

From Bench to Bedside: a new PhD training programme in Infection and Immunity

The global challenge. Infectious disease per se represents a significant and rising burden on health care provision. This trend is likely to continue as increased global mobility facilitates spread of both existing and emerging infections, while increased use of antibiotics/antivirals fosters the emergence of resistance. Malfunction of the immune system also underlies many of the common chronic diseases which are responsible for a large proportion of UK morbidity and mortality. Indeed there are increasing links between inflammation (a manifestation of the innate immune system) and arthritis, atherosclerosis, Alzheimer's disease and cancer. The objective of this scheme is to train future scientists who have both the skills and experience to make fundamental progress in these areas, but at the same time have an understanding and appreciation of the clinical context of their fields of research.

The training scheme. The traditional PhD, in which a student works on a specific independent research project under the mentorship of a senior scientist, remains the foundation of postgraduate training for scientists in the UK, and continues to be the basis also for the current scheme. However, increasingly students expect universities to provide strong formal training in a broader range of transferable skills, and UCL has been at the forefront of developing ways to deliver these additional elements. The key novel feature of this programme lies in the composition of the supervisory committee. This committee will be led by a principal supervisor, who will take the primary responsibility for designing the research project and planning with the student the individual details of the PhD programme, and a clinician scientist (an individual with active clinical commitments and with a proven track record of scientific research). The clinician will be involved in planning/supervision of the project from the beginning, and thus ensure that there is maximum alignment between the scientific research and its translational potential. In addition, together with the student, the clinician will plan and organise an ongoing training programme, which will expose the student to a relevant clinical environment over the course of the whole project. The nature of this training programme is explored in more detail below. However, the outcome of both activities will be to ensure that the students can engage in top quality research on fundamental biological/biomedical questions, while at the same time emerging with a clear understanding of the clinical perspective of their research.

Why UCL? The environment at UCL is ideally suited to developing the innovative programme outline here. Fundamental research in the relevant fields is centred on the Division of Infection and Immunity, but also includes strong groups across the campus (see Appendix I), who will all participate in the programme. The Division of Infection and Immunity at UCL was established in 2003; it brings together research into 2 Research Departments, Immunology and Infection. The Joint UCL Rheumatology Centre, has been affiliated to the Division of Infection and Immunity since its inception. The whole Infection, Immunity and Rheumatology grouping includes 47 Category A academic staff, of whom 37 are HEFCE or part-HEFCE funded academic staff and 10 are Wellcome Trust, MRC, ARC and EU funded research fellows. Since 2001, peer-reviewed grant

income to this group has been approximately £37million. The panel assessment of the Division in the 2008 Research Assessment Exercise (RAE) stated that **"Infection and Immunity, particularly Virology is very strong in this University"** and rated the outputs from this grouping as 20.6% 4* (internationally outstanding), 50.6% 3* (internationally excellent).

The special strength of UCL Biomedicine in general, and the Division of Infection and Immunity in particular, lies in its close and active relationships with the major clinical service providers in this environment, namely UCL Hospitals, the Royal Free Trust, the Whittington Hospital Trust and the Great Ormond St Hospital for Children. Because of this special relationship, and because of the strengths of the UCL Medical School, UCL has attracted one of the largest cohorts of clinician scientists in the UK. This resource provides the impetus for the development of the current programme.

Programme outline

1. **Recruitment/selection.** Studentships will be advertised on-line on findaphd.com in November preceding the start. Applications will be selected in December and shortlisted candidates (about 10%) will be contacted around late December/early January with a date for the interview in mid-January. Shortlisted applicants will be encouraged to contact potential supervisors directly to discuss the projects in more detail and visit the labs. Following the interview, offers will be made based on academic achievement/potential only.
2. **Taught programme.** There is widespread recognition that PhD programmes offer strength in depth often at the expense of a sufficiently broad knowledge base. As a result, and since undergraduate courses vary so widely, students often finish a PhD with surprising gaps in their relevant knowledge base. All students will therefore be required to attend a minimum of a full course UCL unit of taught programmes (equivalent to 15 ECTS credits, approximately 60 hours contact time).

All students will meet initially with the Postgraduate Tutor for the programme (Prof Benny Chain) who will be responsible for the overall supervision of the cohort during the four years of the programme. The first task will be to discuss with the students the programme of taught courses, and the rotations (see below 4). In view of the wide breadth of potential projects being offered within the programme (ranging from epidemiology through bioinformatics to “wet lab” molecular science to clinical/patient based) the individual taught elements will be left flexible, and tailored to the individual student and project. It is anticipated that these will include any of the specialist modules in advanced immunology, virology, bacteriology, cell pathology, and statistics available as current postgraduate MSc/MRes modules or as final year undergraduate modules. The specific choice of modules will depend on the students previous experience and on their research interests.

It is anticipated that most students will complete all taught modules within six months of starting their PhD, but further taught modules can be incorporated if required at later stages of the project.

3. **Clinical programme.** As outlined above, this constitutes one of the major innovations of this programme. Since the clinical supervisor (CS) will be dependent on student selection after rotations the clinical training programme will start at month 7. The CS will initially meet with the student and primary research supervisor (RS) (and secondary supervisors if appropriate) to discuss the rationale and strategy for their research project. These project based meetings will continue throughout the programme, with meetings at least every three months. In addition, the CS will meet with the student and agree a programme of clinical activity. The clinical attachment could extend beyond the speciality of the assigned clinical supervisor – it would be their responsibility to use their connections to arrange appropriate clinical experience with their colleagues. e.g. Sitting in out-patient clinics, attending ward rounds, pathology, histology and radiology meetings, clinical case discussions, grand rounds. The student would be encouraged to present their research at a relevant clinical meeting (in-house and if appropriate national/international) to foster better communication between scientists and clinicians. The clinical supervisor should also make the student aware of

relevant clinical journals for their field of research. The list is not meant to be prescriptive, and will be dependent in part on the clinical specialty involved. However, it is anticipated the total time spent on clinical activities will be one to two days per month. All students will be awarded an Honorary Clinical contract, in order to fulfil NHS requirements, and to facilitate integration into the hospital environment.

4. **Rotation element.** During an initial induction period of 3 weeks (see below) each student will be required to select three laboratories for the rotation element of the programme. Individual rotations will be six weeks. The primary objective of the rotations will be to experience at first hand the environment of different laboratories, so as to make an informed choice of final PhD project/supervisor. The second objective is for the rotations to give opportunities to acquire technical skills in at least three different areas. The relatively short rotation periods provide an attempt to optimise between the balance of achieving these two objectives, while minimising load on participating laboratories, and maximising the amount of time eventually spent on the major research project. The students will select one of their three rotations for their PhD research project.
5. **Transferable skills.** UCL put increasing emphasis on the provision of good training in generic skills as part of the PhD and this is reflected by the program established within the Division of Infection and Immunity. A mandatory one week induction course at the beginning of the programme includes sessions on methodology of science, PhD skills, communication, research ethics, technologies and techniques, and health and safety. Additional practical skills courses (e.g. basic microbiological techniques, use of radioactive substances, venesection and handling of human blood, etc.) are offered as required.
6. **Presentation and communication.** The ability to communicate the results of research is a key skill acquisition target. Attendance at a 'Presentation Skills' workshop organised by UCL during the first or second year of the PhD is mandatory. Training opportunities for this include presentation in internal group lab meetings organized by supervisors, and annually at the Division of Infection and Immunity Tuesday Seminar Series to all members of the Division. There is also an annual Postgraduate Colloquium for all research students and supervisors, and a UCL Poster Exhibition held once a year. Students are encouraged to attend and present their data at UK and international meetings during the course of their PhD, usually during their second and third years (and, for the proposed program, would also do so during their fourth year). Departmental and UCL funding is provided for such attendance. In order to ensure a good level of general scientific knowledge, all students are required to attend a weekly seminar series which features speakers who are external to UCL, broadly based within the themes of infection and immunity. **Other transferable skills.** All students must attend either a residential course in 'Personal and Professional Management Skills' run by UCL Graduate School, or an equivalent course approved by the UK Research Councils. In addition UCL Graduate School provide a broad range of courses, including language training, IT skills, presentation and lecturing skills, how to write successful grant applications, research skills and entrepreneurial skills. Attendance at such courses is discussed on an individual student basis, and strongly encouraged wherever appropriate.

7. **Monitoring.** Progress of the student throughout PhD training is monitored via the UCL Postgraduate Student Log Book. Completion of this fully electronic document is mandatory for all UCL students; it requires regular meetings between students and both supervisors, to discuss progress and plan future work. It covers both the specific research project and broader transferable skills training, and the outcome of these regular meetings are recorded in the log as a record of progress. The log book also contains an extensive self-assessment section to be carried out by the student throughout the project to help to identify and address problem areas at the earliest possible time. Key check points in the log book are end of year reports, and the MPhil to PhD registration transfer. For the latter, students are required to write a full report (usually approximately 20 pages in length) summarising progress, and outlining future plans. The student is then required to give a seminar on their work, and is subsequently examined on the report in viva voce examination by two senior scientists (not including either supervisor) who then prepare a report and recommendation. This transfer usually occurs during the second year.

8. **Problem resolution.** All students on the programme will be under the care of the programme tutor (to be appointed). In case of any problem which is impeding progress of their studies, whether academic or personal, students are encouraged to contact their supervisors in the first instance, the programme tutor or if necessary, the Divisional Postgraduate Tutor or deputy. The UCL Graduate School provides a Code of Practice for student and supervisor, with supervisor training whenever appropriate. The enforcement of this code of practice is the responsibility, in the first place, of the Division of Infection and Immunity Postgraduate Committee, which either student or supervisor can approach. More general issues affecting supervision or postgraduate student issues can be addressed at termly student/staff meetings of the postgraduate students.