ABSTRACT

Under the leadership of the authors, the instruction of endocrine and CNS pharmacology has been integrated with other basic and clinical science disciplines within the Southern Illinois University School of Medicine (SIUSM) sophomore medical curriculum. This effort led to the development of multidisciplinary endocrine and CNS instructional blocks. Generation of patient cases and learning experiences required the efforts of faculty from a diversity of disciplines and introduced discipline-specific learning issues to address important disease types in each organ system. In an integrated curriculum, it is vital that the unique learning objectives and insights which are fundamental to each discipline receive appropriate emphasis. The ability to include additional educational activities in each instructional block, i.e., instruction of physical examination skills and utilization of standardized patients as well as small group sessions, confers considerable design flexibility. Integrated sessions generally are begun by reviewing each paper case, generation of hypotheses, rationale and interpretation of laboratory tests; and ultimately a differential diagnosis and classification of the disease are made. A pathologist presents the pathophysiology of the disease using slides of organs, tissues, and microscopic tissue sections. The pharmacology learning issues for each case are presented in the context of the Pharmacology Mental Algorithm, a systematic and rational approach to teaching and applying drug therapy. Student assessments are based on case vignettes with matching or multiple-choice questions for each case provided by all participating disciplines and designed to evaluate knowledge base in the discipline areas and clinical problem solving. A practical evaluation of student examination skills by clinicians can also be performed. Based on student responses to an exit questionnaire, there was a high level of enthusiasm and participation; and students felt that this presentation style produces an excellent learning experience. From an institutional and faculty perspective, development and maintenance of these sessions requires commitment, leadership skills, and considerable initial time investment. A significant advantage of multidisciplinary sessions is that students are offered an opportunity to acquire an integrated and structured basic and clinical science knowledge base in the context of how it will be used. This will facilitate professional development by having a knowledge base that can be systematically expanded and recalled for rational problem solving. Also, these sessions permit flexibility by allowing use of a number of educational opportunities; appear to improve student attention, enthusiasm, preparation before sessions, and participation during sessions; reduce confusion related to differences in discipline-specific terminology; and promote positive working relationships among basic and clinical science faculty.

INTRODUCTION

Creation of both vertical and horizontal integration of the medical school curriculum has attracted considerable interest (29, 36). An educational methodology that employs multidisciplinary, integrative, and case-based approaches has numerous attractive features (6, 35, 40). For example, introduction of clinical relevance is potentially more stimulating, and motivational, and more likely to encourage medical student participation. Further, this approach facilitates initial acquisition and subsequent use of an integrated basic and clinical science knowledge base, which is thought to foster development of clinical reasoning skills (40, 46). Using objective measures, it has been suggested that the diagnostic competency of medical students is fostered by an integrative curricula (42).

Our decision to make the changes described in this paper was influenced by conversations with third year medical students, who had performed exceptionally well in our traditional (lecture-based) pharmacology curriculum and on the USMLE Step 1. They reported having to develop an integrated basic and clinical science knowledge base by reorganizing their discipline-segregated knowledge, which had been acquired during the first two years of medical school. To promote acquisition of such a knowledge base during the second year, the authors facilitated the development and delivery of multidisciplinary, integrated sessions. These efforts are consistent with the continuing international effort to include basic sciences, such as pharmacology, into the context of broader curricular goals of medical schools (30, 31, 44). In this communication, we will present insights into development and implementation of multidisciplinary, integrated curricula. Preliminary reports of these efforts have been presented (15, 16).

Importance of Pharmacology Information Within an Integrated Medical Curriculum: It has been suggested that adverse reactions to drugs and drug-drug interactions are a significant cause of morbidity and mortality in the United States (5, 25, 28, 32). Although the interpretation of these meta-analysis studies has been debated (7, 19, 32), the necessity for acquisition and maintenance of an adequate and operational knowledge of basic and clinical pharmacology among practicing physicians is not disputed. To facilitate this process, the faculty of the Department of Pharmacology at SIUSM presents a mental algorithm, which provides a systematic framework for teaching, solving, and understanding problems associated with therapeutic management by encouraging logical selection and use of drugs and appreciating that each patient has individualized requirements (11,12). Its development was conceptually influenced by the systematic approach to rational drug
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In context to understanding the interpretation of results and ultimately develops a differential diagnosis based on this information. In context to understanding the interpretative results, it is vital that all multidisciplinary learning issues are presented. The exposure to patient paper cases has been reported to be a critical element in developing diagnostic competence, a key goal of medical education (18, 42). Generally, sessions are two hours and include content experts from different disciplines, i.e., a pharmacologist, pathologist, and/or physician. For the CNS sessions, faculty from the Departments of Psychiatry, Neurology, Immunology, Radiology and Epidemiology were involved. Case presentations are generally introduced by a clinician or pathologist, who delivers clinical details of the case (patient history, physical examination, hypotheses, rationale for ordering laboratory tests and interpretation of results) and ultimately develops a differential diagnosis based on this information. In context to understanding the case, it is vital that all multidisciplinary learning issues are presented. In addition to patient paper cases, a variety of other paradigms have also been used, such as actual patients, patient families, simulated patients, and videotaped patients. Discipline-specific sessions are also useful tools to present essential clinical or basic science material that is less well suited for integrated sessions, e.g., clinical skill training, terminology, and basic knowledge concepts (17).

The multidisciplinary, integrated endocrine block consisted of six sessions of two hours over two weeks and involved a pharmacologist, pathologist, and a clinical endocrinologist. Also, a single session to introduce concepts in endocrine pharmacology and an endocrine clinic day were scheduled. The CNS block was one month in duration and utilized 31 faculty members from nine basic and clinical science departments. In addition to the nine discipline-specific and 13 multidisciplinary sessions, other educational opportunities included five clinical skill-training sessions, four simulated patient encounters, and small group sessions of 6-7 students that were used to evaluate the learning issues identified by the students during the simulated patient encounters. The simulated patients and small group sessions were largely organized, staffed, and evaluated by the clinical members of the Organ System Team. In addition to providing an introduction to clinical medicine for neurological and psychiatric patients, these sessions are thought to greatly amplify the clinical relevance of the integrated sessions (3, 13).

**Steps for Successful Development of Multidisciplinary, Integrated Sessions:** To consider diverse contributions, it is essential to recruit faculty from basic and clinical science disciplines. Further, successful development of these sessions requires identification of faculty who are both willing and capable. A review of the experiences associated with adoption of the multidisciplinary curricula indicated that the key factor for “success” of these curricular alterations was the enthusiasm of the faculty (43). Also, support by the appropriate chairpersons of the basic and clinical science departments and the institutional administration is necessary to sustain these efforts and to encourage faculty involvement. At SIUSM, the groundwork for the integrated, multidisciplinary curriculum began with a series of retreats that were initiated by the Chairperson of the Committee for the Sophomore Standard Curriculum. Although open to all faculty members, every effort was made to include teaching faculty and chairpersons from each basic science and clinical discipline in the second academic year. Agreement by the chairpersons of each participating discipline to cooperate and provide faculty for integrated sessions is a necessary outcome of this phase. A single curriculum segment, the endocrine and reproductive components of Pharmacology, Pathology, and Clinical Medicine, initiated the process. This initial experience was used to evaluate the approach, gain experience for future integration, obtain student feedback, assess faculty time commitment, and assure that these sessions would allow adequate presentation of high quality curricular material using the integrated approach (37). Following the success of the Endocrine Integrated Block, the next year the Central Nervous System Block was integrated. Although not discussed in this paper, an integrated, multidisciplinary infectious disease educational block has been subsequently developed.

**Requirements for Successful Development of Multidisciplinary, Integrated Sessions:** Recruitment of team leaders who possess organizational as well as positive interactive skills is a direct determinant for successful development of integrated cases. Session participants should be knowledgeable, interested in developing and sustaining an integrated curriculum, and cooperative when asked to generate cases, learning issues, and test questions and to attend planning meetings. An understanding that curricular changes will be inclusive and flexible enhances recruitment of faculty who will be enthusiastic and creative. Training sessions for

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**Table 1: Pharmacological Mental Algorithm**

| 1. Knowledge of drug classes available to treat the medical problem(s) |
| 2. Mechanism(s) of drug action |
| 3. Pharmacokinetic factors which influence each drug |
| 4. Alteration of cellular responsiveness (e.g., tolerance, desensitization, dependence) |
| 5. Drug uselessness relative to patient’s therapeutic goals |
| 6. Contraindications (absolute and relative) |
| 7. Adverse (side) effects including drug-drug interactions |
| 8. Drug effects that mimic disease symptoms |
| 9. Drug abuse-related symptoms |
| 10. Drug-induced alterations of clinical laboratory tests |
| 11. Therapeutic Index: risk/benefit ratio of therapy |

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**Content of Integrated Sessions:** Each integrated session uses multiple patient cases as foci for introduction of discipline-specific learning issues. The exposure to patient paper cases has been reported to be a critical element in developing diagnostic competence, a key goal of medical education (18, 42). Generally, sessions are two hours and include content experts from different disciplines, i.e., a pharmacologist, pathologist, and/or physician. For the CNS sessions, faculty from the Departments of Psychiatry, Neurology, Immunology, Radiology and Epidemiology were involved. Case presentations are generally introduced by a clinician or pathologist, who delivers clinical details of the case (patient history, physical examination, hypotheses, rationale for ordering laboratory tests and interpretation of results) and ultimately develops a differential diagnosis based on this information. In context to understanding the case, it is vital that all multidisciplinary learning issues are presented. In addition to patient paper cases, a variety of other paradigms have also been used, such as actual patients, patient families, simulated patients, and videotaped patients. Discipline-specific sessions are also useful tools to present essential clinical or basic science material that is less well suited for integrated sessions, e.g., clinical skill training, terminology, and basic knowledge concepts (17).
Development of Inclusive Multidisciplinary, Integrated Sessions: The development of case vignettes and inclusion of all learning activities for delivery of learning issues was an essential task of the session development group. Sessions for smaller teaching blocks can be developed directly by the Organ System Team. However, for the larger instructional blocks, each session can have Session Development Teams which include a member from the Organ System Team. Session Development Teams determine the general content, i.e., types of paper cases, actual patients, patient families, simulated patients, and videotaped patients and develop a rough timetable for content presentation. The number and types of cases and other learning experiences were established using the current educational objectives for each discipline. Clinicians usually generated new cases or adapted source cases from the medical literature. This information, as well as other relevant instructional material, was collected and distributed to all members of the Organ System Team. This information was also used to identify domains of identical subject matter. When areas of redundancy were identified, Session Development Teams decided on the appropriate individual to present the material. The other disciplines eliminated this material from their portion of the session to provide greater efficiency and consistency and eliminate unnecessary repetition and potential confusion. For example, the Endocrine Development Team identified that introduction to the nomenclature for the different types of diabetes was presented by all disciplines. It was agreed that this material would be provided by the clinical endocrinologist during the first diabetes case. Also, potential confusion between disciplines based on apparent contradictions of material was minimized.

After the learning experiences for each session were identified, it was necessary to develop a schedule which accommodated student and faculty participation, prevented overload of any individual faculty participant, and did not overlap with other learning activities. A tentative schedule for presentation of the case vignettes was developed and circulated to the other members for input and suggestions at a subsequent meeting of the participants or their representatives. The schedule and types of cases developed by the Endocrine Development Team are shown in Table 2. Also, a pharmacology-specific session was presented to cover essential and unique material less suited for integrated sessions, such as introductory concepts and terminology.

Key features of a successful integrative effort involve the following: (1) minimizing perceptions of bias by including as many as possible of the learning issues for all disciplines; (2) eliminating redundancy by having only one discipline present overlapping material; (3) employing a variety of learning experiences in addition to the integrated sessions; (4) establishing common or consistent terminology, e.g., disease classifications and drug names; (5) presenting information in an order which fosters logical acquisition and integration of the student’s knowledge base; and (6) developing a schedule which accommodates student and faculty participation and prevents overload of any individual faculty member.

### Table 2: Types of Cases Used for the Multidisciplinary Endocrine Sessions

<table>
<thead>
<tr>
<th>Session</th>
<th>Diseases Involving Hypothalamus/Pituitary</th>
<th>Diseases Involving the Thyroid</th>
<th>Diseases Involving Adrenal Cortex and Medulla</th>
<th>Diseases Involving Ovary and Testes</th>
<th>Diseases Involving Endocrine Pancreas</th>
<th>Diseases Involving Parathyroids, Bone, and Calcium</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9 cases which have learning issues covering growth diminution, acromegaly, hyperprolactinemia, GnR-related infertility, diabetes insipidus, SIADH, panhypopituitarism, and pituitary tumors.</td>
<td>14 cases which consider age-related problems associated with hypothyroidism, goiters, thyroiditis, Graves disease and other forms of hyperthyroidism including thyroid storm.</td>
<td>10 cases including adrenal insufficiency syndromes, adrenal hyperplasia, Cushing’s syndrome and other forms of hypercortisolism, aldosteronism, principles of adrenocorticosteroids, steroid replacement therapy, use as an antiinflammatory agent including use of alternate day therapy and withdrawal paradigms. Tumors of adrenal medulla are discussed by the pathologist and endocrinologist.</td>
<td>10 cases which cover female disorders, i.e., amenorrhea, dysmenorrhea, endometriosis, dysfunctional uterine bleeding, polycystic ovary disease, hormonal treatment of endometrial and breast cancer, and use of estrogen analogs/selective estrogen receptor modulator’s to treat menopausal symptoms. Also, cases involving male disorders, i.e., hypogonadism, uses of testosterone derivatives, abuse of androgenic steroids, and treatment of prostate hyperplasia are presented.</td>
<td>utilizes 4 cases which include classification of different types of diabetes and etiology, use of different insulin regimens to treat Type 1 diabetes, treatment of diabetic ketoacidosis and management of Type 2 diabetes and use and mechanism of action of oral hypoglycemics, diabetic pregnancy, and hypoglycemia due to increased effects of insulin.</td>
<td>employs 10 cases covering hyperparathyroidism, hypercalcemia, use of agents to reduce blood calcium levels, hypoparathyroidism, hypocalcemia, use of calcium salts and/or various forms of vitamin D, osteomalacia/rickets, treatment of osteoporosis with emphasis on postmenopausal form using antiresorptive agents, and Paget’s disease using calcitonin and bisphosphonates.</td>
</tr>
</tbody>
</table>
Organization of Integrated Session Presentations: Once the session schedule and participants were established, slides and educational materials for each session were shared among faculty. This was facilitated by slide-making programs, which allowed slides to be distributed by E-mail or computer storage disks. Given adequate time for all of the participants to consider the content and order of slides in the integrated presentation, a review of the material by the session faculty was scheduled to finalize the content and order of presentation of session material and to generate an integrated handout. A practice session for the more involved sessions improved organization and presentation continuity. The students were presented the paper cases prior to the session with instructions to make a differential diagnosis before class and personal list of learning issues that they wanted discussed. The challenge of evaluating the paper cases created an opportunity for the students to identify any knowledge deficit and correct this deficit by self-study and/or acquisition of the information during the session. An example of a paper case is shown in Table 3.

Student Evaluation: Assessment of the student’s knowledge base and problem-solving skills was accomplished by an integrated examination, which was constructed by the Organ System Team with input from each Session Team. It consisted of case vignettes with matching or multiple-choice questions from each participating discipline, which was similar to the approach utilized in the USMLE Step I. In the CNS block, evaluation of clinical skills was measured using a practical exam with standardized patients and observation by faculty or senior medical residents. Satisfactory performance on both the written and practical exam were required for successful completion of the CNS block and assessment of each student’s progress toward becoming a physician. The elements for measuring student performance included the following: (1) individual discipline pass/fail decisions, which could be obtained by collating performance of individual discipline-specific questions of the test; (2) total block performance; (3) tutor evaluations; and/or (4) evaluation of clinical skills in the practical exam. The current endocrine block exam is composed of case vignettes with discipline-specific multiple-choice questions. To evaluate performance in each discipline, responses were segregated and used by each Department to make pass/fail decisions. For the multidisciplinary exams which were administered in 1998-2000, the average grade on the pharmacology type questions was 83.1% with no failures (i.e., less than 70% correct responses). The pharmacology endocrine block examination, which had been administered prior to integration, was also case-based and used multiple-choice questions similar to the type used to test pharmacology in the examination of the integrated endocrine block. The average score of this examination for years 1992-1994 was 80.2% with two failures each time it was offered.

Student Feedback: At the end of each organ system, a questionnaire was given to each student to complete anonymously (see Table 4). Individual results were organized confidentially by the curriculum secretary, and the collected information provided to the Organ System Team for review and dissemination to the participating faculty. The feedback was also utilized when the Organ System Team reconvened to assess this input and plan changes for delivery of multidisciplinary, integrated sessions. Each session was prototypically begun by a clinician who presented patient history, physical exam results, and preliminary diagnoses as a rationale for the lab tests to be ordered. An interpretation of patient test results was then presented, and ultimately a diagnosis, with student input, was reached. If available, a videotape of that patient or a similar case was used. Subsequently, the pathological findings (gross and histologic) associated with this type of condition were presented by the pathologist. Following this presentation, the pathophysiology was discussed by one of the session faculty members, often the pharmacologist. This was followed by a discussion of the pharmacological issues raised by the therapy required in the case, referring to the Pharmacology Mental Algorithm (Table I). If available, a videotape which demonstrates the effect of the pharmacological agent on the patient can be used. For example, the use of a video to demonstrate the symptoms of Parkinson’s disease and amelioration after drug therapy was particularly instructive. To finish the session, the clinician can further discuss the clinical aspects of the case and ask or answer student questions concerning patient management. Other treatment modalities, such as criteria for selection of agents to be used in the clinical setting, effectiveness of different blood levels of the drug, and risk/benefit aspects of positive and untoward effects are among the issues that can be discussed in this portion of the session. At any stage of the presentation, students may ask questions or be queried.

Table 2: Example of an Integrated Patient Endocrine Problem

A 40-year-old woman had been treated for five years for essential hypertension that was fairly well controlled with daily use of thiazide diuretics and dietary salt restriction. Over a period of approximately two years, she had been lax in her restriction of salt and only occasionally took her diuretics. During this time, she had gained 40 pounds over her normal weight and during the next several months had increasing incidences of fatigue. At a routine visit, a glucose tolerance test was ordered. The results were: fasting - 130 mg/dl; ½ hour - 240 mg/dl; 1 hour - 269 mg/dl; 1-½ hour - 282 mg/dl; 2 hour - 239 mg/dl. She was subsequently placed on a weight reduction diet. Over the next four months she lost 25 pounds. A subsequent 2-hour postprandial glucose test was 100 mg/dl. With more strict attention to salt intake, her blood pressure remained within normal limits. She claimed to feel much better and promised to continue to lose weight. The following year a routine physical examination revealed that she had regained the lost weight, and was hypertensive: her fasting blood glucose level was 200 mg/dl, and she was exhibiting hyperlipidemia. She was evaluated for management of Type 2 diabetes, elevated blood pressure, and hyperlipidemia.

Delivery of Multidisciplinary, Integrated Sessions: Each session was prototypically begun by a clinician who presented patient history, physical exam results, and preliminary diagnoses as a rationale for the lab tests to be ordered. An interpretation of patient test results was then presented, and ultimately a diagnosis, with student input, was reached. If available, a videotape of that patient or a similar case was used. Subsequently, the pathological findings (gross and histologic) associated with this type of condition were presented by the pathologist. Following this presentation, the pathophysiology was discussed by one of the session faculty members, often the pharmacologist. This was followed by a discussion of the pharmacological issues raised by the therapy required in the case, referring to the Pharmacology Mental Algorithm (Table I). If available, a videotape which demonstrates the effect of the pharmacological agent on the patient can be used. For example, the use of a video to demonstrate the symptoms of Parkinson’s disease and amelioration after drug therapy was particularly instructive. To finish the session, the clinician can further discuss the clinical aspects of the case and ask or answer student questions concerning patient management. Other treatment modalities, such as criteria for selection of agents to be used in the clinical setting, effectiveness of different blood levels of the drug, and risk/benefit aspects of positive and untoward effects are among the issues that can be discussed in this portion of the session. At any stage of the presentation, students may ask questions or be queried.
### Table 4: Student Feedback Sheet

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>No Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA</td>
<td>A</td>
<td>D</td>
<td>SD</td>
<td>NR</td>
</tr>
</tbody>
</table>

#### INTEGRATED SESSIONS

**I. INSTRUCTIONAL OPPORTUNITIES**

Please circle one choice

- Classroom sessions were well organized, covered important concepts and were helpful in achieving the objectives of the block.

- Case presentations highlighted relevant issues to the discipline topics.

**II. BLOCK EVALUATION**

- Integrated Block/Organ system examination tested knowledge of discipline objectives.

- Integrated Block/Organ system examination tested the use of an integrated knowledge base and clinical reasoning skills and required more than just recall of information.

**III. INSTRUCTIONAL MATERIAL**

- Handouts were useful.

- Slides and overheads were useful.

- Videos were useful.

**IV. GENERAL**

- My overall feelings were positive regarding the learning activities and experiences during this Block/Organ system.

- Please provide any constructive suggestions concerning the improvement of this learning experience at the end of this form or on the reverse side.

**V. ATTENDANCE** (percent of sessions attended)

- 0-25%
- 26-50%
- 71-75%
- 76-100%
- NR

**VI. PHARMACOLOGY INSTRUCTIONAL MATERIALS**

- Modules

- The objectives were clear.

- The resources cited or attachments (such as the Medical Letter, etc.) were helpful for achieving the objectives.

**VII DISCIPLINES IN INSTRUCTIONAL SESSIONS**

- PHARMACOLOGY

- PATHOLOGY

- INTRODUCTION TO CLINICAL MEDICINE

**COMMENTS (use reverse side as needed):**
the next year. For the endocrine block, the number of students in 1998-1999 and 1999-2000 who reported a class attendance of 76-100% (see Section V of Table 4) was 91%. For the two most recent times that endocrine pharmacology (1994-1996) was offered as a discipline-specific session, the percentage of students who reported attending 76-100% of the lectures was 70%. It should be noted that class attendance has never been mandatory. Student satisfaction (agree or strongly agree) with instructional activities for the non-integrated sessions in 1994-1996 rose from 56% with 20% non-responders to 91% in 1998-2000 with only one not responding (see Section IV of Table 4). This information suggests that student enthusiasm was high and that they felt these sessions were valid learning experiences which appeared to enhance student-faculty interactions.

DISCUSSION

A primary recommendation for reform of the "first two years of medical school curricula" is less reliance on simple discipline-driven lectures and increased learning experiences with direct clinical relevance, i.e., integrated, multidisciplinary learning opportunities (1, 21, 22, 24, 34, 47). Also, it has been asserted that the discipline-driven lecture format provides inadequate information concerning the development of medical student professional competence (9). It has been suggested that a very effective way to develop professional competence is to acquire new information in the context of how it will ultimately be used (18, 23). Further, it has been pointed out that the ability to supplement knowledge is directly related to the existence of a fact-filled knowledge base (27). It has been recognized that, although teaching students the process of life-long learning skills is a valuable asset, it should not substitute for an extensive knowledge base (27). Further, it was suggested that failure to provide an adequate knowledge base could actually impair the skills of inquiry and discovery (27). It has been proposed that development of professional competence is dependent on establishment of a structured knowledge base which can be recalled as needed to make logical decisions and which is expandable or revisable as new knowledge becomes available (38). To apply these ideas to the education of medical students and clinicians, the underlying basis for developing and maintaining professional competence is a development of a dynamic, integrated knowledge base, which is gained through stimulating and integrated learning experiences that emphasize the interdependence of basic and clinical science. Further, the structure of an integrated knowledge base should facilitate effective information recall and utilization in solving clinical problems as well as provide pre-existing "niches" for storage of new information. These multidisciplinary, integrated sessions can provide an environment for developing an integrated knowledge base.

An important aspect of successful curricular design proved to be flexibility, i.e., utilization of the attributes of a number of educational opportunities. Case-oriented formats, such as problem-based learning curriculum (PBLC) and integrated learning, are suggested to be key elements in developing diagnostic competence (42) and fostering techniques of life-long learning (2, 4, 14, 48). However, the effectiveness of PBLC as the only tool in medical curricula has been reviewed and questioned (10). Learning experiences in the CNS instructional block included simulated patients followed by small group environments in order to offer self-directed learning experiences. Also, basic and clinical science materials which were not easily integrated, but have unique and important insights and knowledge, were presented in discipline-specific sessions. Pharmacology learning experiences should be designed to include the rational approach to the use of drugs, including evidence-based information (in the form of clinical drug trials), the perils of drug misuse, and unbiased sources of drug information, which are of paramount clinical importance.

The multidisciplinary, integrated, case-based sessions which are described in this paper offer simple (endocrine) to complex (CNS) models that can be adapted by most medical schools to offer similar opportunities. Depending on support and availability of interested faculty and curricular goals, either form or some hybrid of these models can become powerful tools to facilitate development of an integrated basic and clinical science curriculum. While conducting these sessions, a number of insights were realized. For example, the observation by medical students of clinical faculty employing a strong knowledge of pharmacology validates its importance as an integral aspect of clinical reasoning, solving patient problems, and functioning as a competent physician. The use of basic and clinical science faculty who are content experts and patient vignettes creates a dynamic environment for the medical student that was well appreciated and appeared to improve student attention, enthusiasm, preparation before sessions, and participation during sessions and foster an attitude that basic science faculty are valuable mentors. Confusion related to differences in discipline-specific terminology was reduced. The pace of the presentation was established by student involvement, i.e., time spent on a subject could be based on the degree of comprehension. Positive working relationships and mutual respect among basic and clinical science faculty developed. An important early step in the process was obtaining support and cooperation from faculty, chairpersons and educational administrators. The many meetings needed to form this type of curricula were time consuming but also built the rapport and feeling of collegiality between departments that are requisite for successful integration and reduction of significant roadblocks and potential "turf" issues. Another issue that will arise is the amount of time required to organize and generate the curricular materials. The initial year of integration of the curriculum required the greatest time commitment, particularly for coordinators. Subsequent years take less organizational and meeting time and generally involve fine tuning and updating. A significant concern was expressed that participation of junior faculty in curricular revision could negatively impact on their ability to be promoted and tenured. Further, senior faculty relate that this time loss could be detrimental to successful careers as clinicians and/or research scientists. Educational revision and increased teaching responsibilities will require consideration of faculty development expectations and reward processes (6, 26 39, 46). In the evaluation of faculty
contributions, it should be recognized that development of new curricula is an important academic contribution.

The emphasis on “evidence-based” approaches to medicine (8, 49) has strong implications for teaching pharmacology and should be introduced into medical student training. This subject is emphasized at SIUSM in integrated sessions for fourth year students and covers evaluation of clinical drug trials and identification and evaluation of unbiased sources of drug information. In an integrated medical curriculum, the importance of maintaining and strengthening the input of pharmacological information integrated with clinical experiences at all levels of medical education development cannot be overemphasized.

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