

# **An Integrated, Case-Based Curricular Model for the Entry-Level Doctor of Pharmacy Degree**

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This paper outlines a proposed entry-level, Doctor of Pharmacy curriculum which emphasizes case study-based presentation of integrated content and concepts, and utilizes small group learning as the primary educational setting. The preprofessional phase of the proposed six-year curriculum consists of a first year of basic science coursework and general education studies, followed by a second year which is centered around the foundational sciences which are involved in the function of the human body. The initial three years of the professional phase of the proposed curriculum are completely integrated among the various pharmacy-related disciplines presented in problem-solving, case study format, and divided into what can be termed "pharmaceutical care modules," rather than traditional courses. The sixth year of the proposed program would consist of eleven experiential rotations. Although there are numerous potential advantages to the proposed curricular structure, the perceived disadvantages of the proposal, which are primarily operational concerns and concerns regarding changing faculty roles, have prevented implementation of such a curricular structure at the present time.

## **INTRODUCTION**

The faculty of the Butler University College of Pharmacy and Health Sciences are in the process of implementing a new entry-level Doctor of Pharmacy curriculum, scheduled to be in place for the freshman class entering in 1996. The integrated, case-based curricular model outlined here is one of the models presented, originally in 1994, to the faculty for

consideration as the possible structure of the new six-year, entry-level Doctor of Pharmacy program. Although the compromise entry-level Doctor of Pharmacy curriculum approved by the Butler faculty resembles a more traditional discipline-centered pharmacy curriculum than that presented here, many of the ideas brought forth in this curricular proposal were endorsed by the faculty. These ideas include

the extensive use of cooperative learning and other innovative instructional techniques whenever possible throughout the curriculum and the coordination of content between different courses presented during each semester of the curriculum. The integrated case-based curricular proposal is outlined here to serve as a potential model for what the future of pharmacy education could be as the profession moves toward a patient-centered, problem-solving model, and away from the traditional product-centered focus.

The framework for this integrated curricular model began to take shape immediately following the American Association of Colleges of Pharmacy Annual Meeting and Teachers' Seminar in Albuquerque, New Mexico, in July of 1994. The presenters outlined their experiences in implementing a problem-based medical curriculum that integrates the basic and clinical sciences. In those presentations, they described a curriculum completely centered around students solving case studies and participating in small group discussions. In the study and discussion of each of these cases, all aspects of the respective patient's condition and potential therapies, including the physical assessment, pathophysiological bases, biochemical bases, and potential regimens which might be utilized to treat the patient are considered. In this way, the student learns to consider all potential aspects related to the care of that particular patient in an integrated manner, as they will need to be able to do with their own patients when they are in professional practice.<sup>1</sup>

These ideas have been extrapolated to educate the pharmacy student. The result is the proposed curriculum presented here. The curriculum is constructed around three basic premises. The first premise is that active learning is superior to passive learning(1). To this end, the proposed professional curriculum is constructed of small group and laboratory experiences, with "modified lectures" included only as an occasional experience to relay a large amount of material to the entire group in an efficient manner(2,3) The second premise is that the curriculum should be presented in an integrated fashion, since the goal of pharmacy education must now be to enhance the status of the pharmacy profession by emphasizing the practice of pharmaceutical care(4,5). Patients are not treated with the knowledge students gain from individual disciplines; rather, they are treated using the combined expertise the practitioner gains from all of the disciplines. The third and final premise is that if pharmacy is moving toward a patient-centered, rather than product centered, profession, then the education of pharmacists should be done with an emphasis on provision of pharmaceutical care(6). To that end, the curriculum is presented as a series of detailed case studies, to be explored and solved by the students, just as they will do with their own patients once they are in practice.

The ideas of including active learning, discipline integration, and patient focus into pharmacy education are not by themselves new. The movement of pharmacy education toward a student-centered, problem-based learning approach has become a widely-discussed idea among pharmacy educators nationwide over the past decade. There have been numerous excellent publications on this general topic(7), including Rabat's monograph "Problem-Based Learning: An Approach to Pharmaceutical Education."<sup>2</sup> The implementation of this idea, however, needs to progress in earnest, because pressure is building on pharmacy educators to graduate practitioners who can solve the complex drug

therapy and "health care economics" problems to be encountered in the next century(8).

It must be emphasized that the curricular model outlined below takes a radical approach in terms of integration of curricular content. The entire professional portion of the curriculum is presented in integrated modules, with each module consisting primarily of the presentation of a series of case studies regarding individual patients or groups, which are to be studied and solved by student learning groups. While cooperative learning groups and case studies can be used in traditional discipline-specific courses with excellent results, the task of integrating the concepts presented in each of those courses together, to conceptualize their relevance to pharmacy practice, is left largely to the students themselves. This latter curricular approach has served the pharmacy profession well in the past. However, as pharmacy is changing from a product focus to a focus on patient-centered care, it would seem that the education of our future practitioners should also likewise shift toward centering on the care of patients, and the complex professional judgments which must be made in the delivery of safe, effective, and economical drug therapy(9). If the goal of the curriculum is to produce a patient-centered graduate, then the primary focus of the entire curriculum must be on those patients as well, and not on the individual disciplines traditionally associated with pharmacy. To that end, the philosophy behind this proposed curricular model is to consider all of the disciplines which are related to patient care while discussing each individual patient, rather than considering all possible patients while discussing each individual discipline.

The proposed curriculum is designed to fit a typical two-semester academic calendar, with each semester extending a total of 15 weeks. The proposal also includes references to a core curriculum, which is defined as a multidisciplinary, general education curriculum required of all students at the university, regardless of college of enrollment or major. This is the current general education format at Butler University(10). The core courses referred to in this proposal were in fact part of a proposed Butler University Core Curriculum proposal, which continues to be discussed within the University governance structure.

## THE FOUNDATIONAL CURRICULUM

A fundamental goal of pharmacy education is to establish in students a solid foundation in the basic sciences which support all of the "higher" pharmaceutical sciences(11). An equally important goal is ensure pharmacy students acquire a broad general education outside of the sciences, in order for them to learn to function as professionals and informed citizens(12,13). The first two years of this proposed curriculum, considered as prepharmacy studies, are designed to deliver both of these goals to the students. Additionally, however, the coursework in these first two years must function to move the student from the dependent, passive learning mode prevalent in many secondary schools, and reinforced by secondary-level textbooks(14), to the student-centered, active learning mode upon which the profes-

<sup>1</sup>Mann, Paul L. and Kabat, Hugh F., (edits.), *Student-Centered, Problem-Based Learning and Interdisciplinary Teaching*, AACP Teachers' Seminar materials, Albuquerque NM, July 16, 1994, pp. 46-62.

<sup>2</sup>Kabat, Hugh F., *Problem-Based Learning: An Approach to Pharmaceutical Education*, GAPS-supported monograph, March, 1991.

**Table I. First year of the proposed curriculum: The introductory basic sciences**

Fall semester courses	Sem. hours	Spring semester courses	Sem. hours
General chemistry with lab	6	Organic chemistry for health science with lab	6
Physics for health sciences	3	Introductory biology	3
Biostatistics (math core)	3	Psychology (social science core)	3
Freshman seminar: composition (core)	3	Freshman seminar rhetoric (core)	3
Pharmacy seminar I	1	Pharmacy seminar II	1
Total semester hours	16	Total semester hours	16

**Table II. Pharmacy seminar topics**

Accidental death and injury issues
Clinical trials design
Defining "pharmaceutical care"
Drug use evaluations
Institutional review boards
Introduction to literature evaluation
Introduction to personnel management
Introduction to pharmacoeconomics
Introduction to practice environments
Introduction to professional ethics
New drug development
Overview of the U.S. health care system
Prescription to over-the-counter "switching"
Pharmacy professional associations
Professionalism
Quackery
U.S. health care providers

sional portion of the proposed curriculum is based. It should be noted that students attempting to transfer into the professional phase of this proposed curriculum from other institutions not emphasizing student-centered, active learning techniques may lack this latter outcome from their prepharmacy studies. For such students, a special summer session devoted to introducing active learning styles will likely be necessary before they can move into the integrated, case-based professional curriculum.

The first year of this proposed curriculum is outlined in Table I. This portion of the curriculum contains the introductory basic sciences, which form the primary foundation on which the pharmacy curriculum is constructed. These basic sciences include general chemistry, organic chemistry, physics, and biology. The balance of the coursework in the first year involves core general education courses, including a course in data handling and statistics. With the exception of the "Pharmacy Seminars," all of the coursework in this year of the curriculum could be staffed by faculty members outside of the professional college, in the various appropriate departments of the university.

The sequence of four courses labeled "Pharmacy Seminars" during the first and second years of the curriculum are designed to be a four-semester introduction to the profession, including on-site experiences at various practice envi-

**Table III. Second year of the proposed curriculum: An introduction to the human body**

Fall semester courses	Sem. hours	Spring semester courses	Sem. hours
Anatomy, physiology, and pathophysiology I	6	Anatomy, physiology, and pathophysiology II	6
Biomolecules and intermediary metabolism	3	Pharmaceutical biotechnology and molecular physiology	3
Immunology	3	Medical microbiology	3
Communications and patient counseling	3	Sociology (social science core)	3
Pharmacy seminar III	1	Pharmacy seminar IV	1
Total semester hours	16	Total semester hours	16

ronments. Current issues relative to pharmacy would be included in the seminars, including the topics found in Table II.

The courses in the first year of the curriculum would begin to expose the students to active-learning styles. This would include initial use of cooperative learning groups(15), and the introduction of problem-based learning techniques to the students(7,16). The "Pharmacy Seminars," by definition, will serve to introduce the students not only to the profession, but to the utility of discussion sessions with their peers and faculty facilitators. These seminar courses, therefore, will set the tone for the case-based, integrated curriculum which builds active learning skills in a patient-focused, pharmaceutical care model.

The second year of the proposed curriculum, outlined in Table III, builds upon the introductory basic sciences, and introduces the student to the functions of the human body. The foundational sciences included in the second year are: anatomy, physiology, pathophysiology, introductory biochemistry, intermediary metabolism, immunology, microbiology, and pharmaceutical biotechnology. These second-year courses could be presented by the pharmacy faculty and/or science faculty from other university departments. Coordination of the topics between these science courses is essential, and would begin to introduce the students to the idea of discipline integration. For example, the coordination of studies on infectious disease, and the body's response to infection, between the disciplines of microbiology, immunology, pathophysiology, and biotechnology would help to facilitate overall student understanding of these processes.

Also included in the second year of the curriculum are two important social science courses which help create the framework for patient-centered practice. These courses are "Communications and Patient Counseling" and "Introduction to Sociology." In the simplest terms, pharmacists must have both an understanding of the people they serve, and the ability to communicate effectively with those people(11).

The second year of the curriculum acts as the transition, or bridge, from the more traditional teacher-centered pedagogical styles utilized extensively in the basic sciences to the case-based, integrated, learning-centered presentation of material in the third, fourth, and fifth years of the curriculum. All coursework in the second year would include the

**Table IV. Disciplines included in the pharmaceutical care modules**

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Clinical laboratory medicine
Clinical Pharmacokinetics
Drug information and literature evaluation
Ethical principles of pharmacy practice
Health care delivery systems
Health promotion, disease prevention, epidemiology
Inpatient and managed care environments
Medicinal and natural product chemistry
Nutrition
Patient counseling
Personnel management and interpersonal skills
Pharmaceutics and physical pharmacy
Pharmacoeconomics
Pharmacology
Pharmacotherapeutics
Pharmacy law
Physical assessment
Toxicology

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use of cooperative learning groups and modified lectures to supplement traditional instructional methods(2,3,15). Problem-solving methodologies and conceptualization skills would be emphasized, while rote memorization of lists of facts would be minimized(16). In this sense, the proposed curriculum begins to shift the instructional mode for these students from a "teaching paradigm" to a "learning paradigm"(17). On the one hand, rote memorization, especially at this level of the curriculum, cannot be completely eliminated, since at a minimum the students must understand and be able to work with the terminology involved in the foundational/medical sciences. On the other hand, practical application of the foundational sciences must be emphasized in these second-year courses, so that students will realize the connection between patient-centered care and the basic sciences.

#### THE PROFESSIONAL CURRICULUM

The third, fourth and fifth years of the proposed curriculum are completely built around case studies, organized into pharmaceutical care modules, rather than courses. Each module will consist of a series of case studies presented to the students. These cases provide the actual problems which the students are expected to understand and solve, hence the emphasis of the professional curriculum focuses on problem-based learning(18). For each case, an in-depth description of the patient, including lifestyle, symptoms at presentation, current drug utilization profile, and other relevant information will be provided. The cases will be followed by a series of questions designed to help the students reach a thorough understanding of and a therapeutic solution for the case. These questions will guide the student to consider the pathophysiological and biochemical bases for the patient's condition; the chemical, pharmaceutical, pharmacological, and therapeutic aspects of potential drug therapies; the ethical, legal, and economic factors which govern the case, and other relevant factors. The students will be asked to purchase a personal reference "library" of commonly-utilized required or elective textbooks, such as a medicinal chemistry textbook, a pharmacology textbook, and so forth, to help them on their journeys. Additionally, students will be encouraged to utilize library holdings and on-line references, especially the pri-

mary literature, when seeking solutions to the cases. The students will discuss the results of their research within their facilitated small group sessions, and occasionally in larger group sessions.

This portion of the curriculum is organized into six semesters, with 12 semester credit hours dedicated to the pharmaceutical care modules per semester. Therefore, a total of 72 semester credit hours are allocated to the pharmaceutical care modules in the entire professional curriculum. The assignment of 12 semester credit hours per semester to the pharmaceutical care modules is in fact an arbitrary designation. The amount of group work and self-study which will be needed for each individual student to understand and to solve individual cases will vary widely(19). Hence, it is difficult to bring the pharmaceutical care modules into line with the traditional concept of the "semester credit hour." At most universities, one semester credit hour corresponds to 50 to 60 minutes of lecture time per week. The modules, where cooperative learning and self-study largely has replaced traditional lectures, will by their nature not fit this model. Therefore, for the sake of meshing with the university registration system, the modules arbitrarily have been assigned 12 total semester credit hours per semester as a starting basis for this curricular model.

Although there is no mention of specific disciplines in the proposed curricular modules, there are obviously many discipline areas which are considered to be essential contributors to pharmacy education, and must be incorporated into the pharmaceutical care modules. These disciplines are necessary to develop the outcome abilities required of a pharmacy graduate, as described in the recent report from the Center for the Advancement of Pharmaceutical Education.<sup>3</sup> The disciplines which must be included in the pharmaceutical care modules over the three years of the professional curriculum are summarized in Table IV.

The exact balance of content or semester credit hours between each of these disciplines would be difficult to calculate for the modules, since this balance will theoretically vary as each new case study is written and modified in subsequent years. The relative balance of these disciplines in the presentation of the case studies is crucial, however—both in the individual cases and the professional curriculum as a whole. Maintenance of faculty expertise in each of these disciplines is essential, as all members of the faculty will review every case study used in the modules on a continuing basis. Faculty members would be responsible for assuring that the cases adequately explore the essential concepts and content, thus insuring that no discipline becomes lost or overwhelmed by the other disciplines. The successful continued integration of the curriculum is dependent upon this constant review of the case studies in the modules by the faculty from all of the pharmacy-related disciplines.<sup>4</sup>

Again, the professional curriculum arbitrarily is based upon 12 semester credit hours of pharmaceutical care modules per semester. Therefore, the number of semester contact hours for each module, as traditionally defined by the lecture hour, would be 12 semester contact hours per week. The weekly schedule to be followed by students enrolled in one of these pharmaceutical care modules would likely

<sup>3</sup>*Education Outcomes*, Center for the Advancement of Pharmaceutical Education, American Association of Colleges of Pharmacy. 1995.

<sup>4</sup>Mann, Paul L. and Kabat, Hugh F., (edits.). *Student-Centered, Problem-Based Learning and Interdisciplinary Teaching*, AACP Teachers' Seminar materials, Albuquerque NM. July 16, 1994, pp. 63-68.

**Table V. Third year of the proposed curriculum: Pharmaceutical care modules**

Fall semester courses	Sem. hours	Spring semester courses	Sem. Hours
Introductory module: Concepts of drug therapy and pharmaceutical care (first 12.5 weeks)	10	Third module: Parenterals and nutrition (first 4 weeks)	2
Second module: Toxicology and substance abuse (subsequent 2.5 weeks)	2	Fourth module: Autonomic nervous system (subsequent 2.5 weeks)	2
Core Curriculum Interdisciplinary or General Education Elective Course (entire 5 weeks; concurrent with modules)	3	Fifth module: Central nervous system (subsequent 8.5 weeks)	7
		Core Curriculum (Interdisciplinary) or General Education Elective Course (entire 15 weeks; concurrent with modules)	3
Total semester hours	15	Total semester hours	15

contain the following sessions:

- Five Modified Lecture or Large Group Discussion Hours (5.0 semester contact hours/week),
- One Three-Hour Pharmaceutical Care Lab (1.0 semester contact hour/week), which would be scheduled each week throughout the semester, and would be available for relevant experiments and demonstrations in all disciplines involved in that particular module,
- Four Three-Hour Small Group Discussion Sessions (6.0 semester contact hours/week), which would be facilitated by one faculty member.

For the cooperative learning groups, the maximum number of students per group would be eight. A smaller number of students per group would be considered optimum, especially in earlier modules, where group competency may not be well established<sup>(20)</sup>. One faculty member would assist as facilitator for the group during these discussion periods. In theory, the faculty member need not be an expert on every topic in the module; rather, he/she would facilitate the discussion by asking questions, making sure all students are involved, and recessing the group to consult further reference materials if they are confused on a concept.<sup>5</sup>

The laboratory sections would be limited to 24 students maximum, consisting of three learning groups of eight members each, or four learning groups of six members each. The laboratory sections would be scheduled once per week for the students. Faculty members from different disciplines could use these lab periods for experiments or mastering of skills as necessary throughout the semester. The laboratories to be conducted during particular modules would be coordinated by a faculty member assigned to oversee that module.

## PHARMACEUTICAL CARE MODULES

The entire third, fourth, and fifth years of the professional curriculum are organized into pharmaceutical care modules in this proposed curricular structure. Most of the modules are loosely grouped by diseases associated with different organ systems. This is consistent with the alignment of different clinics within a hospital, or the alignment of clinical or discovery areas in pharmaceutical companies. Certain modules such as the introductory module and the final pharmacy law module, are grouped instead by the content which needs to be presented in detail at the appointed time in the curriculum. Some of the topics listed in each module may be only loosely associated with that particular module, and there are, in fact, many topics which could be placed in several different modules. Ideally, the latter topics should be covered to some extent in all appropriate modules. On the other hand, since there must be a practical limit to the number of total modules to be presented, the arbitrary placement of certain topics into one of the sixteen modules suggested is necessary to make sure those topics are addressed somewhere in the professional curriculum.

The arrangement of the modules by organ system again is an arbitrary designation designed to provide a foundation for this model. Whether arrangement of the curriculum is best accomplished by organ system, drug classification, alphabetizing, or other designation is certainly open to debate. However, the importance of coordination, integration, and reinforcement cannot be ignored in the curriculum. In the model presented here for disease states which effect a number of different organ systems, patient case studies devoted to a particular disease would need to be incorporated into the modules corresponding to all of the organ systems involved. Although this initially may seem daunting, it is not substantially different from the traditional discipline-specific curriculum, where specific disease states and/or the classifications of drugs used to treat them must be addressed over and over in pathophysiology, pharmacology, medicinal chemistry, therapeutics, and so forth. The major difference between the two models, however, is that for the integrated, case-based curriculum, the content of the professional curriculum is learned in a case-by-case, patient-by-patient, sequence, while the traditional curriculum, also quite arbitrarily, divides this content in a discipline-by-discipline fashion.

The third year of the proposed curriculum, as outlined in Table V, consists of the first five pharmaceutical care modules, as follow:

### First Module: Concepts of Drug Therapy and Pharmaceutical Care

The first module is the pivotal module in the curriculum, as it introduces the students to the basics of drugs and pharmaceutical care. This first module also functions to introduce the students to the modular organization of the curriculum. The first exposure to this style of learning should encourage them to re-evaluate their time-management and study habits, so that they can be successful in completing the remainder of the modules. This first module includes introductions to the medical library and information retrieval, and to clinical chemistry and laboratory assessment. In addition,

<sup>5</sup>Mann, Paul L. and Kabat, Hugh F., (eds.), *Student-Centered, Problem-Based Learning and Interdisciplinary Teaching*, AACP Teachers' Seminar materials. Albuquerque NM, July 16. 1994, pp. 27-37.

**Table VI. Fourth year of the proposed curriculum: Pharmaceutical care modules.**

Fall semester courses	Sem. hours	Spring semester courses	Sem. hours
Sixth module: Cardiovascular disease (entire 15 weeks)	12	Seventh module: Infectious disease (first 12.5 weeks)	10
Core Curriculum Course: Humanities or Fine Arts (entire 15 weeks; concurrent with modules)		Eighth module: Respiratory disease (subsequent 2.5 weeks)	
	3	Core Curriculum Course: Humanities or Fine Arts (entire 15 weeks; concurrent with modules)	3
Total semester hours	15	Total semester hours	15

topics such as pharmacy calculations, the preparation of oral dosage forms, the absorption, distribution, and excretion of drugs, drug receptors, drug metabolism, fluids and electrolytes, pain, emesis, and constipation are included in this module.

**Second Module: Toxicology and Substance Abuse**

The second module exposes students to the dangers of substance abuse and what to do if you suspect such abuse in a patient. The module also introduces the students to the basics of toxicology, including the handling of poisons both in the home and the workplace. Recreational drug use such as smoking and alcoholism are also included in this module.

**Third Module: Parenterals and Nutrition**

The third module is built around three related topical areas. The first is the mastery of the calculations commonly used in pharmaceutical preparation and administration. The second is an introduction to parenteral products, including laboratory sessions devoted to the handling of parenterals in various pharmacy practice settings. The third is discussions regarding proper nutrition, including the roles of vitamins, nutrients, and minerals, enteral versus parenteral nutrition, and the maintenance of proper nutrition while accomplishing weight reduction.

**Fourth Module: Disorders of the Autonomic Nervous System**

The fourth module is the first actually centered around a particular physiological organ system, in this case the autonomic nervous system. In the most general sense, this module will introduce students to the physicochemical and pharmacological properties of cholinergic and adrenergic drugs, as well as the various therapeutic uses of these agents. Included in the module will be case studies involving disorders such as glaucoma and myasthenia gravis.

**Fifth Module: Disorders of the Central Nervous System**

The fifth and final module in the third year of the curriculum is centered around the central nervous system. It involves discussions of both the various disorders associated with the central nervous system, and the types of drugs and other

**Table VII. Fifth year of the proposed curriculum: Pharmaceutical care modules**

Fall semester courses	Sem. hours	Spring semester courses	Sem. hours
Ninth module: Renal disease (first 3 weeks)	2	Twelfth module: gastrointestinal and hepatic disease (first 2.5 wks)	2
Tenth module: Endocrine disease (subsequent 6 weeks)		5	
Eleventh module: Neoplastic disease (subsequent 6 weeks)	5	Fourteenth module: Geriatric and pediatric pharmacotherapy (subsequent 2.5 wks)	2
General Education Elective Course (entire 15 weeks; concurrent with modules)	3	Fifteenth module: special therapeutic concerns (subsequent 2.5 wks)	2
		Sixteenth module: Cases on pharmacy law (subsequent 5 weeks)	
		General Education Elective Course (entire 15 weeks; concurrent with modules)	3
Total semester hours	15	Total semester hours	15

treatments utilized to help patients suffering from these conditions. Topics which could be included here include Alzheimer's disease, stroke, parkinsonism, general anesthesia, sleep disorders, seizures, schizophrenia, psychosis, anxiety, depression, attention deficit disorder, and ophthalmology.

The fourth year of the curriculum, or the second professional year, continues with pharmaceutical care modules six through eight, as outlined in Table VI. These three modules cover three of the most common disease classifications: cardiovascular disease, infectious disease, and respiratory disease.

**Sixth Module: Cardiovascular Disease**

This module includes all topics related to cardiovascular disease, its prevention, and treatment. Cases related to anemia, hemostasis, hyperlipoproteinemia, atherosclerosis, myocardial infarction, arrhythmias, congestive heart failure, peripheral vascular disease, and hypertension would be presented.

**Seventh Module: Infectious Disease**

This module introduces the students to the various types of infectious disease, as well as the numerous agents available to treat these infections. A secondary focus of the module will be the public health implications of infectious disease, including prophylaxis, prevention, and immunization, the development of resistance, and ineffective or inadequate treatment of infectious disease. Included in the module will

be cases on tuberculosis, pneumonia, otitis, sinusitis, septicemia, surgical prophylaxis, urinary-tract infections, sexually-transmitted diseases and viral infections. The care of immunosuppressed patients and the current and future use of immunomodulation are also discussed.

**Eighth Module: Respiratory Disease**

The eighth module brings the fourth year of the curriculum to a close by discussing the diseases of the upper and lower respiratory tracts and their treatment. Since many of the diseases presented in this module do overlap with the content of the seventh module, these two modules are placed together in the same semester intentionally. One especially important aspect of this module is an adequate introduction to the various nonprescription medications available for the "self-care" of respiratory disease. Included in this module are cases relating to tobacco use, allergies, cystic fibrosis, and coughs and colds.

The fifth year of the Doctor of Pharmacy program, or the third year of the professional program, consists of the last eight modules, as shown in Table VII. These eight modules provide a wide variety of case study analyses in numerous areas. The last several modules arbitrarily combine often seemingly-unrelated topics together in an effort to introduce the students to some of the special situations to be considered in pharmaceutical care. These modules are specifically designed to prepare the student to be ready for the experiential or pharmacy practice rotations of the sixth year of the program.

**Ninth Module: Renal Disease and Transplantation**

The ninth module familiarizes students with the different causes and treatments for renal diseases and renal failures. Also included in this module, since they often have a major effect on the renal system, are drug-induced diseases. Finally, discussions of solid organ transplantations and graft versus host disease are included in this module. The latter topics are included in this module because of the frequency of kidney transplant, but the discussions of these topics will more generally encompass transplantation of all solid organs.

**Tenth Module: Endocrine Disease**

The tenth module focuses on the endocrine system and the action of various hormones in the body. Both the normal functions of hormones and the diseases caused by hormone imbalances will be introduced. The related topics of contraception, pregnancy, acne, and psoriasis are also arbitrarily included in this module.

**Eleventh Module: Neoplastic Disease**

Module eleven encompasses the various neoplastic diseases. The module includes discussions of oncogenesis and the surgical, radiological, chemotherapeutic, and alternative treatments of neoplastic disease. Death and dying are also health care issues which might appropriately be included in this module. Cases which involve bone marrow transplants, pain management, and oncology hospices are also presented.

**Twelfth Module: Gastrointestinal and Hepatic Disease**

Module twelve focuses on conditions involving the gastrointestinal tract, and the treatments utilized to treat those conditions. The module includes significant discussions on

**Table VIII. Sixth year of the proposed curriculum: Experiential rotations**

Required rotations		Elective rotations	
Practice site	Sem. hours	Practice site	Sem. hours
Ambulatory care settings (4 rotations; 16 weeks)	16	Elective practice sites as chosen by the student (5 rotations; 20 wks)	20
Managed care organization or HMO (1 rotation; 4 weeks)	4		
Drug information service (1 rotation; 4 weeks)	4		
Total semester hours	24	Total semester hours	20

the nonprescription use of H<sub>2</sub>-blockers and antacids, and on general oral self-care. Diseases on which cases are presented include hepatitis, alcoholic liver disease, inflammatory bowel disease, and peptic ulcer disease.

**Thirteenth Module: Inflammatory and Dermatological Disease**

Module thirteen arbitrarily combines discussions on dermatological disease, including the self-care and prevention of sunburn, with discussions on inflammatory disease, including the use of NSAIDs. Some of the topics discussed in this module are rheumatoid arthritis, Lupus erythematosus, gout, psoriasis, and the preparation of topical dosage forms.

**Fourteenth Module: Geriatric and Pediatric Pharmacotherapy**

The fourteenth module combines discussions regarding the special considerations involved in treatment of both pediatric and geriatric patients. Included in the module are discussions on the long-term care of the elderly, polypharmacy, nursing homes, and neonatal care.

**Fifteenth Module: Special Therapeutic Concerns**

The fifteenth module combines together a number of special therapeutic concerns in the treatment of patients. The module closes with a general summation and review of drug therapy monitoring and interactions between many of the more commonly-used medications. Issues included in this module are obesity, anorexia, bulimia, ethnic and gender considerations, and immunosuppressed patients.

**Sixteenth Module: Cases on Pharmacy and the Law**

The final module focuses on the legal aspects of pharmaceutical care. The inclusion of a separate module on jurisprudence is not meant to imply that these topics should not be included in the earlier modules. Rather, it is meant to emphasize the importance of these considerations in practice, and again to prepare the students for the experiential portion of the curriculum in the sixth year. The cases presented in this module will include the issues of federal and state guidelines and regulations, packaging issues, advertising, mail-order pharmacy, and the legal aspects of personnel management.

## THE EXPERIENTIAL YEAR

The sixth year of the proposed pharmacy curriculum, as outlined in Table VIII, consists of eleven four-week experiential rotations, for a total of 44 weeks. The rotations continue the modular, patient-centered approach followed in the first three years of the professional curriculum. The sixteen pharmaceutical care modules serve to teach students to approach the practice of pharmacy patient-by-patient. The experiential rotations continue that concept in practice, as the site preceptors are to be trained to continue to emphasize case studies, and to encourage students to continue to explore all aspects of a patient's condition and appropriate therapy.

As pharmacy moves to a patient-focus in a health care environment dominated more and more by managed care, graduates must likewise have experience in these new practice environments. To that end, students during the experiential year will be required to study at four different sites where ambulatory care of patients is the dominant form of practice, at one site directly involved in the managed care of a patient population, such as an HMO, and at one site where the primary function is the provision of drug information. The remaining five rotations will be elective rotations from which the student can choose practice environments of interest to him or her.

The expectations of the rotations are that the student will be present at the site for a minimum of 40 hours/week during the experience. The total number of experiential clock hours in the curriculum is 1760 hours.

Each rotation will consist of 4 semester credit hours, meaning the experiential portion of this curriculum consists of 44 semester credit hours. The student would register for 3 rotations (12 semester credit hours) in the summer term between the fifth and sixth years of the curriculum. The student would enroll in the remaining eight rotations during the final two semesters of the program (16 credit hours/semester).

## SUMMARY OF THE PROPOSED CURRICULUM

The first year of the curriculum includes 32 semester credit hours and consists of an introduction to the basic sciences and general education coursework. The second year of the curriculum also includes 32 semester credit hours, and is focused specifically around a study of the human body and its functions.

Each of the first three years of the professional portion of the curriculum includes 30 total semester credit hours, 24 of which are assigned to pharmaceutical care modules, and six of which are allotted to general education or elective coursework.

The sixth year of the curriculum involves a full year of pharmacy experience, and includes 11 pharmacy practice rotations, for a total of 44 semester credit hours. These 44 credit hours are scheduled over the summer, fall, and spring terms of the sixth year.

The total number of semester credit hours in for all six years of the entry-level Doctor of Pharmacy curriculum is 198. This includes study during a full twelve semesters, plus the final summer between the fifth and sixth years of the program.

## DISCUSSION

The curriculum proposed here is a model for an entry-level, "two/four-structured," Doctor of Pharmacy curriculum. The

prepharmacy curriculum, although introductory in nature, does contain considerable pharmacy-related content, and also serves as an introduction for the students to active learning and problem-based learning. Students attempting to enter the professional phase of the curriculum from institutions other than the home program may require a remedial program to remedy their deficiencies in both of these areas. A special summer program could be created to prepare such students to enter the professional program in the fall semester, which would then put them on equal footing with those students tracking into the third year directly from the prepharmacy phase of the curriculum.

The professional phase of this curriculum is completely integrated among the various disciplines, and is presented primarily in case study format. Students must utilize concepts from all the appropriate pharmacy-related disciplines in attempting to "solve" these cases. In this way, the curriculum teaches problem-solving skills involved in patient care itself, rather than attempting to develop problem solving skills with discipline-specific problems. The primary setting for delivery of this curriculum is the small group discussion, although the use of laboratory sessions and a limited number of larger group discussion periods are also allowed. This style of delivery is designed to accentuate active learning of problem-solving skills, and to minimize rote memorization for the sake of memorization. The arrangement of the professional curriculum is in modules of an appropriate length of time, to be taken one at a time, rather than as courses which last for 14 to 15 weeks, taken many at a time.

The perceived advantages of this integrated, case-based professional curriculum are numerous. This learning style teaches students to approach pharmacy practice as patient care involving their expertise in many disciplines; they learn that it is the combination of concepts from many disciplines that is used to make decisions used in patient care. In this way, students learn to tie together concepts from the different disciplines more easily, to build bridges in their thinking skills between the various disciplines, and to make decisions by utilizing those ties and bridges. The curriculum teaches students to look at all aspects of patient care at once, and to explore all potential drug therapies in determining the best course of action.

The use of discipline-integrated case studies is a logical approach to teaching problem-solving and decision-making skills to professional students. In this system, students learn where to look for the answers to their questions, regardless of the particular disciplines from which the answers are derived. The students begin to learn and to understand the references they will need to consult in pharmacy practice. Perhaps most important of all is that this curriculum fosters active learning by the students, by placing the responsibility for learning and enhancing the opportunities for life-long learning and continuing self-education upon the students themselves(16).

Another advantage of this curriculum is the continual reinforcement of those concepts which are most important, and which occur most frequently, in professional practice. Students must apply the basic ideas of medicinal chemistry, pharmacology, therapeutics, ethics, and so on, over and over, throughout the entire professional curriculum. These concepts should be well understood after this repetition and reinforcement.

The organization of the curriculum into patient care modules, each divided into an appropriate number of case



studies, is also a benefit to student learning. This presentation of the curriculum is much more realistic in comparison to the way that pharmacy must be practiced in the professional setting. In other words, students learn to practice pharmacy on a case by case, patient by patient basis, rather than discipline by discipline.

While the perceived advantages of the proposed curriculum are numerous, there are also a number of perceived disadvantages to the proposal. During discussions of curricular revision among the faculty at the Butler University College of Pharmacy and Health Sciences, several possible disadvantages of the proposal were considered. These included:

- The delivery of the proposed curriculum may require a larger number faculty to deliver than a traditional curriculum, and new faculty positions currently are difficult to acquire in the current academic environment.
- The perception exists that this type of curriculum would actually increase the workload of faculty members, many of whom are already overburdened with current job responsibilities.
- Some faculty members view the integration of the curriculum and focus on case studies as an attack on their discipline identity. At a research university, where discipline-specific research is a primary function, an integrated curriculum may be less of a threat. At a small teaching-centered university, however, the integrated curriculum appears to be perceived as an attempt to sever the links between faculty members and their traditional disciplines.
- An integrated, case study-based curriculum has been used successfully in some medical schools. Many pharmacy students, however, are younger and less mature than medical students. The concern has been expressed that traditional undergraduate students in their third year of studies lack the self-motivation and sense of responsibility necessary to learn in the environment proposed by this curricular model.
- Most current pharmacy faculty members have been trained to teach using traditional methods, and most are accomplished lecturers. This proposed curriculum would require substantial "retooling" of faculty to be facilitators rather than lecturers.
- The concepts of cooperative learning, active learning, problem-based learning, and case studies can be applied to discipline-specific courses (21,22). Hence, it may be perceived that implementation of a highly integrated, case-based curriculum amounts to overkill, if the ultimate goal is simply to introduce active learning and problem-based learning concepts to the curriculum.
- The integrated, case-based curriculum may be perceived to lack content. That is, the "material which must be covered" from each of the disciplines is not evident in the curricular proposal.

While these difficulties are certainly not trivial, it is interesting to note that they all address operational concerns or concerns regarding the faculty role in administration of the proposed curriculum. The idea that this proposed curriculum would not be advantageous to pharmacy students or would produce a lesser graduate has not been proposed. The sum total of these disadvantages of the integrated, case-based curriculum, however, has prevented implementation of such a curriculum, at least for the fore-

seeable future. On the other hand, as mentioned above, several of the underlying ideas for this curriculum proposal are being implemented in the pharmacy curriculum at Butler University and at other schools of pharmacy. These include the coordination of content between different courses, the use of cooperative learning to supplement traditional classroom settings, and an increased emphasis on the use of active learning styles and the teaching of problem-solving techniques.

Of the difficulties listed above, perhaps the most common argument against this type of integrated, case-based curriculum is a perceived lack of substance and content, where students are being sent on their own to wander aimlessly, trying to solve problems without having the background to do so. In fact, proper case study preparation will guarantee that students not only "cover the content," but that they digest and internalize the content while solving integrated case studies much better than they will by rote memorization. Perhaps the best assessment of the system is to ask the simple question, "do the students learn what they need to know?" Certainly, if they can successfully find solutions for patient care from the case studies they are presented, then they have indeed learned what they need to know for pharmacy practice. Additionally, they will understand the discipline-specific concepts which form the foundation of pharmaceutical care, since they will have actively learned these concepts while finding solutions to the case studies. As long as assessment of student progress, and feedback to the student, is continual throughout the program, the mastery of these necessary skills can be guaranteed.

In terms of the administration of the proposed curriculum, the curriculum is theoretically easy to administer and assess once it has been established. The individual case studies on a particular disease must be reviewed annually as new approaches to therapy are developed. However, the cases need not be rewritten from scratch, only modified to reflect more recent information and developments. Students would be assessed by both written examination and by face-to-face demonstration of the skills to be mastered in a particular module. Group session and laboratory assessments would be threefold, including self assessment, peer assessment, and facilitator assessment.

Conversely, to get to the point where this new curriculum is "in place" will necessitate a large amount of effort, especially if the implementation of the curriculum is a change from a more traditional, discipline-specific, course-oriented arrangement. Initially, since this style of curriculum is considered an unusual approach, it may be difficult to "sell" the program to faculty and to faculty governance bodies. Additionally, the implementation of this curriculum would be extremely time-consuming, in terms of the initial preparation of the case studies and materials for distribution.

Delivery of this curriculum would require substantial resource allocation in three major areas. First, faculty members need to become facilitators, rather than lecturers, in this curriculum. Therefore, resources would need to be provided in the area of faculty development for those faculty members who need to enhance their skills in these areas. Secondly, facilities may be an issue, since this curriculum would require a large number of small or flexible rooms to hold groups of six to eight students for discussions. Library resources would be a third consideration, since larger numbers of students would need to access these resources on a

constant basis. Therefore, on the basis of space availability, faculty availability, and library resources availability, it can be extrapolated that this curriculum could not be delivered to huge numbers of students, as is presently done with more traditional style curricula, unless substantial resource allocations are made to augment these resources by schools of pharmacy.

## CONCLUSION

This is a curricular model which is presented as an example of an integrated, case-based Doctor of Pharmacy curriculum, centered completely around problem-based learning in the form of case studies. This proposed curricular structure can serve as a starting point for a new approach to entry-level pharmaceutical education, as the focus of the profession itself changes during the coming years. The faculty responsible for training our future health care professionals must continue to work toward implementation of such novel strategies for delivering problem-based education to health care students. Only if graduates of such programs have mastered self-learning and problem-solving skills can we be assured of their success in providing adequate patient care in an ever-changing health care environment.

**Acknowledgment.** The following members of the faculty of the College of Pharmacy and Health Sciences at Butler University contributed their time, ideas, advice, and support toward the creation of this curricular model: Sona I. Elanjian PharmD, Sharon K. Hammerich PharmD, Laurence A. Kennedy PhD, Kathleen S. Martin PhD, Kenneth E. Robertson PharmD, and Edward W. Strubel III, PharmD.

*Am. J. Pharm. Educ.*, **60**, 265-274(1996); received 1/21/96, accepted 7/26/96.

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