidemiological Informatics</td>
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<td>Vacancy reference</td>
<td>136286</td>
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<tr>
<td>Research topic</td>
<td>Investigating the use of mosquito genome sequence data to inform and improve computational models of malaria vector population dynamics that provide predictions regarding the spread of insecticide resistance and introduced genetic modifications.</td>
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<tr>
<td>Principal Investigator / supervisor</td>
<td>Prof Dominic Kwiatkowski</td>
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<tr>
<td>Project team</td>
<td>Genomics and Global Health</td>
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<tr>
<td>Project web site</td>
<td><a href="http://www.ox.ac.uk/">www.ox.ac.uk</a>  <a href="http://www.malriagen.net">www.malriagen.net</a></td>
</tr>
<tr>
<td>Funding partner</td>
<td>The funds supporting this research project are provided by Open Philanthropy</td>
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### 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

Medical Sciences

The Medical Sciences Division is an internationally recognized centre of excellence for biomedical and clinical research and teaching. We are the largest academic division in the University of Oxford

World-leading programmes, housed in state-of-the-art facilities, cover the full range of scientific endeavour from the molecule to the population. With our NHS partners we also foster the highest possible standards in patient care.

For more information please visit: www.medsci.ox.ac.uk

Nuffield Department of Clinical Medicine (NDM) ...fostering your career in science

The Nuffield Department of Clinical Medicine (NDM) is one of the largest departments of the University of Oxford and is part of the Medical Sciences Division, with responsibility for a significant part of the teaching of clinical students within the Medical School.

NDM has significant financial turnover and complexity, resulting from its diverse research portfolio, its geographical spread and its close links with NHS funding and strategic teams involved in the development and delivery of increasingly integrated clinical research platforms. For more information please visit: http://www.ndm.ox.ac.uk/home

The Nuffield Department of Clinical Medicine has been presented with a Departmental Athena SWAN Silver award in recognition of the commitment made to promote gender equality through our organisational and cultural practices and our efforts to improve the working environment for both men and women. For more information please see our Departmental Athena SWAN pages: https://www.ndm.ox.ac.uk/working-for-ndm/aboutndmatheneswan/

The Oxford Big Data Institute

The Oxford Big Data Institute (https://www.bdi.ox.ac.uk/) is an interdisciplinary research centre focussing on the analysis of large, complex, heterogeneous data sets for research into the causes and consequences, prevention, and treatment of disease. To this end, BDI researchers
develop, evaluate and deploy efficient methods for acquiring and analysing information for large clinical research studies. These approaches will be invaluable in identifying the associations between lifestyle exposures, genetic variants, infections and health outcomes around the globe.

The role

Scientific Background
Malaria remains a major cause of human disease, particularly in Africa. The most effective way to control malaria in Africa is to prevent mosquitoes from transmitting the disease. Over the past two decades major mosquito control campaigns have been mounted using insecticide-based control tools, with considerable success. Many mosquito populations are, however, now resistant to insecticides, and these campaigns require massive logistical operations to distribute bed nets and spray houses, incurring substantial cost and complexity. Recent technological advances in genome sequencing and genome editing are opening up new opportunities for the development of highly effective and scalable mosquito control tools.

Two large scientific projects are pioneering the development and application of new genomic technologies to malaria control in Africa. The Malaria Genomic Epidemiology Network (MalariaGEN) has brought together partners from across Africa to sequence the genomes of thousands of mosquitoes collected from the field, and has built the world’s largest reference data resource of natural genetic variation in mosquito populations. The Target Malaria project is the global leader in the development of genome editing technologies with the capability to suppress or modify mosquito populations on a large scale. These two projects are working together to accelerate the development of new genetic technologies for mosquito control, and to model and design optimal strategies for deployment in the field.

A number of important questions need to be answered before genetic control technologies could be deployed in the field. These questions all relate to the ecology and behaviour of the mosquito populations being targeted. For example, we need to know how large mosquito populations are, and how their size fluctuates between seasons and years. We also need to know how mosquitoes are moving over the landscape, in terms of the rate, range and timing of their movement. In particular, there is evidence that different mosquito species and populations have evolved different strategies for surviving the dry season. Some mosquito populations may be coping with seasonal variations in rainfall by engaging in long-distance wind-assisted migration, and others may be able to remain in arid areas by aestivating for several months. We need to establish whether these behaviours are occurring, and if so, estimate key parameters that characterise these behaviours.

These questions are difficult to answer directly via field work. However, they can be answered indirectly via statistical inferences from genome sequence data. As DNA sequences are passed down from generation to generation via mating and reproduction, the processes of recombination and mutation create patterns in the data. These patterns can be observed by sequencing the genomes of present-day individuals, and can be used to infer various aspects of the demographic history of the population of individuals from which the DNA sequences were sampled. Our aim is to use statistical inferences from genome sequence data to fill in these missing gaps in our knowledge of mosquito behaviour and ecology. Those inferences will provide robust estimates for key ecological parameters, which can then be input into computational models that predict how a genetic control construct would spread within mosquito populations, and thus enable the design of optimal deployment strategies.
Overview of role
You will be involved in the analysis of mosquito genome sequence data generated by MalariaGEN in partnership with the Target Malaria project and other partners. The data are derived from whole-genome sequencing of thousands of mosquitoes collected from field sites in Mali, Burkina Faso, Uganda, and a number of other African countries. Mosquitoes have been collected and sequenced from several field sites within each country, and have been regularly sampled over a period of several years, thus there is a comprehensive data resource spanning both spatial and temporal dimensions. All mosquitoes are individually sequenced to high depth at the Wellcome Sanger Institute, and pipelines are already in place to process the sequence data to generate high quality, analysis-ready genotype and haplotype data.

The main focus of the role will be on exploring and analysing these data and applying computational and statistical methods to make inferences about mosquito population dynamics and demographic history. The general field of statistical genetics is an extremely active and fast-moving area of research, and new developments are continuously emerging from similar biological studies on human populations and a range of other species that could be applied to mosquitoes. However, the population biology of mosquitoes is quite different from many other species, and we expect a considerable amount of effort will be required to investigate, adapt and evaluate available statistical methods and computational tools. We also expect that some development of novel statistical methods and computational tools will be required. A deep and intimate familiarity with the data will also be necessary, and an important part of the role will be to perform a range of exploratory population-genetic analyses to understand the data and the mosquito populations that have been sampled, and to identify the features within the data that are most informative for the inferences we want to make. Finally, another aspect of the role will be to perform computer simulations of mosquito populations under a range of demographic scenarios, to build intuitions for how patterns in the genetic data can be related to demographic processes, and to evaluate the sensitivity and specificity of different inferences methods.

This role requires strong skills in bioinformatics, statistics, and population biology and will operate at the leading edge of this area of science.

Main Responsibilities
You will:

- Develop and implement a research plan for the use of large-scale genomic data sets to inform and improve computational models of malaria vector population dynamics consistent with the overall objectives of MalariaGEN and Target Malaria and the interests and expertise of the PI.

- Conduct statistical and computational analyses of large-scale genomic data sets. This will involve tailoring or developing novel statistical methods to meet the project’s research objectives and maximise the information gain from the rich data set.

- Apply, evaluate, adapt and improve statistical methods for demographic inference from genomic data.

- Estimate key parameters defining the ecology and behaviour of African mosquito populations; investigate the impact of uncertainty in those parameters on computational models of mosquito population control.
• Contribute to the production of scientific reports and publications for high profile journals, including taking leadership in more specialised publications on novel aspects of bioinformatics. Author manuscripts, technical reports, presentations and other means of publicly disseminating results.

• Contribute to open source software for the analysis of large-scale genomic data sets.

• Work closely with colleagues and collaborators within the MalariaGEN and Target Malaria consortia, providing regular progress reports and participating in teleconferences, meetings and workshops on both technical and biological topics.

• Represent the research group at external scientific and technical meetings, seminars and conferences; remain up to date with recent developments in relevant fields.

• Keep accurate records of analytical plans, work and results; be responsible for creating reproducible analytical outputs.

• Communicate with the group head regularly, ensuring they are kept fully informed of research progress.

• Work independently but also as part of the wider research team, interacting co-operatively with senior and junior colleagues and sharing resources.

• Report and communicate research results to other members of the MalariaGEN team, including presentations at project meetings and workshops.

• Present research papers at national conferences, and lead seminars to disseminate research findings (internal and external).

• Contribute to reporting and data sharing requirements that are specified in the respective grant agreements (deliverable and milestone reports, and annual reporting).

• Be accountable for personal professional conduct within the project.

• Give due regard to the University Equal Opportunities, Data Protection and other relevant policies.

• Agree clear task objectives, organise, and delegate work to other members of the team and coach other members of the group on specialist methodologies or procedures.

Selection criteria
Essential

• A PhD in a subject with a substantial quantitative and/or computational component, or equivalent experience in a commercial setting.
• Previous experience of processing and analysing large data sets.
• Previous experience of applying statistical inference and/or machine learning methods to non-trivial data sets.
• Fluent with a high-level programming language (e.g., Python, R or MATLAB).
• Proven ability to plan and execute complex analytical projects.
Proven ability to think scientifically, i.e., exploring data to generate hypotheses, designing appropriate analyses to test hypotheses, estimating uncertainty and drawing balanced, evidence-based conclusions.

- Ability to work both independently and as part of an integrated team.
- Excellent English written and verbal communication skills.
- Experience of substantial contributions to peer-reviewed scientific papers or equivalent experience of written technical communication.

Desirable

- Experience of population genetics.
- Experience of infectious disease epidemiology.
- Experience of analysing data from high-throughput genome sequencing studies.
- Experience of disease modelling or analogous modelling via computer simulation.
- Experience of geostatistical modelling.
- Fluent with C or C++.
- Previous experience of contributing to open source software projects.
- Experience of giving talks at conferences, seminars etc.

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, at www.ox.ac.uk/about_the_university/jobs/research/

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. Please provide details of two referees and indicate whether we can contact them now.

You will also be asked to upload a CV and a supporting statement. The supporting statement should explain how you meet the selection criteria for the post using examples of your skills and experience. This may include experience gained in employment, education, or during career breaks (such as time out to care for dependants).

Your application will be judged solely on the basis of how you demonstrate that you meet the selection criteria stated in the job description.

All applications must be received by midday on the closing date stated in the online advertisement.

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

Pre-employment screening

Please note that the appointment of the successful candidate will be subject to standard pre-employment screening, as applicable to the post. This will include right-to-work, proof of identity and references. 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/.

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. From 1 October 2017, 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+/

From 1 October 2017, 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

**University Club and sports facilities**

The University Club provides social, sporting and hospitality facilities. It incorporates a bar, café and sporting facilities, including a gym. 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 international staff (or those relocating from another part of the UK)**

If you are relocating to Oxfordshire from overseas, or elsewhere in the UK, the University's International Staff website includes practical information related to moving to and settling in Oxford such as advice on immigration, relocation, accommodation, or registering with a doctor. See: www.internationalstaffwelcome.admin.ox.ac.uk/

**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 to settle into Oxford and to provide them with an opportunity to meet people in the area. See www.newcomers.ox.ac.uk/

**Childcare**

The University has excellent childcare services with 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.

**Family-friendly benefits**

The University subscribes to My Family Care (www.admin.ox.ac.uk/personnel/staffinfo/benefits/family/mfc/) and staff are eligible to register for emergency back-up childcare and adultcare services, a 'speak to an expert' phone line and a wide range of guides and webinars through a website called the Work + Family space.

**Disabled staff**

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

**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/

**Other benefits**

Staff can enjoy a range of other benefits such as free visitor access to the University’s colleges and the Botanic Gardens as well as a range of discounts. See www.admin.ox.ac.uk/personnel/staffinfo/benefits