

# Undergraduate Pharmacy Education in the United States and New Zealand: Towards a Core Curriculum?

JOHN P. SHAW\*

*School of Pharmacy, University of Otago, PO Box 913, Dunedin, New Zealand*

In recent years, bodies such as the World Health Organisation have attempted to provide guidance to pharmacy educators on the preparation of students for future careers in pharmacy. Although a global core curriculum has not been defined, there appears to be wide consensus on the knowledge, skills and attributes that a modern pharmacy graduate should possess. The undergraduate pharmacy programmes at the University of North Carolina at Chapel Hill (UNC-CH) and at the University of Otago (Otago) are described and evaluated here in the context of global developments. These programmes broadly represent the "American" and "British" models of pharmacy education, respectively. Despite many similarities, there are also major differences. These include: a separate preregistration year (Otago); a high degree of in-course experiential work (UNC-CH); a greater "practice" orientation at UNC-CH and a corresponding "science" orientation at Otago; and the nature of the qualification (PharmD at UNC-CH, BPharm at Otago).

*Keywords:* Curriculum, Pharmacy education

## INTRODUCTION

Healthcare systems worldwide are in a state of rapid change and the roles of health professionals, including pharmacists, continue to evolve in response to both global trends and local needs. In recent years, bodies such as the World Health Organisation (Anon, 1998a) and the International Federation of Pharmacy (Anon, 1998b) have attempted to provide guidance to pharmacy educators regarding the preparation of students for contemporary and future careers and a code of Good Pharmaceutical Education Practice (GPEP) is currently being developed by FIP.

The WHO has summarised the role of the pharmacist in seven areas (termed the "seven-star" pharmacist) which should be considered

---

\*Tel.: 006493737599, Fax: 006493737481, e-mail: j.shaw@auckland.ac.nz

essential, minimum, common expectations for pharmacists by national healthcare systems worldwide. These characteristics are organised as three educational outcomes specific to pharmacists (caregiver, manager, teacher), and as four qualities attributable to university graduates and educated citizens (knowledge, decision-making and thinking abilities; communication abilities; leadership abilities; lifelong learning abilities) (Anon, 1998a).

The WHO has not attempted to define a core curriculum, although the characteristics are framed in the context of pharmacists as medication experts in the treatment of disease and the promotion of health. This expertise, in its broadest sense, is described as including the preparation, supply, control, and assurance of desired outcomes of medication use, beginning with the drug development process and continuing through to a medicine's benefit to the patient and society. It is suggested by WHO that as schools of pharmacy worldwide consider future curricular revision and innovation, special attention should be placed on the knowledge, skills, attitudes and behaviours which support a pharmaceutical care model (Anon, 1998a).

Few could argue with the broad intent of the WHO guidelines, yet it remains for national pharmacy organisations and individual schools of pharmacy to rise to the challenge of devising curricula that meet these aspirations (Kabat, 1997). The intent of this article is to describe two examples of contemporary pharmacy undergraduate curricula, in order to stimulate discussion on the "ideal" global model.

The programmes discussed can be considered as examples of the "American" (UNC-CH) and "British" (Otago) models of pharmacy education. The former is represented in the United States and Canada, and the latter in countries such as the United Kingdom, Eire, Australia, and New Zealand. Other countries have adopted these models in part or in full; for example, some Malaysian schools offer the Doctor of Pharmacy degree, while Singapore and Hong Kong follow

the British model. In recent years, pharmacy education in the United States has adopted a far greater clinical practice orientation, underpinned by the concept of pharmaceutical care (Anon, 1993; Anon, 1996; McGhan, 1996). In contrast, programmes following the British model have generally moved much more cautiously in this direction, in line with the recommendations of the Nuffield Foundation Inquiry into pharmacy practice and education (Anon, 1986).

## BACKGROUND

Before describing the undergraduate programmes, some background on the two locations is provided. North Carolina has a population of 6.5 million and two schools of pharmacy, at UNC-CH and Campbell University at Buies Creek, respectively. UNC-CH is a publicly funded institution, in fact it is the oldest state-funded university in the United States, founded in 1793. Students who are residents of North Carolina pay annual fees of about US\$3300 towards the cost of their tuition; fees for out-of-state residents are much higher. In the United States, UNC-CH is regarded as giving excellent value for money. Campbell is a private university; it admits about 75 PharmD students annually and fees are considerably higher, in the region of US\$20,000.

The UNC-CH School of Pharmacy admits approximately 120 students each year to its four-year Doctor of Pharmacy (PharmD) programme. Shortly after graduation, students take the North Carolina Pharmacy Board and national licensure (NAPLEX) examinations. Successful completion of these examinations together with experiential work undertaken during undergraduate studies allows graduates to practise pharmacy in North Carolina. Depending on local provisions, graduates may be required to take further examinations if they wish to register in other states. UNC-CH graduates work predominantly in community pharmacy settings, usually for one

of the many pharmacy chain stores. Others undertake residencies in hospitals if they wish to pursue a hospital-based career, or follow a variety of other career routes such as industry, academia, or regulatory affairs.

Since 1996, UNC-CH has also offered an external PharmD programme for practising pharmacists in North Carolina who wish to upgrade their qualifications. This programme is of two years full-time equivalence, although the time for completion is usually four years. There are currently about 200 students at various stages of completion.

At the time of writing, New Zealand has a population of 3.8 million and a single school of pharmacy based at the University of Otago at Dunedin, in the South Island. Otago is a publicly funded university, although students also pay part of their tuition costs with annual fees currently set at NZ\$4200 (about US\$2100). In fact, when adjusted to local income and cost-of-living, the tuition fees at UNC-CH and Otago are similar. Also similar is the number of students admitted to the four-year Bachelor of Pharmacy (BPharm) course, with a quota of 110 New Zealand residents and up to ten non-residents per annum. Many of the non-residents are from Pacific Island countries and are sponsored by their own governments or by the New Zealand Ministry of Foreign Affairs. The first year at Otago is a common health sciences foundation year, taken by students aiming to gain admission to one of the health professional disciplines including dentistry, medicine, pharmacy, and physiotherapy. Admission to these courses is competitive, based on academic performance in the foundation year.

Otago graduates must successfully complete the Pharmaceutical Society of New Zealand's (PSNZ) competency-based one-year pre-registration training programme before being registered as pharmacists. This programme is similar to that in the United Kingdom with graduates being employed as pre-registration trainees by individual community or hospital pharmacies. On registration, career routes are similar to the

United States with the majority being employed in community pharmacy (although there are currently no chain stores in New Zealand). After an additional year of practice in New Zealand, graduates are eligible to seek reciprocal registration in Australia or the United Kingdom. Many New Zealand pharmacists take up this opportunity, some permanently but most temporarily, for the experience of living and working overseas.

The United States operates a privatised system of healthcare delivery, with individuals being covered by a variety of private insurance plans. These are usually associated with employer-funded benefits and increasingly operate within the managed care environment. There are "safety-net" social security systems such as Medicaid for the elderly population and Medicare for the unemployed. New Zealand has a taxpayer-funded public health system, although this has been subject to much change in recent years and there is now restricted access to some services and numerous co-payments (e.g. for pharmaceuticals). One major difference is that New Zealand pharmacists contract with one payer (a government agency), while American pharmacists are faced with an often bewildering array of private payers (insurance companies and managed care organisations). Interestingly, the ratio of pharmacists to the total population in the two settings is almost identical at about 1 to 1000.

## ADMISSIONS CRITERIA

The great majority of UNC-CH students will have undertaken two years of pre-pharmacy university or college studies before being admitted to the PharmD programme. Most students undertake these studies at the Chapel Hill campus although they can also study at other sites in North Carolina or out of state. The subject requirements include statistics, calculus, biology, microbiology, general and organic chemistry, physics, English, a foreign language, and

liberal arts courses such as history, sociology or philosophy. An increasing number of applicants already have a Bachelor's degree; a little over one-third of the 1998 intake was in this category.

All applicants must take a standardised Pharmacy College Admission Test (PCAT) that assesses their ability in relevant pre-requisite subjects; this is especially useful in assessing transfer applicants. They also attend an interview at which they are required to write a short "unseen" essay on a topical issue. However, the primary determinant of their admission is the grade-point average (GPA). This expresses the average of all their pre-pharmacy courses as a mark out of 4. The mean GPA for 1998 applicants was 3.04. There were 381 applicants for the 120 places.

The Otago procedures are quite different. The majority of students attempting to enter pharmacy are required to complete a common foundation health sciences first year at Otago. On the basis of results from these studies, applicants compete for entry to the various health professional programmes. Medicine generally requires an A average across all subjects (>80%), while pharmacy usually requires a B average (>70%). Under this system, it is inevitable that a number of candidates will not have nominated pharmacy as their first choice. Required subjects include biology, chemistry, biochemistry, statistics, physics, and English (see Table I). Some exemptions are allowed on the basis of excellent high school grades (>75%), in which case candidates can substitute other papers. A small number of places are reserved for applicants who have already completed another degree, are transferring from other studies, or who are Maori or Pacific Islanders (for whom an affirmative action policy exists). Interviews are reserved for a small number of applicants, for example those transferring from other universities or applying from overseas.

Of interest in the New Zealand context has been the recent rapid increase in foundation students who have English as a second language.

Most are recent immigrants from South East Asia who have permanent resident status. For the 1998 intake to pharmacy, as an example, approximately half of the students had not been born in New Zealand. In recognition of the importance of English communication skills for health professionals, the University recently introduced an English screening test for all health sciences foundation students. If unsuccessful in this test, the student is required to take an additional English paper during the foundation year.

It is difficult to make direct comparisons of the two systems but students are at roughly comparable levels of academic preparation on admission to the first year of the PharmD and the second year of the BPharm respectively. The PharmD candidates have a broader educational base and their aptitude for pharmacy has been more thoroughly evaluated than for their BPharm counterparts. As for demographics, both have a predominantly female intake (UNC-CH: 74%; Otago: 70%), but there is a difference in ethnic mix (UNC-CH: 82% Caucasian; Otago: 49% Caucasian). About one in ten UNC-CH students are from out of state.

## UNDERGRADUATE PROGRAMMES

The basic structure of the two degrees is shown in Table I (UNC-CH) and Table II (Otago).

## COMMENTARY ON THE PROGRAMMES

What is provided is a description of some of the major similarities and differences of the two programmes in order to highlight areas of general interest to pharmacy educators and to provoke debate on "best practice".

### Nature of the Qualification

The PharmD is set to become the entry level qualification for pharmacy in the United States

TABLE I The Doctor of Pharmacy programme at the University of North Carolina

Semester 1		Semester 2	
Course Title	Hours	Course Title	Hours
<i>YEAR 1</i>			
PHYI 93 Physiology	4	PHCO 54 Principles of Pharmacology 1	2
PHCY 51 Pharmaceutics 1	3	PHCY 61 Pharmaceutics 2	3
PHCY 52 Biochemistry 1	3	PHCY 62 Biochemistry 2	3
PHCY 53 Health Systems	2	PHCY 63 Pharmaceutical Care	2
PHCY 59L Pharmaceutical Care Lab 1	3	PHCY 69L Pharmaceutical Care Lab 2	3
		PHCY 60 Intro. Practice Experience	4
Total	15	Total	17
<i>YEAR 2</i>			
PHCO 55 Principles of Pharmacology 2	2	PHCO 56 Principles of Pharmacology 3	2
PHCY 71 ANS Medicinal Chemistry	1	PHCY 82 Applied Pharmacokinetics	3
PHCY 72 Biopharmaceut/Pharmacokinetics	3	PHCY 84 Pharmacy Law and Ethics	3
PHCY 73 Rheumatology/Endocrinology	3	PHCY 85 Cardiology/Nephrology	3
PHCY 74 Literature Analysis/Interpretation	4	PHCY 87 Neurology/Psychiatry	2
PHCY 75 Pulmonology/Gastroenterology	2	ELEC Professional Elective	3
PHCY 79L Pharmaceutical Care Lab 3	2	PHCY 89L Pharmaceutical Care Lab 4	2
Total	17	Total	18
PHCY 70 Advanced Practice (summer)	4		
<i>YEAR 3</i>			
PHCY 150 Pharmacy Operations	3		
PHCY 151 Haematology/Oncology	3	PHCY 167 Physical Assessment	3
PHCY 152 Infectious Diseases	3	PHCY 168 Nonprescription Drugs	3
PHCY 153 Immunology	2	PHCY 169 Problems in Pharmacotherapy	5
ELEC Professional Elective	3	ELEC Professional Elective	3
ELEC Professional Elective	3	ELEC Professional Elective	3
PHCY 159L Pharmaceutical Care Lab 5	1		
Total	18	Total	17
<i>YEAR 4</i>			
PHCY 174 Commun/Hospital Clerkship	4	PHCY 184 Ambulatory Care Clerkship	4
PHCY 175 General Medicine Clerkship	4	PHCY 185 Elective Clerkship	4
PHCY 176 General Medicine Clerkship	4	PHCY 186 Elective Clerkship	4
PHCY 177 Elective Clerkship	4	PHCY 187 Elective Clerkship	4
PHCY 178 Seminar	1	PHCY 188 Seminar	1
Total	17	Total	17

Hours: The unit used is a semester hour which is the number of hours per week in a formal teaching situation; L: Signifies a laboratory/practical component to the course; Electives: Students choose from a variety of electives offered both within pharmacy and other disciplines; Clerkships: Students may choose one "non-traditional" clerkship e.g. in industry, regulatory affairs, overseas; Service Teaching: Courses with titles PHYI or PHCO are service-taught. All PHCY courses are taught by pharmacy faculty.

from the year 2000. Like many schools, UNC-CH has been making the transition from the Bachelor's degree to the PharmD programme over the past few years, and the first all PharmD class will graduate in 2000. This move adds an additional year of study to the former Bachelor's programme and is in line with the recommendations of the national accreditation body, the

American Council of Pharmaceutical Education (ACPE) (Anon, 1996).

It is difficult to gauge the significance of the change to PharmD status. It certainly puts pharmacy in line with other health professions in the United States that have a professional "doctoral" degree, for example medicine and dentistry, and it signifies a general "upskilling" of the profession



TABLE II The Bachelor of Pharmacy programme at the University of Otago

Semester 1		Semester 2	
Course Title	Credits	Course Title	Credits
<i>YEAR 1</i>			
BIOL 111 Biology of Cells	6	BIOL 115 Foundations of Biochemistry	6
STAT 115 Introduction to Biostatistics	6	BIOC 111 Biology for Health Sciences	6
CHEM 112 Chemistry: Molecular Reactivity	6	ENGL 124 Language and Communication	6
PHSI 110 Introduction to Physics	6	Additional Paper	6
Total	24	Total	24
<i>YEAR 2</i>			
ANAT 211 Anatomy	5	MICR 218 Introductory Microbiology	5
PHSL 215 Physiology for Health Sciences	5	PHSL 215 Physiology for Health Sciences	5
PHCY 251 Biopharmaceutical Chemistry	5	PHCY 252 Pharmaceutical Analysis	5
PHCY 254 Physical Pharmacy A	5	PHCY 255 Physical Pharmacy B	5
BIOC 230 Biochemistry	5	PHCY 261 Pharmacy Practice	5
Total	25	Total	25
<i>YEAR 3</i>			
PHCY 301 Basic Pharmacology	5	PHCY 302 Applied Pharmacology	5
PHCY 351 Principles of Medicinal Chem.	5	PHCY 352 Systematic Medicinal Chem.	5
PHCY 354 Pharmaceutical Microbiology	5	PHCY 315 Human Disease	5
PHCY 355 Biopharmaceut/Pharmacokin A	5	PHCY 356 Biopharmaceut/Pharmacokin B	5
PHCY 362 Pharmacy Practice A	5	PHCY 363 Pharmacy Practice B	5
Total	25	Total	25
<i>YEAR 4</i>			
PHCY 460 Clinical Pharmacokinetics	4	PHCY 451 Pharmaceutical Sciences	5
PHCY 461 Disease and Drug Therapy 1	6	PHCY 462 Disease and Drug Therapy 2	6
PHCY 463 Clinical Pharmacy	4	PHCY 467 Topics in Professional Devpt.	4
PHCY 465 Pharmacy Law and Ethics	3	PHCY 468 Sterile Dispensing	3
PHCY 466 Community Pharmacy Practice	5	PHCY 466 Community Pharmacy Practice	5
PHCY 470 Research Elective	3	PHCY 470 Research Elective	2
Total	25	Total	25

Credits: The credit point is the number of hours an "average" student is expected to spend in both formal and non-formal study over a 30-week academic year (*i.e.* for a 5 credit point course 150 hours of total study is expected); Laboratories: The great majority of courses have a laboratory/practical component; Externships: Four weeks of experiential work in hospital and community pharmacy is incorporated in pharmacy practice courses; Service Teaching: In Years 2 to 4, the following courses are service-taught: Microbiology, Physiology, Anatomy, Biochemistry, Pharmacology, Human Disease.

and an emphasis on the pharmacist's clinical role. There is also political advantage to be gained by the change in title. To give another comparison, the base qualification for physiotherapists in the United States is a Masters degree.

The honorific "doctor" seems to be used in the hospital and industrial sectors, but not yet widely in the community pharmacy sector. There is currently some confusion on the part of employers in assessing the relative "value" of the degree with respect to Masters and PhD qualifications. There are also some difficulties

in defining the required qualifications of academic pharmacists. While the PhD remains the norm for tenure-track staff, the PharmD may be more appropriate for clinical-track appointees. There exists a danger of two "classes" of academics, with the obvious attendant tensions this creates. As the PharmD progressively becomes the established entry-level qualification, these issues should hopefully be resolved.

In New Zealand, it is not possible at the present time to award a "doctoral" qualification at the undergraduate level. Despite the fact that

medical and dental graduates are generally known as "doctor", their undergraduate qualification is actually a bachelor's degree. Otago has recently been investigating the development of a postgraduate doctoral degree in pharmacy (provisionally entitled Doctor of Clinical Pharmacy), but even this would not be approved unless it was principally based on original research.

There is a worldwide trend to extend the length of pharmacy undergraduate courses and consequently rename the qualification. In the United Kingdom all pharmacy students will now graduate with a Masters degree. This makes international comparisons difficult. Certainly, in the United States, a professional degree such as the PharmD is regarded as being of greater "currency" than a bachelor's degree. There is probably little real difference in the preparedness of American, British and New Zealand pharmacy graduates at the time of registration, yet their nominal qualifications are quite distinct.

#### Mix of "Science" and "Practice"

A major difference between the two programmes is in the science/practice mix. Even allowing for imprecision in defining this mix, it is clear that the Otago programme is more "traditional" and rooted in the pharmaceutical sciences. This reflects a general distinction between the British/European and American models of pharmacy education.

A classification of the subject content of the two programmes is attempted here using three broad themes, namely physical (pharmaceutical) sciences, biological sciences, and pharmacy practice. Some rather broad assumptions were made in this analysis. Year 1 at Otago (similar to pre-admission at UNC-CH) and Year 4 at UNC-CH (similar to the pre-registration year in New Zealand) were excluded, as were other experiential components. Pharmacotherapy subjects (at UNC-CH) and Disease and Drug Therapy (at Otago) were classified as biological sciences. Electives were distributed in the three areas according to student uptake.

The allocation to biological sciences in the two programmes is reasonably similar, but there is disparity in the respective allocations to physical sciences/pharmacy practice. There is a view, even in the United States, that American schools may have sacrificed too much of the pharmaceutical science base in order to accommodate clinical/practice developments. Most commentators agree that a firm science foundation must continue to underpin the practice of pharmacy, and that it is the pharmaceutical sciences which provide pharmacy's unique character (Penna, 1997; Rutledge, 1997). On the other hand, the mix at Otago could be regarded as too "traditional". On this issue, there will no doubt be continued and lively debate.

#### Laboratory/Practical Components

The use of laboratory/practical exercises in the two programmes is also markedly different. Apart from the Pharmaceutical Care Skills Laboratories (described later), UNC-CH has almost no laboratory-based elements in the remainder of its core courses (some electives include laboratory work). This reflects a general trend in American schools of pharmacy. The decrease in laboratory work has freed up time and resources to develop a greater clinical and pharmaceutical care orientation.

In contrast, the great majority of Otago courses have a significant laboratory component. This is true not only for the physical sciences, but also for the biological sciences and pharmacy practice. It should be noted, however, that there is an increasing use of simulations and demonstrations, at least in the biological sciences. In contrast to the American trend, the prevailing British/European view is that "hands-on" laboratory experience is essential in order for students to understand and develop skills of scientific enquiry.

Is there is an acceptable middle course? As previously noted, there is some concern in the United States that pharmacy graduates are now

less scientifically literate than their predecessors. On the other hand, practical work is expensive of both human and physical resources. It is also increasingly difficult to convince students of its worth and relevance. As with the science/practice mix, there needs to be careful consideration of this issue.

### Experiential Components

This section must be interpreted in the context of the different models of pre-registration activity in the two locations. As for the United Kingdom, Australia and many other countries, New Zealand pharmacy students are required to undertake a specified period of pre-registration training (internship) after graduation.

In the New Zealand case, this is a one-year period during which pre-registration trainees undertake a competency-based training programme administered by the Pharmaceutical Society of New Zealand. Trainees receive a salary during this period, as they are employed by individual community and hospital pharmacies. They usually spend the entire period in a single location (a small number undertake two six-month periods in separate locations, but this is the exception). It has been proposed that this year should be a further year of university study, and that students should rotate through a number of practice sites (similar to the US model). Not surprisingly, there has been no enthusiasm on the part of Government to support such a move as it would have to fund a further year of university study.

Otago students do have a relatively small component of experiential activity during their undergraduate studies as part of their pharmacy practice courses. This comprises several local community pharmacy visits in Year 2, two one-week community pharmacy externships in Years 3 and 4, and an one-week hospital pharmacy externship in Year 4.

The fourth year of the PharmD at UNC-CH is given over to a series of clerkships which stu-

dents undertake in a range of practice settings. Eight one-month clerkships are required, four of which must be in community/hospital pharmacy, general medicine and ambulatory care. The remaining four are electives, either in the areas already described or in specialities such as oncology or paediatrics. One clerkship may be non-traditional, for example in industry, veterinary practice, the FDA, or overseas (in fact, two or three UNC-CH students travel to New Zealand each year on an overseas clerkship). Students also spend two stipulated one-month periods in community or hospital pharmacy practice earlier in the programme (see Table II). This earlier experience is regarded as being especially valuable in orienting students to the profession.

During clerkships, the students apply their previous academic and didactic course work, under supervision, in actual patient care situations. North Carolina is particularly fortunate in having a long-established Area Health Education Centre (AHEC) programme with a network of nine AHEC regional centres, based at major hospitals or medical centres throughout the state. Health science students (including pharmacy students) rotate through these sites for their clerkships.

The UNC-CH School has 22 full or part-time faculty and over 500 volunteer practitioner-instructors who teach pharmacy students in their practice settings (both hospital and community). In order to facilitate accommodation etc., students generally spend the entire fourth year at one, or possibly two, of the AHEC regional centres, coming together at the School of Pharmacy for short periods at the end of each semester. The State Pharmacy Board and national examinations are timed to coincide with graduation at the end of Year 4 and the ten-month experiential activities undertaken during the PharmD, together with paid pharmacy work undertaken during vacations and free time, are accepted as sufficient practical experience for registration. It should be pointed out that while



the general model for clerkships described here is common to most PharmD programmes in the United States, systems similar to the North Carolina AHEC are found only in a handful of other states. The UNC-CH system is widely admired.

It is interesting to contrast the two systems. A major feature in the case of UNC-CH is the extensive array of resources which support the clerkships and experiential activities. Students are able to experience pharmacy practice activities in a wide range of locations and settings, and there is a natural progression from the role of student to that of practitioner. There is excellent integration of the taught courses and practice experience; this is facilitated by the fact that a large number of faculty members are teacher-practitioners working in the AHEC system.

The New Zealand system separates the academic and experiential components almost completely. Pre-registration trainees are also employees and this inevitably introduces a certain ambivalence into the relationship with their employers/preceptors. The number of practice sites to which the trainee is exposed is very limited and on registration an individual may have only ever spent one week in a hospital setting, for example. The School of Pharmacy has no direct influence on the content of pre-registration training and it therefore becomes difficult to integrate material with the undergraduate curriculum. In the same vein, the School does not receive the same degree of direct feedback as at UNC-CH. Perhaps one advantage of the New Zealand system is that the trainees are paid. On balance, however, the UNC-CH system provides a more comprehensive preparation for future practice.

#### **Integration of Curricular Material and Teaching/Learning Methods**

Both programmes have made significant advances in the integration of curricular material and the development of student-centred teach-

ing/learning methods in recent years, albeit in different ways which reflect their particular environment. Some selected examples are discussed here.

The Pharmaceutical Care Lab courses at UNC-CH represent an innovative approach to the integration of practice-related material. This series commences in Year 1 and continues over five semesters through to Year 3. The aim of these courses is, through small group activities, individual or team laboratory activities, and independent study, to develop the skills required to provide comprehensive pharmacy and pharmaceutical care services. The goals of these courses are articulated as the four C's: confidence, competence, communication, and caring.

Commencing with basic skills in drug information retrieval/analysis, communication skills, pharmaceutical calculations, and pharmacy law, the courses progressively introduce dispensing practice (including extemporaneous and sterile dispensing), patient counselling, medication review, pharmaceutical care services, documentation, and so on. These activities are not taught as separate entities but are integrated in a fashion similar to the "real-life" operation of a pharmacy. From the outset, students are required to utilise information technology and the main laboratory area is designed around a number of on-line computer workstations. These courses can be visited on the internet ([www.pharmacy.unc.edu/pharmacy/courses](http://www.pharmacy.unc.edu/pharmacy/courses)) where the entire course material is displayed.

One interesting facet of the extemporaneous dispensing exercises is that every product made is analysed for active ingredients. If levels are unacceptable, the student is required to repeat the exercise on Friday afternoon!

The Pharmaceutical Care Lab activities parallel and reinforce topics in the concurrent pharmacotherapy modules, so that practice with inhaler therapy, for example, coincides with the respiratory pharmacotherapy module. Students seem to enjoy and appreciate the relevance of this approach. There is also integration

within the pharmacotherapy courses, for example in the Cardiology/Nephrology module, there is integrated study of the epidemiology, pathophysiology, molecular basis of drug action, pharmacokinetics, socio-economics, and pharmacotherapy of cardiac and renal diseases.

At Otago, the programme is less integrated at Years 2 and 3, although there is a high degree of integration at Year 4. Opportunities for integration at the earlier years is constrained in part by the high level of service teaching, however there is potential for greater consolidation of practice material. Prescription (ethical) dispensing, extemporaneous dispensing, and sterile dispensing are still taught and examined as separate entities, but could be rationalised fairly readily. The Drug and Disease Therapy courses, Pharmacy Practice and Clinical Pharmacy are all well integrated at the final year and teaching/learning activities are principally in small groups emphasising a problem-solving approach. The students particularly enjoy this approach and have requested that it commence earlier. There is an increasing use of computer assisted learning (CAL) packages in a range of subjects, for example Disease and Drug Therapy. Again, these are well received.

The issue of service-courses *vs.* "in-house" provision is an interesting one. At UNC-CH there is limited service teaching by the School of Medicine in Years 1 and 2 (Physiology and Pharmacology). As already noted, almost half of the Year 2 and 3 courses at Otago are service taught by departments of the School of Medicine. The claimed advantages of service courses include teaching by research specialists in relevant disciplines, and the opportunity for pharmacy students to mix with those from other programmes. One feature of the Otago experience is that there does appear to be greater opportunity for interaction with students from other health science disciplines such as medicine, physiotherapy and pharmacy. Conversely, with a high level of service teaching, there is loss of control over the course

material and, as indicated above, difficulty in achieving the sort of integration seen at UNC-CH.

There is a view that interprofessional education is the way of the future, reflecting a move towards a "healthcare team" (Holden, 1997). In planning their curricula, pharmacy schools need to be aware of these larger trends and to seek every opportunity to interact with other disciplines.

## CONCLUSION

It would be inappropriate (and foolhardy) to conclude that one of the two curricular models presented here was "better" than the other. As discussed previously, pharmacy curricula must respond to both local and global influences. Perhaps more salient would be to ask whether they provide the specific knowledge, attributes, abilities and behaviours for graduates to practise pharmacy in a rapidly-changing world. The answer in both cases is emphatically yes, and one is struck by the similarities rather than the differences in both philosophy and implementation.

Where differences have been highlighted, the intention has been to provide "best practice" examples for improvement. As a general comment, UNC-CH (and American schools in general) has far more fully embraced the clinical/pharmaceutical care model of pharmacy practice and this is reflected in the organisation of the curriculum. Otago maintains a more "traditional" orientation, despite a gradual shift towards a more clinical outlook. Particular strengths of the UNC-CH curriculum are the integration of material and the quality of the experiential components. However, the apparent dilution of the basic scientific foundation is of concern.

It will be of interest to observe if the two systems continue to evolve towards a "global" pharmacy curriculum.

### Acknowledgements

I wish to thank the University of Otago for supporting my study leave, and the faculty and students of the School of Pharmacy, University of North Carolina at Chapel Hill for their hospitality and encouragement. Special thanks to Dr Tina Brock for reviewing this paper.

### References

- Anonymous (1986). Pharmacy: the report of an inquiry by the Nuffield Foundation. London: the Nuffield Foundation.
- Anonymous (1993). Commission to Implement Change in Pharmaceutical Education. "Background Paper II: Entry-level, curricular outcomes, curricular content and educational process." *Am. J. Pharm. Educ.*, 57, 377-385.
- Anonymous (1996). Commission to Implement Change in Pharmaceutical Education. "Position Paper: Maintaining Commitment to Change." *Am. J. Pharm. Educ.*, 60, 378-384.
- Anonymous (1998a). "Preparing the Future Pharmacist: Curricular Development." Report of a Third WHO Consultative Group on the Role of the Pharmacist. Canada: Vancouver. (WHO/PHARM/97/599).
- Anonymous (1998b). Good Pharmaceutical Education Practice (GPEP) Draft 3. Academic Section, FIP Congress, The Hague, Netherlands.
- Holden, R. W. (1997). Interprofessional education: Our common destiny. *Am. J. Pharm. Educ.*, 61, 430-432.
- Kabat, H. F. (1997). Pharmaceutical education's global village. *Am. J. Pharm. Educ.*, 61, 426-430.
- McGhan, W. F. (1996). Structure, process and outcomes: Assessing pharmacy education and faculty. *Am. J. Pharm. Educ.*, 60, 218-219.
- Penna, R. P. (1997). Nurturing the pharmaceutical sciences. *Am. J. Pharm. Educ.*, 61, 453.
- Rutledge, C. O. (1997). Principles and observations on pharmaceutical education. *Am. J. Pharm. Educ.*, 61, 424-426.

**John P. Shaw**, Chair, Division of Pharmacy, The University of Auckland, Auckland 1, New Zealand. This article was written while on study leave at the School of Pharmacy, University of North Carolina at Chapel Hill (UNC-CH).