Pharmacy
Subject benchmark statements

Subject benchmark statements provide a means for the academic community to describe the nature and characteristics of programmes in a specific subject. They also represent general expectations about the standards for the award of qualifications at a given level and articulate the attributes and capabilities that those possessing such qualifications should be able to demonstrate.

This Subject benchmark statement refers to the Master’s level award (MPharm).

Subject benchmark statements are used for a variety of purposes. Primarily, they are an important external source of reference for higher education institutions when new programmes are being designed and developed in a subject area. They provide general guidance for articulating the learning outcomes associated with the programme but are not a specification of a detailed curriculum in the subject. Benchmark statements provide for variety and flexibility in the design of programmes and encourage innovation within an agreed overall framework.

Subject benchmark statements also provide support to institutions in pursuit of internal quality assurance. They enable the learning outcomes specified for a particular programme to be reviewed and evaluated against agreed general expectations about standards.

Finally, Subject benchmark statements may be one of a number of external reference points that are drawn upon for the purposes of external review. Reviewers do not use Subject benchmark statements as a crude checklist for these purposes however. Rather, they are used in conjunction with the relevant programme specifications, the institution’s own internal evaluation documentation, in order to enable reviewers to come to a rounded judgement based on a broad range of evidence.

The benchmarking of academic standards for this subject area has been undertaken by a group of subject specialists drawn from and acting on behalf of the subject community. The group’s work was facilitated by the Quality Assurance Agency for Higher Education, which publishes and distributes this statement and other statements developed by similar subject-specific groups.

In due course, but not before July 2005, the statement will be revised to reflect developments in the subject and the experiences of institutions and others who are working with it. The Agency will initiate revision and, in collaboration with the subject community, will make arrangements for any necessary modifications to the statement.

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Academic standards - Pharmacy

Introduction

1 Pharmacists are the nation's experts on medicines. They work, directly or indirectly, to benefit patients, carers and other health professionals. Their education takes a minimum of five years; four years at university and a year of practical training. The pharmacy degree establishes a basis for learning, which continues throughout the pharmacist's career, in the following broad areas:

- sources of medicinal agents;
- how chemical compounds are developed into medicines;
- what medicines do to the body;
- what the body does to medicines;
- the processes leading to disease and the symptoms of common illnesses;
- the safe and effective use of medicines to treat disease;
- the law and ethical framework governing the supply of medicines;
- how to communicate with patients, fellow health professionals and the public; and
- how to work effectively in the health care environment.

Definitions: a medicinal agent is a chemical compound of synthetic or natural origin which has an effect when given to a person or animal. Such an agent is usually provided in a specialised form for administration: examples are tablets, injections, eye drops, solutions, and ointments. These preparations are known as medicines, although increasingly the terms 'medicine' and 'medicinal agent' are used interchangeably. Medicinal agents have traditionally been known as 'drugs', but the name 'drug' is capable of confusion with the common term for substances of misuse.

2 The practice of pharmacy continues to develop and evolve. For increasing numbers of pharmacists, practice comprises or includes managing medicines at a strategic as well as an individual patient level, the management of repeat dispensing systems, supplementary prescribing, monitoring the effects of medicines, and specialisations such as independent prescribing, diagnostic testing and running anti-coagulant clinics. Currently, the majority of pharmacy graduates practise their profession in community pharmacies or National Health Service (NHS) hospitals, although, reflecting the evolution of practice, a growing number are employed in general medical practitioner practices or by NHS primary care organisations and strategic health authorities. Pharmacists also work in the pharmaceutical industry and universities. Small numbers work in other sectors, applying their knowledge of medicines to a wide range of issues.

3 In the community, pharmacists are responsible for dispensing prescriptions, counselling patients and responding to their symptoms, health promotion, and medication review. They provide pharmaceutical services to nursing and residential homes and they are widely involved in reducing the harm that drug misusers inflict on themselves and on society, by participating in needle exchange and supervised medicine administration schemes. The widespread use of computer systems in dispensing ensures that medicine interactions, overdoses and incompatibilities are readily detected, allowing pharmacists more time to give advice to patients and other health care professionals. Many pharmacists are directly involved in making sure that the patient has been prescribed the most appropriate medicine, and that s/he is motivated, and knows how, to take it.

4 In hospitals, pharmacists have a clinical appraisal function, whilst also ensuring that prescriptions are legal and appropriate for the patient. Additionally, they are a major source of information on medicines, for doctors and nurses. Most hospital pharmacists, acting as clinical pharmacists, are directly involved with patients; they are expected to provide prompt advice to other professionals and to develop treatment protocols. They also counsel and educate patients on the best use of their medicines as well as monitoring the effects of their therapy. Some hospital pharmacies have facilities for the preparation of special medicines, such as complex cancer treatments, and others have special licences for the small-scale manufacture of medicines which are not commercially available. Some pharmacists are involved in clinical trials of new medicines, with the education of nurses, doctors and other health care professionals.

5 In the pharmaceutical industry, though their numbers are modest, pharmacists have key roles in a broad spectrum of activities, including the formulation of new products, planning and optimisation of drug development strategies, advising on regulatory issues, marketing, and the management of scale-up and large scale production of medicines. Pharmacy is one of the three graduate professions eligible to obtain the status of a Qualified Person for the oversight of the manufacture of pharmaceutical products within the European Union.
A small proportion of the profession work in veterinary pharmacy, which has a specialist knowledge and skills base.

The breadth and multi-disciplinary character of the pharmacy degree, along with the ever-changing nature of pharmaceutical services, places pharmacists in a pivotal role for research into the discovery, characterisation, formulation, administration and therapeutic activity of medicines. In conjunction with this, pharmacists play a leading role in research into the safe and economically responsible use of medicines in practice. Most of this research is undertaken in universities, the pharmaceutical industry and increasingly within the NHS and the professional body, the Royal Pharmaceutical Society of Great Britain (RPSGB).

All UK pharmacy degree courses are of four years or, in the case of sandwich programmes, which include the pre-registration year, five years duration and lead to a Master of Pharmacy classified honours award.

All degree courses which lead, after pre-registration training and passing a registration examination, to qualification as a pharmacist in Great Britain are accredited by the RPSGB, and in Northern Ireland by the RPSGB and the Pharmaceutical Society of Northern Ireland (PSNI). The regulations for the accreditation of pharmacy degrees are made under the Pharmacy Act 1954 and are now, in part, also governed by EU directive 85/432/EEC and recommendations of the EU Advisory Committee on Pharmaceutical Training (see Appendix A: The European dimension).

Themes and concepts underpinning pharmacy education

Pharmacists are the legal and physical guardians of an enormous range of valuable, potent and potentially dangerous substances. They are expected to have impeccable standards, which are enforced by the RPSGB. To fulfil society's expectations, they must have a thorough knowledge of the relevant law, ethics, and codes of practice.

While practitioners in different branches of the profession will have particular kinds of expertise, all pharmacists should be able to explain medicines-based health care to other health professionals and, where appropriate, to members of the public. To accomplish this, they must be able to communicate with health care workers in their own specialised language and also be able to express complex issues in terms that lay people can understand.

In communicating with doctors and nurses, pharmacists must have a profound knowledge of the actions and uses of medicines. They must also know where to find and how to assess information quickly and reliably.

When communicating with the public, pharmacists must be able to gather information, make logical deductions, make critical decisions about the patient's state of health and give clear advice. Such advice may not only be related to medication, but may extend to health promotion, disease prevention and encouraging self-care.

In community pharmacy particularly, pharmacists are available to the public without an appointment. They must be able to distinguish minor illnesses from those which require prompt medical intervention; to do so requires a sufficient knowledge and comprehensive understanding of the clinical features and general medical management of diseases, including non-medicine management.

Increasingly, pharmacists are being called upon to give advice to other health professionals on the correct choice of medication, including considerations of evidence-based health care and cost effectiveness, prior to the issue of a prescription. Following on from this, they may be expected to manage the patient's medication by a process of periodic review.

For those members of the profession whose role is primarily the preparation of medicines, most of which takes place in the pharmaceutical industry, the knowledge base is more concerned with the properties of the materials that they handle and the effects that these properties have on the formulation of medicines. All pharmacists are expected to have a basic understanding of the physical and chemical properties of the materials that go into the medicines which they handle, to ensure safe and effective usage.

Pharmacists working in community or hospital settings should be capable of formulating and preparing medicines for individual patient use, should the need arise, possibly when a commercially prepared product is not available.

Pharmacy degrees are designed to produce graduates who can think clearly and systematically, but the courses also have a very strong vocational element, which prepares them for their preregistration training. Graduates have a strong academic science base, are competent pharmaceutical scientists, and are well prepared for a role in health care.
In a rapidly changing health care environment with regular therapeutic advances, the pharmacy graduate must be prepared for a career-long commitment to continuing professional development.

**Defining principles**

Pharmacy integrates the main strands of the chemical and biological sciences which relate to medicines (the pharmaceutical sciences) and combines these sciences with all the related aspects of health care for the benefit of patients. Pharmacy is also concerned with the provision of evidence-based advice to patients and the public on general health matters. Thus, pharmacy is a professional discipline, defined by the application in a healthcare context of scientific principles and intellectual rigour, in and through:

- the design and development of safe and effective medicines, and their supply to patients;
- the purposeful integration of information and the process of critical evaluation leading to the application of pharmaceutical knowledge;
- the optimal clinical use of medicines; and
- advice on the use of medicines and the promotion of good health.

Pharmacists are scientists in the health care community, bringing together physical, biological, clinical, social and behavioural sciences in relation to medicines and their usage. In so doing, their activities are underpinned by:

- mastery of a substantial body of knowledge, with practical and manipulative skills forming a significant part of the subject;
- the application of scientific and technical rigour to the use of medicines;
- evidence-based decision-making skills;
- independent learning skills, forming the basis for lifelong learning;
- a multidisciplinary and integrative approach to solving health care problems;
- the assumption of personal and professional responsibility for the proper discharge of their role in society;
- a thorough understanding of law and ethics relating to pharmacy; and
- development of a high level of interpersonal skills, which are analytical, critically aware, evaluative, interpretive, empathic and reflective.

**Subject knowledge**

**Substances used in medicines**

Every medicine contains one or more biologically active ingredient and other materials which are used to make the product suitable for administration (excipients). Pharmacists are expected to know the background to the origins of medicines and the factors which influence the preparation and shelf life of medicines, under the following broad headings:

- sources and purification of substances used in medicine, including radio-labelled pharmaceuticals;
- biotechnology products and excipients;
- physico-chemical aspects of medicines and biological systems, including thermodynamics, chemical kinetics and an assessment of chemical and physical stability;
- analytical methods: principles, design, development, validation and application; Good Laboratory Practice;
- the properties of medicinal substances, and their relationship to molecular structure;
- the design of medicinal agents and approaches to their discovery; and
- pharmaceutical application of the technologies of genomics and proteomics.
Design and manufacture of medicines

23 The preparation of medicines requires a thorough understanding of development and manufacturing processes, so that the finished product will be suitable for its purpose. Achieving suitability involves a wide range of issues, in particular:

i properties of materials used for the delivery of biologically active molecules;
ii principles of medicine formulation and systems for medicine delivery in the body;
iii Good Pharmaceutical Manufacturing Practice;
iv quality assurance of pharmaceutical products and processes;
v packaging and labelling: purpose, design and evaluation;
vi pharmacopeial and regulatory requirements;
vii stability of medicines; evaluation and control of biological, chemical and physical degradation;
viii microbial contamination and its control;
ix sterilisation processes and aseptic procedures; and
x dressings, diagnostic systems, medical appliances and devices.

The actions and uses of medicines and other agents

24 While the preparation of medicines is a vital part of a pharmacist's education, increasingly the role of the pharmacist in the community and in hospitals is to give advice on the safe and effective use of medicines within the overall management of disease. To carry out this function, it is essential that the pharmacist has a thorough understanding of disease processes as well as the use of medicines and devices to alleviate disease, as follows:

i normal and abnormal bodily function: physiology, biochemistry, genetics, microbiology, nutrition, immunology, infective processes, pathology and pathophysiology;
ii actions of medicines within living systems: molecular, cellular, biological and physical aspects;
iii absorption, distribution, metabolism and excretion of medicines, including routes of administration, concepts and mathematical modelling;
iv aetiology and epidemiology of major diseases;
v therapeutic uses of medicines in man, including adverse reactions to, and interactions of medicines, and their significance in treatment;
vi recognition of disease states and the management of symptoms;
vii clinical evaluation of new medicines;
viii drug and substance misuse;
ix medicine delivery devices, wound management products and other medical devices (including diagnostic agents and devices); and
x complementary therapies.

Legal framework, ethics and health care provision

25 The socio-economic role of pharmacists, particularly in the community, involves not only being guardians of a wide range of potent substances, for which handling and storage are legally controlled, but also applying knowledge and understanding of a wide range of issues, including:

i the pharmacist's role in health care;
ii managing medicines: dispensing, clinical pharmacy (including good clinical practice), responding to symptoms, prescribing, provision of medicine and patient information, reporting of adverse reactions to medicines, medicine utilisation review;
iii measuring outcomes in support of evidence-based practice and achieving maximum clinical effectiveness;
iv health screening and promotion, including diagnostic testing;
v the social and behavioural sciences relevant to pharmacy;
vı health policy and economics, including particularly pharmacoconomics and pharmacoepidemiology;
vıı the law relating to pharmacy and medicines;
vııı ethics of health care and its impact on relationships with patients and other healthcare professionals;
 índicepharmacists' contribution to public health, which can be termed pharmaceutical public health;
x health services research methodology;
xı the political, legislative and economic frameworks relevant to pharmacy; and
xıı analysis and management of risk.

 Abilities and skills

26 The abilities and skills demanded of the future pharmacist reflect the defining principles of the discipline. S/he must command a profound knowledge and understanding of medicines and the aptitude to apply such to health care, either by direct instructions or advice to patients or, very often, by properly informing and effectively influencing the decisions and actions of other health or social care professionals.

Pharmacy-related cognitive abilities and skills

i Demonstration of knowledge and critical understanding of essential facts, concepts, principles and theories relating to the subject areas identified above.
ii Ability to apply in practice settings the knowledge and understanding required to meet the needs of patients and other health care professionals.
iii Recognition and analysis of problems and planning of strategies for their solution.
iv Critical evaluation, interpretation and synthesis of pharmaceutical information and data.
v Production of pharmacy-specific scientific documentation.
vi Presentation of pharmaceutical science material and arguments clearly and correctly, in writing and orally, to both specialist and lay audiences.
vii Calculation of medicine doses and dosage regimens.
vıı Interpretation of patient and clinical data, including patient records held within practice settings.
ix Ability to contribute to the development of health care through reflective practice, enquiry and innovation.
x Interpretation of prescriptions and other orders for medicines.

Pharmacy-related practical skills

i The safe handling of chemical and pharmaceutical materials, taking into account their physical and chemical properties, including any specific hazards associated with their use.
ii The ability to undertake risk assessments concerning pharmaceutical procedures and practices.
iii Skills required for the conduct of standard pharmaceutical laboratory procedures.
iv The planning, design and execution of self-directed and original research investigations, from the problem-recognition stage through to the evaluation and appraisal of results and findings; this to include the ability to select appropriate techniques and procedures.
v The operation of standard pharmaceutical instrumentation.
vi The ability to evaluate critically and to interpret purposively data derived from laboratory and clinical observations and measurements, in terms of their significance and the theory underlying them.
vıı Preparation and presentation of medicines, by manufacture and extemporaneous dispensing, including sterile products.
vııı Skills in the analysis of medicines.
ix The ability to advise patients and others on the safe and effective use of medicines.
Transferable skills

i Interpersonal skills; the ability to interact effectively with patients, the public and health care professionals; including communication, both written and oral.

ii Team-working.

iii Problem-solving, relating to qualitative and quantitative information, extending to situations where evaluations have to be made on the basis of limited information.

iv Numeracy and computation, including such aspects as error analysis, order-of-magnitude estimations, correct use of units and modes of data presentation.

v Acquisition, transformation, interpretation and critical evaluation of data.

vi Information retrieval in relation to primary and secondary information sources, including information retrieval through online computer searches.

vii Information technology skills, including word processing, spreadsheet use, database use, archiving data and information, and internet communication.

viii Time-management and organisation, as evidenced by the ability to plan and implement efficient and effective modes of working.

ix Independent study skills as preparation for continuing professional development.

x An ethical attitude and approach.

xi Analysis and critical appraisal of published literature.

xii Application of general, biological and medical statistics.

xiii The ability to operate within a quality management framework; and

xiv Recognition of the need to work within personal limitations.

Teaching, learning and assessment

Teaching and learning

27 Teaching and learning have the feature of positioning knowledge, understanding and capability in a pharmaceutical context, with frequent reference to examples from current pharmaceutical practice. Pharmacy is one of the small number of professions subject to an EU sectoral directive and with an EU advisory committee on training (see Appendix A: The European dimension). In curriculum delivery:

i the student is encouraged to take responsibility for his/her own lifelong learning both within the degree course and as a basis for later continuing professional development;

ii teacher-practitioners and visiting lecturers from community, hospital and industrial pharmacy practice, and appropriate persons from other health professions, are involved in teaching/support for learning and assessment;

iii the degree course features a variety of teaching approaches chosen to meet stated learning objectives, including:

- lectures;
- practical classes;
- workshops;
- seminars;
- tutorials;
- other forms of interactive small-group teaching;
- IT-based teaching and learning;
- work-based learning;
- independent assignment-based learning;
- auditable, directed private study;
- team-working; and
- project work.
Assessment

28 It is essential that the procedures used for the assessment of students’ achievements in pharmacy should correspond with the knowledge, abilities and skills that are to be developed through their degree programme. Both formative and summative modes of assessment should be used.

29 Evidence on which assessment of student achievement is based should include:

- formal written examinations;
- summative practical assessments;
- laboratory and other written reports;
- problem-solving exercises;
- oral presentations;
- individual planning, conduct and reporting of project work; and
- essay assignments.

30 Evidence on which assessment of student achievement is based may include:

- literature surveys and evaluations;
- collaborative project work;
- preparation and displays of ‘posters’ reporting project work;
- reports of external placements (where applicable and appropriate);
- personal portfolios of learning achieved;
- computer-based assessments; and
- self and peer assessment.

Standards

31 The following is in two parts: first, minimum threshold standards for the award of a pharmacy degree (standards i to ix) and second, standards additional to the minimum which will be achieved by typical - the overwhelming majority of - pharmacy graduates (standards a to d). Both parts of this statement of standards reproduce or reflect the M-level descriptor of the national qualifications framework for England, Wales, Northern Ireland, and Scotland.

Minimum threshold standards

Master of Pharmacy degrees will be awarded to students who have, as a minimum, demonstrated:

i a systematic knowledge and understanding of the topics listed above under ‘Legal framework, ethics and health care provision’ and ‘Actions and uses of medicines and other agents’ with significant knowledge and understanding of ‘Substances used in medicines’ and the ‘Design and manufacture of medicines’;

ii a critical awareness of current problems and/or new insights in pharmacy, much of which is at, or informed by, the forefront of pharmaceutical science and practice;

iii a comprehensive understanding of techniques applicable to research or advanced scholarship in pharmacy;

iv originality (showing the capacity for independent thought, creativity and rigour) in the application of knowledge, together with a practical understanding of how established techniques of research and enquiry are used to create and interpret new knowledge in pharmaceutical science and practice;

v conceptual understanding that enables the student:

- to evaluate critically current research and advanced scholarship in pharmaceutical science and practice; and
- to evaluate methodologies and develop critiques of them and, where appropriate, to propose new working hypotheses.
vi dependability in the supply/provision of medicines in accordance with pharmaceutical knowledge, legislation and codes of professional conduct and practice, and with other aspects of pharmacy law and ethics;

vii the qualities needed for sound judgement and personal responsibility for decisions, when potentially working independently, in professional environments;

viii the ability to communicate effectively with patients and other members of the healthcare team; and

ix the independent learning ability necessary for continuing professional development.

Additional standards to be achieved by the typical graduate

In addition to the above, typically, holders of the qualification will be able to:

i integrate available information to deal with complex issues both systematically and creatively, make informed judgements in the absence of complete data, and test and refine solutions;

ii communicate their conclusions clearly to specialist and non-specialist audiences;

iii demonstrate self direction and originality in tackling and solving problems, and act autonomously in planning and implementing tasks; and

iv continue to advance their knowledge and understanding, to develop new skills to a high level and to demonstrate the qualities and transferable skills necessary for employment requiring:

● the exercise of personal responsibility;

● decision-making in complex and unpredictable situations; and

● the exercise of initiative and management responsibility.
Appendix A

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Article 2

Member States shall subordinate the award of the diplomas, certificates and other formal qualifications referred to in Article 1 to the following minimum conditions:

1. Training leading to the award of the diploma, certificate or other formal qualification shall ensure:
   (a) adequate knowledge of medicines and the substances used in the manufacture of medicines;
   (b) adequate knowledge of pharmaceutical technology and the physical, chemical, biological and microbiological testing of medicinal products;
   (c) adequate knowledge of the metabolism and the effects of medicinal products and of the action of toxic substances, and of the use of medicinal products;
   (d) adequate knowledge to evaluate scientific data concerning medicines in order to be able to supply appropriate information on the basis of this knowledge;
   (e) adequate knowledge of the legal and other requirements associated with the practice of pharmacy.

2. In order to be accepted for such training, the candidate must have a diploma or a certificate which entitles him to be admitted for the course of study concerned to the universities of a Member State or to higher education institutions recognized as having equivalent status.

3. The diploma, certificate or other formal qualification shall testify to the completion of a course of training covering a period of at least five years and comprising:
   - at least four years of full-time theoretical and practical training in a university, in a higher education institution of a level recognized as having equivalent status, or under the supervision of a university;
   - at least six months of in-service training in a pharmacy open to the public or in a hospital under the supervision of the pharmaceutical department of that hospital.

4. By way of derogation from point 3:
   (a) if at the time of the adoption of this Directive two courses of training coexist in a Member State, one of which lasts five years and the other four years, the diploma, certificate or other formal qualification testifying to the completion of the four-year course of training, shall be considered to fulfil the condition concerning duration referred to in point 3 provided that the diplomas, certificates or other formal qualifications testifying to the completion of the two courses of training are recognized as equivalent by that State;
   (b) if, because, there are insufficient places in pharmacies open to the public and in hospitals near training establishments, a Member State is unable to provide six months of in-service training, it may, for a period of five years following the expiry of the time limit laid down in Article 5, make provision for no more than half of that training period to involve activities as a pharmacist in an undertaking which manufactures medicinal products.

5. The course of training referred to in point 3 shall comprise as a minimum theoretical and practical training in the following subjects:
   - Plant and animal biology;
   - Physics;
   - General and inorganic chemistry;
   - Organic chemistry;
   - Analytical chemistry;
   - Pharmaceutical chemistry, including analysis of medicinal products;
   - General and applied biochemistry (medical);
   - Anatomy and physiology; medical terminology;
   - Microbiology;
   - Pharmacology and pharmacotherapy;
   - Pharmaceutical technology;
   - Toxicology;
   - Pharmacognosy;
   - Legislation and, where appropriate, professional ethics.

The balance between theoretical and practical training shall, in respect of each subject, give sufficient importance to theory to maintain the university character of the training.

1 October 1987
European Commission

DIRECTORATE GENERAL XV

Internal Market and Financial Services

Intellectual and industrial property: freedom of establishment and freedom to provide services, notably in
the regulated professions, the media and data protection

Regulated professions (qualifications)

Brussels, 12.9.1994

XV/E/8341/5/93-EN

ADVISORY COMMITTEE ON PHARMACEUTICAL TRAINING

Report and recommendations on pharmaceutical education undergone at higher-education institutions

Adopted by the Committee at its meeting on 3 and 4 May 1994

4. RECOMMENDATIONS OF THE ORGANISATION AND STRUCTURE OF TRAINING AT HIGHER-
EDUCATION INSTITUTIONS

Firstly, the Advisory Committee on Pharmaceutical Training points out that:

- The length of pharmaceutical training and the minimum range of subjects in which theoretical and
  practical training must be undergone are laid down in Directive 85/432/EEC, which also explicitly
  states that the balance between theoretical and practical training must, in respect of each subject, give
  sufficient importance to theory to maintain the university character of the training.

- Future developments in pharmacy and medicine will lead to constant revisions of syllabus as has been
  seen with the introduction of new subjects such as molecular biology and biotechnology in recent years.
  This is essential if pharmacists are to be equipped properly by their course of education and training for
  practice in various fields.

The Committee makes the recommendations set out below without, however, excluding individual national
provisions which are not contrary to the principles in the Directive.

4.1 A thorough grounding in the basics of sciences of chemistry, physics and biology plus mathematics
should be accepted as a prerequisite for admission to studies of the pharmaceutical sciences.

4.2 In view of the minimum period of four years' training at a higher-education institution laid down in
Article 2(3) of Directive 85/432/EEC, the number of hours of such training should total at least 3,000
directed and supervised by the academic staff of the higher educational institution concerned.

4.3 At least half the higher-education course identical for every student should consist of theoretical
instruction, and at least 35% of that course should take the form of practical training.

4.4 During the training period, pharmacy students must be provided with a sound and balanced grounding
in the physical, chemical and biological sciences that represent the basis for their main training in:

- biological systems, the chemistry of drugs and other constituents of medicines, and the interaction
  between medicines and biological systems;
- medicines design and manufacture;
- the actions and uses of drugs, medicines and other products;
- an introduction to the practice of pharmacy in hospital, industrial, academic and community pharmacy
  settings, including an introduction to the relevant aspects of the social and behavioural sciences.

At least one third of the whole course should be occupied by the components which collectively deal with
the actions, uses and manufacture of drugs and medicines, and a broad balance should be maintained
between the other sectors of the course.

4.5 Intermediate examinations should be held during the course.

4.6 In addition to the core course, which all students must take, individual students should be able to select
one or more optional pharmaceutical subjects from a list provided by the academic institution, to reflect their
special interests.

4.7 Each student should carry out a personally directed research project covering about three to six months
under the supervision of the academic staff and present a paper or dissertation on the project.
Appendix B

Membership of the benchmarking group

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