

# Introduction to Skills Training (revised 14/10/2024)

[Extracts from Materials Graduate Student Handbook 2024-25]

## 1. SKILLS-TRAINING COURSES (Research-Specific Skills and Transferable Career Skills)

Graduates need to be skilled not only in the experimental and/or theoretical techniques relevant to their own research, but also in skills for communicating their results to a wider audience and for managing their own research programme and future career development. The Materials handbook 'Postgraduate Lecture Synopses and Research Colloquia' lists the different skills training courses on offer under the title 'Postgraduate Training'. **You should keep a log-book or portfolio to record the various training that you undertake**, of all kinds, formal and informal, since you may be asked to summarise this by your research sponsor or by a prospective employer and you will be required to summarise it on your applications for transfer of status and confirmation of status. There is an expectation by some sponsors and by the University that you will engage in approximately 100 hours per annum of transferable career skills training during years one to three of your research degree. Included in the 100 hours is skills training and feedback provided by your supervisor, for example on presentation skills, report writing or writing a scientific paper.

Transferable career skills are those in addition to your academic and research skills that employers both inside and outside academia value. The UK Government and funding agencies believe that these skills are essential for maintaining employability in a global economy which is increasingly requiring people to respond to and anticipate change.

If you wish to attend a 'course' external to the Department of Materials for which there is a modest charge and which is important for your research, including a 'summer school', then your supervisor is permitted to cover the costs from the 'baseline research costs' allowance she/he receives for each research student whose project is not funded directly by a sponsor.

### MPLS Graduate Training Framework

You might find it helpful to use the framework set out in the table below as a tool for planning and recording your training needs as you progress through your DPhil programme. It has been pre-populated with the small number of courses that are compulsory for Materials research students.

Phase Category	Foundations Phase (0-12 months)	Intensive Research Phase (12-30 months)	Completion Phase (24+ months)
Transferable Career Skills	<ul style="list-style-type: none"> <li>• Project Management</li> <li>• Career Planning</li> <li>• Teaching (JD)</li> </ul>	<ul style="list-style-type: none"> <li>• Research Talk</li> </ul>	
Research Skills	<ul style="list-style-type: none"> <li>• Safety Induction Talk</li> <li>• Colloquia</li> <li>• The University's on-line 'Research Integrity Training' course</li> </ul>		<ul style="list-style-type: none"> <li>• Poster Presentation</li> </ul>
Academic Skills	<ul style="list-style-type: none"> <li>• Two assessed lecture courses</li> <li>• Literature Review</li> </ul>		

**Notes:**

1. The phases are for guidance rather than rigid timescales.
2. The skills categories are defined as follows: **Academic skills** are lecture courses/subjects that form an extension to, and fill gaps in, UG-level knowledge; **research skills** are those needed to actually carry out research, for example safety, equipment use, programming; **transferable career skills** are those which are core to every student's development and are genuinely transferable, although they may have a subject nuance.
3. Therefore Academic skills and Research skills sit in departments. Transferable career skills sit in both Department and Division (and other providers as appropriate).

Several years ago University College London compiled a table of key transferable career skills:

<b>Academic</b> Learning Actively Using Sources	Analysing Data Solving Problems	Thinking Critically Managing Projects
<b>Self-Management</b> Reflecting on Learning Assessing Oneself	Managing Time Being Independent	Being Creative/Innovative Managing Resources
<b>Communicating</b> Writing Presenting	Listening Communicating Globally	Using Information Technology Planning and Making Decisions
<b>Working with Others</b> Working in Teams Understanding Others	Negotiating Assessing Self and Peers	Leading Managing Change

The Vitae organisation has compiled a **Researcher Development Framework** (RDF) which you are strongly encouraged to browse:

The Vitae 'Researcher Development Statement' (<https://www.vitae.ac.uk/vitae-publications/rdf-related/researcher-development-statement-rds-vitae.pdf>).

The RDF provides a framework for planning and supporting the personal, professional and career development of graduate students and research staff. It encourages individual researchers to identify strengths and prioritise their professional development. It helps them consider the skills and experiences that will enhance their career prospects and to articulate their knowledge, behaviours and attributes to employers.

The RDF and RDS are made up of four top level domains which encompass the knowledge, behaviour and attributes that are needed to be a successful researcher. These are:

- A: Knowledge and intellectual abilities
- B: Personal effectiveness
- C: Research governance and organisation
- D: Engagement, influence and impact

The RDS is put in context by the UKRI Statement of Expectations for Postgraduate Training (<https://www.ukri.org/publications/statement-of-expectations-for-postgraduate-training/>).

Further information on the Researcher Development Statement (RDS) and RDF can be found at

<https://www.vitae.ac.uk/researchers-professional-development/about-the-vitae-researcher-development-framework/> and <https://www.vitae.ac.uk/researchers-professional-development/why-focus-on-professional-development>.

Some of the skills training courses available to you as a Materials graduate student are:

- (i) Project management skills (Dr A O Taylor and others, MT Week 4);
- (ii) Presentation skills (Staff of IT Services, HT);
- (iii) Writing skills, lab notebooks, IPR and patents (Prof H E Assender & others, HT);
- (iv) Information skills (Staff of the Bodleian, MT Week 2);
- (v) Career-planning (Alumni of Dept, OU Careers Service & Dr A O Taylor, MT Week 1);
- (vi) Workshop skills (workshop technicians, throughout year);
- (vii) Microscopy skills (see Materials Postgraduate Lecture & Training Course Synopses – an optical microscopy course and a very wide range of electron microscopy courses);

- (viii) A suite of 'Enterprise' training courses (see MPLS courses);
- (ix) Institute of Materials – Benefits of student membership (Jamie Graham, MT Week 3);
- (x) Preparing an article for submission to a materials journal (Prof Richard Todd – a recording)
- (xi) Teaching skills (Lecturing, laboratory demonstrating, tutorials, classes, maths classes, [see lecture lists]);
- (xii) Managing your References - Bibliographic software (Staff of the Bodleian, HT);
- (xiii) Academic Writing Skills (for non-native English speakers);
- (xiv) Foreign Language Skills (register on-line with the [OU Language Centre](#) by noon on Wednesday of MT Week 1);
- (xv) Your successful DPhil course (MPLS event);
- (xvi) An introduction to Public Engagement and Science Communication (see MPLS courses);
- (xvii) Patent Literature (Staff of the Bodleian, HT);
- (xviii) Owning a successful DPhil (run by JCCG, MT, tbc);
- (xix) Research Integrity (on-line course via [Integrity & Ethics Training](#) );
- (xx) Research Impact and Open Access - Chemistry and Materials (Staff of the Bodleian, HT);
- (xx) LabVIEW training, tbc (MT,tbc);
- (xxi) Dr Taylor's 2022 slides on the topic of 'Poster Presentation Skills' and a recording plus associated slides from his 2024 talk on 'Practical Tips for Delivering a Research Talk', are available at [Postgraduate Skills Training](#) .

**The Project Management Workshop in Week 4 of Michaelmas Term is compulsory.**

**The Career Planning Workshop in Week 5 of Michaelmas Term is compulsory.**

**The Training Workshop for Junior Demonstrators (MT, Week 6) is compulsory.**

**The University's on-line course on Research Integrity Training is compulsory before you apply for Transfer of Status. For more information on Research Integrity and the on-line course see [Appendix XIII](#).**

It is also strongly recommended that you attend some of the workshop sessions in Hilary Term on 'Presentation skills' and on 'Writing skills', since you will need the former to give a good presentation at your first-year interview and second-year talk, and you will need good writing skills for your Literature Review, first-year report and your thesis. These courses assume you know the basics of word processing and use of Powerpoint, but introductory courses to these (and a wide range of other IT courses) are available from the University IT Services (<http://www.it.ox.ac.uk/do/training-and-facilities>).

Students whose first language is not English, should consider attending the courses on 'Academic Writing' and 'Advanced Communication Skills' that are offered by the Oxford University Language Centre at 12 Woodstock Road (<http://www.lang.ox.ac.uk>). For some, this attendance will have been set as a compulsory course requirement.

You should also attend the lecture in Week 2 of Michaelmas Term on 'Information Skills' as the latter is critical for accessing the research already done in your chosen field. Information on accessing and searching the materials literature can be found at <http://libguides.bodleian.ox.ac.uk/friendly.php?s=oxford>.

**In Michaelmas Term of your first year, sometimes supported by one or two alumni/ae of the Department, together with a representative from the Oxford University Careers Service, Dr Taylor will run a compulsory and very useful workshop on Career Planning - Looking to the Future.** Further information about the Careers Service can be found on their website (<http://www.careers.ox.ac.uk/>).

Towards the end of your degree there is an opportunity to discuss career opportunities for Materials Scientists on a one-to-one basis with several alumni and alumnae of the Department. This complements the many activities available through the OU Careers Service.

The MPLS Division also offers a range of courses on enterprise and entrepreneurship, as outlined to you at Materials Induction. See <https://www.mpls.ox.ac.uk/training/enterprise/enterprise>.

The MPLS Division runs a workshop on 'Your Successful DPhil', which to some extent complements the Department's Project Management Scheme, details can be found at <https://www.mpls.ox.ac.uk/training/mpls-training/our-courses/mpls-induction-courses/your-successful-dphil>.

In Michaelmas Term normally the JCCG run a workshop on "Owning a Successful DPhil".

**If you wish to attend a transferable, academic or research skills training course that is not offered by the Department of Materials or MPLS Division and for which a fee is charged, you may apply to the Director of Graduate Studies for funding using a copy of the form shown in [appendix VI](#) of this handbook. A Word version of this form can be found via the 'Materials: PGR Progression' site.**

If you wish to use the supervised mechanical workshop, then it is mandatory that you first attend a Workshop skills course given by one of the technicians.

Similarly, if you wish to use the electron microscopes, then you should first complete an access and training request form (see [Section 7](#) of this Handbook).

You should also attend the lecture in Week 4 of Michaelmas Term by Jamie Graham on the benefits of student membership of the Institute of Materials. The receipt of their monthly magazine 'Materials World' and attendance at their meetings should both increase your general knowledge and improve your networking skills! If you are not already a student member of the IOM3 the first year's membership is paid for you by the Department if you attend this lecture.

You may wish to develop skills in 'Public Engagement'. The ability to communicate the essence of your work to a non-scientist, to excite them, without hyperbole, about its potential applications and benefits, and to help them understand any associated societal risks is a valuable transferable skill. To find out more see the 'Public Engagement' pages of the MPLSD website (<http://www.mpls.ox.ac.uk/support-services>).

**Further transferable skills training information and courses can be found via the MPLSD Researcher Training site at <https://www.mpls.ox.ac.uk/training/pgr> .**

**For example in addition to the transferable skills training courses offered by the Materials Department, the MPLS Division's Graduate School and other academic departments, Oxford University IT Services and the Bodleian Library provide a wide range of courses, and courses in foreign languages are offered by the Oxford University Language Centre (OULC).**

### **OULC Courses**

If you wish to develop your skills in a foreign language that is not essential to the progress of your research the Department will fund or partially fund one such OULC course as follows:

- General Course (non-priority) – Subject to completion of the course, the Department will fund up to three terms of study (current cost = £125 per term)
- Fast-track course – Subject to successful completion of the full course the Department will fund 50% of the total cost of the course (current total cost = £545). Often a student's college will also fund 50%.

In both cases you should submit in advance an application for funding (see paragraph on previous page). You will need to pay for the course yourself initially, and once you have completed the course may claim reimbursement via an expenses claim to which you attach (i) evidence that you have paid the course fees, (ii) a copy of the approved funding

application form and (iii) a copy of the OU Language Centre 'Certificate of Course Completion' or 'Certificate of Course Attendance'.

**Finally, a wide range of on-line courses and training are available via the University IT Services site '[Self-service Learning](#)'.**

## **2. VITAE**

Vitae was set up under the sponsorship of the UK's Engineering and Physical Sciences Research Council (EPSRC). The Vitae website contains an excellent section, originally designed by postgraduate students, 'Postgraduate Researchers', and you are strongly advised to browse through this at your earliest convenience (<https://www.vitae.ac.uk/doing-research/doing-a-doctorate>). It contains several interlinked sections some of which we have referred to earlier in this Handbook, including:

- Managing yourself
- Planning your research project
- Developing as a researcher
- Career management
- Completing your doctorate – tips on writing your thesis, submission and viva
- Supervision and key relationships.

In their February 2001 review of the original site, Science magazine wrote: 'The great strength of this site is that it has been put together for a very specific target group (doctoral students) and has clearly been written by people who know what they are talking about.'

## **3. TRAINING IN ELECTRON MICROSCOPY**

The David Cockayne Centre for Electron Microscopy (DCCEM) offers an extensive range of research instrumentation, and training courses that run throughout the year. The DCCEM allocates researchers to practical training courses that are suitable and timely for their research projects. A provisional plan for access to electron microscopy(EM) and requisite training is normally drawn up between DCCEM research support and project supervisors prior to the arrival of new graduate students in order to get teaching and training off to an efficient start. Researchers normally master one technique or instrument before embarking on the next, and training is tailored to match instrument capability with the scientific objectives of user projects. There are three research support scientists, each specialising in

one of the three main technique areas of scanning electron microscopy (SEM), transmission electron microscopy (TEM) and focused ion beam (FIB).

EM training courses are designed to teach new users how to obtain the required data for their research project and also use the instrumentation safely. Following successful completion of a training programme, "approved users" may book equipment themselves, operating within the booking rules detailed on the website and on-line booking form. These are designed to give a fair share of instrument time to all. Requests for additional instrument access outside the booking rules should be directed to the relevant support scientist. DCCEM support scientists are here to make sure you get the most out of EM for your research project so do not be afraid to ask questions about EM or data analysis.

The Postgraduate Synopses booklet contains the EM training course synopses and details of associated post-graduate level lecture courses. More information can be found at <http://www-em.materials.ox.ac.uk/>. Applications for training and access will be made by your supervisor using the online form provided in consultation with the relevant research support scientist. For further information please contact DCCEM staff at [emaccess@materials.ox.ac.uk](mailto:emaccess@materials.ox.ac.uk), or Dr Neil Young directly at [neil.young@materials.ox.ac.uk](mailto:neil.young@materials.ox.ac.uk).

#### **4. OUTREACH TO SCHOOLS - AMBASSADOR PROGRAMMES**

Oxford Materials Science has a very active Access and Outreach team. Each year we offer a wealth of activities and events aiming to inform schools about this exciting discipline, raise aspirations, and inspire the next generation of Materials Scientists. The outreach team are supported by staff and students across the department in realising these aims and welcome your involvement as an ambassador.

*What do I gain as an ambassador?*

Apart from it being good for the Department as a whole if some of our research students are involved with such schemes, it is a good thing to have on a CV for jobs in industry or education: for anyone even remotely thinking of a career in teaching it can be very helpful indeed as it provides useful contacts in teaching and a good insight into what is involved. Anyone who is already involved with schools through their children, as governors etc., may also find it useful. Finally, developing communication skills with the general public, as well as communicating with other scientists and engineers, is a valuable personal skill in itself.



*How do I get involved?*

- (i) Information on outreach ambassador programmes is outlined below and further details are available from the Access & Outreach Manager, Helena Cotterill, in the Department. (Email: [schools.liaison@materials.ox.ac.uk](mailto:schools.liaison@materials.ox.ac.uk) ). Helena will be very pleased to hear from you so just drop our Access & Outreach team an email expressing interest.
- (ii) Student members of the Department are invited to complete this online form to express interest in acting as ambassadors at outreach workshops and projects we are running: <https://oxford.onlinesurveys.ac.uk/oxford-materials-outreach-ambassador-mailing-list-2023-24>.
- (iii) Keep an eye out for emails or Departmental Newsletter items requesting assistance with specific activities.

#### **4.1 Materials Outreach Ambassador**

There are a wide range of opportunities to help with the Department's substantial outreach work to schools: giving short talks, assisting with laboratory-based workshops for school pupils, helping with open days, visiting schools, acting as a student mentor for residential courses held at Oxford, and supporting our wealth of collaborative events. We offer training and support to those interested in developing and delivering outreach activities and we are always looking for enthusiastic volunteers. An overview of our outreach events can be found at <http://www.materials.ox.ac.uk/admissions/schools/schools-outreach-events.html>.

#### **4.2 Making Materials Matter Ambassador**

Making Materials Matter (MMM) aims to inspire students to become the next generation of materials scientists and engineers through early and sustained engagement from Y8 to Y10 (these are the years leading up to the sitting of GCSE exams in the summer of Y11, normally at age 16). The project has been running since 2016/17 (with a gap due to the pandemic) with support from the Ironmongers' Company working closely with the University of Oxford in particular. We are planning to relaunch the programme this academic year.

The core programme is run for Y8 students and their teachers. It is centred on independent research projects pursued by groups of 10 students at their schools, with guidance from materials ambassadors and support from their teachers. Prior to the pandemic, we had 10 partner schools (7 in London, 3 in Sheffield) and materials ambassadors involved from Oxford, Cambridge, Imperial, and Sheffield. The projects are managed by MMM ambassadors and the students have around 5 months in which to carry out the project. At

least one visit to each school is made by the ambassadors and the students report their work during a “Student Conference” in Oxford. Finally, a teachers’ conference is held at Ironmongers’ Hall to share resources and raise awareness of materials science within the school curriculum. To sustain engagement with previous project participants, follow up events are held for Y9 and Y10 students that previously completed the main programme. Further details on this project including a short video clip can be found at <http://www.materials.ox.ac.uk/admissions/schools/making-materials-matter.html> .

### **4.3 STEM Ambassador**

This important voluntary programme aims to put “real” scientists and engineers in school classrooms with the intention of motivating school children towards further study and careers in science and engineering. STEM Ambassadors bring a fresh and inspiring perspective to STEM subjects and careers, engaging young people from around the country. They achieve this by delivering a range of activities such as career talks, mentoring, practical workshops, and exhibitions.

Further information can be found at <https://www.stem.org.uk/stem-ambassadors> and you can apply online directly from this website.

### **4.4 Discover Materials Ambassador**

Discover Materials (DM) is a collaboration between a group of UK universities’ Materials Science Departments, the Henry Royce Institute for Advanced Materials, and other members of the materials science community. The group also manages a network of student ambassadors from the partner universities, and they are always looking for more students to join the network. As a Discover Materials Ambassador you would become a part of a UK-wide network of Materials Science communicators, have the opportunity to improve your skills in outreach and public engagement through a variety of training opportunities, and get the chance to participate in various collaborative outreach activities, from engaging the public at national science festivals to contributing to digital content on the [Discover Materials website](#). Please get in touch with the Department of Materials Access & Outreach Manager, Helena Cotterill, (Email: [schools.liaison@materials.ox.ac.uk](mailto:schools.liaison@materials.ox.ac.uk) ) if you have any questions or are interested in joining the Discover Materials Ambassador network.

## 5. TEACHING EXPERIENCE

Some experience of teaching, whether as a Junior Demonstrator in our Teaching Laboratory, as a tutor, or assisting with activities provided for school pupils, is a very useful transferable skill. Also, such teaching is paid work. As part of your skills training you are encouraged to volunteer for teaching and/or outreach duties. Unless your sponsor forbids it, the Department expects its graduate research students to participate in a minimum of 30 hours per annum teaching **if so requested** by the Department. This teaching is paid at standard University rates and is subject to 'right-to-work' checks.

UK students: please note that earnings from sources such as teaching and demonstrating may be taxable and should be aggregated with income from any other employment when assessing income tax liability for a given tax year (your EPSRC maintenance grant is counted as a training award and not normally regarded as income for UK income tax purposes; a small number of exceptions include certain European Commission-funded studentships, where you are paid a salary).

Overseas students: please note that whether or not we are able to employ you will depend on the terms of your visa. In some cases your visa may still permit you to take a teaching role but unpaid.

### 5.1 JUNIOR DEMONSTRATING IN THE TEACHING LABORATORY

An essential part of the undergraduate courses is practical work which is undertaken in the Teaching Laboratories. This provides an opportunity for graduate students to gain experience of teaching by acting as Teaching Assistants (TA) and at the same time earn a useful supplement to their subsistence grant.

Each year the Department requires about 15 TAs to help with the Undergraduate Practical Classes. The TA appointments are for one year, with the expectation of renewal for a second and perhaps a third year subject to satisfactory performance, and provided the Department continues with the scheme. Students will be remunerated at the appropriate rate **for work done**.

Normally **all** new research students are required to attend our Junior Demonstrating Training Workshop (usually held in MT). This means that you all become eligible to apply for a Practical Course Teaching Assistantship.

Each Teaching Assistant on Practical Class duty will be in the teaching laboratory for, typically, 4-6 afternoons (2.00 - 5.00 pm) for each of two terms. Second year students should ensure that any commitments they agree to do not clash with the 2nd Year Talks in Hilary Term. There will also be some training time, including a requirement to assist with setting up equipment and a requirement to attend experiment specific training, and to carry out the full experiment and to produce a set of model results. Each TA will be expert in one particular undergraduate practical being carried out during the term. The contract is for up to 120 hours per year, but in most years for most TA's the actual requirement is much less. As ever, good verbal communication skills and a reasonable amount of practical expertise will be essential requirements. You should also have the agreement of your supervisor from whom we will seek a reference. Further details on junior demonstrating can be obtained from the Practical Courses Organiser (in 2025/25 this is Professor Pete Nellist).

## **5.2 TUTORING**

A special feature of undergraduate courses at Oxford is the college tutorial. Every week students prepare work for 1 or 2 tutorials, which they then discuss (usually in pairs or groups of three) with a college tutor. Tutoring undergraduates is valuable experience and an excellent way of consolidating your knowledge. It also provides extra income. If opportunities arise, in an area where you feel confident, you are encouraged to take on a moderate amount of teaching (discuss it with your supervisor). You should be aware though that the ratio of staff and postdoctoral researchers to undergraduates is high in the Materials Department and relatively few postgraduate students actually have the opportunity to act as tutors. If you attend the 'Tutoring Materials Science' Workshop your name will be added to the list of potential tutors that we make available to the Materials Tutorial Fellows at the Colleges.

Some demonstrators are needed for Y1 UG crystallography classes, Y1 UG computing for materials science classes, Y3 UG materials modelling and materials characterisation modules, and some tutors for Y1 & Y2 UG mathematics classes.

Further details (i) on tutoring materials science can be obtained from the Chair of the Tutors' Committee, Professor Robert Weatherup, and (ii) on tutoring Maths Classes from Professor Simon Benjamin.

### **5.3 TRAINING TO TEACH**

A number of training workshops are organized for those new to teaching. Details are announced by e-mail and appear in the termly lecture lists, <http://www.materials.ox.ac.uk/teaching/lecturelists.html> .

## **6. SCHOOLS OUTREACH WORK**

There are a wide range of opportunities to help with the Department's substantial outreach work to schools: giving short talks, assisting with laboratory-based workshops for school pupils, helping with open days, visiting schools, acting as a student mentor for residential courses held at Oxford, and acting as a MMM, DM, or STEM Ambassador (see Section 8 of this booklet). We offer training and support to those interested in developing and delivering outreach activities and we are always looking for enthusiastic volunteers. For more details, please contact our Access & Outreach Manager ([schools.liaison@materials.ox.ac.uk](mailto:schools.liaison@materials.ox.ac.uk)) at any time in the year and also look out for emails seeking help with specific outreach events.