REVIEW

PERSPECTIVES IN MEDICAL EDUCATION

5. Implementing a More Integrated, Interactive and Interesting Curriculum to Improve Japanese Medical Education

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Summary: Exact parallels can be drawn between the shortcomings in medical education in the US in the 80s and those prevalent in Japan today. Research and clinical practice had primacy over teaching, and primary care medicine, with its focus on humanistic principles, was subordinated to specialization and tertiary care. US medical schools undertook a wide-ranging reform of the traditional curriculum, recognizing its four major shortcomings. These were (i) an institutional failure to accord academic status to teaching, resulting in a disincentive to teach, (ii) a failure by faculty to perceive a shared interest in education, resulting in teaching that was fragmented and even contradictory, (iii) a failure to integrate preclinical and clinical material, resulting in fragmented learning, (iv) a failure to encourage the development of the most important attributes of a physician (independent thinking, problem solving, and self-directed learning). The reform of medical education in the US was achieved through a wholesale restructuring that (i) integrated basic science with clinical medicine across the curriculum; (ii) coordinated teaching across departments by organizing the curriculum into "blocks"; (iii) integrated problem based instruction into the curriculum to encourage active learning; and (iv) elevated the importance of both teaching and primary care. The successful effort to reform medical education in the US can serve as a source of encouragement and a road map for academic institutions in Japan, like Keio University, who recognize the same shortcomings in Japanese medical education and are attempting to develop and implement a curriculum that is more integrated and problem-oriented. (Keio J Med 56 (3) : 75 – 84, Septmber 2007)

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Introduction

This paper is the fifth in an ongoing series of articles on the effort to reform medical education at Keio University School of Medicine, one of the premier medical institutions in Japan. Preceding papers have dealt, in turn, with the identification of problems in clinical training for students at Keio,[1] recommendations on how to solve those,[2] the justification of the need for reform in Japan,[3] and the very commendable progress over the past 3 years of the effort to reform clinical training at Keio.[4]

It has been argued in an earlier paper in this series that progress in reforming the system of medical education in Japan cannot occur until curriculum reform is enacted. The fact is, however, that curriculum reform has been on the agenda in Japan for at least two decades without much success.[5,6] It has even received official sanction more recently,[7] despite which the pace of implementa-

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tion remains painfully slow. The reasons for this resistance to change have been detailed in an earlier paper in this series,[3] and will not be reiterated here. Suffice it to say that progress is stifled by the existing medical school curriculum, constrained by tradition, and obstructed by medical school authorities who fail to see a need to change. Despite these barriers, the reform effort has taken root in places like Keio University, thanks to visionary leadership that recognized the need for change, and had the will to proceed with reform.[4]

Keio University is now embarking on the arduous task of reforming the medical school curriculum. This constitutes the next step in the natural progression of a process that began in 2003, and derives from the series of recommendations that were put forth to guide the reform effort.[2] Incorporated into those recommendations was the explicit recognition of an acute need to reform the medical curriculum so that students could not only develop the proper foundation for assimilating basic sciences into a clinical framework but also develop into problem solvers.

Explicit in that recognition, also, was a recognition that such a profound change—particularly one that was widely viewed as being both unnecessary and "unproven"[3] — in an institution like Keio University, with its well-established tradition, preeminent reputation, and long track-record of success, would be met with resistance, at best, or overt hostility, at worst. It was therefore recommended that curriculum reform be undertaken only after demonstrating its viability in the Keio context, using a "Demonstration Project". Furthermore, it was suggested that the Demonstration Project might be best attempted in a subject area that (a) was self-contained and thus amenable to a limited effort that did not affect other areas of the curriculum, and (b) was blessed with the departmental leadership essential to sustaining its viability. The department that met both these criteria was felt to be Anatomy, based on the fact that (a) it was a relatively self-contained subject, by its very nature, and (b) because Vice-Dean Aiso, the Chairman of Anatomy, was at the forefront of the reform effort.

In 2006, the reform effort at Keio University had progressed to the point that curriculum reform was the next logical step in the process. At that point, Professor Takahiro Amano, Head of the Department of Medical Education sought advice from the authors on the practical aspects of implementing a Demonstration Project in Anatomy, in order to show how to achieve integration between basic and preclinical sciences in the medical curriculum. In that context, it is noteworthy that one of us (RHR) has been closely involved in the ongoing effort to reform clinical training at Keio over the past 3 years,[1–4] and the other (KHR) was just as closely associated with the highly successful effort to reform the preclinical curriculum at the University of Pittsburgh, School of Medicine (UPSOM) in 1992. The focus and the ultimate result of that effort was a heavier emphasis on teaching the clinical relevance of basic sciences in the preclinical years and on introducing problem based learning into the curriculum at UPSOM.

This paper, which is based partly on an address (by KHR) to the Keio Medical Society delivered during our visit to Keio in November 2006, traces the evolution of the process which resulted in the formation of the new curriculum at UPSOM, and how that experience might be used at Keio University (and other like-minded institutions in Japan) to bring about curriculum reform.

A Brief History Of Curriculum Reform In Medicine In The US

During the 1980's, a number of medical schools in America undertook a radical re-organization of the curriculum that was in place at the time. The situation that currently exists in Japanese medical schools (at least, as it is reflected in the situation that prevails at Keio) is very similar, if not identical, to the one that existed in the US two decades ago. Even more striking parallels may be drawn between the barriers to reform and resistance to change that existed at that time in the US,[8] and those facing educators currently engaged in this same effort in Japan.

Background

The movement to reform medical education in the US started against the backdrop of a realization that the traditional curriculum was failing to prepare physicians for the future. In 1982, the Annual Report from the Council on Medical Education of the American Medical Association (AMA), in discussing "those issues and forces that very likely will have an important impact on medical education" focused on "the balance between generalism and specialism required to permit persons to develop into well-educated physicians who possess a broad perspective".[8] It was felt that "many of the changes that have occurred in undergraduate and graduate medical education were stimulated by the growth of specialism". The Report went on to say that "multiple divisions of the classic broad clinical disciplines of medicine and surgery…(have resulted) in aggregates of semiautonomous units that… (may not share) the institution's educational goals… (and) often become further and further separated from the educational philosophy of the parent discipline. Technological skills may be emphasized at the expense of the broad education needed by graduates…to provide general medical care" (ref #8, p 3225).

The Project Panel of the Association of American Medical Colleges (AAMC) in its 1984 report on the General Professional Education for Physicians (GPEP), entitled "Physicians for the Twenty First Century",[9] fo-

cused on a different aspect of the problem: the growing conflict between the three distinct roles served by medical schools, namely education, research and patient care. The GPEP Report stated, "Despite frequent assertions that the general professional education of medical students is the basic mission of medical schools, it often occupies last place in the competition for faculty time and attention. Graduate students, residents, research, and patient care are (all) accorded higher priorities" than medical education (ref #9, p19). The Report attributed the lack of commitment to medical education among the faculty to the fact that "institutional recognition and reward are not perceived to be forthcoming for significant dedication to this educational mission" (ref #9, p 3).

Bloom, in a comprehensive analysis of the barriers to reforming medical education in the US in the 80s,[10] agreed, as suggested in the GPEP Report, that the roots of the problem indeed lay in the fact that "…research and education, despite the sincere manifest intention to be partners, have become rivals and sometimes even enemies." However, he also acknowledged that increasing specialization was a compounding factor, as suggested in the AMA Report. He incorporated both viewpoints in formulating eight interlinked "propositions" that summarized the increasingly dysfunctional state of medical education in academic medical centers in the US in the eighties. These are quoted here (in abbreviated form, with annotations) because they apply so aptly to the dysfunctional state of Japanese medical education today.

(i) "*Medical education, much like medicine itself, tends to be perceived primarily as an intellectual activity*", so that "*the emphasis in training...is placed on medical knowledge*", and "*goals of performance, of professional behavior, are subordinated to goals of ideation*". In other words, the need to learn how to apply knowledge in the clinical context assumes secondary importance to the primary goal in medical education of simply acquiring that knowledge as an end in itself.

(ii) "*The curriculum has been assumed to be the educational instrument that channels and controls the teaching of knowledge, skills, values, and attitude…The curriculum plans of medical schools, however, have tended… to focus on the primacy of scientific knowledge.*" Thus, the curriculum is used as an instrument to reinforce the primary goal of acquiring knowledge without reference to its practical application.

(iii) "*Reform programs assume a consensus of faculty value orientation that does not account for differences among educators according to their place in the social structure of the institution*", which is divided into "*basic scientists, specialized clinical scientists, and clinicians*". The inference here is that vastly different academic goals lead to vastly different perceptions of the importance of education between the divisions, and just as vast a difference in commitment to its goals.

(iv) "*The modern medical school has grown to include the generic characteristics of large complex social organizations*", which prefer to "*paper over the persistent underlying structure.*" In other words, a large organization—like any medical school in the US or Japan—possesses a bureaucratic inertia that prefers to preserve the status quo rather than acknowledge the need for any meaningful change.

(v) "*The crisis of medical education today is based in the clash between ideology and social structure*", so that "*educational values become subordinate to the requisites of the organizational structure.*" These requisites are dedicated to preserving "*resources that are allocated to support the goals either of research or of…specialized tertiary care typical of teaching hospitals.*" The inference is that medical education is not a priority for resource allocation, which implies that the mission of medical schools to provide medical education has been subordinated to the goals of generating income from research and highly specialized tertiary care.

(vi) "*Educational values oriented toward teaching humanistic and competent physician behavior are subordinated to the bureaucratic requirements of the modern medical center's corporate structure.*" This follows from proposition (v), whereby the organizational focus on activities that preserve its financial security lead to a shift away from the altruistic aspects of medical practice, *which is, in turn, reflected in the educational focus as well.*

(vii) "*High-technology specialization orientations, already well-entrenched, have been reinforced, crowding out the community-oriented primary care perspectives.*" This is the next logical progression of the sequence that Bloom outlines, combining the consequences of the two foregoing propositions (v and vi), so that the educational focus is shifted away from primary care.

(viii) "*Programs of change (must) address the structural problems of organization, the sources of authority and allocation of resources, the power sources of decision making*". This is self-explanatory, combining the organizational inertia of proposition (iv) with the financial priorities of proposition (v).

All eight of Bloom's propositions are capable of being applied without any alteration to the situation that exists in Japanese medical education today. In that transposi-

tion, however, there is hope. Japanese medical educators who are engaged in the difficult and frustrating task of reforming medical education in Japan can take heart from the fact that the exact same difficulties and frustrations were overcome by medical educators in the US two decades ago.

It is helpful to review the process that led to the successful introduction of the integrated curriculum across most US medical schools in the 90s, despite the same problems, so that the same process can be followed by medical educators who are pursuing reform in Japan. That process can be broken into two steps

1. Recognizing the shortcomings in a traditional medical curriculum, and accepting the need for change.
2. Developing and implementing an integrated medical curriculum that meets the need to develop clinical problem solving skills in future physicians.

Step 1
Recognizing the Shortcomings in a Traditional Medical Curriculum

The underlying motivation for curriculum reform was generated through the efforts of a number of organizations that investigated the state of the general professional education of physicians in the US in the 1980s. Two of these have already been referred to: the AMA Council on Medical Education,[8] and the GPEP Report of the AAMC.[9] A third was the New York Academy of Medicine; it organized a Symposium whose title, "The Training of Tomorrow's Physicians: How Well Are We Meeting Society's Expectations?",[11] summed up the problem.

As can be expected (and has already been alluded to earlier), each of these bodies had a slightly different focus in their deliberations. As a result, they reached conclusions that were somewhat different in certain respects, and overlapped in others, but were mutually compatible. Taken together, these conclusions provided a comprehensive view of the problem as it existed at that time in medical education in the US.

It is not the scope of this paper to review all of these reports in detail, nor is it necessary to do so. However, it is very relevant to the reform effort in Japan to summarize the major shortcomings in the traditional medical school curriculum identified in the reports. All those same shortcomings are widespread in the situation that exists in Japan today: [3,5,6]

1. There is a failure to recognize teaching as a respectable academic discipline;[9] hence,
    a. Good teaching does not confer academic status or recognition;
    b. There is no salary support for time spent in teaching medical students; and
    c. No consideration is given for teaching talent at the time of promotions.
2. There is a failure to integrate material across the curriculum, because faculty members do not recognize the intellectual common ground in the shared mission of medical student education by different departments; this is particularly apparent between the basic and clinical sciences.
3. There is a failure to coordinate the teaching of material across artificially created divisions between different departments. Moreover, faculty members do not stay abreast of developments in any but their own fields, and so remain ignorant of how information in other academic areas impacts on their own.[13]
4. Finally, there is a failure to "engage" students in the learning process, because the curriculum is highly information-intensive and instruction is passive. [8,12]

Medical educators in Japan will readily recognize all of these "failures" as being identical to the situation that exists in Japan today. In order to understand their relevance, and the impact they have in a traditional curriculum, as it exists in Keio, and many other medical schools in Japan, it is necessary to expand on each of these "failures" to some degree.

1. ***The Failure to Recognize Teaching as a Respectable Academic Pursuit:*** This meant that teaching excellence was not one of the criteria for academic advancement. Therefore, there was no status or recognition given to faculty members who devoted their time to medical education. This acted as a powerful disincentive to faculty members to teach, so that it was just as inevitable (and completely understandable!) that faculty members should prefer to focus on research (in the case of scientists) or clinical practice (in the case of clinicians). In giving those commitments precedence, faculty members made no more than a token commitment to teaching. Among the basic science faculty, in particular, such a token commitment resulted in a tendency for faculty members to limit their focus to their individual areas of research even when lecturing to medical students, at the expense of broader or more general concepts.
2. ***The Failure to Integrate Knowledge:*** This meant that students never received a multifaceted understanding of any topic taught to them, since there was a fragmentation of interests, resources and approaches between a variety of departments responsible for teaching different aspects of that topic. With each department deciding for itself what was important, and what was not, there was a total lack of integration of course materials throughout medical school.

    A narrow focus on individual research interests by faculty engaged in teaching also contributed to the teaching of often irrelevant details to medical students, with little or no reference to its clinical

material being taught in other parts of the curriculum. This was particularly true between the preclinical and clinical courses. By extension, the traditional curriculum was indicted for (i) failing to emphasize the clinical relevance of the basic science material that was taught in the pre-clinical years on the one hand, and (ii) on the other, ensuring that the relevance of the basic sciences was completely lost on the students by the time they reached the wards.

The effect of these dual drawbacks was to devalue and denigrate the importance of the basic sciences in the minds of the students while they were engaged in learning those, and to later complicate immeasurably the important task of understanding the pathology and pathophysiology of clinical disease processes in the context of normal anatomy and physiology. Thus, when students in a traditional curriculum entered their clinical clerkships, a considerable amount of whatever basic science material they had learned was either completely forgotten or had receded so far into the background as to be inaccessible! It was left to the students to refresh this knowledge, depending on their individual motivation and understanding, and apply it, without any guidance or experience, to the understanding of disease processes and patient care.

3. ***The Failure to Coordinate Material:*** The lack of overall integration of course materials was compounded even further by a lack of coordination of material being covered on a daily basis. For example, during the basic science years, at the time a student was studying the Thorax in the Anatomy course, the material being taught in the Physiology course may well have focused on the Nervous System, while the Biochemistry course was engaged in teaching Protein Metabolism! The fragmentation of attention and interest associated with such fragmentation of learning would ensure that students failed to develop an integrated understanding of the material. The retention of such material would also be considerably impaired.

   Consider, by contrast, if the material being taught across the courses had been coordinated so that Thoracic Anatomy was taught at the same time as Alveolar Gas Exchange and Oxygen Transport in Physiology, and Aerobic Oxidation in Biochemistry. Such coordination of material in an integrated curriculum would engage the student's attention by providing a comprehensive learning experience and encourage retention, particularly if it was combined with material in Clinical Pulmonology to establish the relevance of the material.

   In most instances, the reason for the lack of integration of subject matter all through medical school was because there was *no coordinating body to oversee the curriculum*. The oversight provided by such a coordinating body would ensure that the material was appropriate, relevant and consistent between the departments involved in medical education. In the absence of such a coordinating body with the authority to enforce integration and relevance, departments were left to determine for themselves what they would teach and when they would teach it in a traditional curriculum, without any reference to its importance or its relevance to what was being taught in other courses at the same time.

4. ***A Failure to "Engage" the Medical Student in Learning:*** There were many reasons for this failure, and it is not within the scope of this paper to describe all of these. The GPEP report, in recommending widespread changes in the medical curriculum, stressed that "*a general professional education should prepare medical students to learn throughout their professional lives rather than simply to master current information and techniques.*" (ref #9, p 11).

   The traditional curriculum was not meeting this objective because "*Students are led to think that their education depends on memorizing as much information as possible. Consequently, they lack a clear idea of the skills, values, and attitudes that are important.*" (ref #9, p 5). The Panel felt that a traditional curriculum was ineffective because

   a. Students became passive recipients of information, rather than active participants in their own intellectual growth;
   b. They were not encouraged to develop the most important attributes of a physician, namely, independent thinking, problem solving, and self-directed learning.
   c. The curriculum was information centric, not problem based, and evaluation of student performance was based on recall of memorized information rather than the ability to analyze and solve problems.

   The third criticism is particularly relevant to the Japanese curriculum, which is focused almost entirely on didactic learning. Didactic lectures, which form the backbone of a traditional curriculum, are not conducive to active learning or problem solving, because they are purely unidirectional and information-intensive and the facts taught to the students in lectures are not necessarily relevant to the practice of medicine. It is not surprising that the GPEP Report felt that "*the educational yield from lectures is generally low*" (ref #9, p 12). This is not to say that didactic lectures do not have a place in a curriculum. But their role has to be de-emphasized and restricted to only to explaining difficult concepts and to clarify complicated material, rather than as a rou-

tine method of instruction.

It may be deduced, therefore, that the motivation for changing the traditional curriculum in US medical schools came from a general acceptance of the fact that it was failing to meet the needs of future physicians. The multiple "failures" associated with a traditional curriculum meant that future physicians were neither provided knowledge with reference to clinical context, nor taught how to address and solve a clinical problem in the "real world".

The recognition of these shortcomings provided the impetus to reorganize and restructure the curriculum, so that learning for medical students was integrated, interactive, and problem-based. The same recognition was also the motivation that led to a major change in attitudes towards teaching as an avenue for academic advancement. It is of critical importance to understand that an integrated curriculum could never have been implemented if teaching had not been recognized as a worthwhile academic pursuit. That fact is emphasized here but will not be discussed further, having been discussed at some length in two earlier papers in this series.[2,4] Therefore, the remainder of this paper will focus on the practical aspects of implementing an integrated, problem based curriculum in general terms, and the specific issues related to restructuring the Anatomy curriculum, to meet those goals.

Step 2
Developing and Implementing an Integrated Curriculum

A number of medical schools across the US decided to embark on the rather daunting process of restructuring and reorganizing their curricula during the late 1980's because they recognized the traditional curriculum failed to address the needs of future physicians. The University of Pittsburgh, School of Medicine (UPSOM) was one of them. In order to address and overcome the shortcoming in medical education outlined above, wholesale changes had to be made to the traditional format. The end result was a new curriculum developed, organized and implemented in the early 1990's at UPSOM.

The journey was a long and difficult one, but the road map for its successful completion was drawn up by a series of Task Forces appointed by the Dean. The tasks assigned to each of these is evident in their titles, some examples being Basic and Clinical Integration, 1st year curriculum reform, 2nd year curriculum reform, 3rd and 4th year curriculum reform, Teaching Evaluation, Doctor-Patient Relationship.

The members of these Task Forces interviewed chairmen, faculty members and students, and after considerable deliberation, they identified the deficiencies in the existing curriculum and made a number of recommendations that were then compiled into a series of joint recommendations, as follows:

A. Establish a hierarchical system dedicated to medical education
B. Introduce Problem Based Learning in the curriculum
C. Organize the curriculum into integrated "Blocks"
D. Formalize the evaluation of teachers and teaching

The new curriculum was developed based on the above recommendations. The following is a summary of the most important changes that were made to the system of traditional medical education at the University of Pittsburgh, School of Medicine, which resulted in the implementation of an integrated curriculum with an emphasis on Problem Based Learning.

A. Establishing a hierarchical system dedicated to medical education

1. A *Curriculum Committee* was formed to develop, organize, and implement a new curriculum. One of the most important goals of this committee was to create a curriculum that integrated the basic sciences with clinical medicine throughout the four years of medical school.
2. An Office of Medical Education was set up to oversee the implementation of the new curriculum.
3. A Director of Medical Education was appointed by the Dean.
4. Course Directors were appointed who were answerable to the Dean and the Curriculum Committee (rather than the Chairmen of the Department to which they belonged) in all matters related to the courses for which they were responsible, such as organization of material, and its integration into the larger framework of the Block in which it was to be taught.
5. Course Directors were chosen based on experience and talent as teachers.
6. The Course Directors were responsible for:
   - Developing the course material based on the recommendations of the Curriculum Committee.
   - Organizing and implementing the new curriculum.

B. Introducing Problem Based Learning (PBL) into the medical school curriculum: The goal of problem based learning is to promote active learning. What does active learning accomplish? It encourages students to develop the most important attributes of a physician. Students learn to become:

- Problem solvers
- Independent thinkers
- Self-directed learners

The most effective method for implementing active learning is the incorporation of Problem based learning

(PBL) in the curriculum, because it develops problem solving skills and encourages independent thinking. The key features are as follows:

- It is done in small groups
- The teacher is a facilitator, who only guides the discussion but does not direct it.
- The students identify the problem, search for ways to solve the problem and finally, solve the problem (with the help of the facilitator).

The PBL format should be familiar to anyone who has read earlier papers in this series. It is composed of two sessions, as follows:

1. Session 1: Presentation
   - To start the session, each group of students is given the case history including the chief complaint/s, history of presenting illness and relevant past, family and social history. (The PBL cases are created such that they increase in the level of complexity with the increase in the student knowledge base).
   - Further information is given to them in stages such as the results of clinical investigations including lab reports, X'Rays, CT scans and MRI's.
   - Students discuss the clinical presentation and generate a differential diagnosis.
   - Students identify gaps in their knowledge and allocate different topics ("learning objectives") for further study. These could include: etiology, normal physiology, pathophysiology, diagnostic work-up and treatment.
2. Session 2: Resolution
   - Students return with handouts showing the information they have gathered
   - They share this information with their colleagues

After the completion of both sessions, the students learn for themselves how to analyze a specific clinical problem and identify for themselves the gaps in their knowledge as it relates to that problem (they become "independent thinkers"), they learn how to resolve that specific clinical problem (they become "problem solvers") by directing themselves to gather the necessary information to fill in those gaps (they become "self-directed learners"). It can be seen, thus, that PBL is the most effective way to foster those attributes that have been identified earlier as the most important for a future physician to possess.

C. Organizing the curriculum into "Blocks": The new curriculum was divided into four major blocks, as follows:

1. The Patient-Doctor Relationship Block (26 weeks): The importance of this component of the curriculum cannot be overstated, if the desired outcome of medical education is a compassionate, caring and competent physician. The goal of this Block was to encourage the development of humanistic traits in the student physician. These traits include skill in listening and establishing rapport, recognizing a patient's perspective on illness, understanding principles of medical ethics and health promotion (*i.e.* wellness in addition to illness), and the formation of respectful working alliances with peers and other healthcare workers.[13] The specific content areas of this block that focused on the development of these traits in medical students were as follows:

- The Importance and the Art of Interviewing Patients
- Medicine, Ethics and Society
- Behavioral Medicine
- Clinical Epidemiology

2. The Basic Science Block (26 weeks): Some of the basic science subjects covered in this block were:

- The Human Body
- Cell Science and Metabolism
- Genetics
- Microbiology

3. The Organ/Systems Block (52 weeks): The major systems of the human body were taught during this block. Each Organ/System Block comprised of a comprehensive review of clinically relevant aspects of basic science subjects like anatomy, physiology, biochemistry etc., together with pathology, pathophysiology, clinical presentation and management (medical as well as surgical) of diseases in that organ/system.

4. The Clinical Block (104 weeks): This block comprised of ward rotations in Medicine, Surgery, Obstetrics-Gynecology and Pediatrics, and electives in clinical areas that varied depending on the preferences of individual students. (It must be noted, in regard to the selection of those electives, however, the GPEP Report recommended that "*Medical faculties should encourage students to concentrate their elective programs on the advancement of their general professional education rather than on the pursuit of a residency position*" [ref #9, p 17])

D. Evaluation: The key to successful curriculum reorganization is a process of evaluation that, on the one hand, lays out explicit criteria by which teachers can evaluate student performance in a wide variety of settings, and, on the other, formalizes a reward system for good teachers and a commitment to teaching. The Task Force for the Evaluation of the Curriculum created Evaluation Forms that had a number of pertinent questions for students and teachers to answer with regard to each other and the curriculum. The students, in particular, were asked to evaluate the course and the teachers. The information gleaned from these evaluations was tabulated by the Office of Medical Education and returned to

the Course Directors. The latter, after consulting with the teaching faculty identified any changes that would improve their courses and implemented them for the following year. The faculty was also asked to evaluate the students, particularly in the 3rd and 4th years of medical school. In this way, the students were able to improve their academic performance and clinical skills.

To summarize all of the foregoing, the effort to integrate basic sciences with clinical medicine in the curriculum at the University of Pittsburgh, School of Medicine had two major components:

1. Emphasize the clinical relevance of material taught in the pre-clinical years.
2. Coordinate learning within each year of medical school.

The best way to show what this meant in practice is by describing how one particular Block was re-organized in order to meet the needs of the new curriculum. In the last section of this paper, we will describe how the Anatomy curriculum was reorganized into a "Human Body Block".

Re-designing the Anatomy Curriculum into "Blocks" with an Emphasis on PBL

The most important task facing the faculty members involved in the development and organization of the new curriculum was to answer the following questions:

(a) What should be taught?
(b) How much should be taught?
(c) When should it be taught?
(d) What are the National Board requirements?

By answering these questions, it was possible to create a new problem-based curriculum that emphasized the relevance of anatomy to clinical medicine and to determine the level of anatomical detail that was to be included in the instruction of anatomy throughout the four years of medical school.

The re-organization of the Anatomy curriculum occurred as follows:

A. The Human Body Course was the first course in the Basic Science Block. The main goals of this course were to:

- Introduce students to Medical Terminology
- Teach students the 3-dimensional relationship of structures to one another and to the body as a whole.
- Teach students to correlate 3-dimensional anatomy to the relevant X'Rays, CT Scans and MRI's as these imaging techniques constitute the direct application of anatomy to clinical medicine.

The course was planned with strict adherence to the directives issued by the Curriculum Committee.

1. Lectures were greatly reduced in number, being restricted to the specific goal of only explaining difficult concepts and simplifying complicated subject matter. They were not used to teach details that were ideally suited to demonstration, e.g.:
   - Origins/insertions of muscles
   - The anatomical relationships of every structure
   - The branches of every nerve and every artery in the body
2. A number of multimodal instruction methods were used. These were as follows:
   - Dissection of the body using a dissection guide developed "in-house" to fit the needs of the course. This guide gave clear instructions concerning the important structures that the students needed to locate.
   - The opportunity to view sequential sections of the body and compare them to CT Scans and MRI's taken at comparable levels.
   - Small group demonstrations conducted by the faculty in order to explain those areas of anatomy that were difficult to explain in a lecture format
   - The use of computer-assisted programs in order to reinforce important concepts.
3. The clinical importance of anatomical concepts and material was emphasized through the following methods:
   - *Problem-Based Learning (PBL):* The creation of the PBL cases was a collaborative effort between the Anatomy Course Director and a Surgeon. There was one PBL case for each anatomical area, which conducted after the students had finished dissecting that particular area. Hence, there was a PBL case each on the Thorax, Abdomen, Pelvis and Neck.
   - *Live Surgeon/Patient contact:* This was used as an extremely effective and interesting way to demonstrate the clinical relevance of anatomy. At the end of each week (on Friday afternoon), a surgeon brought one of the patients on whom he had operated to the classroom. He gave the students the patient's case history and explained the relevant clinical anatomy. He then went on to show the students the operative procedures that he had used (with the use of intra-operative videos, where appropriate) and described the post-operative recovery of the patient. At the end, he invited the patient to the podium and asked him/her to describe personal experiences regarding the illness, the operation and the recovery following the operation. After the patient had finished, the surgeon and the patient invited questions from the students.

B. The Anatomy component in the Organ/System Block. The goals of this particular segment were:

a) To review and familiarize students once again with the basic anatomy of each organ/system as it was

covered in the Block, and

b) To learn further anatomical details not covered in the Human Body Course, and provide contextual relevance relative to pathology, pathophysiology, and treatment of diseases of that organ system.

The way in which these goals were achieved can be best understood through an example. For instance, during the Organ/System Block in Cardiology, the normal anatomy of the heart would be reviewed, including the heart valves, myocardial oxygen supply, and the conduction system, in order to provide a foundation for a better understanding of valvular disease, ischemic heart disease, and cardiac dysrhythmias. Furthermore, the practical clinical relevance of the basic science material would be reinforced in the context of imaging studies, such as echocardiography and coronary angiography.

C. Surgical Anatomy Elective Course. It is important to emphasize that this course was taught by surgeons. The goals of these elective courses were to:

- Re-introduce the students to 3-dimensional anatomy (the students got an opportunity to dissect the human body again)
- Teach the students anatomical details relevant to the clinical practice of Surgery and other specialties such as Obstetrics and Gynecology, ENT, Neurosurgery etc.

From the foregoing, it is obvious that one of the most important aspects of the new curriculum was to teach the students the clinical relevance of Anatomy at the start of their medical education. Another was to integrate it with other subjects, so that its immediate relevance was evident. Finally, students were given every opportunity to review and refresh the anatomy that they had already learned and add further details when necessary, throughout the years they spent in medical school.

Conclusion

The effort to reform medical education at Keio University School of Medicine is gathering momentum. The very fact that such a premier institution should have made a serious commitment to reform is a major development, worthy of comment and commendation. That commitment is shown in the enthusiasm and eagerness with which we were received on our trip in November 2006. One of the highlights of that visit was the PBL sessions in Anatomy conducted by one of us (KHR) to show the effectiveness of this format for emphasizing clinically relevant concepts in relation to Anatomy. The interaction with the students who attended the PBL sessions was similar in every regard to the multiple, incredibly fulfilling and exciting experiences with PBL that have been recorded in previous papers in this series.[1,2,4] Just as it was reported there, at the start of the presentation session, the passivity for which Japanese students are notorious made it difficult to get some of them to open up and participate in the discussion at first. However, as time went on, they got more animated and before long, all the students were involved in discussing the case with a vigor and intellectual curiosity that was amazing, given that they had no prior exposure to the PBL format. At the end of the Presentation session, the end result was an excellent, self-generated list of learning objectives that covered all the important issues that needed to be covered. Each student went home with one learning objective to research and resolve.

The Resolution session was even more interesting and gratifying. The handouts prepared by the students were as good as any produced by students at UPSOM, and the discussion was both lively and interactive. Most importantly, the case was resolved with the minimal of intervention on the part of the facilitator.

The success of the PBL session could be predicted, given the established track record of Keio medical students documented in earlier papers in this series.[1,2,4] It only serves to reinforce the value and the appropriateness of Problem Based Learning in the Japanese medical curriculum. There is no question in our minds that the students at Keio University would be enthusiastic participants in active learning through the inclusion of PBL sessions in the Anatomy course. In addition, we feel that it is necessary to restructure the Anatomy curriculum to make it more clinically relevant and problem-based, rather than detail-oriented, along the lines that have been described in this paper. Finally, at the risk of re-stating the obvious, we cannot emphasize strongly enough that it is critically important to have a group of dedicated teachers at Keio University who are truly concerned about the education of medical students at all levels. This has been emphasized in previous papers[1–4] with regard to clinical training, but it is just as relevant to preclinical instruction in an integrated curriculum.

Our visit has left us convinced that the will exists at Keio to implement the radical reforms that are necessary for medical education to become more dynamic and responsive to student needs. Many ground-breaking changes in medical education are already being implemented at Keio University, as detailed in an earlier paper.[4] The Herculean efforts initiated by former Dean Kitajima and continued by Dean Ikeda, and implemented by Vice Dean Aiso and Professor Amano, Head of the Department of Medical Education are to be highly commended. Their dedication and commitment to the uphill task of improving medical education at Keio University could provide a role model for other institutions in Japan that have similar goals.

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