Wellcome Trust PhD Programme in Mathematical Genomics and Medicine

Centre for Mathematical Sciences,
Wilberforce Road, Cambridge

Biomedical Research campus
Clinical School of Medicine

Wellcome Trust Sanger Institute
Contents

1. Introduction .............................................................................................................. 3
   1.1 Management Committee .................................................................................. 3

2. Departments, Institutes & Colleges ................................................................. 3

3. Guidelines for Students and Supervisors and general information ............ 5

4. Course Content ..................................................................................................... 6

5. Research Training, Transferable Skills Training & Log books ............ 10

6. Deadlines, useful dates and other information ............................................. 11
   6.4 Useful Links: .................................................................................................... 12
1. Introduction

This 1 + 3 year MRes + PhD programme is a collaboration between the University of Cambridge and The Wellcome Trust Sanger Institute. The programme will provide the opportunity to work at the interface between the mathematical and computational sciences, and genome-scale and translational medical research. We expect that students will have strong mathematical, statistical and computational skills, and may include among them exceptional biologists. You will develop quantitative techniques and theoretical approaches and apply them to practical problems in both translational and basic biomedical research.

Year 1 comprises a tailored first year of taught modules drawn from the existing Masters level courses in Computational Biology, Advanced study in Mathematics, Epidemiology, and Translational Medicine and Therapeutics; each student will also undertake two research rotations. You will be enrolled as a student of DAMTP and subject to assessment of satisfactory progress in year 1 students will then move to the probationary first year of the three year PhD to commence their research project, which could be any of the Science Schools of the University. All students will have two supervisors, one from a mathematics, engineering or other quantitative science background, and the second from a genetics or genomics/biomedical background.

1.1 Management Committee
Programme Director: Professor Simon Tavaré - st321@cam.ac.uk
Deputy Directors:
  Professor John Todd
  Dr Gos Micklem - gm263@cam.ac.uk
  Dr Richard Durbin
  Dr Jeffrey Barrett
  Dr Chris Wallace
Secretary to the Management Committee: Jo Heritage jkh47@medschl.cam.ac.uk

Please contact Professor Tavare or Dr Micklem with any queries, advice or guidance around research proposals and your academic progression.

2. Departments, Institutes & Colleges

2.1 Department of Applied Mathematics and Theoretical Physics

The Department of Applied Mathematics and Theoretical Physics (DAMTP) is one of two Mathematics Departments at the University of Cambridge, the other being the Department of Pure Mathematics and Mathematical Statistics (DPMMS). The two Departments together constitute the Faculty of Mathematics, and are responsible for teaching Mathematics and its applications within the Mathematical Tripos.

Both Mathematics Departments are located alongside the Isaac Newton Institute for Mathematical Sciences and the Betty and Gordon Moore Library at the Centre for Mathematical Sciences.

DAMTP has a 50-year tradition of carrying out research of world-class excellence in a broad range of subjects across applied mathematics and theoretical physics. Members of DAMTP have made seminal theoretical advances in the development of mathematical techniques and in the application of mathematics, combined with physical reasoning, to many different areas of science. A unique strength is the G K Batchelor Laboratory, in which fundamental experimental science is also performed. Research students have always played a crucial role in DAMTP research, working on demanding research problems under the supervision of leading mathematical scientists and, in many cases, moving on to become research leaders themselves. The current aims of DAMTP are to continue this
In tradition, in doing so broadening the range of subject areas studied and using new mathematical and computational techniques.

DAMTP has approximately 50 academic staff, 85 postdoctoral staff and 110 research students, supported by a team of 30 administrative, technical and secretarial staff under the guidance and leadership of Head of Department, Professor Peter Haynes. As a member of DAMTP, you are encouraged to interact as much as possible with colleagues at DPMMS. There are many joint ventures, seminars, lectures, and social events.

2.2 Biomedical Research Campus-Clinical School of Medicine

The Cambridge Biomedical Campus is located on a green-field site to the southern edge of Cambridge and comprises (i) the University School of Clinical Medicine with its 12 Departments and associated Institutes, (ii) Addenbrooke’s Hospital, a major University Teaching Hospital with 1100 beds and providing regional services to the whole of the east of England, and (iii) two directly funded Research Institutes – the Medical Research Council Laboratory of Molecular Biology (MRC LMB), and the Cancer Research UK Cambridge Research Institute (iv) the GSK Clinical Research Unit the UK’s largest pharmaceutical company, which houses its European Clinical Unit on site, immediately adjacent to the Wellcome Trust Clinical Research Facility (CRF).

2.3 The Wellcome Trust Sanger Institute (WTSI)

The Wellcome Trust Sanger Institute is a charitably funded genomic research centre located in Hinxton, nine miles south of Cambridge. It is a leader in the application of genomics to health and disease, uncovering the basis of genetic and infectious disease and providing results that can be translated into diagnostics, treatments or therapies that reduce global health burdens. Research is broadly divided into several main areas: human genetics, cancer genomics, mouse and zebrafish genetics, pathogen genetics and bioinformatics.

More information about The Wellcome Trust Sanger Institute is available on the following link: www.sanger.ac.uk/

2.4 Colleges

A graduate student also becomes a member of one of the 31 colleges in the University with the opportunity to meet staff and students from other disciplines, participate in a wide variety of cultural, sporting and social activities and arrange accommodation and meals.
3. Guidelines for Students and Supervisors and general information

This section describes what is expected of you (and your supervisor) in your capacity as a Research Student. It should be noted that, apart from these local arrangements, the University, through the Board of Graduate Studies (BGS), has its own regulations applying to all research students, as set out on the BGS website: http://www.admin.cam.ac.uk/offices/gradstud/current/.

All research students carry out their work under the direction of a supervisor who, in the first year will be the director of the programme Professor Simon Tavaré, st321@cam.ac.uk. Subject to satisfactory progress you will then work with your proposed PhD supervisor to develop a research proposal and be considered for acceptance and transfer to their department to commence the first year of your three year PhD (which is effectively the 2nd year of your MGM programme). You will then be a probationary PhD student for that year. Your PhD supervisor may not be same supervisor as in year 1 of the programme. Throughout the programme all students will be assigned a second supervisor in a complementary field, and an advisor to provide support outside the project. If your chosen PhD research is based at the Sanger, please note that your Sanger supervisor will not be the primary supervisor as WTSI has its own dedicated PhD programme. A University primary supervisor will be allocated to you from the same department in agreement with the Degree Committee. Where a student is registered with a University Partner Institution (UPI) and the supervisor is not a University employee, the UPI will identify and nominate an appropriate University Supervisor for appointment by the Degree Committee.

3.1 1st Year
The duty of your first year supervisor is to guide your research proposal and monitor your progress towards preparing for your PhD years (2nd-4th year). You will meet on a regular basis, and your supervisor will provide guidance on rotation projects, attendance to a range of courses from across the science schools of the University and PhD subject area selection, and provide assistance and advice as and when necessary.

Students are formally evaluated at the end of the first year and the evaluation is based on written rotation reports, two supervisor rotation reports, courses attended and the student log book. In addition, approval of the PhD proposal by the Wellcome Trust, incoming department and degree committee acceptance to continue to the 2nd year is required.

Students who are successful progress to the second year and those who are not exit the program. Those who are not successful will have their work assessed for consideration of an MRES if their assessment is sufficiently good and with no qualification otherwise.

During the Easter Term and summer you should be approaching potential PhD supervisors and discussing a research proposal to submit to the directors and Wellcome Trust for consideration.

3.2 2nd Year – Probationary PhD
In the second year, subject to satisfactory progress in the 1st year, PhD proposal approval by the Wellcome Trust and acceptance of your proposal by the incoming department and degree committee, you will move to your PhD supervisors and department as a probationary PhD student.

You should agree a programme of regular progress meetings with your supervisors.

At the end of this year you will undergo a viva to assess your progress and be considered for registration to full PhD status.

NB: Those supervisors who have accepted MGM students in the past year cannot take on a new student in the following year. They may take on a student in the next year after that.
3.3 3rd & 4th Year - Full PhD
In the third year and fourth year meetings are arranged according to need and by mutual agreement. At the final writing stage, you should be producing draft sections of your thesis, for the supervisors to read and comment on.

The primary supervisor will write regular reports on CGSRS (the Cambridge Graduate Supervision Reporting System) that you will be able to view on CamSIS.

The supervisors will also keep a record of your meetings and progress. Supervisors are often busy, so it is best to be proactive in your approach.

3.4 Graduate Education support
Each school has a graduate education committee overseeing admissions, research and other training, transferable skills training, monitoring progress and completion. In the first year you will be working under the graduate education committee in DAMTP.

Depending on where you decide to spend your PhD years (years 2-4 of the programme) you will either fall under the Graduate Education Committee for Biological Sciences, the School of Clinical Medicine or Mathematics.

3.5 Clinical Academic Training Office (CATO)
Due to the unique collaborative nature of this programme and the subsequent dispersal of its students in laboratories and institutes throughout Cambridge, additional administrative support is available from the Clinical Academic Training Office (CATO). CATO is available to assist with applications, identifying supervisors and projects, and will carry out the necessary administrative process when moving from the first year at DAMTP to PhD supervisor laboratories.

Graduate Programme Manager: Mrs Elizabeth McIntyre ejm45@medschl.cam.ac.uk
Graduate Programme Administrator: Jo Heritage jkh47@medschl.cam.ac.uk

4. Course Content

4.1 Year 1:
You will be based in the Department of Applied Mathematics and Theoretical Physics and you will undertake an individually designed programme of courses drawn from, but not limited to, the following Master level courses.

- MPhil in Computational and Systems Biology [www.ccbi.cam.ac.uk/Education/MPhil/]
- Master of Advanced Study in Mathematics [www.maths.cam.ac.uk/postgrad/mathiii/]
- MPhil in Epidemiology [www.phpc.cam.ac.uk/graduate-studies/mphil-in-epidemiology/]
- Wellcome Trust Sanger course in Genomic Technologies [www.wellcome.ac.uk/Education-resources/Courses-and-conferences/Advanced-Courses-and-Scientific-Conferences/Advanced-Courses/index.htm]
- MPhil in Clinical Medicine/Translational Medicine and Therapeutics (TMAT) [http://cato.medschl.cam.ac.uk/graduate-programmes/mphil-in-clinical-science/]
### 4.1.1 Year 1 milestones and activities

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### PhD project selection

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4.1.2 Year 1 Rotations

In addition to individual curricula students will undertake two research rotations in the first year of the programme, each lasting approximately eight weeks.

Supervisors will nominate rotation projects by writing a one-page outline, including background reading, before Friday 4 December 2015 (the end of the first term). These will be posted on the programme's internal website. Students will arrange to discuss projects of interest with the supervisors and will be allowed to nominate 4 ranked choices of project to the CATO office at jkh47@medschl.cam.ac.uk. Likewise, supervisors will rank applicants and the Management Committee will match students with supervisors accounting for the rankings/nominations as much as possible.

At the end of each rotation students will be expected to present a report to the management committee. The deadline for the first rotation report is mid-June, for the second report it is mid-August.

4.1.3 Annual Research Day

All students regardless of year will present either orally or by poster presentation at the Annual Research Day held in May. This is a two day event with the first day dedicated solely to this programme, student talks and posters followed by in depth afternoon discussions. The second day is dedicated to the Cambridge Computational Biology Institute (CCBI) Annual Symposium, which is now in its eighth year and is attended by around 180 researchers. Attendance at this two-day event is mandatory for all students on this programme.

4.1.4 Wednesday meetings – subject to change

All students regardless of year will attend the fortnightly Wednesday meetings during full term. For first year students this will be an excellent opportunity to meet with potential PhD supervisors from other schools/departments and also a chance for the whole student group to get together. The timetable for these is posted on the programme website at www.ccbi.cam.ac.uk/Events/Seminars/ and http://cato.medschl.cam.ac.uk/events.

Each of these meetings will be held at DAMTP and will begin at noon with an informal self-bought lunch followed by:

- **Critical Thinking Workshop:** lead by one of the supervisor pool members. This workshop will focus on a small set of related papers that the students will read in advance and then discuss critically. (1-2pm)
- **DAMTP MPhil Seminar:** (2-3pm) see link above
  - Break
- **Student talks:** Two students from the 3rd and 4th Year will present a 15 minute talk each on a paper or their research. Papers to be circulated in advance where necessary. (3.30-4pm)
- **Journal Club:** 2nd Year students will organise for 1st and 2nd Years to conduct two ½ hour talks to include their supervisor if required. Students will present a published paper for discussion by their peers, relevant supervisors and or researchers. Papers will be circulated in advance. (4-5pm)
4.1.5 First year assessment and Progression to PhD

At the end of your 1\textsuperscript{st} year your progress will be assessed for consideration to progression to the probationary year of your PhD.

Assessment will be based on the two rotation reports, any course work you may have undertaken and your log book (details of this are explained below).

You will also be required to submit your PhD research proposal to the Wellcome Trust. This proposal requires rotation reports from supervisors and approval from the programme directors. All these documents should be forwarded to jkh47@medschl.cam.ac.uk and they will then be reviewed by the management committee toward the end of the academic year. If satisfactory progress is made you will be put forward for consideration for PhD.

During this period you will be in close discussion with your proposed PhD supervisor with whom you will conduct your 3 year PhD research project. Your PhD supervisor and research may be based in a different department and School to which you were registered for your 1\textsuperscript{st} year. Therefore your transfer to that new department will be subject to approval and acceptance by that department and degree committee. Once accepted you will then be registered as a probationary (NOTAF) PhD student.

4.2 Year 2

On the second year of the programme you will be registered as a probationary (NOTAF) PhD student. This is effectively the 1\textsuperscript{st} year of your 3 year PhD research project. Progression to registration for full PhD at the end of this year is subject to an assessment (viva). You and your department are responsible for arranging this process. However, instructions from the Degree Committee of the School of Graduate Life Sciences is included below for your information.

As you will know, you are not registered for the PhD degree until the end of your first year (probation year) of the PhD. This is to ensure that the study you have embarked upon suits you and that you are making satisfactory progress. Towards the end of your probationary year, you will be asked to produce a report. This, together with your student Log and the reports of your supervisor and assessors, forms the basis for the recommendation that you should be formally registered for admission to the PhD programme. It is also, since it involves the production of a piece of scientific writing and the opportunity to reflect upon the progress and direction of your research, an important part of your transferable skills training.

4.3 Year 2-4

Overview: Once students have started their research projects they will be supervised throughout and progress reports submitted termly to the degree committee by their supervisor. The way progress is assessed varies slightly from department to department but your departmental administrator can guide you in this. In the 3\textsuperscript{rd} year you will be asked to submit and discuss a plan for your 4\textsuperscript{th} and final year – outlining a timetable of their remaining research activities and skeleton outline of their thesis. By the middle of the third year, the majority of your research work should be complete and the drafting of several chapters of your thesis should be well underway.

4.4 Lifecycle of a PhD Student

Detailed information on all aspects of the Lifecycle of a 1+3 PhD student, with relevant links and processes can be found here:

http://www.gradschl.lifesci.cam.ac.uk/Current%20Students/Lifecycles/PhD
5. Research Training, Transferable Skills Training & Log books

5.1 Each school has its own version of a Research Training and Transferable Skills Log Book and in the first year you will be working within the framework of DAMTP. This record should be included with your research proposals at the end of the first year and also presented when you come to submit your first year PhD report in term seven of the programme. Follow the link to the pdf or word version of the log at www.damtp.cam.ac.uk/internal/graduate/. It is short and easy to complete.

In years 2-4 students will take the equivalent of ten days training (20 credits) per year from the wide selection of courses available.

In the first year, credit will be gained as follows:

- 'Wednesday meetings': 0.5 credit per meeting (~10 per year in total)
- Leading a journal club: 1 credit
- Annual 'retreat' talk: 1 credit
- Annual retreat poster: 1 credit
- Rotation 1 write up: 4 credits
- Talk at rotation 1 lab group meeting: 1 credit
- Rotation 2 write up: 4 credits
- Talk at rotation 2 lab group meeting: 1 credit

It is important that you keep a record of all courses, lectures and seminars you have attended or given on the Skills Training Log form, a copy of which will be in your induction pack, and on the programme wiki. This form, which should be submitted with your first year report, will also enable you to record all your training activities.

The purpose of graduate study is not just to produce a brilliant thesis, but also to learn the skills which will allow you to have a successful career, whether in research and teaching, or beyond academia, for example in industry. Your supervisor will be responsible for much of your training, by helping you to acquire the skills needed to survey the literature, show you how to organise your work, how to keep records, and to present your results in a clear and coherent way.

Other aspects of research training and TST are addressed as follows:

- Presentation skills:
  Your work must be communicated to be effective. You learn communication skills primarily by giving talks and using feedback to make improvements. Different research groups have different ways of organising this aspect of your training and in your first year you will follow the process as outlined by your supervisors.

  In addition, in your first year of research, you should give a short talk either to your group, as part of the Wednesday meetings, or at the annual research day.

  In year two you will be expected to give a talk on your research at the end of the academic year as well as presenting it during the Wednesday meetings.

  In the third year, it is expected that you will give a full-length seminar, either in your department and/or a seminar at another institute and/or a talk at a conference.
• **Supervision Training:**
  All research students have the opportunity to give supervisions (small group teaching) to undergraduates. This is normally arranged through Colleges, and can be a useful supplement to income. There is no requirement whatsoever to supervise, and students rarely do more than 3-4 hours per week. Even if you do not wish to supervise, it is an important part of your training to learn the skills required. We therefore expect all new graduate students to attend one of the training sessions which are organised by the Human Resources Department [www.admin.cam.ac.uk/offices/hr/cppd/graduates/#courses](http://www.admin.cam.ac.uk/offices/hr/cppd/graduates/#courses)

• **Writing Skills:**
  During the course of your training you will need to acquire writing skills, in particular for scientific writing (reports, papers and your dissertation). It is important to learn how to present your work clearly. Various workshops will be available to give you advice and practice. If your first language is not English, the Language Centre and Graduate Union can advise you on additional help.

Courses on writing and presentation skills are provided by the Graduate school and you are strongly encouraged to attend these: [www.biomed.cam.ac.uk/gradschool/skills.html](http://www.biomed.cam.ac.uk/gradschool/skills.html)

Second year students whose progress justifies it are encouraged to submit an essay for the Smith-Knight and Rayleigh-Knight contests. The essays are read and graded by a jury of CMS professors. Although the essays are not part of the formal assessment process, they offer an excellent opportunity to present your work in a clear and coherent manner, possibly gain a cash prize and, were your essay to be graded in a high category, a very useful entry on your CV.

5.2 **Attendance**

Regular attendance is extremely beneficial for the progress of a student’s research. Accordingly, you are expected to keep regular hours, and to be present in the Department for a substantial part of each weekday, for example 0900 to 1730 or 1000 to 1830 (more if you wish). Holiday entitlement is normally 6-8 weeks per year in total and you are urged to take some holiday every few months to provide a proper break from study.

Please keep your supervisor informed if you are going to be away for an extended period, for whatever reason. Advance notice of planned absences of more than 2 weeks must be discussed with the supervisor (if you are an international non-EU student, you also need to advise your College Tutor since the immigration regulations require the University to keep track of students’ time away from University).

6. **Deadlines, useful dates and other information**

<table>
<thead>
<tr>
<th>Event</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>Induction day (MPhil) followed by lunch</td>
<td>To: DAMTP/CMS</td>
</tr>
<tr>
<td>Induction day (CATO)</td>
<td>TBA</td>
</tr>
<tr>
<td>Induction day (Graduate School of Life Sciences)</td>
<td>Please see web link for dates <a href="http://www.gradschl.lifesci.cam.ac.uk/skills/events/annual/induction/">www.gradschl.lifesci.cam.ac.uk/skills/events/annual/induction/</a></td>
</tr>
<tr>
<td>Christmas dinner</td>
<td>To be advised</td>
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<tr>
<td>Smith-Knight and Rayleigh-Knight contests</td>
<td>To be advised</td>
</tr>
<tr>
<td>Smith-Knight and Rayleigh-Knight contests</td>
<td>Venue to be advised</td>
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<tr>
<td>First rotation</td>
<td>To: CATO</td>
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<tr>
<td>Submit choices</td>
<td>To: CATO</td>
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<tr>
<td>Report</td>
<td>To: CATO</td>
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<tr>
<td>Annual Research Retreat (MGM and DAMTP)</td>
<td>To: TBC</td>
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<td>To: TBC</td>
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6.1 Progress in Research, Fees and Completion

Your University fees will be automatically remitted from the thirteenth term onwards. Maintenance support will come from your funding body for the duration of this 4-year award, but not longer. It is essential that you submit your thesis before the end of your 3rd year of research (4th year of the programme), when you will be automatically removed from the Register. If you think that you may have difficulties in meeting this deadline, you must discuss this with your supervisors at the earliest possible opportunity.

While your supervisors are available for advice and direction, you have the final responsibility for writing and submitting the dissertation, and for checking that the work in it is free from error. The work presented must be your own; if some of the material has been produced in collaboration, this must be declared, on a form available from the Board of Graduate Studies. Your supervisors can advise you in doubtful cases.

6.2 Expense claims

As scholarship awardees you will have budgets for training, meetings and conferences and associated travel allocated to you. For expense claims use the following form: http://www.admin.cam.ac.uk/offices/finance/forms/expenses/expenseforms.html

Wellcome Trust has list of acceptable expenditures but you should check the procurement processes of the University with CATO to make sure. For unusual or large expenditures, ie IT equipment/software or training courses not offered at Cambridge you will need to seek Programme director approval before committing. Again please contact CATO with your request.

6.2.1 Financial Procedures Manual, Chapter 5b

“2.1.5c) Claims should be supported by documentary evidence of expenditure e.g. receipts, invoices, bills. If these are not available, claims may be paid for items less than £5 provided there are not a significant number of such items. Otherwise they are not reimbursable except in exceptional circumstances and in that event will be taxable.”

6.3 Other department handbooks

You will have been given a handbook from DAMTP that provides some department-specific information, including library use, useful links and societies. This also contains information about access and safety while on site. When you move to your PhD years your new department will also provide you with similar details of their site and what you can expect. In the meantime if you still have questions relating to the programme please do not hesitate to contact your dedicated admin team at CATO or the staff at DAMTP. Best of luck!

6.4 Useful Links:

DAMTP - http://damtp/
Centre for Mathematical Science - www.cms.cam.ac.uk/
Wellcome Trust Sanger Institute - www.sanger.ac.uk/
Medical Research Council Laboratory for Molecular biology - www2.mrc-lmb.cam.ac.uk/
Cambridge University hospitals NHS Trust - www.cuh.org.uk/addenbrookes/addenbrookes_index.html
Cancer Research UK – Cambridge Research Institute - www.cambridgecancer.org.uk/
The Wellcome Trust Clinical Research Facility - www.wtcrf.cam.ac.uk/
Cambridge Biomedical Campus - www.cuh.org.uk/cuh/profile/the_future/the_future.html
Cambridge Computational Biology Institute - www.ccbi.cam.ac.uk/
University of Cambridge Term Dates - www.cam.ac.uk/univ/termdates.html
Clinical Academic Training Office - http://cato.medschl.cam.ac.uk
Cambridge University Skills Portal - www.skills.cam.ac.uk/postgrads/training/epigeum.html
Graduate School Skills Training - www.biomed.cam.ac.uk/gradschool/skills.html