Department of Computer Science and Technology

M.Phil in Advanced Computer Science

Course Information for Applicants

UNIVERSITY OF CAMBRIDGE

Welcome

Welcome to the Postgraduate Studies Open Day.

We hope that this brief guide will be of some help but if you have further questions you are welcome to ask us, Lise Gough, Joy Rook and Marketa Green, the Course Administrators, by email cst-graduate-admissions@cst.cam.ac.uk.

Postgraduate Education Team

Contents

1. Department of Computer Science and Technology

The Department of Computer Science and Technology was founded in 1937 as the Mathematical Laboratory on the part of the New Museums Site now occupied by the Arup Building. The name was changed to Computer Laboratory in 1969 and the Computing Service was created in 1970 as part of the same department. With effect from 1 October 2017, the name changed to the Department of Computer Science and Technology.

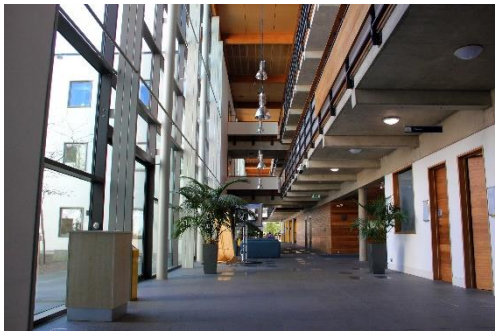
Professor Sir Maurice Wilkes was the Head of Department from 1946 until 1980 when he was succeeded by Professor Roger Needham. In 1996, Roger was appointed Pro-Vice Chancellor of the University. Subsequent heads have been Professor Robin Milner, Professor Ian Leslie, Professor Andy Pitts and currently Professor Andy Hopper.

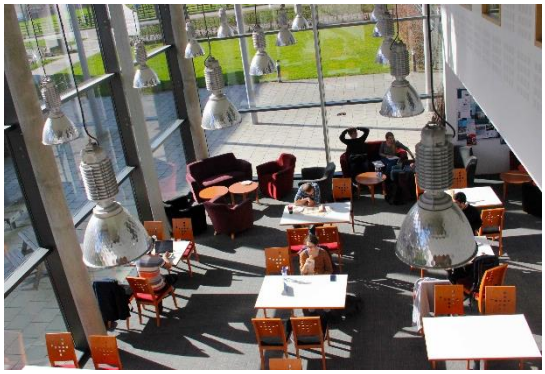
In 2001 we moved into purpose-built facilities in West Cambridge. Our address is:

Department of Computer Science and Technology
The Computer Laboratory
William Gates Building
15 JJ Thomson Avenue
Cambridge, CB3 0FD

The Department of Computer Science and Technology and is part of the School of Technology along with Engineering, Chemical Engineering and Biotechnology and the Judge Business School. See http://www.tech.cam.ac.uk/Graduate/aboutgrad

The department occupies the ground, first floor and most of the second floor of the William Gates Building. The large central entrance corridor is known as The Street. MPhil students use Teaching Rooms SW01, FS07 and FS09 and the Teaching Laboratory SW02. The Intel Lab in SW11 is a large computer room for undergraduate students.





Other facilities include a small café on the ground floor which is open 09:30-16:00 Monday to Friday excluding public holidays, and small kitchens around the department. There is also a cafe in the Hauser Forum at the end of JJ Thomson Avenue south of the West Cambridge site. A Sainsbury's supermarket is a ten-minute bike ride away in the new Eddington site, and there is a state-of-the-art Sports Centre on the West Cambridge site.

2. THE COURSE FORMAT

The Basics

The MPhil in Advanced Computer Science (the ACS) is designed to prepare students for doctoral research, whether at Cambridge or elsewhere. Typical applicants will have undertaken a first degree in computer science or an equivalent subject, and will be expected to be familiar with basic concepts and practices. The ACS is a nine–month course which starts in early October and finishes on 30 June. It covers advanced material in both theoretical and practical areas as well as instilling the elements of research practice. The course combines lectures, seminars and project work in various combinations tailored to the individual student. The course code for the MPhil in Advanced Computer Science is **CSM3**.

Prerequisites

Applicants for the MPhil in ACS are expected to have met the following prerequisites:

- First-class honours degree, or equivalent, in computer science. Alternatively, a degree of equal status in engineering, science, or mathematics where the applicant can demonstrate significant relevant preparation for the Cambridge MPhil course.
- Mathematics to A-Level standard or equivalent
- Programming experience
- A good IELTS or TOEFL score is also required where an English Language qualification is necessary.

Applications

Formal application for admission for the M.Phil degree must be made via the applicant portal http://www.graduate.study.cam.ac.uk/applicant-portal. The deadline for all applications is the 27 February of the year preceding the October admission. However, if you are applying for funding support from the University and Cambridge Trust, please see the Funding competitions section below for the relevant deadlines.

The application will also require the submission of the following supporting documentation:

- Transcript
- Two academic references
- One personal reference *(only required if applying for the Gates Cambridge Scholarship)*
- CV / Resume

Please note that applications can only be considered by the department once they are complete.

Course specific questions

The application form also requires the following course specific questions to be answered:

- Write a brief project proposals of no more than 500 words each (see below)
- Choose five modules chosen from the current year's syllabus (please see section 3)
- Programming experience

Research project proposal

Students will spend a considerable amount of their time carrying out an individual research project under the supervision of a member of faculty. Your brief research proposal will identify the area in which you wish you work and a possible research problem in that area.

This proposal is not by any means binding; rather it serves to help us with our assessment of your application as well as identify potential supervisors. Candidates who are not yet certain of their area can visit the web pages of the various research groups and faculty members for inspiration.

Funding competitions

Applicants wishing to be considered for funding competitions should check their eligibility on the University-wide Sources of Funding web page. The deadlines for the Postgraduate Funding competitions can be found on webpage
https://www.graduate.study.cam.ac.uk/finance/funding

Postgraduate Loans for postgraduate degrees for UK residents are also available. Please see the UK Government's web page for further details at https://www.gov.uk/funding-for-postgraduate-study

Course Structure

This course consists of:

a) 5 taught full modules;
b) 12 units from the mandatory Research Skills programme; and
c) a research project report of no more than 15,000 words.

The project can be research or application oriented and industrial collaboration is possible. Project selection and planning occurs in the first term and the project is undertaken in the following two terms. A final report is submitted at the end of the project.

The taught modules are delivered in a range of styles. For example, there are traditional lecture courses, lecture courses with associated practical classes, reading clubs, and seminar style modules.

Course Advisers

In Michaelmas Term, students are assigned a Course Adviser who will monitors their progress, meets with them at least once during the term and write a progress report. In Lent Term, Project Supervisors take over as adviser. MPhil students will also have a Postgraduate Tutor assigned to look after pastoral matters by their College.

Research Skills Programme

The Research Skills Programme is designed to provide advice on and training in a variety of practical skills required for research. The skills learnt will be useful in the student's individual project, other research-led modules, and in the student's future career.

All MPhil students are required to take 12 units in total which includes the core units and a number of optional units.

Core Units

There are 4 - 5 mandatory core units covering topics such as Academic English; Academic Writing; How to prepare a research presentation.

Optional Units

Students should choose units that are most relevant to their research plans, and supplementary to their previous experience. Optional units will not require coursework to be completed or submitted beyond participation in the session itself. Some options will involve practical work, which will be carried out during the session. This will provide an opportunity for students to practice specific skills, but will not be formally assessed.

Examples of units offered in current and previous years are:

- Academic Writing in UK HE
- How to prepare a research presentation
- How to write a good abstract
- How to interpret experimental results
- Research ethics and GDPR
- Mathematical writing skills
- How to nail your literature review
- Working with sensitive data in the wild
- Internet & other standards - how & why to get involved
- Introduction to qualitative research methods
- Motion capture for experimental Robotics Research
- Buzzwords surrounding Data Science

3. MODULES

Students study five taught modules, preferably 3 in Michaelmas Term and 2 in Lent Term. Module choices should ideally underpin the student's research project. The taught modules are delivered in a range of styles: traditional lecture courses; lecture courses with associated practical classes; reading clubs; and seminar style modules.

Every year new modules are introduced and obsolete one removed. Below is a list of some of the modules which have been previously or are currently on offer to MPhil students. Details of modules on offer this academic year can be found on the webpage www.cl.cam.ac.uk/teaching/current/acs.html.

- Advanced Graphics and Image Processing
- Advanced Operating Systems
- Advanced Topics in Computer Architecture
- Advanced Topics in Computer Systems
- Advanced Topics in Natural Language Processing or Machine Learning
- Advanced Topics in Mobile Systems and Mobile Data Machine Learning
- Algebraic Path Problems
- Affective Computing
- Automated Reasoning
- Category Theory
- Computer Security: Principles and Foundations
- Computer Vision
- Cybercrime
- Digital Signal Processing
- Distributed Ledger Technologies: Foundations and Applications
- Hardware Security
- Interaction with Machine Learning
- Interactive Formal Verification
- Introduction to Natural Language Syntax and Parsing
- Large-scale data processing and optimisation
- Machine Learning and the Physical World
- Machine Learning for Language Processing
- Mobile Robot Systems
- Multicore Semantics and Programming
- Network Architectures
- Overview of Natural Language Processing
- Principles of Machine Learning Systems
- Probabilistic Machine Learning
- Technology, Law and Society

4. ASSESSMENT AND EXAMINING

Students must take five modules, selected from those offered in each year in consultation with their course adviser, each of which is assessed independently.

Each year ACS teaching staff will propose research projects that they are willing to supervise and these will be published on the web in the second part of Michaelmas Term.

Students must obtain an average mark of **60.0%** (300/500 marks) across all taught modules and also **60.0%** (420 / 700 marks) in the project to obtain the MPhil degree. The Distinction grade is awarded to candidates obtaining **75.00%** (900 / 1200 marks) and greater overall.

Coursework and Written Tests

Each student must take 5 taught modules, 12 units from the Research Skills Programme and undertake a project and submit a project report of up to 15,000 words.

Each taught module consists generally of 16 contact hours over 8 weeks which may consist of any combination of lectures and/or supervised practical classes, seminars or reading groups.

Modules may be assessed by a combination of tests and/or coursework. Coursework may consist of recorded ‘ticks’ for ungraded assignments and/or graded term papers, practical reports, or essays. Ticks for ungraded reading assignments, oral presentations, or practical work may constitute a maximum of 25% of the coursework for any individual module.

Written papers may be set on selected modules. Test questions are marked according to a marking scheme and solution notes that are made available to the course examiners and agreed in advance of the test. Test papers will indicate the assignment of marks to each question and each component of a question. Students taking modules in which a ‘take home test’ test is set will be required to sign an undertaking that the work will be their own and not completed in collaboration with any other person.

Formal notices of the schedule and format of **written and take-home tests** will be sent electronically to all students and posted in the teaching laboratory SW02 at the end November (for Michaelmas modules) and early March (Lent modules). Written and take-home tests are, in general, set during the first week of following term. Written tests are no longer than two hours’ long and reading time is provided; students are generally given between 48 and 72 hours to complete take-home tests. For modules where assessment is by **coursework alone**, the deadlines for final essays and mini-projects are, usually, also set for the first week of the following term.

Students are recommended to use the ‘study weeks’ immediately after and immediately before the Cambridge full terms to revise for the tests and to complete coursework.

Deadlines

A schedule of coursework deadlines will be published each term. Deadlines are taken seriously and marks will be deducted for late coursework submission.

The penalty will be calculated as follows: **penalty = n/10 x mark** where **n** is the integer part of the number of days late, rounded up to the nearest integer. Failure to submit the **research project** by the published deadline will result in outright failure of the course.

Oral examinations (viva voce examinations)

After the final meeting of the Examiners for the course, the Examiners will announce which students will be called for an oral examination after the meeting. An oral examination can only improve a result or leave it unchanged.

Research projects

Every student is required to conduct a substantial research project. A research project is equivalent to seven taught modules. Students are required to pass the research project report with a minimum mark of 60%.

- Project selection and planning is in Michaelmas Term.
- The project itself is undertaken in Lent and Easter Terms.
- Projects can be research oriented or application oriented. Industrial collaboration on projects is possible.
- A member of the Faculty's academic staff will be appointed as a project supervisor. This person is responsible for overseeing the project student.
- A member of the Faculty's academic staff may be appointed as a project advisor. The person is available as a second advisor to the project student.
- The supervisor and adviser will assist the student in producing a Project Proposal document and work plan.
- If the research project involves experiments on human subjects, approval from the Department's Ethics Committee is required.
- The supervisor, the adviser, and the Management Committee must all approve the Project Proposal document prior to the student starting work on the tasks specified in the Proposal.
- The supervisor will monitor the progress of the project and a formal progress review will be conducted in conjunction with the student and advisor at the end of Lent term. Presentations of work in progress will be given in the second week of Easter term to all students and departmental teaching staff.

The report shall provide evidence that the candidate can design and carry out investigations, assess and interpret the results obtained, and place the work in the wider perspectives of the subject.

5. RESEARCH GROUPS

Students are integrated into the research culture of the Department by joining one of the research groups. Students are expected to attend the Department's and research group's programme of research seminars. An element of the research training will be in the context of a research group and will be overseen by their project supervisor.

Artificial Intelligence Group
Theory and applications of intelligent systems.

The work of the Artificial Intelligence Group is multi-disciplinary, spanning genomics and bio-informatics, computational learning theory, computer vision, and informal reasoning. A unifying theme is understanding multi-scale pattern recognition problems, seeking powerful (often statistical) algorithms for modeling and solving them, and for learning from data. The AI Group seeks to find synergies amongst ideas based in statistics, mechanised reasoning, cognitive science, biology, and engineering, and to develop practical applications from them.

Computer Architecture Group
Microarchitecture, VLSI techniques and design, electronic CAD, secure hardware

The Computer Architecture Group's specialty is all aspects of tomorrow's computing hardware including its supporting circuit and compiler technology. Improvements in fabrication technology will ultimately provide the ability to construct computing devices from atomic scale components. These advances may be exploited to provide many orders of magnitude more processing power or equally impressive reductions in power consumption. The group's goal is to investigate how to exploit these advances in order to realise a broad range of efficient, scalable and robust computing platforms. The group's interests and expertise include multi-core processors and compilers, on-chip interconnection networks, novel approaches to system-timing, FPGA architectures, software programmable processing substrates and hardware security. They also have a keen interest in building chip and system prototypes in order to drive and demonstrate our research.

Digital Technology Group (DTG)
All aspects of technology in particular for pervasive, sentient and mobile computing and communication systems.

The research conducted within the Digital Technology Group is highly multi-disciplinary in nature. The current research topics include *Computing for the Future of the Planet, Indoor Location and Tracking, Athlete Automatic Coaching, OS Kernel Enhancement, Low-Power Microprocessor Design, Privacy Systems and Policies, Wireless Sensor Networks, Cross-Layer Wireless Access, Cooperative Networks, Wireless Propagation Models for Challenging Environments, Channel Coding and Signal Processing for Wireless communications* and more.

The group has also conducted research into conventional network systems and applications as well as more esoteric network technologies.

Graphics & Interaction Group (Rainbow)

Computer graphics, image processing, human-computer interaction, affective computing

The interests of the graphics and interaction group span computer graphics, image processing, interaction devices, and interdisciplinary design and is split into 3 sub-groups:

Graphics and imaging

Research in computer graphics started in the late 1960s. Over the decades the focus has moved from considerations of display hardware and hardware architecture (1970s), through rendering algorithms (1980s), 3D display technologies (1990s) and modelling (2000s), to our current work on new display technologies and imaging.

Interaction and design

Research in the field of human-computer interaction has mainly focused on novel interface techniques that put computing power into the hands of a wider range of users. This work has been complemented by research into theoretical aspects of HCI, including cognitive science and design theory.

Affective computing

With rapid advances in key computing technologies and the heightened user expectation of computers, the development of socially and emotionally adept technologies is becoming a necessity. This group are investigating the inference of people's mental states from facial expressions, vocal nuances, body posture and gesture, and other physiological signals, and also considering the expression of emotions by robots and cartoon avatars.

Natural Language and Information Processing Group (NLIP)

Computational modelling of natural (human) languages and related applications.

This research group works on a wide range of topics in Computational Linguistics, Natural Language Processing and Information Retrieval.
Current projects cover all areas of language processing, but especially syntax, semantics and discourse processing, and on a range of information management applications.

Programming, Logic, and Semantics Group

Programming languages, compilers, and analysis; development and application of automated reasoning tools; mathematical models of hardware, software, and networks; finite model theory.

Research in the Programming, Logic, and Semantics group is centred around the study of programming languages, logics, and mathematical models, addressing hardware, software, and networks. It spans a wide range of applied and theoretical work: programming language design, compilers, and program analysis; the development of interactive theorem provers and automatic proof procedures; the formal verification of computational systems; and semantic models using techniques such as structural operational semantics, type systems, domain theory, category theory, finite model theory and linear logic. Work is in progress on the underlying mathematical structures of these, and on their application to the study of higher-order typed programming languages; object-based

languages; low-level machine languages; foundational languages for concurrent, distributed and mobile computation; hardware description languages; security and networking problems; database theory; and computational complexity.

Security Group

Security, cryptology, and their applications.

Computer security has been among the Laboratory's research interests for many years, along with related topics such as cryptology, formal methods, hardware design, biometrics, and the robustness of distributed systems in general.

Systems Research Group

Networks, operating systems, multimedia, mobile and sensor systems, distributed systems.

Systems is the largest research area in the department, covering hardware, communications hardware and software, operating systems and distributed systems. The group undertakes teaching and research into topics including computer architecture, operating systems design, network monitoring and protocol design, practical distributed systems and mobile communications.

6. STUDENT REPRESENTATION

M.Phil Students are represented on the **Faculty of Computer Science and Technology** by a Junior Member. Elections for members are held in the November of each academic year. The Faculty receives the Minutes of the Staff Student Consultative Forum, the Postgraduate Education Committee, the Teaching Committee, and the Forum of Directors of Studies, and itself reports to the General Board of the University. The Faculty Minutes are sent to the Secretary General of the Faculties, the members and to Officers in the department.
The junior members attend the first part of each meeting during which unreserved business is discussed - that's the bulk of the business and includes things like the Head of Department's annual report, accreditation matters, examiners' reports, teaching matters related to the Tripos and M.Phil courses, the use of calculators in exams, new proposals for courses, etc.

Reserved business covers matters referring to named members of staff (e.g. promotions and leave of absence), and such things as the appointment of Examiners and the Form and Conduct of examinations.
Whilst the faculty representative elections are formally independent of the Graduate Union, under the terms of the GU Constitution (which has the approval of the University Council) the elected postgraduate representative is also a voting member of the GU governing council. Further information about the GU Council is available at
http://www.gradunion.cam.ac.uk/gradunion/council/

Faculty meetings are fairly formal and reasonable dress is required!

M.Phil students are also represented on the **Staff Student Consultative Forum** and the **Postgraduate Students' Forum.** Both of these groups are relatively relaxed occasions and provide the opportunity for student and staff representatives to exchange comments about facilities and teaching.

The **Postgraduate Students' Forum** is made up of research student representatives from research students and the M.Phil course, the Postgraduate Students Coordinator and a member of the Student Administrative team. The Forum has the opportunity to suggest courses and activities that fall within the remit of the Transferable Skills allocation as well as issues that are particularly relevant to research students in the Faculty. Meetings are held at lunch time once a term and the minutes are received by the Postgraduate Education Committee and Degree Committee.

The **Staff Student Consultative Forum** (SSCOF) is made up of student representatives from every year of the undergraduate course, a M.Phil student, a research student, and members of the academic, support and Student Administration team. Meetings are held at lunch time twice a term.

Postgraduate Students also have a representative on the **Postgraduate School of Technology Committee.**

7. WOMEN@CL

The purpose of the women@CL network is to put in place a positive action programme for women in computing research, with a particular focus on interdisciplinary research, leadership and enterprise.
The programme consists of career development activities including regional and national workshops, mentoring and networking, with long term goals of:

- providing support for women in computing research;
- stimulating new research by bringing diverse viewpoints and expertise to bear;
- increasing the recruitment and retention of women in computing research careers;
- encouraging and supporting women to aim for early leadership roles;
- increasing women's understanding and participation in entrepreneurial ventures;
- contributing to a positive public perception and image of computer science;
- increasing public engagement in computer science;

The programme consists of a variety of local activities such as women@CL lunch talks that provide role models to our students and early career women, and our national and international activities include events like career development workshops at major conferences, regional technical meetings, and senior women leadership summits. We forge formal connections with existing bodies with similar goals. We also promote successful women and projects by placing articles, profiles and interviews in all forms of media.

women@CL events are open to all, women and men. For more information on the meetings and resources for and about women in computing, please visit the *women@CL* webpage http://www.cst.cam.ac.uk/women.

For more information please email clwcladm@hermes.cam.ac.uk

8. AFTERWARDS…

Graduation

Graduation ceremonies are handled by the colleges and students can choose from a number of Congregation dates throughout the year. They are generally held about three times a term and once in the Long Vacation. The earliest date MPhil students can graduate is at the mid-July ceremony.

Students graduate with their college. It is possible to take the degree in person or in absence (also known as 'in absentia'). Please note that if a degree is taking in absence, it is not possible to subsequently graduate in person with the same degree.

Degree ceremony dates can be found at https://www.cambridgestudents.cam.ac.uk/your-course/graduation-and-what-next/degree-ceremony-dates. Note that not all Colleges present candidates at every date listed.

MPhil students 2019-20

Applying to study for a Ph.D.

Many of our successful M.Phil students have progressed to study for the Ph.D. Degree in our department, other departments at the University of Cambridge and other UK and overseas institutions.

Applications

There are two intakes of research students each year: October 1st (preferred) and January 5th. The latter date may be of interest to M.Phil students as there is a small possibility that students *might* not graduate until the beginning of the new academic year.

If you are considering applying for admission at Cambridge as a research student after the M.Phil in Advanced Computer Science course you should complete an online application form available via your CamSIS self-service webpage. It is very important to discuss your research ideas with a potential supervisor before submitting your application.

The application, which should include two references and a research proposal, will be made as an electronic submission

When applying for admission as a research student in the Department of Computer Science and Technology we will expect you to submit a proposal of research. This will be a document of no more than 3,000 words. You should be able to show an understanding of existing work in the field, the first-year deliverables and be able to identify an area for new work. You will also need to provide two academic references one of which should be from a staff member from the department. At present, you will not need to provide transcripts again.

If you are accepted by the department as a research student we would not necessarily expect you to adhere to the draft proposal, but it is useful to be able to pin down your area of interest more specifically. It also provides a good opportunity for you to demonstrate that you are able to select an interesting research topic, and present any insight you may have into how it could be tackled. We would recommend that you look at our web pages at http://www.cl.cam.ac.uk/research/ to gain some insight in to our current areas of research.

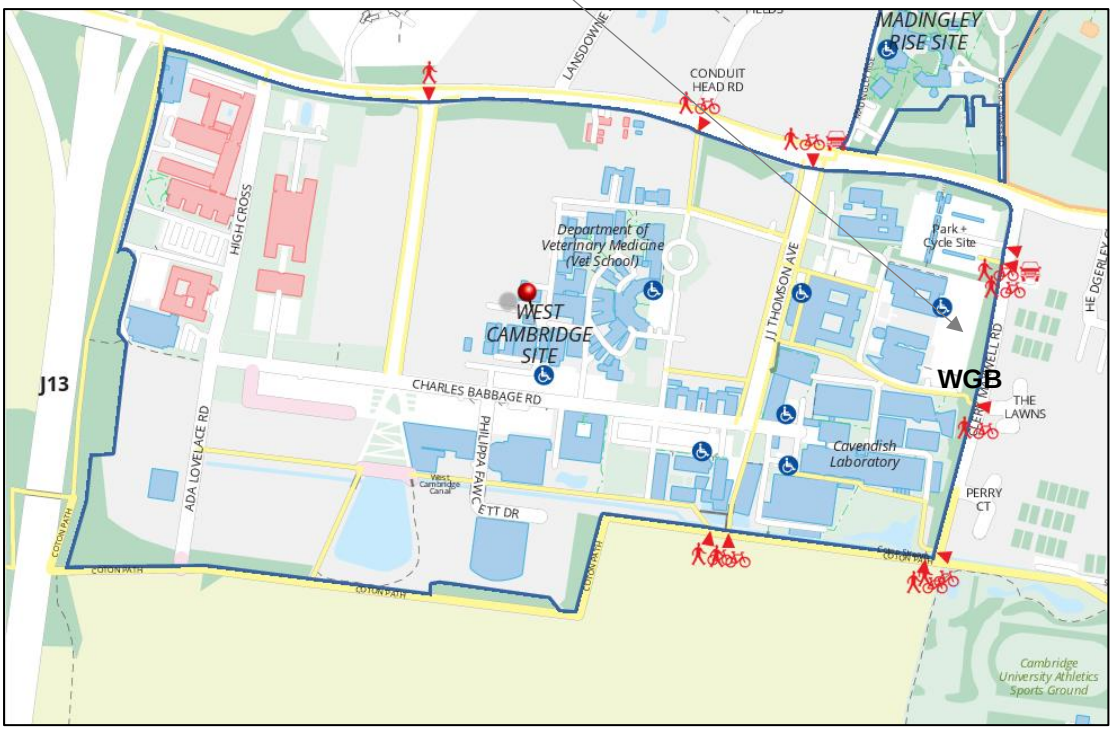
All offers for places as research students are conditional upon achieving a good pass in the M.Phil course as well as funding and College membership, **and** having secured the full support of a willing supervisor. All offers must be ratified by the Degree Committee at its final meeting following the approval of results and the awarding of degrees.

9. GETTING TO THE LAB

Students at the University of Cambridge are not permitted to have cars except under very special circumstances.

Walking or cycling

The William Gates Building is 2 km (1.3 miles) west of the city centre. From the city centre go west on Garret Hostel Lane, Burrell's Walk (past the University Library), Adams Road, the Coton Cycle-path, and then turn right into Clerk Maxwell Road then left beside the Centre for Applied Photonics and Electronics to the William Gates Building.



Map of West Cambridge site

Please take care when cycling. The EMBS has a useful website for cyclists, old and new, at http://www.admin.cam.ac.uk/offices/embs/travel/cycle/. We also strongly recommend purchasing a strong D-lock.

Buses

Buses **Universal** (substantially reduced fares for University Card holders) and **Citi 4** run from the city centre to the West Cambridge Site. Both buses stop on the West Cambridge Site itself. In the city centre they stop on Silver Street (on the west side of Silver Street Bridge) and Trumpington Street (near the Fitzwilliam Museum and near Pembroke Street).

For more information about these services, see the links from the Bus Services page (http://www.admin.cam.ac.uk/offices/embs/travel/bus/index.html) which is maintained by the Estate Management and Building Service.

Anyone planning to make three or more journeys in a day on Stagecoach buses (other than the **Universal** or **Citi 4)** will find it cheaper to purchase a *Dayrider* ticket, which can be used on any Stagecoach route within the city.

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CB3 0FD

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