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Teaching of pharmacology in Universiti Malaya and the other medical schools in Malaysia – a historical perspective

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ABSTRACT

Traditional pharmacology teaching has focused more on drug instead of therapeutics, such that although pharmacological knowledge is acquired, practical skills in prescribing remain weak. In Malaysia many new medical schools (both public and private) have been set up in the last 12 years due to a change in government policy, resulting in a wide spectrum of medical curricula. Universiti Malaya (UM) being the oldest medical school in Malaysia was deep set in its traditional way of teaching-learning, since its inception in 1962, until a visit from the General Medical Council of the United Kingdom in 1984 triggered off a change of tide. Since then the medical curriculum in UM has undergone two major revisions. The first revised curriculum (1988) aimed to inject more clinical relevance into basic science teaching, through introducing clinical lectures and skills in the paraclinical year. Professional behaviour was also addressed. The second revised curriculum (1998) sought to improve further the integration of knowledge as well as to produce a holistic doctor, viewing the patient as a person instead of a clinical entity. The teaching-learning of pharmacology has gradually moved from factual regurgitation to more clinical reasoning, from lab-based to more patient-oriented approach. As more new medical schools are being set up in Malaysia, exchange of experience in this area of learning will hopefully help us find a happy medium between “the old is best” and “the new is better” type approach so that a pedagogically sound and yet logistically practical curriculum can be found in our local setting, to help produce doctors with good prescribing practice.

INTRODUCTION

In producing the “Guide to good prescribing”, the authors commented: “Pharmacology training for most medical students concentrates more on theory than on practice. The material is often drug centred and focuses on indications and side effects of different drugs. But in clinical practice the reverse approach has to be taken, from the diagnosis to the drug. Moreover patients vary in age, gender, size and sociocultural

characteristics, all of which may affect treatment choices. Patients also have their own perception of appropriate treatment and should be fully informed partners in therapy. All this is not always taught in medical schools, where the number of hours spent on therapeutics may be low compared to traditional pharmacology teaching. As a result although pharmacological knowledge is acquired, practical skills remain weak.” (de Vries, Henning, Hogerzeil & Fresle, 1995).

This is the problem faced by many of us pharmacology teachers in a medical school setting. Does this problem arise because many of us who are basic scientists do not understand the role pharmacology plays in

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medical practice? Is it fair to expect a basic science-trained pharmacologist to be in the best position to teach pharmacotherapeutics to medical students? On the other hand, how many clinicians feel adequately equipped to teach their students the many different and sometimes complex mechanisms of drug actions as well as the diverse factors that affect the actions and fate of a drug in the body? Do medical students really need to have comprehensive knowledge of pharmacology before they can acquire good prescribing practice?

Therefore, as older medical schools review their curricula and as newly established medical schools design their programmes, the above questions will doubtless need to be considered with respect to the teaching of pharmacology. In this paper, I have attempted to highlight the process of change and the challenge faced by pharmacology teachers, both in the oldest established medical school as well as in some of the newer medical schools in Malaysia, in preparing their students to be competent with respect to pharmacotherapeutics; to be able to decide on the “best-choice” medications (with respect to efficacy, safety, suitability and cost) for their patients.

A BRIEF HISTORY AND GENERAL PROFILES OF MALYANSIAN MEDICAL SCHOOLS

For the first 18 years after the establishment of the first medical faculty (Universiti Malaya, UM, 1962) in Malaysia, only two other medical faculties (Universiti Kebangsaan Malaysia, UKM, 1972, and Universiti Sains Malaysia, USM, 1979) were set up, producing 400-500 medical doctors each year. Over the next 12 years, no new medical schools were established. However, the last decade of the twentieth century saw the mushrooming of eight new medical schools, both in the public (UPM, UNIMAS and IIUM) as well in the private (IMU, MMMC, PMC and PCM) institutes of higher learning, producing more than 1,500 medical doctors annually (Tab 1). Four of these newer medical schools are faculties in universities and the remaining three are medical colleges, which offer twinning medical degree programmes with partner medical schools overseas or locally. As we embark on the new millennium, another three new medical schools (Asian Institute of Medicine, Science and Technology, AIMST, Universiti Malaysia Sabah, UMS and Universiti Teknologi MARA, UiTM) have just been set up between 2001 and 2003, making a total of 13 medical schools. The students in these newer schools (<50 per class) are still in their pre-clinical stage

of training and not much information is available on their medical programme.

This tremendous increase in the number of medical schools was in part in response to the increased demand of medical professionals and better health care for local needs, and in part due to the Government's effort in promoting Malaysia as a country of academic excellence. Many private colleges have been set up offering degree programmes in twinning with overseas partner universities.

All the seven medical faculties offer a 5-year undergraduate medical programme with the clinical clerkship training ranging from 2 to 3 years (Tab 1). The medical programmes offered by the private medical schools are between 4½ to 6 years, depending on their partner universities in the respective twinning programmes. Whether the degree offered is MD or MBBS/MBChB/MBBCh, the teaching approach employed by these medical schools is predominantly traditional – lecture-based, discipline-oriented, and teacher-centred, except for three medical schools (USM, IMU and UNIMAS) where problem-based learning (PBL) approach was built into their respective curricula, so-called “hybrid PBL” curricula (Yee HY & Tan GJS, 2002), right from the inception of the medical schools.

TEACHING PHARMACOLOGY IN UNIVERSITI MALAYA (UM) – A WALK DOWN THE MEMORY LANE

1984-1988 (The traditional heritage) When I joined the Faculty of Medicine in UM as a lecturer in the department of pharmacology in October 1984, the medical curriculum was still the “original” curriculum, which was a typical traditional lecture-based, teacher-centred and discipline-oriented curriculum. The first two years were devoted to basic science teaching with very little clinical input. As with most traditional medical curriculum, anatomy, physiology and biochemistry disciplines were taught in Year I (so-called “preclinical” year), while pathology, pharmacology, medical microbiology, parasitology and some epidemiology and statistics were taught in Year II (so-called “paraclinical” year), before students proceeded to the clinical years of training (Year III to Year V).

At that time, each discipline was taught in a sequence as deemed best by the department that was responsible for teaching the discipline. There was no serious attempt to coordinate the teaching on the different disciplines to the same class of students in a par-

Tab 1. Summary profiles of Malaysian medical Schools and their respective undergraduate medical programmes.

Medical School	Year Estab- lished	First Intake of Students	Medical Degree	Duration of Training		Predominant Teaching Approach	Class Size (Intake per Year)
				Pre-clinical (years)	Clinical (years)		
Faculty of Medicine, Universiti Malaya (UM)	1962	1964	MBBS	2 ½	2 ½	Traditional [†]	151-200 (Once)
Faculty of Medicine, Universiti Kebangsaan Malaysia (UKM)	1972	1973	MD	2	3	Traditional [†]	201-250 (Once)
School of Medical Sciences, Universiti Sains Malaysia (USM)	1979	1981	MD	3	2	Hybrid PBL	151-200
School of Medicine, International Medical University (IMU)#	1992	1993	MBBS	2 ½ local	2-3 local/ overseas	Hybrid PBL	151-200 (Twice)
Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak (UNIMAS)	1993	1995	MD	2	3	Hybrid PBL	101-150 (Once)
Kulliyyah of Medicine, International Islamic University Malaysia (IIUM)	1995	1997	MBBS	2	3	Traditional	51-100 (Once)
Faculty of Medicine and Health Sciences, Universiti Putra Malaysia (UPM)	1996	1997	BS (Med Sc) & MD	2½	2½	Traditional	51-100 (Once)
Penang Medical College (PMC)#	1996	1996	MBBCh & BAO	2½ - 3½ overseas	2½ local	Traditional	51-100 (Once)
Melaka Manipal Medical College (MMMC)#	1993	1998	MBBS	2½ overseas	2½ local	Traditional	51-100 (Twice)
Perak College of Medicine (PCM)#	1999	a) 1999* b) 2001	a) MBChB* b) MBBS	a) 2* b) 2½ overseas/local	a) 3* b) 2½ local	a) Traditional* b) Traditional [†] (Once)	a) <50* b) 51-100

Private institutes of higher learning.

* This twinning programme with the University of Sheffield is now defunct (intake stopped since 2001), and has been replaced by twinning with Universiti Malaya (UM).

[†] A modest amount of PBL-style tutorials are used alongside lectures and other traditional modes of instruction.

ticular year. For example, in a typical week, pathology might be teaching on “anaemias” and “bleeding disorders”, whereas medical microbiology was teaching on “systemic infections” and “intrauterine and perinatal infections”, parasitology on “control of vectors”, and pharmacology on “anxiolytic agents”, “antipsychotic agents” and “antidepressant agents”. There were no obvious links among these various topics taught by

the different departments in that same week. The integration of these different disciplines was left totally to the devices of students themselves, if at all it happened.

A typical day of a Year II student’s timetable at that time would consist of three hours of discipline-based lectures, one hour of discipline-based tutorial and a two-to-three hour discipline-based practical class (often hands-on) from Monday to Friday. Some lec-

tures might also be scheduled on Saturday. Besides these medical science disciplines, students were also required to attend some language classes to improve their proficiency in the use of Bahasa Malaysia (our national language) in communication. Time for self-study was limited, with an average of about 28 hours per week of students' school time being scheduled for structured class activities.

In an academic year of 29 teaching weeks (three terms of 9-10 weeks each), there were 66 hours of lectures on pharmacology, 26 hours of "wet" practicals (hands-on or live demo) and 30 hours of tutorials (often turned into "mini lectures" or "question-and-answer sessions") on the same discipline. Summative assessments on pharmacology were carried out at the end of Term I and Term II (together constituted 20 % of total) and a final examination (80 % of total) at the end of the academic year. The final examination on pharmacology comprised two theory papers (MCQ and essays, 3 hours each) and a practical paper (1 hour). Attempting to answer 500 true-false statements and another five essay questions was a grilling experience. The pharmacology practical examination focused on data handling and interpretation with 10 stations of 5 min each. Students had to pass pharmacology as well as the other three main paraclinical discipline examinations before being allowed to proceed to the clinical year.

1988-1999 (The transition/juggling stage) In 1988, the medical curriculum in UM underwent the first major revision following feedback from a visiting team representing the General Medical Council (GMC) of the United Kingdom. As a result, clinical exposure and lectures on clinical disciplines were introduced to students at Year II (then known as Stage II) of the so-called "new" curriculum. Attempts were also made to group the teaching of the various paraclinical (ie Year II) disciplines into "core" and various "organ-system" blocks. Lectures on preclinical (ie Year I) as well as clinical disciplines were brought in at paraclinical year as review or introductory lectures in almost every organ-system block in an attempt to integrate vertically, between basic sciences and clinical practice.

For example, in a 4-week teaching block on cardiovascular system, there were review lectures on anatomy and physiology of the heart, followed by medicine lectures on examination of the heart and detection of cardiac abnormalities, and pathology lectures on the various cardiovascular disorders, while pharmacology would come in near the end to teach on the drugs used

in the treatment of various cardiac and vascular diseases. In between there were a couple of lectures on infection of the cardiovascular system by microbes and parasites, and a lecture on the psychological aspect of cardiovascular disorders. The teaching of these various topics were synchronised, rather than truly integrated, with clear boundaries of knowledge on the various disciplines. Often there were repetitions of information in the lectures given by the different departments in a particular organ-system. For example, the causes and treatment of iron-deficiency anaemias were taught by pathology, pharmacology and medicine departments, as well as in a multidisciplinary seminar. Not that repetition of information is necessarily a bad thing; sometimes it helps to reinforce each other or help students to look at things from different perspectives, but more often than not it is an exact duplication of information and thus not an efficient use of student or staff time.

At the beginning of the academic year of Stage II, there was an 11-week "Paraclinical Core" teaching block, where the various paraclinical departments (ie pathology, pharmacology, microbiology and parasitology) laid the foundation knowledge on their respective disciplines. These lectures were not at all correlated with each other. For pharmacology discipline, the core teaching included the general principles of pharmacology, drugs acting on the autonomic nervous system and neuromuscular blocking drugs. The "Paraclinical Core" block was followed by 3 weeks of "Clinical Core", where multidisciplinary seminars and some introductory clinical lectures were used to introduce students to clinical signs and symptoms before they moved on to the "Organ-system" block.

While there was a general reduction in the number of lectures on the various basic science disciplines (the most obvious being pathology, from 118 h in 1985/86 to 97 h in 1988/89; while pharmacology lectures was reduced from 66 h to 61 h in the same period), the number of clinical lectures and clinical skills sessions introduced was quite substantial (60.5 and 174 h, respectively), compared to the "original" curriculum (4 h; Fig 1a). Stage II now stretched to 41 weeks instead of 29 weeks of teaching, and the amount of classroom activities was reduced to about 23 hours per week.

Discipline-oriented tutorials and practicals continued to be the norm for pharmacology teaching as for the other paraclinical disciplines. However, attempts were made to use more clinical scenarios or cases (i.e.

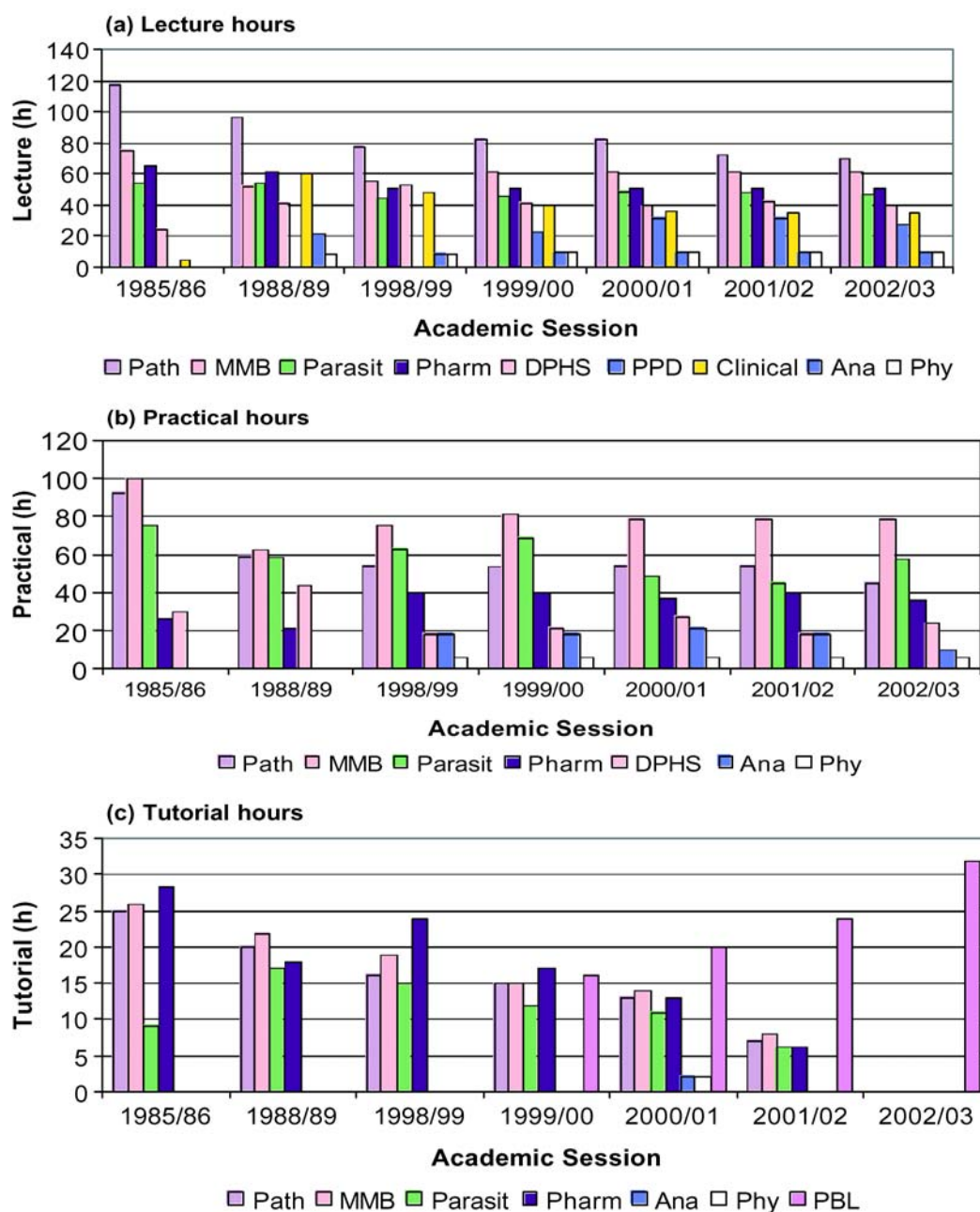


Fig 1. Total hours of (a) lectures, (b) practicals and (c) tutorials for each discipline given during the Paraclinical period (Year/ Stage/Phase II) of the MBBS programme in UM from 1985/86 to 2002/03 [1985/86=“original” curriculum; 1988/89 to 1998/99=“new” curriculum; 1999/00 to 2002/03=NIC]

case-based teaching) in the tutorials to help students see the relevance of pharmacology in their preclinical years of training, which at the same time served to improve problem-solving skill and aid integration of pharmacology with other disciplines, especially pathology and clinical disciplines. A few of the “wet” (live demo) practicals were converted to “dry” practicals in the form of a video-taped experiment, eg the effect of sympathomimetic drugs on the cardiovascular system in cat. This

was done in part due to the increasing difficulty in obtaining supplies of a large number of cats and polygraphs for physiological recording of live experiments. The difficulty of obtaining standard experimental results in all the teaching laboratories was another contributing factor to the change. A few of the external examiners had queried the necessity of pharmacology practicals (especially animal experiments) in medical training. Despite these concerns raised, the practicals

stayed.

Over the ensuing eleven years of this “new” curriculum, there were further adjustments made to improve the medical programme, with emphasis mainly on better integration of basic sciences with clinical disciplines and on achieving a more holistic approach in patient care. Thus, behavioural science was given a more prominent role in Stage II teaching. By 1998/99, pathology lecture hours had dropped to 77 h, while pharmacology lecture decreased to 50.5 h, representing about 23 % reduction compared to the 1985/86 (“original” curriculum) teaching schedule. Similar reduction was noted in medical microbiology and parasitology lectures (26 % and 17 %, respectively).

The assessment remained discipline-oriented and knowledge-focused, but the final examination (75 % of total, while the other 25 % came from continuous assessments) of pharmacology in Stage II had been reduced to just a 3-hour theory (MCQ+Essay) and a 1-hour practical paper (OSPE, objective structured practical examination).

1999-present (The pressing-on stage) In the late 90s, further review of the MBBS curriculum led to the implementation of the so-called “New Integrated Curriculum (NIC)” in 1998/99 at Year I (now called Phase I) level. The curriculum outline remained basically the same as the one immediately before, i.e. there is a core teaching block(s) before the organ-system block in both Phase I and Phase II. However, some new features were introduced, which aim to help students in their professional and personal development (PPD module) as well as to encourage students to view the patient as a person living within a community and not as a clinical entity (Doctor, Patient, Health & Society, DPHS, module).

These new features are in line with the philosophy of the faculty to produce “competent, highly-skilled and knowledgeable doctors, who can work with others as a team, who are caring and concerned about their patients and society, and who can emerge as leaders in their community” (Students’ Handbook for MBBS, Session 2003-2004).

I took over as the overall coordinator of Phase II (ie Year II/III), just as the NIC was going to be implemented at Phase II in 1999. The task lay before me and my team of discipline coordinators was to implement a Phase II programme that is in line with the above philosophy. At that time, a few of the academic staff have had previous exposure to PBL approach from vari-

ous medical schools, while I was first introduced to it through the visit of a visiting professor from McMaster University in June 1999. The philosophy of PBL is in agreement with the learning outcomes desired for our UM medical graduates. However, it was not possible to redesign the whole MBBS curriculum nor were we sure if our Malaysian students could adapt to PBL approach. As a result, PBL-style tutorials were introduced into Phase II of the NIC in 1999/2000 in a very modest scale (4 problem-cases only). Discipline-oriented tutorials existed side by side with PBL-style tutorials. As the years progressed, discipline-oriented tutorials decreased gradually until they were totally taken out of the timetable in 2002/03 (Fig 1c). By then, the number of PBL tutorials has increased to eight problems in Phase II and the student class time has now decreased to about 18 hours per week, allowing more time for self-directed learning. The intention is to press on increasing the number of PBL tutorials while removing lectures that contain topics that will be discussed in the PBL tutorials.

Interestingly, except for pathology and parasitology, the amount of time devoted to discipline-oriented practicals has not decreased further in the NIC, after the initial marked drop in the practical hours as we moved from the “original” to the “new” curriculum (Fig 1b).

In the NIC, the number of pathology lectures continued to decrease from 1999/2000 to 2002/2003 as it sought to integrate with medicine lectures, but pharmacology lectures remained at 51 hours (same hours as the earlier “new” curriculum) despite some of the lectures on the antimicrobials and antiparasitics being taken over by the medical microbiology and parasitology departments, respectively. Nevertheless, a couple of introductory lectures on antimicrobial agents focusing on the mechanisms of actions and pharmacokinetic properties of representative classes of antimicrobial agents are still given by the pharmacology department during the “Clinical Core” block to prepare students to better understand the therapeutic usage of these drugs, which they may encounter in the “Organ-system” block that follows.

Assessment in the NIC has taken a bold step by eliminating all discipline-based examinations in the pre- and para-clinical years. Instead, the papers, which still consist of theory and practical components, are now “integrated” with inputs from all the relevant disciplines (mostly basic sciences and some clinical aspects). In

Phase II, the theory papers consist of multiple-choice questions (MCQ) and short-answer questions (SAQ) on the different basic science disciplines, including anatomy, physiology, behavioural science and epidemiology in the same papers - these questions are more "composite" rather than truly integrated in nature. However there are a few problem-based questions (PBQ) which are paper simulations of patient and community health problems (Edariah, 2002). Questions (in the form of SAQ) are interspersed between brief scenarios as the patient/community problem develops. These questions test clinical reasoning ability and require integration of knowledge from various disciplines to answer. PBQ is also often the place where issues related to ethics and behaviours are best tested, and the clinical application of pharmacology knowledge best assessed. Unlike in the previous two curricula, students can no longer study one subject at a time for examination purpose, but need to come to each examination armed with knowledge on all the relevant disciplines.

COMPARISON OF PHARMACOLOGY TEACHING IN UM, USM AND UPM – THREE MEDICAL SCHOOLS WITH DISTINCTIVE MEDICAL CURRICULA

As a result of global changes and local adjustments made in medical training, cross-breeds of different medical curricula have produced a wide variety/spectrum of teaching-learning methods in medical schools in Malaysia. However, I have selected three medical schools (UM, USM and UPM) to illustrate the possible different approaches in the teaching and learning of pharmacology in Malaysian medical schools. These schools have been selected as representatives because they represent distinctly different approaches in medical training and because more detailed information on the teaching of pharmacology in these three schools has been made available to me.

Universiti Malaya (UM) In UM the learning of pharmacology, as described above, is still mainly through didactic lectures, supplemented with experiments that are either pre-recorded or demonstrated live (with very little hands-on experience presently), and this is often followed up by a "small" group discussion to reinforce the theoretical information obtained in the lectures given prior to the practical sessions.

Elective projects of 5-week duration are part of the Year II/III (Phase II) programme, and students are encouraged to undertake a scientific study. However,

this rather short duration often discourages the teachers (especially pharmacology which frequently uses animals in research) from offering laboratory-based research projects which may require time for students to master the necessary laboratory techniques. Thus, while students often seem to be keener in trying their hands on such lab-based studies than to conduct survey-type clinical studies, logistics and cost often preclude such learning opportunities.

Universiti Sains Malaysia (USM) The medical curriculum in USM is an integrative curriculum and the first in Malaysia to adopt a PBL approach. However, preclinical disciplines such as anatomy, biochemistry and physiology are still taught in a predominantly conventional manner where lecture is the main method of delivering knowledge throughout Year I (Yee HY & Tan GJS, 2002). This may be due to the perceived difficulties in pursuing certain of the objectives of these disciplines, especially anatomy and biochemistry, in PBL (Barrows, 2000). Clinical practice is introduced from Year II onward and PBL tutorial is a regular feature in Years II and III, where on average one problem case is discussed over two to three sessions each week, totalling to about 300 hours in the two years (Tab 2). While the PBL tutorials may discuss issues involving all basic sciences as well as clinical disciplines, the lectures that are conducted concurrently focus mainly on pathology, pharmacology, microbiology and some clinical aspects. Parasitology lectures are given mainly in the "Infectious Diseases" block. Student seminars are also a common class activity in every organ-system block. As with UM, there is a "General" block that precedes the various organ-system blocks, both in Year I and in Year II/III.

Despite the much greater amount of time given to PBL tutorials in USM, the number of lecture hours devoted to teaching pharmacology (49 h) is not much less than the much more traditional medical school like UM (51 h) in the preclinical years (Tab 2). There is no practical specifically for pharmacology, but there are a couple of fixed-learning modules (FLM, 2.5 h each session) involving pharmacology, e.g. one in the endocrinology and another in the musculoskeletal system.

Universiti Putra Malaysia (UPM) The UPM medical programme is modelled on a British medical school, which has adopted a modular and integrative approach, but to date has no PBL component in its teaching-learning method. Basic sciences, clinical disciplines and any other relevant disciplines are packaged into

Tab 2. Teaching of Pharmacology in three medical schools with distinctly different undergraduate medical curricula in Malaysia (based on information from 2000/2001 to 2003/04).

Medical School	UM	USM	UPM
Degree conferred	MBBS	MD	BS (Med Sc)/MD
Preclinical training period	Yr 1 to mid-Yr3	Yr 1 to Yr 3	Yr 1 to mid-Yr3
Clinical exposure starts in	Yr 2	Yr 2	Yr 1
Pharmacology lectures:			
Total hours in Year 1:	0	1.5	15
Total hours in Year 2:	51	25.5	29
Total hours in Year 3:	0	23.5	0
Total hours in clinical years:	6	NA	NA
Pharmacology practicals:			
Total hours in Year 1:	0	0	@6
Total hours in Year 2:	#27	0	0
Total hours in Year 3:	0	0	0
Pharmacology tutorials:			
Total hours in Year 1:	0	0	§7
Total hours in Year 2:	4	0	§6.5
Total hours in Year 3:	0	0	0
PBL tutorials:			
Total hours in Year 1:	16	0	0
Total hours in Year 2:	24	145.5	0
Total hours in Year 3:	*8	152.5	0
Total hours in clinical years:	16	0	0

* This refers to the first half of Year 3 that is part of Phase 2 (paraclinical) training. The amount of PBL tutorial hours for the second half of Year 3 is included in that for the clinical years.

12 h “wet” practicals and 15 h “dry” practicals.

@ 6 h “dry” practicals.

§ Include 2-3 h data-handling.

modules of different topics under one of four major themes. For example, “cells and tissues”, “gene expression” and “general pathology” are modules under the theme “The cell”; whereas “general and biochemical pharmacology”, “cardiovascular system” and “behavioural sciences” are modules under the theme “The person”. Similarly there are several modules under two other themes – “The Community” and “Personal and Professional Development”. Several of these modules from different themes may be conducted concurrently in any one of the first four semesters, and lectures are the main tool of instruction. A few practicals (mostly “dry”) and tutorials (often case-based) may be included in each module but that very often depends on

the module leaders. There is a greater tendency for module leaders who are basic scientists to include more discipline-oriented tutorials and/or practicals. Unlike in UM and USM, students in UPM are given clinical training right from Semester 1 of Year I (Tab 2). They therefore should have a better opportunity to correlate clinical observations with their basic science knowledge.

Pharmacology lectures in UPM total to about 44 hours; even less than in USM (50.5 h), which follows a PBL approach and should therefore have less didactic lecture input. Furthermore, unlike UM and USM, pharmacology in UPM is taught at Year I, right from Semester I through to Semester 4. Often these pharmacology lectures are integrated with other disciplines, such

Tab 3. Pharmacology lecture coverage for the undergraduate medical programmes in UM, USM, and UPM (based on information from 2001/2002 to 2003/04) .

Medical School	UM	USM	UPM
(Sessions)	(2002/03)	(2002/03-2003/04)	(2000/01-2001/02)
Pharmacology lecture coverage (hours per area):			
General pharmacology	8 (Yr 2)	1.5 (Yr 1)	10 (Yr 2)
Autonomic pharmacology	5 (Yr 2)	0	6 (Yr 1)
Introductory topics	2 (Yr 2)	3.5 (Yr 2)	0
Respiratory system	2 (Yr 2)	3.5 (Yr 2)	1 (Yr 1)
Cardiovascular system	6 (Yr 2)	[@] 7.5 (Yr 2)	6 (Yr 1)
Gastrointestinal system	3 (Yr 2)	3 (Yr 2)	1 (Yr 2)
Genitourinary/Renal system	3 (Yr 2)	4 (Yr 2)	1.5 (Yr 2)
Reproductive system	2 (Yr 2)	4 (Yr 2)	0 (Yr 2)
Blood system	3 (Yr 2)	3.5 (Yr 3)	2 (Yr 1)
Endocrine system	4 (Yr 2)	3 (Yr 3)	2.5 (Yr 2)
Musculoskeletal system	3 (Yr 2)	1.5 (Yr 3)	*0
Central nervous system	8 (Yr 2)	4.5 (Yr 3)	12 (Yr 2)
Infections	[#] 0 (Yr 2)	7 (Yr 3)	*0
Others (<i>eg</i> pharmacogenetics, drugs in the elderly, <i>etc</i>)	2 (Yr 2) 4 (Yr 4) 2 (Yr 5)	4 (Yr 3)	2 (Yr 2)
Total lecture hours:	51 [+ 6 [§]]	50.5	44

[#] Lectures on drugs used for treating microbial and parasitic infections are given by Medical Microbiology (4 hours) and Parasitology (3 hours) departments, respectively.

[§] Six hours are given in clinical years.

* Presently, there are no modules on these systems, but proposal has been made to include some lectures on the pharmacology of anti-inflammatory, antimicrobials and antiparasitic drugs for 2002/03 onward.

[@] Two hours are for lectures on "Autonomic drugs".

as physiology or medicine, and given by the same lecturer. So too are some of the practicals.

In Semester 5, UPM medical students are required to carry out a 3-month research project, which can earn them a degree in Bachelor of Science (Medical Science). During this time, in-depth pharmacology knowledge and laboratory skills may be acquired should a student choose to do so. However, the number of laboratory-based scientific projects offered is usually very small due to logistic and cost problem. Animal supplies and laboratory equipment are often a constraint. Medical teachers who are basic scientists and actively engaged in research are also few. Thus most of the projects offered are of clinical-oriented or community-based survey type studies.

CONCLUSION

Notwithstanding the minor variations existing in

the curricula of the different medical schools, UM curriculum is representative of the traditional approach such as that found in UKM, IIUM, MMMC, PMC, and PCM; USM curriculum represents a hybrid PBL approach that is also employed by IMU and UNIMAS; whereas UPM curriculum is unique, being the only one in Malaysia practising the integrative modular approach.

Although many of these medical schools have indicated that PBL approach is being employed in their teaching (calling it a hybrid-type PBL curriculum; Yee HY & Tan GJS, 2002), yet a careful examination of their curricula (as given in their websites, module guides or students' handouts) revealed that except for USM, IMU and UNIMAS, only a small to modest amount of PBL-style tutorials or some form of clinical problems have been used in the teaching, mainly to supplement the otherwise traditional teaching of basic sciences, especially in the preclinical years. The predominant

delivery of knowledge, however, is still through didactic teaching in lectures. Even for the three medical schools that employ “hybrid PBL” curricula, there is still a fair load of teaching done through lectures, especially in the first year (USM website, IMU study guide). Furthermore there has been a tendency to increase the number of lectures with time (Malik AS & Malik RH, 2002, and personal communications).

Regardless of which curricular designs, there is a general feeling that there should be some foundation course or core teaching on pharmacology before students can fully benefit from the subsequent study of pharmacology in the management of different disease conditions, often arranged according to organ-systems. Hence, even a hybrid PBL school like IMU has a “Foundation 2” course which includes 18 hours of pharmacology lectures covering topics such as general principles of pharmacology (pharmacodynamic and pharmacokinetic concepts), autonomic pharmacology, eicosanoids, autocoids, and antimicrobial therapy. This “Foundation 2” course was introduced in Semester 2 (Year I) after feedback from some of their overseas partner medical schools that the students in their earlier PBL programme (preclinical stage) was weak in their basic science knowledge of paraclinical disciplines (which include pharmacology) as they entered the clinical training in some of these traditional medical schools overseas. Interestingly, USM (another hybrid PBL school) does not have such a foundation course on pharmacology – the autonomic pharmacology (2 hours) is taught in the cardiovascular system block (Year II), while a general introduction to pharmacology (1.5 hours) is given at the beginning of Year I and a large amount of lectures on antimicrobials and antiparasitics are included in the infectious diseases block (Year III). In UNIMAS (the third hybrid PBL school), pharmacology is taught mainly in Years I and II, and lecture is still a major delivery tool. Being one of the newer medical schools staffing is a major problem and basic science lecturers are difficult to find.

In UPM, the lectures on general pharmacology and autonomic pharmacology are taught in Semester 4 (Year II) as it was thought that examples of drugs used to illustrate the general principles would be better understood after students have had some exposure to drug usage in therapeutic situations. However, some teachers felt that these should be given earlier as “introductory lectures”, eg in Semester 2 (Year I), as in most traditional pharmacology programme. On the other

hand, the cardiovascular block was considered to be too difficult for students to handle in Year I as most of the drugs used in treating cardiovascular diseases are drugs that have effects on the autonomic nervous systems, and they have not had these lectures. There were also feedbacks from clinicians that the Year I students did not have adequate knowledge of antibiotics when they attended the clinical training sessions as there were no scheduled lectures on these drugs.

Although pharmacology by nature is an interdisciplinary science subject and to come to a total understanding of how a drug works requires a multidisciplinary approach, which means an integrative approach to the learning of pharmacology such as in a PBL curriculum should be ideal, yet this does not appear to be so (Kwan, 2002). At McMaster University, where “pure PBL” approach is used, students still complained of gap in pharmacology knowledge as compared to other basic science knowledge. Is it a problem with the design of the health care problems used in the PBL tutorials, which may not include sufficient pharmacological perspective? Or is it because of lack of pharmacology experts in facilitating the tutorial discussion? Such concerns may be the reason for some of the hybrid PBL schools to still retain pharmacology lectures, especially on the general principles of pharmacology and autonomic pharmacology. A study on IMU students in the preclinical stage had shown that while they perceived the benefits of PBL in helping to stimulate thoughts, improve presentation and communication skills, and in helping to become a team player, they did not seem to see the benefit of PBL in helping them to gain knowledge nor in helping them in the examinations (Nadarajah, Ponnudurai & Chen, 2002). Our own surveys in UM also indicated that PBL tutorials have helped the students to improve on their communication skill, problem-solving skill and integration of knowledge from various disciplines, but it is my own view that the students do not yet see this as the main means to obtain in-depth knowledge of basic sciences. This of course could be due to the conflicts of interest arising from lectures running concurrently and that it takes time to change the mind set of our students, who are much accustomed to teacher-centred, passive learning.

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