Programme Specification for the MRes in Plant Chemical Biology: Multidisciplinary Research for Next Generation Agri-Sciences

PLEASE NOTE. This specification provides a summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. This specification provides a source of information that may be used by the College for review purposes and sent to external examiners. More detailed information on the learning outcomes, content and teaching, learning and assessment methods of each module can be found in the course handbook or on-line at http://www3.imperial.ac.uk/chemicalbiology/mrescrop. The accuracy of the information contained in this document is reviewed by the College and may be checked by the Quality Assurance Agency.

1. Awarding Institution: Imperial College London
2. Teaching Institution: Imperial College London
3. External Accreditation by Professional / Statutory Body: Not applicable
4. Name of Final Award (BEng / BSc / MEng etc): MRes
5. Programme Title (e.g. Biochemistry with Management): Plant Chemical Biology
6. Name of Department / Division: Chemistry
7. Name of Faculty: Natural Sciences
8. UCAS Code (or other coding system if relevant): Not applicable
9. Relevant QAA Subject Benchmarking Group(s) and/or other external/internal reference points (http://www.qaa.ac.uk/Publications/InformationAndGuidance/Pages/Subject-benchmark-statement-Chemistry-2007.aspx)
The main aims of the master's by research (MRes) degree programme include:

- to extend students’ comprehension of key physical, chemical and biological concepts, and so provide them with an in-depth understanding of specialised areas at the physical and life sciences interface.
- to provide students with the skills and knowledge to plan and carry out experiments independently and assess the significance of outcomes
- to develop in students the skills to adapt and apply methodology to the solution of unfamiliar types of problems
- to instil a critical awareness of advances at the forefront of the chemical science and related physical and biological science disciplines
- to prepare students effectively for professional employment or doctoral studies in the chemical sciences.

Activities to be undertaken by the student in this degree programme are given below:

Research training
- Project-specific experimental skills.
- Accessing literature.
- Research planning, including evaluation of hazards and environmental effects.
- Making oral presentations, writing reports, including critical evaluation.
- Participating in colloquia.

Research project
- Critical appraisal of literature
- Formulation of coherent and feasible research proposal
- Implementation of planned experiments.
- Recording of data and their critical analysis.
- Dissertation.
- Outcome potentially publishable.

Advanced studies
- In area of specialism to support research topic.
- Complementary studies outside, but cognate to, area of specialism.

Problem-solving
- Development of general strategies including the identification of additional information required and problems where there is not a unique solution.
- Application of knowledge gained from advanced studies to the solution of problems.

Professional studies
- Ethics and societal responsibilities.

Students are expected to develop a wide range of skills and competencies. These divide into three broad categories:

- Physical/life sciences-related cognitive skills, i.e. relating to intellectual tasks, including problem-solving
- Physical/life sciences-related practical skills, e.g. competencies relating to the conduct of laboratory work
- Generic skills that may be developed in the context of life/physical sciences, and are of a general nature and applicable in many other contexts.

Natural Sciences-related cognitive skills
- Demonstration of knowledge and understanding of essential facts, concepts, principles and theories relating to the subject areas identified above
- Competence to apply such knowledge and understanding to the solution of qualitative and quantitative problems mostly of a familiar nature
- Competence in recognising and analysing problems, and in planning strategies for their solution
- Skills in the evaluation, interpretation and synthesis of biological and chemical information and data
- Skills in the practical application of theory using computer software and models
• effective communication of scientific material and arguments
• information technology (IT) and data-processing skills, relating to biological/chemical information and data.
• adaptation and application of methodology to the solution of unfamiliar problems
• assimilation, objective evaluation and presentation of research results
• high level competence in undertaking a research project, the outcome of which is of a quality that is potentially publishable.

**Natural Sciences-related practical skills**
• safe-handling of chemical and biological materials, including any specific hazards associated with their use and the ability to conduct risk assessments
• proper conduct of documented laboratory procedures involved in synthetic and analytical work
• skills in monitoring, by observation and measurement, of chemical properties, events or changes, and in systematic and reliable recording and reporting thereof
• operation of standard and specialised instrumentation
• interpretation and explanation of the limits of accuracy of their own experimental data in terms of significance and underlying theory, and to inform the planning of future work.
• knowledge and judgment required to select appropriate biological, chemical and physical science techniques and procedures
• competent planning, design and execution of experiments
• skills required to work independently and be self-critical in the evaluation of risks, experimental procedures and outcomes

**Generic skills**
• communication skills, covering both written and oral communication
• problem-solving skills, relating to qualitative and quantitative information
• numeracy and mathematical skills, including such aspects as error analysis order-of-magnitude estimations, correct use of units and modes of data presentation
• information retrieval skills, in relation to primary and secondary information sources, including information retrieval through online computer searches
• IT skills
• interpersonal skills, relating to the ability to interact with other people and to engage in team-working
• time management and organisational skills, as evidenced by effective planning and efficient implementation of appropriate modes of working
• skills needed to undertake appropriate further training of a professional nature.
• problem-solving skills including the demonstration of self-direction and originality
• effective communication and interaction with professionals from other disciplines
• appropriate exercise of initiative and personal responsibility
• expert decision making in complex and unpredictable situations
• independent learning ability required for continuing professional development.

All students graduating are expected to demonstrate that they have acquired the knowledge, abilities and skills in the areas identified in the foregoing sections.

• Knowledge base extends to a systematic understanding and critical awareness of topics which are informed by the forefront of the discipline
• Problems of an unfamiliar nature are tackled with appropriate methodology and taking into account the possible absence of complete data
• Experimental work is carried out independently and with some originality
• Substantial research project at the forefront of the discipline is completed effectively
• Generic skills are developed appropriately for professional practice.

10. **Level(s) of programme within the Framework for Higher Education Qualifications (FHEQ):**

<table>
<thead>
<tr>
<th>Programme</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor's (BSc, BEng, MBBS)</td>
<td>6</td>
</tr>
<tr>
<td>Integrated Master's (MSci, MEng)</td>
<td>7</td>
</tr>
<tr>
<td>Master's (MSc, MRes)</td>
<td>7</td>
</tr>
</tbody>
</table>

3 MRes in Plant Chemical Biology
11. **Mode of Study:** Full Time (12 months) with a Part Time option (24 months)

12. **Language of Study:** English

13. **Date of production / revision of this programme specification:** February 2013

14. **Educational aims/objectives of the programme**

The programme aims/objectives are to:

- Produce physical sciences postgraduates equipped to pursue careers at the interface between the physical and life sciences, in industry, the public sector and non-governmental organisations;
- Develop the ability to undertake research in multidisciplinary teams at this interface;
- Develop a knowledge of a range of basic and advanced biomolecular concepts, relevant to topics and problems in Plant Chemical Biology;
- Develop research and analytical skills related to biomolecular science with potential applications in Plant Chemical Biology;
- Develop oral and written scientific presentation skills;
- Attract the most motivated physical sciences graduates, both from within the UK and from overseas;
- Develop new areas of teaching in response to the advance of scholarship and the needs of vocational training.
15. Programme Learning Outcomes

Knowledge and Understanding

Knowledge and Understanding of:

A. Core concepts relevant to the Plant Chemical Biology subject area, including: cell biology and biochemistry, chemical biology and enzymology, analytical tools & techniques, physical techniques in biology, molecular basis of photosynthesis, theoretical approaches to biology, molecular plant defence mechanisms, single cell technologies;
B. A selection of three of the following areas of biomolecular science – chemistry of proteins and nucleic acids, cellular signalling, trafficking, theoretical methods and instrumentation and analysis;
C. Research techniques, including information retrieval, experimental design and statistics, modelling, sampling, biomolecular techniques, molecular biology, and laboratory safety;
D. Essential facts, concepts, principles and theories relevant to the student’s project; management and communication skills, including problem definition, project design, decision processes, teamwork, written and oral reports, scientific publications.

Teaching/learning methods and strategies

- Acquisition of the above knowledge and understanding (15.A-15.D) is through a combination of lectures, seminars, coursework and research.
- Throughout, the students are encouraged to undertake independent reading both to supplement and consolidate what is being taught/learnt and to broaden their individual knowledge and understanding of the subject.
- Assessment of the knowledge base is through a combination of unseen written examinations (15.A and 15.B) and assessed project work (15.C and 15.D).

Skills and other Attributes

Intellectual Skills:

Able to:

E. analyse and solve biomolecular problems using an integrated multidisciplinary approach;
F. integrate and evaluate information;
G. formulate and test hypotheses using appropriate experimental design and statistical analysis of data;
H. plan, conduct and write-up a programme of original research.

Teaching/learning methods and strategies

- Intellectual skills are developed through the teaching and learning methods outlined above under Knowledge and Understanding.
- Experimental design and statistical skills are developed in lectures and subsequently in the individual research project. Individual, formative and summative feedback is given to students by the project team. The feedback on the literature survey submitted in January, provides important summative feedback on student progress.
- Assessment is through literature report, unseen written examinations and the individual research project.

Practical Skills:

Able to:

I. plan and execute safely a series of experiments;
J. use laboratory–based methods to generate data;
K. analyse experimental results and determine their strength and validity;
L. prepare technical reports;
M. give technical presentations;
N. use the scientific literature effectively;
O. use computational tools and packages.

Teaching/learning methods and strategies

• Practical skills are developed through the teaching and learning programme outlined above (and in Knowledge and Understanding section).
• Practical experimental skills (15.I to 15.K) are developed through project work.
• Skills 15.I and m are taught and developed through feedback on reports written and presentations made as part of coursework assignments.
• Skill 15.N is developed through the literature report, journal club and supervised research project.
• Skill 15.O is taught and developed through project work.
• Practical skills are assessed through the literature report and the research project dissertation and talk.

Transferable Skills:

Able to:

P. communicate effectively through oral presentations, computer processing and presentations, written reports and scientific publications;
Q. apply statistical and modelling skills;
R. management skills: decision processes, objective criteria, problem definition, project design and evaluation, risk management, teamwork and coordination;
S. integrate and evaluate information from a variety of sources;
T. transfer techniques and solutions from one discipline to another;
U. use Information and Communications Technology;
V. manage resources and time;
W. learn independently with open-mindedness and critical enquiry;
X. learn effectively for the purpose of continuing professional development.

Teaching/learning methods and strategies

• Transferable skills are developed through the teaching and learning programme outlined above and in the Knowledge and Understanding section.
• Skill 15.P is taught through coursework and developed through feedback on assessed reports and oral presentations.
• Skill 15.Q is taught through lectures and practical work and developed, as appropriate, during individual research project.
• Skill 15.R is developed in the bi-weekly research team meetings.
• Skill 15.S is developed through feedback on a literature report.
• Skill 15.T is a core activity of the research projects and is additionally taught in lectures.
• Skill 15.U is taught in lectures developed through project work and individual learning.
• Skill 15.V is developed throughout the course within a framework of staged coursework deadlines.
• Although not explicitly taught, skills 15.W and 15.X are encouraged and developed throughout the course, which is structured and delivered in such a way as to promote this.
• 15.P to 15.X are all assessed in the student’s research project and literature survey.

16. The following reference points were used in creating this programme specification

• Student Handbook for Course approved by Senate of Imperial College
17. Programme structure and features, curriculum units (modules), ECTS assignment and award requirements

The programme is only offered as a full-time, one-year course and leads to the MRes degree. Students begin their lecture programme with core courses mostly in the first term (October-December) and follow this up in second term (January-March) with optional courses. The taught courses are examined in January. In the second term students also participate in a weekly Journal Club. In October students choose a 9 month (January-September) multidisciplinary research project. They present a literature report on the topic of their research in December and a final report and talk on the research in September. This is followed by an oral examination of the thesis.

The overall pass mark is 50%, and students must gain at least an overall pass mark in both the taught element and research element in order to be awarded the degree. The percentage weighting of marks contributing to the degree are given in the following table:

<table>
<thead>
<tr>
<th>Assessed Component</th>
<th>Taught Element (25%)</th>
<th>Percentage weighting of marks contributing to degree</th>
<th>Research Element (75%)</th>
<th>Percentage weighting of marks contributing to degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written Examinations</td>
<td></td>
<td>15 %</td>
<td>Literature Report</td>
<td>10 %</td>
</tr>
<tr>
<td>Group Learning Seminars</td>
<td></td>
<td>5 %</td>
<td>MRes manuscript</td>
<td>50 %</td>
</tr>
<tr>
<td>Journal Club</td>
<td></td>
<td>5 %</td>
<td>Oral Viva</td>
<td>15 %</td>
</tr>
</tbody>
</table>

The ECTS assigned to the course is given in the following table with 90 total ECTS for the course:

<table>
<thead>
<tr>
<th>Course Element</th>
<th>ECTS Allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taught (2 written examinations and Journal Club)</td>
<td>16</td>
</tr>
<tr>
<td>Research (Literature Report, MRes manuscript, and Oral Viva)</td>
<td>74</td>
</tr>
</tbody>
</table>

Year One:

Term one:

Students choose a research project after discussion with academic staff during the first two weeks of the course. Each research project has at least one physical and one life sciences supervisor. Under the guidance of their supervisors, students write a literature report and research proposal for submission at the end of term.

Students begin their taught lecture programme with 8 core courses mostly in this term, which cover the following topics: Introduction to Cell Biology and Biochemistry, Chemical Biology and Enzymology, Analytical Tools & Techniques, Physical Techniques in Biology, Molecular Basis of Photosynthesis, Theoretical Approaches to Biology, Molecular Plant Defence Mechanisms.

Term Two:

At the beginning of the spring term students are examined in two written examination papers (Paper 1 is 2 hours and Paper 2 is 1.5 hours) on the core lecture courses.
Following the examinations, students begin their research project in the laboratory. The students also present their project summary to each other in an afternoon seminar in January.

Students must choose and attend two elective lecture courses given in this term (these are non-examinable). Courses are selected after discussion with their project supervisors.

Students also attend Journal Club meetings which take place in this term. Journal Club is an assessed transferable skills course, which aims to develop presentation skills, whilst encouraging scientific debate, and providing the opportunity to broaden scientific knowledge. At each meeting students will work together in a group and make a presentation about a seminal high impact paper. This will be followed by a chaired discussion/debate about the paper. Students are assessed on their ability to organise the presentation in a logical manner, the use of clear power-point slides, the clarity of the presentation and its scientific content.

**Term Three:**

Students present their research findings at a one-day MRes Conference held at the beginning of September. The research projects will be finished and the MRes Thesis will be handed in beginning of September. Project assessment is based on a written MRes thesis and an oral examination with Internal Examiners in mid-September. Students may also have a viva on their project along with other aspects of the course with the External Examiners. This takes place prior to the MRes Examination Board meeting in late September.

18. **Support provided to students to assist learning (including collaborative students, where appropriate).**

- Students attend an Induction Session by the Course Directors in the first week of term. At the induction, students receive a copy of the MRes Student Handbook, which includes course details and assessment guidelines for Literature Report and MRes thesis, as well as the lecture course timetable. Course Directors explain the course structure and assessment methods to the students.
- Students are given a Day One Safety Induction by the Course Directors.
- Staff:student ratios for research training of 2:1 or greater.
- A large community of postgraduate research students and postdoctoral research workers working in the Institute of Chemical Biology at Imperial College.
- Students attend the Institute of Chemical Biology colloquia twice a year, where visiting speakers are invited to give a variety of talks within the research area of Chemical Biology.
- Library and other learning resources and facilities at South Kensington campus.
- Dedicated student computing facilities in the Chemistry and Life Sciences Departments.
- Extensive research facilities for biophysical and biochemical research.
- A postgraduate staff - student committee, which meets three times per year.
- Students attend an Institute of Chemical Biology informal lunch once a term.
- In addition to the Departmental Postgraduate Senior Tutor, a Personal Tutor is assigned to each student who assists students with personal problems and advice on pastoral and academic issues. The Course Directors are also available to assist students.
- Student email and open personal access to staff including the Course Directors.
- Access to student counsellors on the South Kensington site.
- Access to Teaching and Learning Support Services, which provide assistance and guidance, e.g. on careers and English language support.

19. **Criteria for admission:**

- The minimum qualification for admission is normally an upper Second Class Honours degree in a Physical Sciences-based subject from an UK academic institution or an equivalent overseas qualification.
- Where an applicant has a lesser degree qualification but has presented well at interview, a special cases for admission may be submitted to the Dean of the Royal College of Science by the Course Director.
20. **Processes used to select students:**

- All UK applicants (and where possible overseas applicants) are invited to Imperial College for a site tour and interview.
- All overseas applicants will be interviewed by telephone.
- Offers made to students are initiated by Course Directors.

21. **Methods for evaluating and improving the quality and standards of teaching and learning**

**a) Methods for review and evaluation of teaching, learning, assessment, the curriculum and outcome standards:**

The external examiner system and Boards of Examiners are central to the process by which the College monitors the reliability and validity of its assessment procedures and academic standards. Boards of Examiners comment on the assessment procedures within the College and may suggest improvements for action by relevant departmental teaching Committees.

The Faculty Studies Committees and the Graduate School Postgraduate Quality Committee review and consider the reports of external examiners and accrediting bodies and conduct periodic (normally quinquennial) and internal reviews of teaching provision. Regular reviews ensure that there is opportunity to highlight examples of good practice and ensure that recommendations for improvement can be made.

At programme level, the Head of Department has overall responsibility for academic standards and the quality of the educational experience delivered within the department or division. Postgraduate Staff – Student Committee, held each term, will report to Departmental Teaching Committee.

The course is also reviewed by EPSRC every year and there are peer review of lectures at random intervals.

**b) Committees with responsibility for monitoring and evaluating quality and standards:**

The **Senate** oversees the quality assurance and regulation of degrees offered by the College. It is charged with promoting the academic work of the College, both in teaching and research, and with regulating and supervising the education and discipline of the students of the College. It has responsibility for approval of changes to the Academic Regulations, major changes to degree programmes and approval of new programmes.

The **Quality Assurance Advisory Committee (QAAC)** is the main forum for discussion of QA policy and the regulation of degree programmes at College level. QAAC develops and advises the Senate on the implementation of codes of practice and procedures relating to quality assurance and audit of quality and arrangements necessary to ensure compliance with national and international standards. QAAC also considers amendments to the Academic Regulations before making recommendations for change to the Senate. It also maintains an overview of the statistics on completion rates, withdrawals, examination irregularities (including cases of plagiarism), student appeals and disciplinaries.

The **Faculty Studies Committees** and **Graduate School Postgraduate Quality Committee** are the major vehicle for the quality assurance of undergraduate / postgraduate courses respectively. Their remit includes: setting the standards and framework, and overseeing the processes of quality assurance, for the areas within their remit; monitoring the provision and quality of e-learning; undertaking reviews of new and existing courses; noting minor changes in existing programme curricula approved by Departments; approving new modules, changes in module titles, major changes in examination structure and programme specifications for existing programmes; and reviewing proposals for new programmes, and the discontinuation of existing programmes, and making recommendations to Senate as appropriate.

The **Faculty Teaching Committees** maintain and develop teaching strategies and promote inter-departmental and inter-faculty teaching activities to enhance the efficiency of teaching within Faculties. They also identify and disseminate examples of good practice in teaching.
**Departmental Teaching Committees** have responsibility for the approval of minor changes to course curricula and examination structures and approve arrangements for course work. They also consider the details of entrance requirements and determine departmental postgraduate student numbers. The Faculty Studies Committees and the Graduate School Postgraduate Quality Committee receive regular reports from the Departmental Teaching Committees.

The Postgraduate Staff – Student Committee and the Boards of Examiners also have responsibility to monitor and evaluate the quality and standards of the course.

c) **Mechanisms for providing prompt feedback to students on their performance in course work and examinations and processes for monitoring that these named processes are effective:**

- Postgraduate Staff – Student Committee.
- Meetings with project supervisors.
- Meetings with Course Directors.

d) **Mechanisms for gaining student feedback on the quality of teaching and their learning experience and how students are provided with feedback as to actions taken as a result of their comments:**

- Taught Core Courses Anonymous Feedback Forms.
- Masters Online Evaluation (MOLE) survey.
- Postgraduate Staff – Student Committee.
- Meetings with project supervisors.
- Meetings with Course Directors.
- Viva with External Examiner.
- Direct feedback to External Examiner at External Examiner’s Meeting

Actions taken as a result of the students comments will be sent to the students by email.

e) **Mechanisms for monitoring the effectiveness of the personal tutoring system:**

- Postgraduate Staff – Student Committee.
- Direct feedback to External Examiner at External Examiner’s Meeting

f) **Mechanisms for recognising and rewarding excellence in teaching and in pastoral care:**

Staff are encouraged to reflect on their teaching, in order to introduce enhancements and develop innovative teaching methods. Each year College awards are presented to academic staff for outstanding contributions to teaching, pastoral care or research supervision. A special award for Teaching Innovation, available each year, is presented to a member of staff who has demonstrated an original and innovative approach to teaching. Nominations for these awards come from across the College and students are invited both to nominate staff and to sit on the deciding panels.

Students are asked to vote for the ‘Best Lecturer’ from their taught lecture courses at the end of the spring term to recognise and award the staff's outstanding teaching on the course.

g) **Staff development priorities for this programme include:**

- Development of multidisciplinary research programmes between life science and physical science researchers.
- Staff appraisal scheme and institutional staff development courses.
22. Regulation of Assessment

a) Assessment Rules and Degree Classification:

For postgraduate taught programmes: The Pass Mark for postgraduate taught courses is 50%. In order to be awarded a result of merit, a candidate must obtain an aggregate mark of 60% or greater; a result of distinction requires an aggregate mark of 70% or greater.

Where appropriate, a Board of Examiners may award a result of merit where a candidate has achieved an aggregate mark of 60% or greater across the programme as a whole AND has obtained a mark of 60% or greater in each element with the exception of one element AND has obtained a mark of 50% or greater in this latter element.

Where appropriate, a Board of Examiners may award a result of distinction where a candidate has achieved an aggregate mark of 70% or greater across the programme as a whole AND has obtained a mark of 70% or greater in each element with the exception of one element AND has obtained a mark of 60% or greater in this latter element.

b) Marking Schemes for postgraduate taught programmes:

The Pass Mark for all postgraduate taught course modules is 50%. Students must pass all elements in order to be awarded a degree.

c) Processes for dealing with mitigating circumstances:

For postgraduate taught programmes: A candidate for a Master's degree who is prevented owing to illness or the death of a near relative or other cause judged sufficient by the Graduate School from completing at the normal time the examination or Part of the examination for which he/she has entered may, at the discretion of the Examiners, (a) Enter the examination in those elements in which he/she was not able to be examined on the next occasion when the examination is held in order to complete the examination, or

(b) be set a special examination in those elements of the examination missed as soon as possible and/or be permitted to submit any work prescribed (e.g. report) at a date specified by the Board of Examiners concerned. The special examination shall be in the same format as specified in the course regulations for the element(s) missed.

Applications, which must be accompanied by a medical certificate or other statement of the grounds on which the application is made, shall be submitted to the Academic Registrar who will submit them to the Board of Examiners.

d) Processes for determining degree classification for borderline candidates:

For postgraduate taught programmes: Candidates should only be considered for promotion to pass, merit or distinction if their aggregate mark is within 2.5% of the relevant borderline. Nevertheless, candidates whom the Board deems to have exceptional circumstances may be considered for promotion even if their aggregate mark is more than 2.5% from the borderline. In such cases the necessary extra marks should be credited to bring the candidate's aggregate mark into the higher range.

e) Role of external examiners:

The primary duty of external examiners is to ensure that the degrees awarded by the College are consistent with that of the national university system. External examiners are also responsible for approval of draft question papers, assessment of examination scripts, projects and coursework (where appropriate) and in some cases will attend viva voce and clinical examinations. Although external examiners do not have power of veto their views carry considerable weight and will be
treated accordingly. External examiners are required to attend each meeting of the Board of Examiners where recommendations on the results of individual examinations are considered. External examiners are required to write an annual report to the Rector of Imperial College which may include observations on teaching, course structure and course content as well as the examination process as a whole. The College provides feedback to external examiners in response to recommendations made within their reports.

23. Indicators of Quality and Standards

The External Examiner writes a report which is passed to the Executive Committee of the Graduate School, the Head of the Chemistry Department, and the MRes course director/coordinator for comments and action if required.

24. Key sources of information about the programme can be found in

- Postgraduate Prospectus, Imperial College of Science, Technology & Medicine (available on-line http://www.imperial.ac.uk/pgprospectus
- MRes course booklet (available on-line