

## *In Focus*

# Developing the Pharmacy Curriculum in a Hungarian Faculty

ISTVÁN ANTAL\*, PÉTER MÁTYUS, SYLVIA MARTON and ZOLTÁN VINCZE

*Faculty of Pharmacy, Semmelweis University, Budapest, Hungary*

"In focus..." will be an occasional section in the Journal to highlight regional trends and developments in educational practice. Authors, universities and institutions wishing to highlight novel aspects of education, recent policy changes or curriculum design issues are invited to write to the Editor-in-Chief. In this issue, *Pharmacy Education* looks at Hungary, reflecting on the contemporary trends in Hungarian pharmaceutical studies. Pharmacy education in the Republic of Hungary (population about 10 millions) takes place in four cities (Budapest, Szeged, Debrecen and Pécs). Traditionally, pharmacy education in Hungary was closely aligned with medical training. Records indicate that medical training in Hungary began as early as the 13th and 14th centuries. Education in pharmacy at the University of Nagyszombat started in 1770, then continued at the Pázmány Péter University before moving to the capital city of Hungary. The present Faculty of Pharmacy, as part of Budapest Medical University, was established in 1955. From 1969, the name of the University honours *Ignác Semmelweis* who discovered the cause of puerperal fever and was a professor in the Faculty of Medicine.

Semmelweis University has a 230-year-old tradition of academic excellence and commitment to the education and to the care of patients in the clinical facilities. The University Hospital has 2850 beds and admits 98,000 patients

annually. The outpatient departments care for more than one million patients each year. Among Semmelweis alumni are Nobel laureates (Albert Szent-Györgyi; György Békésy, György Hevesy, János Harsányi) and world renowned researchers and clinicians. Although the Nobel Prize in 1994 was awarded to János Harsányi in Economic Sciences, he was a graduate of the Pharmaceutical Faculty of the Budapest University in 1942.

The academic program offered by the Faculty of Pharmacy leads to the degree of Master of Pharmacy. The current enrolment is about 600 undergraduates and training is pursued in Hungarian and in English Languages. The Faculty of Pharmacy at Semmelweis University admits students after successive entrance examination comprising both written and oral tests in two general subjects (Biology, Physics or Chemistry) requiring some basic knowledge.

Education in Pharmacy has the characteristic feature that the teaching some subjects of basic sciences is provided by Departments of Eötvös

\*Corresponding author. E-mail: antist@hogyes.sote.hu

TABLE I Groups and weights of compulsory subjects

Group	Subjects	Lecture (h)	Practice (h)	Seminar (h)	Total (h)	Total (%)	Group (h)	Group (%)
Chemistry, Pharmaceutical/Medicinal Chemistry	Analytical Chemistry	90	225	0	315	8.7	1350	37.1
	Colloid Chemistry	30	30	0	60	1.7		
	General and Inorganic Chemistry	105	75	15	195	5.4		
	Organic Chemistry	120	150	15	285	7.8		
	Pharmaceutical Chemistry	150	210	0	360	9.9		
	Physical Chemistry	60	60	15	135	3.7		
	Biochemistry	75	15	0	90	2.5	570	15.7
	Biology	45	52.5	0	97.5	2.7		
	Immunology	22.5	0	0	22.5	0.6		
	Microbiology	45	30	0	75	2.1		
Biology, Biochemistry	Pharmaceutical Botany	30	75	0	105	2.9		
	Pharmacognosy	60	120	0	180	5.0		
	Pharmaceutics—Pharmacokinetics	24	36	0	60	1.7	915	25.2
	Biophysics	60	90	0	150	4.1		
	Information Technology	30	30	0	60	1.7		
	Mathematics	60	45	0	105	2.9		
	Pharmaceutical Technology	150	390	0	540	14.9		
	Anatomy	30	30	0	60	1.7	663	18.2
	Basic Drug Therapy	48	0	0	48	1.3		
	Clinical Pharmacy	24	36	0	60	1.7		
Medicine, Pharmacology	First Aid	0	15	0	15	0.4		
	Pathophysiology	60	0	0	60	1.7		
	Pharmacology—Toxicology	120	60	0	180	5.0		
	Physiology	120	30	30	180	5.0		
	Public Health	30	30	0	60	1.7		
	History of Sciences, Propedeutics	30	0	0	30	0.8	138	3.8
	Pharmaceutical Ethics—Sociology	30	0	0	30	0.8		
	Pharmacy Administration	54	24	0	78	2.1		
	Total	1702.5	1858.5	75	3636	100	3636	100

TABLE II Elective subjects (3 × 36 h in the 9th semester)

Basic Drug Therapy
Bioorganic Chemistry
Bioinorganic Chemistry
Computer Information System in Pharmacy
Communication
Drug Innovation
Drug Synthesis
Electro analytical Methods of Pharmaceutical Analysis
Environmental Protection
Industrial Pharmacy
Instrumental Drug Analysis
Model Membranes
Pharmaceutical Biotechnology
Pharmacy Economics
Phytochemistry
Phytotherapy
Psychology for Pharmacists
Theoretical Organic Chemistry
Veterinary Pharmacy

Lóránd University and some medical subjects by departments belonging to Faculty of Medicine. Students take part in general and special pharmaceutical education at the university departments, teaching pharmacies, institutes, laboratories and pharmaceutical works. The Faculty has six departments (Department of Pharmacy Administration, Department of Organic Chemistry, Department of Pharmaceutics, Department of Pharmacognosy, Department of Pharmaceutical Chemistry and Department of Pharmacodynamics) engaged with teaching special pharmaceutical sciences.

The curriculum includes five years of basic and special studies. The first two years are devoted to the basic sciences: physics, mathematics, general chemistry, inorganic and organic chemistry, qualitative and quantitative chemical analysis, physical chemistry, colloid chemistry, biochemistry, pharmaceutical botany, biology. The second stage of studies (3rd, 4th and 5th years) focus more on specialist pharmaceutical sciences and medicine: pharmaceutical chemistry and chemical analysis, pharmacology and toxicology, pharmaceutical technology, biopharmacy, clinical pharmacy, pharmacognosy,

TABLE III Weights in types of training

Type of training	Total (h)	Weight (%)
Lecture	1795.5	48
Seminar	75	2
Practice	1873.5	50

microbiology, physiology, pathophysiology, immunology, public health and epidemiology, ethics, pharmacy administration and management. Compulsory subjects (without 60 h of Latin Language) are detailed in Table I in comparison with their weights in hours and percentages.

Although the European Pharmacopoeia is not a separate subject, the teaching of quality control, pharmaceutical analysis, preparation and testing of materials or dosage forms is incorporated into the compulsory subjects of pharmacy administration, pharmaceutical chemistry and pharmaceutical technology, respectively.

Students can choose three elective subjects (Table II) according their special interest, involving 108 lecture hours. The weights of learning approaches, involving total hours of both compulsory (97.1%) and elective (2.9%) subjects, are summarised in Table III. Almost half of subject provision is by lectures, according to the European guidelines (EEC Directive 1985<sup>†</sup>; European Commission 1994). During 7th, 8th and 9th semesters students must write a thesis and defend it (comprising 132 additional assigned hours). The evaluation criteria for the thesis are described as "requirements satisfied at a high level", "requirements satisfied" or "requirements not satisfied". Compulsory summer practice (35 h per week) after the 4th, 6th and 8th semesters can be fulfilled in a public or institutional pharmacy, a galenic laboratory, or within an industrial placement associated with pharmaceutical technology. In the 10th semester the students are engaged for a further 16 weeks in a practical training program within the

<sup>†</sup>EEC Council Directive 85/432/EEC of 16 September 1985 concerning the coordination of provisions laid down by Law, Regulation or Administrative Action in respect of certain activities in the field of pharmacy.

community pharmacy sector (12 weeks) and/or in pharmaceutical manufacturing, or university department or hospital pharmacy (4 weeks). From the year 2002, the schedule of practice will be changed to ensure 6 months according to the European Union requirements.

To receive the diploma, students must also take a general board examination demonstrating their practical skills and theoretical knowledge in pharmaceutical sciences.

### NEW CHALLENGES IN A FLEXIBLE CURRICULUM

Traditionally, pharmacy education has focused on drug products, emphasising chemistry, pharmaceuticals and the control and regulation of drug product delivery systems. At the beginning of the 1990s, the curriculum was developed by strengthening the biological approach, including new subjects such as biopharmaceutics, pharmacokinetics and pathophysiology. More recently, clinical pharmacy and basic drug therapeutics have been incorporated into the degree program, emphasising the human biological and medical knowledge base in pharmacy. Since pharmacogenomics has the potential to radically change the therapy and health care, immunology has also been introduced as a new subject.

Pharmaceutical education is dominated by a knowledge focused curriculum delivered in traditional classroom lectures. Besides theoretical principles, education has to provide students with practical skills. The current curriculum emphasises practical training by the weight of practice hours (see Table III). Practical classes are suitable not only for individual experiments, but for small groups of students they give an opportunity for problem-based learning and more interactive training. The aim is for pharmacy graduates to be able to utilise the principles of scientific inquiry, to be able to think analytically and critically, while solving problems and making decisions during daily

practice and while conducting practice-related research. However, progress in science may change the weights of seminars (Eckert-Lill, 2001), which can be more suitable to intensively develop active knowledge.

### CENTRAL PROBATIONAL SYSTEM FOR THE SPECIALIZATION OF PHARMACISTS

In Hungary, the Central Probational System for professional training of pharmacists was introduced in 2000. This residency type program is designed to develop skills and knowledge in a broad range of specialist pharmaceutical areas. The following basic professional qualifications can be chosen: pharmaceutical technology, quality control, pharmacodynamics, pharmaceutical chemistry, social pharmacy, pharmacognosy and phytotherapy, clinical laboratory diagnostics, community pharmacy, pharmaceutical administration and management, radiopharmacy, hospital pharmacy and clinical pharmacy. Further qualifications can be also obtained by post-professional programs requiring a basic specialization: Toxicology (requires pharmacodynamics), pharmaceutical microbiology (requires quality control), and quality assurance (requires any).

Graduates can enter the 4 year pharmacy residency program as candidates. The primary training period takes one year while candidates are employed by the university. The form of training involves classroom lectures, practices and problem solving under tutorial instruction. The first semester provides students with general information (for example, health care administration, quality assurance, economics, management, law, ethics, communication, information systems). In the second semester, probationers extend their knowledge in several fields of pharmaceutical sciences (which may include drug design and synthesis, biotechnology, pharmacology-toxicology, drug formulation and biopharmacy, pharmaceutical analysis and control, clinical pharmacy, registration of medicines, pharmacoeconomics

and drugs of natural origins). Although residency programs are affiliated with a pharmacy school, the training is practice-orientated and the secondary professional practice period (3 years) is offered in accredited community pharmacies, hospitals, departments of industrial companies and several healthcare facilities.

### PHARMACEUTICAL SCIENCES RESEARCH

Research at the Faculty is carried out by the individual departments, ranging from basic to applied research. The departments are equipped with a wide range of instruments and equipment to permit study of a broad field of pharmaceutical research. This instrumentation includes an NMR spectrometer, mass spectrometer, HPLC and gas chromatography, modern UV-Visible spectrometry, NIR and FTIR spectroscopy, spectropolarimetry, research quality optical microscopes, research viscometer and the thermogravimetric analyser. The pharmaceutical pilot plant laboratory contains equipment for the processing of solid, semi-solid and liquid dosage forms and includes a tablet laboratory with rotary and single punch machines, semi-automatic capsule-filling equipment, a high shear granulator, fluid bed granulator and complete coating facilities. The University Pharmacy is capable to produce infusions, galenic ointments, solutions and tablets.

The ongoing research projects are interlinked and multi-disciplinary, with research teams collaborating with other institutions in order to make maximum use of resources. Scientific research is supported by the Ministry of Education, Ministry of Health, by the National Scientific Research Foundation and by the Hungarian Academy of Sciences. Additional grants come from pharmaceutical companies, interdisciplinary projects (TEMPUS, ERASMUS, etc.) and other funds. Students may attach to research projects as undergraduates in the Student Research Group or as graduates in the

Doctoral School. Yearly conferences are held that serve to rate the results of experimental research work.

### DOCTORAL PROGRAMS

In Hungary, the PhD degree is the universally recognised qualification which guarantees and licenses the recipient to plan, execute, organise, evaluate and communicate experimental problems and results independently in a given research area. The Act of Higher Education (1993) charged universities with preparing students for academic degrees in addition to providing them with awarding powers for doctoral (Ph.D.) degrees.

Essentially, the activity at the School is divided into educational phase (Part I) and qualification phase (Part II). The aim of Part I is to train students by providing courses (for which certain number of credits can be obtained), and by selecting a scientific topic for research work. The research is usually conducted in departmental laboratories under the guidance of academic staff, providing students with the opportunity to evaluate the results of the experiments and to publish in acknowledged scientific journals. In Part II, students are required to show their research competence by passing a comprehensive examination and to write and defend the dissertation. The doctoral examination is a public oral examination, which must be taken before a committee and it is intended for summarising the applicant's knowledge on broader area of research. The candidate must demonstrate their scientific activity prior to the completion of the dissertation with scientific papers published or accepted for publication. The School offers three forms of education:

- Full-time students, who enter Part I (Scholarships can be obtained from state, foundations, industrial sponsorships, etc.)

- Part-time students may also enter Part I, but they are in employment (at industrial companies, research institutes, regulatory agencies etc.)
- Individual students, who have more experience in their research field and hence can enter directly as a Part II candidate.

Students may participate in the research projects of the departments in the fields of pharmacognosy, pharmaceutical chemistry and analysis, organic synthetic drug chemistry, pharmaceutical technology and biopharmaceutics, pharmacy administration, pharmacodynamics, experimental and clinical pharmacology. Although doctoral courses are based on credits, the subjects in our undergraduate curriculum will be affixed with credits from 2002 in order to facilitate students mobility and to correspond with European Credit Transfer System.

## SUMMARY

The dramatically changing health care delivery system in Hungary, and the increasingly prominent role of pharmaceutical agents in the diagnosis and treatment of disease is shifting the focus to a broader role for pharmacy practitioners. New pharmacy curricula should emphasise skills such as patient assessment, drug therapy management, and problem solving abilities in order that pharmacy practitioners are prepared to practice effectively in a changing environment. It is necessary to develop a concept of pharmaceutical care, evidence-based medicine and pharmacoeconomics.

## References

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