Disclaimer

Every effort has been made to ensure that the information in this Handbook is correct at the time of going to press (September 2016). UCL reserves the right to make amendments to the information contained in this Handbook as a result of unforeseen events or circumstances beyond UCL's control or if deemed reasonably necessary by UCL.

This handbook is deemed to be the definitive version of information for all students on this taught programme of study.

In the event that amendments are made, UCL shall take reasonable steps to notify students as soon as possible.
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Welcome from the Programme Team

Welcome to the UCL School of Pharmacy and congratulations on gaining a place to study here on the MSc in Pharmaceutics.

During your time at the School you will become an integral member of the Pharmaceutics Department, learning about the latest developments in drug delivery platforms, devices and strategies and undertaking your research project. You will also develop a range of transferable skills, notably in pharmaceutical analysis, that will help you with career progression whether you stay in academia or move to industry. We have comprehensively refreshed the MSc programme for this academic year, aiming to introduce more cutting-edge topics and to ensure that our assessment methods align with the skills you will need in your future careers.

Completing an MSc in 12 months is a challenge, particularly for international students who are studying in a foreign language. Moving to a new country and leaving behind family and friends can be overwhelming. Good time management and practising and improving your English will help you cope with the demands of the programme, as will forming friendships with your fellow Pharmaceutics students. The relationships you build over the next year, especially those with the School itself, will last a lifetime and we are sure that you will always look back on your time with us with fond memories.

Do read this handbook carefully and keep it for reference throughout the year. Your tutors at the School are here to mentor and to support you, so if you have any problems or queries please do come and talk to one of us.

We wish you good luck with your studies and look forward to getting to know you over the coming year.

Dr Gareth Williams
Programme Director, MSc in Pharmaceutics

Professor Simon Gaisford
Head of Department and Deputy Programme Director, MSc in Pharmaceutics
1. General Information

1.1 PROGRAMME HANDBOOK

This Programme Handbook provides an introduction to the programme and contains the key information you need about the programme of study. Amongst other things, this handbook covers the curriculum, teaching and learning, administrative procedures, key personnel and assessment.

This handbook should be read in conjunction with the School Student Handbook which provides information about School staff, academic regulations and policies and administrative procedures.

The Handbook is relevant to you throughout your studies. There will inevitably be some changes during your time with us, possibly in relation to the teaching staff, programme content and assessment patterns and we shall keep you informed of any important changes. However, you should make sure that you keep up to date by reading our communications, checking the notice boards, reading your emails and browsing Moodle and the School and UCL Websites.

More detailed information on UCL procedures and policies in relation to students can be found on the UCL website at the following link: http://www.ucl.ac.uk/current-students. You can also find important information on the School website here: http://www.ucl.ac.uk/pharmacy/current-students. Students are expected to be fully aware of procedures but, if in any doubt, please enquire at the Student and Academic Support Office (known as the School Office – SASO).

We hope you find this handbook useful. It is revised every year to include new information and to make it easier to use. If you have any comments about the handbook or suggestions for improving the information provided, please forward your comments to the School Office (SASO) (email sop.saso@ucl.ac.uk).
1.2 PROGRAMME STAFF

Programme Director
Dr Gareth Williams
Room: 323
Tel: 020 7753 5868
Email: g.williams@ucl.ac.uk

Deputy Programme Director
Professor Simon Gaisford
Room: 304
Tel: 020 7753 5853
Email: s.gaisford@ucl.ac.uk

Programme Team
Most academic members of the Pharmaceutics staff contribute to the MSc in Pharmaceutics.

<table>
<thead>
<tr>
<th>Name</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professor Duncan Craig</td>
<td>Director of the UCL School of Pharmacy and Professor of Pharmaceutics</td>
</tr>
<tr>
<td>Professor Simon Gaisford</td>
<td>Head of Department (Pharmaceutics) and Professor of Pharmaceutics</td>
</tr>
<tr>
<td>Professor Abdul Basit</td>
<td>Professor of Pharmaceutics</td>
</tr>
<tr>
<td>Professor Stephen Brocchini</td>
<td>Professor of Chemical Pharmaceutics</td>
</tr>
<tr>
<td>Professor Kevin Taylor</td>
<td>Professor of Clinical Pharmaceutics</td>
</tr>
<tr>
<td>Professor Ijeoma Uchegbu</td>
<td>Professor of Pharmaceutical Nanoscience</td>
</tr>
<tr>
<td>Professor Klara Valko</td>
<td>Visiting Professor</td>
</tr>
<tr>
<td>Dr Sudax Murdan</td>
<td>Reader in Pharmaceutics</td>
</tr>
<tr>
<td>Dr Catherine Tuleu</td>
<td>Reader in Paediatric Drug Delivery</td>
</tr>
<tr>
<td>Dr Susan Barker</td>
<td>Senior Lecturer in Pharmaceutics</td>
</tr>
<tr>
<td>Dr Majella Lane</td>
<td>Senior Lecturer in Pharmaceutics</td>
</tr>
<tr>
<td>Dr Gareth Williams</td>
<td>Senior Lecturer in Pharmaceutics</td>
</tr>
<tr>
<td>Dr Mine Orlu Gul</td>
<td>Lecturer in Pharmaceutics</td>
</tr>
<tr>
<td>Dr Jose Prieto Garcia</td>
<td>Lecturer in Pharmacognosy</td>
</tr>
<tr>
<td>Dr Soma Somavarapu</td>
<td>Lecturer in Pharmaceutics</td>
</tr>
<tr>
<td>Dr George Pasparakis</td>
<td>EPSRC Fellow</td>
</tr>
<tr>
<td>Dr Khalid Sheikh</td>
<td>Senior Teaching Fellow</td>
</tr>
<tr>
<td>Dr Sunny Gill</td>
<td>Academic-Related Tutor</td>
</tr>
</tbody>
</table>
1.3 PROGRAMME ADMINISTRATION

The School Office (SASO) is the main administrative hub for your programme of study and is located in Room G11, Brunswick Square. You may also need to visit the UCL Student Centre on some occasions, and further information can be found here: http://www.ucl.ac.uk/current-students/student-centre

Your main administrative point of contact during your time on the programme will be the Student and Academic Support Office (SASO). The contact details for SASO and other administrative points of contact are listed in the table below:

<table>
<thead>
<tr>
<th>Name</th>
<th>Role</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ms Kirsty Martin</td>
<td>Student and Academic Support Manager</td>
<td><a href="mailto:kirsty.martin@ucl.ac.uk">kirsty.martin@ucl.ac.uk</a></td>
</tr>
<tr>
<td>Ms Elizabeth Mead</td>
<td>Admissions &amp; Student Services Manager</td>
<td><a href="mailto:elizabeth.mead@ucl.ac.uk">elizabeth.mead@ucl.ac.uk</a></td>
</tr>
</tbody>
</table>

Opening Hours and Contact Information

Hours: 09.00 to 17.00 (Monday-Friday)
Location: Room G11, Brunswick Square
Tel/Fax: +44 (0) 20 7753 5831
Fax: +44 (0) 20 7753 5829
E-mail: sop.saso@ucl.ac.uk

Postgraduate Programmes Manager
Dr Rosemary Smyth provides general support on academic and welfare matters for students on the full-time postgraduate programmes at the School (MSc and MRes). Her details are as follows:

Dr Rosemary Smyth
Room: 432
Tel: 020 7753 5950
Email: r.smyth@ucl.ac.uk

END OF SECTION 1
2. Programme Information

2.1 PROGRAMME DETAILS

Award: MSc Pharmaceutics
Awarded by: University College London
Department: UCL School of Pharmacy, Dept of Pharmaceutics
Length and Mode: 1 year full-time
Credits: 180 credits at Level 7
ECTS: 72 ECTS
Programme Director: Dr Gareth Williams
Deputy Programme Director: Professor Simon Gaisford

Teaching site

UCL School of Pharmacy
29/39 Brunswick Square
London WC1N 1AX
UK
Tel: 020 7753 5800
Fax: 020 7753 5829

2.2 THE MSc PHARMACEUTICS PROGRAMME

The MSc in Pharmaceutics is a 12-month full-time taught postgraduate programme. The aim of the MSc programme is to enable students to acquire a comprehensive knowledge of the processes involved in the delivery of drugs to therapeutic targets and to equip students with the research skills and practical ability to successfully develop products and processes relevant to the needs of the pharmaceutical industry.
The programme has drawn international students, mainly with first degrees in Pharmacy, from a variety of countries including Afghanistan, Australia, Bangladesh, China, Cyprus, Denmark, Egypt, Ghana, Greece, India, Iran, Iraq, Italy, Jordan, Kenya, Kuwait, Malaysia, Malta, Nepal, Nigeria, Pakistan, Palestine, Peru, Portugal, Romania, Spain, Sri Lanka, Saudi Arabia, Sudan, Thailand, Turkey, the United Arab Emirates and Venezuela.

2.3 MASTER’S LEVEL DESCRIPTORS

Master’s level awards are set at Level 7 of the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (FHEQ) published by the Quality Assurance Agency for Higher Education (QAA). Descriptors for the Level 7 qualification are in two parts – (1) what each student must demonstrate in order to gain the award, and (2) the wider abilities that the typical student is expected to develop.

The MSc degree is awarded to students who have demonstrated:

1. Systematic understanding of the knowledge and skills required in the development of contemporary drug delivery systems.
2. Critical awareness of the current state of the art in marketed drug delivery systems.
3. Comprehensive understanding of techniques applied to advanced scholarship in pharmaceutics, which include problem solving skills, evaluation, research methods and data analysis.
4. Originality in the application of knowledge, together with a practical understanding of how established techniques of research and enquiry are used to create and interpret knowledge in pharmaceutics.
5. Conceptual understanding that enables the student to:
   - Evaluate critically current research and advanced scholarship in the discipline, and
   - Evaluate methodologies and develop critiques of them and, where appropriate, to propose new hypotheses.

Typically, holders of the MSc degree will be able to:

1. Deal with complex issues both systemically and creatively, make sound judgments in the absence of complete data, and communicate their conclusions clearly to specialist and non-specialist audiences;
2. Demonstrate self-direction and originality in tackling and solving problems, and act autonomously in planning and implementing tasks at a professional or equivalent level;
3. Continue to advance their knowledge and understanding through continuing professional development, and
4. Develop new skills in pharmaceutics to an advanced level.
and will have:

5. The qualities and transferable skills necessary for employment requiring:
   • The exercise of initiative and personal responsibility; decision-making in complex and unpredictable situations, and
   • The independent learning ability required for continuing professional development.

2.4 PROGRAMME STRUCTURE

The MSc programme comprises two main components:

   • Eight taught modules (four in term 1 and four in term 2)
   • A research project

The taught modules are assessed by a combination of coursework and written examination.

2.5 LEARNING AND TEACHING METHODS

Teaching methods are varied and include lectures, seminars, small group work, problem-based learning approaches and individual project work. National and international experts from the pharmaceutical industry and practicing pharmacists contribute to the programme. Class size varies from 8 - 50 students depending on the teaching format.

END OF SECTION 2
3. Modules

3.1 MODULE CHOICE

The list of taught modules may change from year to year to reflect changes in the research areas of the staff and to ensure that the syllabus covers the latest research developments in the pharmaceutical sciences. Every effort is made to inform students of any changes before the programme starts.

Within the first two weeks of term 1 you must log onto the PORTICO Student Database in order to enrol for your modules. PORTICO can be found at the following link: https://evision.ucl.ac.uk/urd/sits.urd/run/siw_lgn

**Term 1 – Students take 4 core modules**

<table>
<thead>
<tr>
<th>Module</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>PHAYG061</td>
<td>Analysis and quality control</td>
<td>15</td>
</tr>
<tr>
<td>PHAYG062</td>
<td>Preformulation</td>
<td>15</td>
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<tr>
<td>PHAYG063</td>
<td>Formulation of small molecules</td>
<td>15</td>
</tr>
<tr>
<td>PHAYG064</td>
<td>Personalised medicines</td>
<td>15</td>
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</table>

**Term 2 – Students take 1 core module and 3 optional modules**

**Core module**

<table>
<thead>
<tr>
<th>Module</th>
<th>Title</th>
<th>Credits</th>
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<tr>
<td>PHAYG065</td>
<td>Pharmaceutical biotechnology</td>
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**Optional modules (choose three of the following)**

<table>
<thead>
<tr>
<th>Module</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>PHAYG066</td>
<td>Clinical pharmaceutics</td>
<td>15</td>
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<tr>
<td>PHAYG067</td>
<td>Nanomedicines</td>
<td>15</td>
</tr>
<tr>
<td>PHAYG068</td>
<td>Formulation of natural products and cosmeceuticals</td>
<td>15</td>
</tr>
<tr>
<td>PHAYG060</td>
<td>Initiating a pharmaceutical start-up</td>
<td>15</td>
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**Terms 2 & 3 – Students take the core research module:**

<table>
<thead>
<tr>
<th>Module</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>PHAYGX98</td>
<td>Research project for MSc Pharmaceutics</td>
<td>60</td>
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</table>
3.2 MODULE OUTLINES

You will receive more detailed module outlines at the start of the module, and the content may be slightly different to the information published here. This is because staff are constantly updating their teaching in light of developments in current research and new thinking.

Compulsory modules

Term 1

PHAYG061 ANALYSIS AND QUALITY CONTROL
Module Leader(s): Dr Gareth Williams

The module will teach students about key aspects of pharmaceutical analysis and quality control, focusing on the major techniques which will be crucial for their future careers/studies. They will learn about high-performance liquid chromatography, UV spectroscopy, nuclear magnetic resonance spectroscopy, X-ray diffraction, differential scanning calorimetry, thermal analysis, microscopy (light, electron, atomic force), and hyphenated techniques. The focus of the module will be on data acquisition and interpretation, with the aim of inculcating the students taking the module with the skills needed to use these techniques to solve real pharmaceutical problems.

PHAYG062 PREFORMULATION
Module Leader(s): Prof Simon Gaisford

The course will give an overview of the basic information required to build up a picture of the physicochemical properties of a potential drug candidate and how this information is used to (i) make a decision on the likely developability of a compound and (ii) inform and direct likely formulation strategy. Key concepts to be introduced include solubility, partitioning, acid-base chemistry, dissolution behavior and effect of physical form. The use of the data to inform formulation strategy will be achieved with reference to case studies of marketed products and/or generic drug delivery devices.

PHAYG063 FORMULATION OF SMALL MOLECULES
Module Leader(s): Prof Abdul Basit

Students will learn the key principles of formulating small molecule active ingredients. Mainstream techniques such as tableting and capsule manufacture will be introduced, with further discussion of advanced modified release systems and how to assess drug release from
a formulation. The focus will be on oral delivery, but with homage paid to other administration routes, particularly pulmonary, dermal, and ocular delivery.

**PHAYG064 PERSONALISED MEDICINE**

*Module Leader(s):* Dr Mine Orlu Gul

This module will provide a perspective in pharmacogenomics applied to clinical and pharmaceutical research, with particular emphasis on patient-centric medicine. The focus of the module will be on the development and use of personalised medicine for the treatment of diseases. The module will also provide an introduction to the use of personalised medicine for prevention and diagnosis of diseases. Students will develop a theoretical knowledge and understanding of personalised medicine in pharmaceutical sciences alongside drug discovery, clinical pharmacology, pharmacogenetics, pharmacokinetics/pharmacodynamics, tailored drug delivery, epidemiology, ethics and governance of individualized therapies.

**Term 2**

**PHAYG065 PHARMACEUTICAL BIOTECHNOLOGY**

*Module Leader(s):* Prof Steve Brocchini

The module will teach students about key aspects of biotechnology as it relates to the development of medicines for human use. Coverage will include a survey of the medical uses of vaccines, proteins and peptides. Students will learn about recombinant technology, protein purification, characterisation and formulation. A key focus of the module will be to ensure students understand the different classes of proteins (e.g. blood factors, antibodies, alpha helical barrel proteins) that are used clinically. Discussion will also cover regulatory issues, including biosimilars and biobetters. Future perspective will be provided by covering companion diagnostics and principles of cell based therapies.

**Optional modules**

**Term 2**

**PHAYG060 INITIATING A PHARMACEUTICAL START-UP**

*Module Leader(s):* Prof Abdul Basit

The course will permit students to learn the best practice of initiating and building a pharmaceutical start-up company from the ground up. It will be taught by members of academic staff from the UCL School of Pharmacy who have direct experience of doing so (Profs Basit, Brocchini, Buckton, Uchegbu; Dr Gaisford), complemented with industry speakers from SMEs. Issue around generating the idea/concept for the business, developing a sound
business case to raise finance, and the key resources (staff and otherwise) that need to be in place will be considered in depth. Methods to cultivate contacts both to initiate and grow the business will be discussed, as will intellectual property aspects and common pitfalls.

**PHAYG066 CLINICAL PHARMACEUTICS**  
*Module Leader(s):* Prof Kevin Taylor / Dr Gareth Williams

This module will focus on the theory and practice of clinical pharmaceutics: it will consider how the properties of a formulation affect its performance in patients, and will use examples and case studies to illustrate the concepts discussed. In the context of developing new medicines and treatments, we will discuss the unmet clinical need and potential clinical use of a medicine.

**PHAYG067 NANOMEDICINES**  
*Module Leader(s):* Dr Soma Somavarapu

This module explore the use of nanotechnology for the delivery of therapeutic molecules and for diagnostics. It will cover nanocarriers such as liposomes, micelles, dendrimers and inorganic and organic nanoparticles. The overall emphasis will be on the need for novel nanoscale delivery vectors (both natural and synthetic), a better understanding of targets, and the routes that delivery systems have to traverse to reach their targets. Another topic of interest will be focused nanotheranostics, which involves the integration of a therapeutic and diagnostic function into a single nanocarrier system.

**PHAYG068 NATURAL PRODUCTS AND COSMECEUTICALS**  
*Module Leader(s):* Dr Soma Somavarapu / Dr Jose Prieto Garcia

This module will focus on the formulation principles to be considered in the design and development of phytochemicals as cosmeceutical products. The module will consider the basic skin structure/function and the design of skin-targeted formulations. Students will also cover the basic principles of colloidal systems, widely used for the preparation of topical products. Laboratory work will be carried out in small groups and will focus on the development of topical products suitable for administration to skin. Quality control and regulatory framework concepts will be discussed. The main focus of learning will be both theoretical and practical concepts of formulation development.

END OF SECTION 3
4. Research Project

4.1 PHAYGX98 Research Project for MSc Pharmaceutics

The major component of the MSc programme is the research project. Projects are in general supervised by an academic member of staff in the Department of Pharmaceutics, but industry and hospital based projects are also likely to be offered. Students are provided with information on the staff members available to supervise them and the likely projects available early in Term 1, and are asked to make a selection of 3 – 5 preferred supervisors. Projects are then allocated towards the middle of Term 1, taking into account student preferences. Each project is unique and usually complements the particular research activities of the supervisor. Laboratory work (undertaken in the supervisor’s laboratory) is undertaken between February and August. Students are expected to develop their own research ideas and experimental series in discussion with their supervisor, and complete a comprehensive literature review to supplement their work. Results are written up and submitted as a dissertation and presented in an oral presentation in late August/early September.

Although projects are unique and depend upon the specific research being conducted at the time, examples of research projects undertaken in the past are set out in Section 4.2. It is a reasonable expectation that research work is published; listed below are examples of peer-reviewed research papers involving former MSc students (the MSc student’s name is highlighted).


4.2 SAMPLE PROJECT TITLES AND OUTLINES

The following research projects were offered to students in previous years. The list of research projects changes each year but this list is intended to show the typical range of projects on offer.

Core/shell nanofibres for colon-targeted delivery
This project seeks to prepare core/shell nanofibres with a shell made of a pH sensitive polymer and a mucoadhesive core, with the aim to providing targeted local delivery of drugs to the colon for the treatment of e.g. cancer or irritable bowel syndrome

Solid-lipid nanoparticles generated by electrospinning
This project will prepare nanoscale fibres comprising a fast-dissolving polymer, a drug, and a lipid carrier (tristearin). Upon addition of the fibres to water, previous studies have shown that the polymer dissolves and the drug/lipid components self-assemble into nanoparticles. This permits the on-demand production of nanoparticles, overcoming many of the stability issues which can arise on their storage. The project will prepare new formulations using anti-cancer drugs, and will fully characterise these. We will also look to scale up the production process from the bench to the medium-scale, a vital first step towards commercialisation.
3D printed medicines
The aim of this project is to explore the use of 3D printing to produce small batches of personalised medicines, with the dose precisely tailored to the individual taking it. The required drug and polymer will be processed into long strands by hot-melt extrusion, before being printed into tablets with a range of drug loadings. The tablets will be characterised and the drug release profiles explored.

Protein nanoparticles for inhalation
This project will examine the process of protein (lysozyme) nanoparticle formation. The nanoparticles will be characterised by photon correlation spectroscopy and electron microscopy. An assay of enzymatic activity will be established to assess the retention of biological activity under processing conditions. The nanoparticles will be formulated in an HFA propellant and the pMDI formulation evaluated by Andersen Cascade Impaction analysis.

Surface modification by surfactants of carrier lactose particles and the effect on drug aerosolisation
Lactose is a commonly used carrier in dry powder inhalation formulations. This project will seek to change the lactose particle surface by adsorption of a range of surfactants. This will provide the opportunity of varying the hydrophobicity and surface charge of the lactose. The influence of these adsorbed films on the aerosolisation of a drug will be examined.

Safe use of the extemporaneous preparation of sildenafil citrate for children with pulmonary hypertension
The practice of extemporaneous or small volume compounding is widespread even if the quality and applicability of the information on the product is often inconsistent. In order to improve safety of use of sildenafil citrate (Viagra) used unlicensed in children with pulmonary hypertension, the aims of this work are to provide better quality information on paediatric extemporaneous formulations of Viagra by:

- Comparing the crushed tablets (commonly used on the wards) and the extemporaneous preparation (2mg/ml suspension proposed by Princess Margaret hospital, Perth, Australia) in terms of uniformity of dose, effect of dilution and in vitro dissolution profiles.
- Establishing the physicochemical and bacteriological stability of the extemporaneous preparation over 6 months and during a simulated treatment course. The extemporaneous preparation, if it is stable enough, could be then prepared in GMP conditions from appropriate suppliers for hospitals.

Cysteamine ophthalmic gels in children
In the long-term treatment of cystinosis, administration of 1 drop of cysteamine in each eye many times daily is required. This leads to profound problems with patient compliance. Therefore, a sustained release preparation such as an in situ ophthalmic gel would prove useful. When installed into the cul-de-sac of the eye, it shifts from an easy to administer liquid to a transparent or translucent gel that is retained longer in the eye, increasing bioavailability while reducing both systemic absorption and the need of frequent administration. The solgel
transition can occur as a result of physicochemical changes such as pH, temperature, ionic strength or a combination of different mechanism depending on polymers used. The aim of the project is the formulation of ophthalmic gels of cysteamine with different polymers and comparison of different formulations in vitro (viscosity measurement, drug release through diffusion studies).

**The use of disintegrants in HPMC capsule formulation**
In recent years, capsule shells made from the polymer hydroxypropyl methylcellulose (HPMC) have been made available for oral administration of drugs. These capsules, unlike the commonly used gelatine capsules, are non-animal material derived eliminating problems with contamination and religious or dietary restrictions. Unlike gelatine capsules, their disintegration is not temperature dependant but their dissolution was shown to be influenced by the concentration of potassium ions (if over 12.5 mM) and total ions (if over 355 mM) rather than by the pH. Those results were obtained with a formulation containing 10% of disintegrant (Croscarmellose Sodium, Acdisol). Preliminary results in vitro showed that higher levels of Acdisol in HPMC capsule formulations actually retards drug release and lead to more variable results then with gelatine capsules. In vivo, the presence of a low fluid environment such as the fed stomach could further prolong HPMC capsule disintegration, drug release and therefore have serious clinical implications. The aims of this project are to investigate in vitro the mechanisms involved in this retardation phenomenon.

**Development and in vitro evaluation of novel delivery systems for colonic targeting**
Targeting drugs to the colon has become an increasingly important avenue of research investigation. Traditionally, pH responsive polymers in the form of enteric coatings have been utilised to deliver drugs to the colon; however, the site specificity of such formulations is known to be poor. Systems that are susceptible to degradation by colonic bacteria are believed to offer a more precise approach to targeting. However, drug release from such formulations is generally slow because of the slow rate of fermentation in the colon. This project will seek to develop and assess the in vitro potential of a multi-triggered delivery system for colonic delivery, which is based on the simplicity of the pH responsive approach and the site specificity of the bacterial approach. Such a system should offer a practical solution to the problem of site specific targeting to the colon via the oral route.

**An assessment of the stability of aspirin in solid-state mixtures using isothermal microcalorimetry**
Microcalorimetry offers the potential greatly to reduce the time taken to determine product stability because of its inherent sensitivity to changes in heat, but its application to solid-state samples is limited. In this project, the interactions between two commonly used excipients (lactose and magnesium stearate) will be studied; lactose does not interact with aspirin but magnesium stearate is known to cause the drug’s degradation. The data obtained will be used to understand the nature of the interactions occurring and to demonstrate the utility of the method for stability assessment.
The prediction of product stability for multi-component formulations by analysis of microcalorimetric data

Virtually all processes can be followed using microcalorimetry, but this often results in complex data comprising responses from different samples. What is needed is an approach to data analysis that allows deconvolution of the data into their respective individual responses. In this project, real and simulated data for complex pharmaceutical systems will be analysed using a number of recently derived models with the intention of being able to isolate the heat-flow response of a specific process (such as drug degradation).

Development of a formulation for the respiratory delivery of the anti-appetite peptide

A specific peptide appears to have remarkable appetite suppressive effects when administered parenterally immediately before a meal. We suggest that, from a patient’s point of view, it would be easier and more acceptable to simply inhale a mist containing the peptide in an insoluble form prior to a meal. Generally polypeptides have limited physical and chemical stability when dissolved in an aqueous vehicle. By analogy with some investigations on human growth hormone currently being carried out at the University of Illinois at Chicago, we suggest it should be possible to produce insoluble adducts of this peptide with aminoglycosides and deliver these in a number of carriers including chitosan microparticles formulated to be at the optimum size range for respiratory delivery by inhalation from a mist.

Microencapsulation of antigens using supercritical fluid technology and spray drying for pulmonary delivery of vaccines

Supercritical fluid (SCF) technology has been in use for the past 30 years as an environmentally benign, energy- and cost-saving tool in various industries. SCF technology is making progress in many different fields of the pharmaceutical industry especially in operations including crystallization, particle size reduction, and the preparation of drug delivery systems, coating, and product sterilization. The advantages of SCF technology include the use of mild conditions for pharmaceutical processing (which is advantageous for labile proteins and peptides), the use of environmentally benign nontoxic materials (such as CO2), minimization of organic solvent use, and production of particles with controllable morphology, narrow size distribution. We have recently shown in a pioneering study that by using supercritical fluid technology, liposomes can be produced. We are now aiming at further evaluation of this technology towards a pulmonary drug delivery platform. For this purpose, microparticulate carrier systems will be prepared and loaded with protein based vaccines. The carrier systems will then be characterized with regard to physicochemical parameters and antigen loading and release. Testing will also involve cell culture experiments as well as in vivo studies in animals.

Can piperine enhance the permeation of drug into skin?

The transdermal route is a popular route because of its non-invasiveness, access, low variability between patients, etc. But the skin is a very good barrier. One way to increase drug permeation through the skin is to use enhancers. Piperine, a component of pepper, has been shown to enhance oral drug absorption. The aim of the study is to determine whether piperine can enhance drug permeation into and through the skin. During the conduct of the study, you
will formulate drug preparations containing drug and piperine and measure the permeation of drug into and through skin, in the presence and absence of piperine.

**Jojoba oil microemulsions**
Jojoba oil is used in the cosmetics industry. It is a stable oil, chemically resembles spermaceti (which has been widely used in cosmetic products), resembles the oil secreted on the skin and deeply moisturizes skin. This oil is also non-irritant and hypoallergenic. Hypothesis: Due to the hydrating effect of the oil on skin, microemulsions prepared from jojoba oil may be suitable vehicles for the transdermal delivery of drugs. Last year’s MSc project showed that microemulsions of jojoba can be formulated. The aim of this year’s project is to characterize the microemulsions for transdermal drug delivery.

**The formulation and evaluation of particulate-based proliposomes for pulmonary delivery**
The suitability of nebulisers for the delivery of liposomal aerosols is well established. However, conventional liposomes present problems in terms of physical and chemical instability. In this study, particulate-based proliposomes will be prepared that are capable of reconstitution to yield an isotonic formulation of liposomes following hydration within the reservoir of a nebuliser. Work in the laboratory has recently demonstrated that such a system is possible. The proposed study will involve an investigation of strategies to optimise such systems, such that during nebulisation, liposomes of an appropriate size for drug delivery to the lung will be readily formed. The student will prepare proliposome formulations from a range of phospholipids, initially using sucrose as a carrier material. Additionally, an effervescent proliposome formulation will be developed, as published studies have shown that these hydrate rapidly on addition of water to generate a population of small liposomes. Aerosols will be generated from a range of jet and ultrasonic nebulisers, operated under a range of conditions. Systems will be evaluated in terms of:
- Their ability to generate liposomes
- The size and morphology of the liposomes generated
- The delivery of liposomes into an impinger
- The influence of nebuliser design on the operation of the above

**The formulation and evaluation of ethanol-based proliposomes for pulmonary delivery**
Whilst the suitability of nebulisers for the delivery of liposomal aerosols is well established, the use of conventional liposome formulations is limited due to their physical and chemical instability. In this study, ethanol-based proliposomes will be prepared which can be reconstituted to yield an isotonic formulation of liposomes following hydration within the reservoir of a nebuliser. Preliminary work in our laboratory has shown the potential of such a system. The proposed study will involve an investigation of strategies to optimise one such proliposome formulation. In this case, an optimised formulation is one that on hydration will generate drug-containing liposomes of an appropriate size for drug delivery to the lung. The student will prepare proliposome formulations from a range of phospholipids and other excipients, and will encapsulate a model water soluble drug. Aerosols will be generated from a variety of jet nebulisers, and the systems will be evaluated in terms of:
- Their ability to generate liposomes
- The size and morphology of the liposomes generated
- The ability of the liposomes to incorporate a model drug
- The delivery of liposomes and liposome incorporated drug into an impinger
- The influence of formulation variables on the above

**Intracellular trafficking of delivery systems using confocal laser scanning microscopy**

Delivery systems interact with cells in a variety of ways that commonly lead to uptake and localization at a specific cellular compartment. The interactions and the eventual intracellular fate of a delivery system depends largely on the type of delivery system, its chemical composition, physicochemical characteristics as well as the cell type. In this project, a variety of delivery systems used in transport of drug and gene-encoding molecules will be prepared, fluorescently labelled and allowed to interact with different cell types. Time-dependent intracellular trafficking events will be monitored by confocal laser scanning microscopy. The interaction of delivery systems with cells will be monitored under different conditions to confer different mechanisms of cellular uptake (endocytosis, phagocytosis, etc). Correlation between the physicochemical characteristics of delivery systems and their time-dependent intracellular trafficking profiles will offer valuable information as to their therapeutic capabilities.

**Engineering non-viral gene delivery systems: physicochemical and structural characterisation studies**

Non-viral gene therapy vectors are predominantly composed of condensates between cationic lipids and other macromolecules (polymeric or biological) with the negatively charged plasmid DNA. This condensation process is governed by complex electrostatic, hydrophobic and other biophysical interactions that usually lead to polydisperse and morphologically non-homogenous soft particles between the condensed DNA and the cationic molecules. Recently, ternary systems between a cationic small molecule (peptide), plasmid DNA and the cationic lipids have been proposed as gene transfer vectors of improved colloidal stability and pharmaceutical viability. The project will focus on the physicochemical and structural characterization of ternary non-viral gene therapy vectors composed of a small peptide (up to 20 amino acids) as the cationic condensing agent, plasmid DNA and cationic cholesterol- and phospholipid-based lipids. A variety of techniques will be used to characterize the vector systems including photon correlation spectroscopy, laser Doppler electrophoresis, electron microscopy, microcalorimetry, and atomic force microscopy.

**Site-specific delivery to the eye**

Many conditions of the eye require surgery for treatment. Differentiated healing is often required for a successful outcome. Cytotoxic molecules such as 5-fluorouracil (5-FU) are administered daily. This collaborative project will examine the release characteristics of 5FU from commercial gels and from excipient-less pellets.
Particulate associated medicines
A library of polymers has been prepared for this collaborative project. They have not shown any in vitro toxicity. This project will examine the processing characteristics of these polymers in the presence of a model protein to determine the potential to stabilise the protein. Release profiles of the protein will also be determined.

Studies of salt formation and the use of salts to improve dissolution and modify physical properties of drugs.
It is well known that changing the salt form of a drug can result in improved solubility and stability. However, the selection of the best salts for optimised properties is far from clear. In this project we will explore the selection of salts and assess which ones yield crystalline and which yield amorphous material. We will assess the stability and solubility and attempt to make general plans for the best way to optimise pharmaceutical performance.

Investigation of reasons for adhesion of drug to the container wall of pressurised metered dose inhaler formulations.
Many micronised drugs adhere to container walls and this results in loss of the drug to be delivered to the lung. It is not clear why the drug adheres above the liquid line on the container wall. In this project we will explore reasons for adhesion to the container as well as elucidating strategies to prevent adhesion (including the use of coatings for the container and additives to the propellant). As part of the project attempts will be made to stop adhesion above the liquid fill line.

Encapsulation of nanoparticles inside large liposomes and niosomes
The object of this project is to prepare large vesicles and use various techniques to encapsulate nano- and microspheres of various diameters and surface properties inside the vesicles. In the study various methods of vesicle preparation will be undertaken to achieve either unilamellar or multilamellar vesicles. The release of the nanoparticles from the vesicle and other characteristic will be studied by micromanipulation techniques which we have developed.

Electronically responsive release of drugs from room temperature ionic liquids
Room temperature ionic liquids have rarely been used in pharmacy but we have been studying their potential as reservoirs and vehicles for drugs. A phenomenon discovered is that the application of an electric field can increase release of dissolved drugs, giving rise to the possibility of pulsatile delivery prototypes. The project probes this phenomenon in more detail.

END OF SECTION 4
5. Assessment and Regulations

5.1 PROGRAMME REGULATIONS

The full Programme Regulations for Taught Postgraduate Programmes can be found on the UCL website at the link below. **Students must also read the information contained in the School Student Handbook.** We have included a brief summary of the main regulations in this handbook; **however students must read the Academic Manual in full.**

http://www.ucl.ac.uk/srs/academic-manual/overview

**Coursework**
Students must complete a number of formative and summative assignments. Formative assignments give feedback to students on their performance but do not count towards final marks (however, it may still be a requirement to complete these). Marks for summative assignments do count towards the final mark for each module. The minimum pass mark is 50%.

**Examinations**
Students will normally take written examinations for term 1 modules in January and written examinations for term 2 modules in April-June. Resit examinations are normally held in the last week of August or the first week of September and will be of the same format and duration as term 1 and 2 examinations.

**Overall module marks**
Your overall mark for each module will be made up of your coursework and exam marks (see below for details). To pass a module you must obtain overall at least 50%, including a coursework mark of 50% at minimum and an exam mark of 40% or more.

**Resits**
The regulations permit students a first opportunity at an assessment and one resit opportunity only (at the discretion of the Board of Examiners). No further opportunities are permitted. The higher of the marks achieved at the first attempt and the re-sit attempt will apply. Students cannot re-sit modules which they have passed.

**Condoning**
Please refer to the Academic Manual, Chapter 4, Section 4.6.2

http://www.ucl.ac.uk/srs/academic-manual/c4/progression-award/postgraduate#top

**Final Degree Mark**
The overall pass mark for the award of the MSc is 50%. The final degree mark is calculated on the average module marks weighted according to the number of credits they carry. The Master’s degree is worth 180 credits in total so a 15 credit module would contribute 15/180 to the final mark.
Criteria for the Award of Pass, Merit and Distinction
Please refer to the Academic Manual, Chapter 4, Section 9.5.
http://www.ucl.ac.uk/srs/academic-manual/c4/classification/taught-postgraduate#top

5.2 SCHEME OF AWARD

The scheme of award sets out the individual assessment components and their relative weighting. Students will be subject to the scheme of award in effect at the time they start the programme. The MSc is worth 180 credits. This is comprised of 120 credits of taught modules and a 60 credit dissertation.

The MSc in Pharmaceutics comprises the following weighted assessment components:

<table>
<thead>
<tr>
<th>Module</th>
<th>Marks</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Term 1 Core</td>
<td>100</td>
<td>15</td>
</tr>
<tr>
<td>Term 1 Core</td>
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</tr>
<tr>
<td>Term 1 Core</td>
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<td>Term 1 Core</td>
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<td>Term 2 Core</td>
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</tr>
<tr>
<td>Term 2 Core</td>
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<td>15</td>
</tr>
<tr>
<td>Terms 2 &amp; 3</td>
<td>100</td>
<td>60</td>
</tr>
</tbody>
</table>

Modules are assessed by a mixture of coursework and written examinations, as detailed below. The relative weighting of coursework to examinations varies between modules and is summarised below; this will be outlined in more detail in the individual module guides.

Module Assessment for PHAYG060, PHAYG061, PHAYG064, PHAYG067, PHAYG068

<table>
<thead>
<tr>
<th>Assessment Component</th>
<th>Pass Mark</th>
<th>Weighting</th>
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</thead>
<tbody>
<tr>
<td>Coursework</td>
<td>50%</td>
<td>100%</td>
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</table>

Module Assessment for PHAYG062, PHAYG065, PHAYG066

<table>
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<tr>
<th>Assessment Component</th>
<th>Pass Mark</th>
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</thead>
<tbody>
<tr>
<td>Coursework</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>Unseen written exam</td>
<td>40%</td>
<td>50%</td>
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### Module Assessment for PHAYG063

<table>
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<tr>
<th>Assessment Component</th>
<th>Pass Mark</th>
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</thead>
<tbody>
<tr>
<td>Coursework</td>
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</tr>
<tr>
<td>Unseen written examination</td>
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<td>33%</td>
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</table>

### Module Assessment for PHAYGX98 Research Project for MSc Pharmaceutics

<table>
<thead>
<tr>
<th>Assessment Component</th>
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</thead>
<tbody>
<tr>
<td>Assessment of working method</td>
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<tr>
<td>Oral presentation</td>
<td>10%</td>
</tr>
<tr>
<td>Written report</td>
<td>80%</td>
</tr>
</tbody>
</table>

END OF SECTION 5
Appendix 1: Academic Calendar

The MSc is a full-time, twelve-month programme. Students should not plan any activities to interfere with the 9:00am – 5:00pm schedule, Monday – Friday for the entirety of the programme.

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Induction Week</td>
<td>26 September 2016</td>
</tr>
<tr>
<td>Term 1 Starts</td>
<td>26 September 2016</td>
</tr>
<tr>
<td>Classes start</td>
<td>3 October 2016</td>
</tr>
<tr>
<td>Term Ends</td>
<td>16 December 2016</td>
</tr>
<tr>
<td>Term 2 Starts</td>
<td>9 January 2017</td>
</tr>
<tr>
<td>Examination Period</td>
<td>9 – 13 January 2015</td>
</tr>
<tr>
<td>Lab work for research projects begin</td>
<td>Mid-January 2017</td>
</tr>
<tr>
<td>Term 2 Ends</td>
<td>24 March 2017</td>
</tr>
<tr>
<td>Term 3 Starts</td>
<td>24 April 2017</td>
</tr>
<tr>
<td>Examination Period</td>
<td>April – June 2017</td>
</tr>
<tr>
<td>Full time lab work for projects</td>
<td>May 2017</td>
</tr>
<tr>
<td>Term 3 Ends</td>
<td>9 June 2017</td>
</tr>
<tr>
<td>Summer Period Starts</td>
<td>12 June 2017</td>
</tr>
<tr>
<td>Full-time lab work for project</td>
<td>June – August 2017</td>
</tr>
<tr>
<td>Resit Examination Period</td>
<td>Late August/Early September 2017</td>
</tr>
<tr>
<td>Deadline for Project Submissions</td>
<td>Early September 2017</td>
</tr>
<tr>
<td>Project oral presentations</td>
<td>Early September 2017</td>
</tr>
</tbody>
</table>

Important Notes

1. UCL School of Pharmacy reserves the right to change these dates if necessary. The School will inform students of any changes.
2. Students must ensure that they are available to attend all classes throughout the terms.
3. Students on full-time Taught Master’s programmes study for a full calendar year. Therefore students are expected to study beyond the end of the third term to prepare their dissertation in time for submission in September.