Problem-Based Medical Education:
A Comparative Study of Three Medical Schools

By

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Table of Contents

FOREWORD

The research of this thesis began with my initial interest in surveying all of the medical schools in the U.S. to ascertain which institutions currently had problem-based medical curriculums or a problem-based learning (PBL) component. I quickly learned that a third-year medical student at Duke University, Jennifer Hoock, had recently done a similar survey and had identified these schools. There are seven medical schools in North America with problem-based curricula: Bowman Gray School of Medicine of Wake Forest, Harvard University School of Medicine, McMaster University School of Medicine, Mercer University School of Medicine, Michigan State University School of Medicine, Rush Medical College, and the University of New Mexico School of Medicine, and three medical schools with PBL components: Case Western Reserve University School of Medicine, Southern Illinois University School of Medicine, and Tufts University School of Medicine. I shifted my focus to looking at similarities and differences between the curricula of some of these schools and found a rich resource in a book published in 1987 entitled Innovative Tracks at Established Institutions for the Education of Health Personnel (Kantrowitz M, et al; WHO Offset Publication No. 101; 1987) which compares the problem-based curricula at eight national and international medical schools, as well as recommending strategies for implementing change in medical education.

My interest in exploring an area where little literature is available has directed my focus to looking at the successes and problems various schools have experienced in implementing such curriculum, and the creative solutions which have evolved to meet these obstacles. In addition, my visits to several schools and interviews with faculty, administrators, and students have

stimulated my interest in examining how these programs evaluate their students and themselves, how evaluation methods in medical schools (in the classroom and on the wards) "drives" and defines medical curricula and teaching style, and how the teaching style affects students' cognitive development as clinical problem solvers and their approach to patient care and management.

A major portion of this thesis is based on primary sources -- unpublished articles, reports, and personal interviews. Where there are appropriate articles and books, I have attempted to reference them, but the literature is only now being written on some of these programs.

What is most exciting for me is that through researching, interviewing, and attending conferences I feel I have just begun what will be a lifelong journey or exploration in examining and critically assessing innovative developments in medical education -- a field where such developments have been long overdue.

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Part I: Problem-based Medical Education:

1) Historical development:

As has been shown throughout the past eighty years, the form and content of medical education responds to the social, economic, and political forces of the times, although often quite slowly. Just as the structure and focus of medical education in the early 1900's lagged behind the advances in medical science at that time (Starr, P; 1982), the same is true today with respect to medical education and the current social and economic realities of medicine (i.e. the explosion of medical knowledge, exceedingly high cost of health care, corporatization of medicine, etc...).

Starting with the John Hopkins School of Medicine model in the late 1800's and culminating with the recommendations of the Flexnor report in 1910 (Flexnor, A; Bulletin No. 4; 1910), medical education in the U.S. has slowly evolved toward a structure that rewards scientific expertise and research -- a "model of medical education more closely wedded to research than to medical practice" (1). Although Flexnor appreciated the importance of training general practitioners and producing physicians who were broadly educated and socially minded, the model he chose focused almost exclusively on the biomedical aspects of disease, producing increasing specialization among physicians and fostering a faculty devoted to publishing research (Light, D; 1983). Following the Flexnor-induced shake-out of the commercial and proprietary medical schools and the elevation and standardization of requirements for medical education and training of physicians, the number of medical schools was reduced by more than 50%, and physicians and the AMA succeeded in elevating allopathic medicine above osteopathic, chiropractic, and homeopathic medicine and keeping non-M.D.

practitioners out of the mainstream of medical practice (Starr, 1982).

During the next seventy years, the methods and structure of medical education changed very little, in part due to the social and economic impact (and support) of Flexnor's model. The pace of medical discovery increased rapidly (especially after World War II), spurred by billions of dollars in federal aid each year to finance biomedical research, and with government support "teaching hospitals transformed themselves into vast temples of research and laboratories blossomed with equipment of immense sophistication" (2). During the 1950s and early 1960s, changes in medical education were limited to small experiments: Case Western Reserve introduced the "organ systems" approach to teaching, Boston University pioneered the six-year B.S./M.D. sequence, Cornell University founded a Comprehensive Care and Teaching Program, and the University of Colorado instituted a General Medical Clinic -- the latter two being attempts to train more "humanistic" physicians (Light, 1983). In the late 1960s, public officials became concerned about the lack of primary care physicians in the U.S. and federal funds became available for the creation of new medical schools (especially those which would develop programs in primary care), including the development of three-year medical curricula (Rosinski, E; 1983). However, the traditional emphasis on research and specialization persisted and most curricular changes were minor; the lack of significant change was primarily due to lack of leadership and faculty commitment, and lack of data on the effects of such changes. The pioneering university in medical education was not in the U.S., but in Canada. In 1969, McMaster University created a medical school program based entirely on problem-based learning (PBL); it was a curriculum which would serve as a model for PBL programs to come (Neufeld, VR & Barrows, HS; 1974).

In the mid and late 1970s, curricular modifications were aimed at making medical school programs broader and more "relevant" with the development of new courses in bioethics, human sexuality, nutrition, history of medicine, etc..., but such courses were offered as electives and made up a small portion of the curriculum (Rosinski, 1983). Studies on the effectiveness of PBL were being conducted at this time by Howard Barrows, Robyn Tamblyn (both of McMaster University), and others (Barrows, HS & Tamblyn, RM; 1980). PBL medical education programs (specifically, parallel curricular tracks) were instituted at Michigan State University School of Medicine (1973) and the University of New Mexico School of Medicine (1979).

In the early 1980s, there were several influential conferences and reports on the state of medical education which had considerable impact on the development of problem-based and innovative programs. In 1982, the Macy Foundation sponsored a conference on medical education which recommended far-reaching reforms in the teaching of medical students (Friedman, CP & Purcell, EF; 1983) and a year later, the Institute of Medicine published a study on medical education and societal needs (Institute of Medicine; 1983). Both Derek Bok's address to the Harvard Board of Overseers appraising the current discontent with medical education (Bok, D; 1984) and the GPEP report (released in 1984) calling for sweeping changes in the training of physicians increased the impetus for innovation. The result was the development and implementation of PBL programs or components at several medical schools: Mercer School of Medicine (1982), Rush Medical College (the "Alternative Curriculum", 1984), Harvard School of Medicine (the "New Pathway" program, 1985), Tuft's School of Medicine (1985), and Bowman Grey School of Medicine (the "Parallel Curriculum", 1987).

Why medical education has changed so little in structure and form (until recently) in the face of persistent criticism and during an era when the practice of medicine has changed so dramatically, is an issue of much speculation. One important reason is that faculty are given very little recognition for the time and effort they spend on teaching. Professional recognition, academic advancement, and public acclaim all go to those who succeed in research, just as the rewards of material gain favor patient care (Bok, 1984). Teaching hospitals need (and will pay handsomely for) academic physicians who can attract patients and fill beds. Clinical facultys' primary obligation is to their hospital and their department (which depends far more on federal research funds and patient fees than on the medical school). Second, ordinary medical students rank well below residents and fellows (or Ph.D. students and postdoctoral fellows) in competing for whatever time and attention professors and clinical faculty are willing to give. Third, the Western medical view of human disease as a scientific phenomenon consisting of deviations from a biomedical norm (which are thought to result from a determinate, finite set of somatic or biochemical causes), and the "narrow" concept of the physician's role have had a major effect on the nature of medical education. In a profession which emphasizes scientifically determined findings, faculty are inclined to impart knowledge didactically, as truths to be described rather than problems to be discussed (Bok, 1984). Matters outside the domain of science (such as psychosocial factors, bioethics, prevention of disease, and health policy, all of which can significantly influence health and health care) are left largely to other professionals and relegated to secondary status in medical curricula. In addition, over the past seventy years, physicians have increasingly based their professional reputation and competence

on their ability to know information rather than their ability to research information, hypothesize and solve problems, and use judgement and insight, and along with scientific and technological advances, they have "sold" this image of a physician to the public. However, there are new forces in the medical environment which are changing and expanding the concept of a physician's role and have been instrumental in promoting a problem-based approach to medical education.

First, in an age when it is predicted that information doubles every 22 months, the tremendous growth of scientific knowledge is making impossible demands on human memory and creating new difficulties in analyzing problems. Scientific progress constantly expands the range of alternative diagnoses to be considered and the number of tests available to test a clinician's hypotheses. As problems become more complicated, physicians will need to become proficient in the uses (and limitations) of computer information retrieval and analysis, statistics, and decision theory (Bok, 1984). Second, up to 50% of all patients who visit primary care physicians have no biomedical ailment, yet most physicians are much more likely to overlook (or not deal with) significant emotional, behavioral, and cognitive disorders than physical signs and symptoms. By virtue of their expertise and their involvement with people at particularly vulnerable times in their lives, physicians can have a major impact in persuading their patients to follow treatments and alter poor health habits, but only if doctors take the time and develop the skills to help patients understand the importance of changing their behavior (Bok, 1984) -- the importance of psychosocial factors in disease and an understanding of psychology is critical for physicians. Third, with the rapid growth of life-sustaining techniques and malpractice litigation, physicians more than

ever need to be exposed to bioethical and legal issues (as they relate to medicine) early in their training. Fourth, in order to contribute and be involved in influencing policies to control rising health care costs, physicians need to know more about the issues of health care policy and administration. In summary, a problem-based approach to medical education has, and is, being seen as a method to incorporate into the curriculum a range of subjects which have a significant impact on health care (yet are not biomedical in nature), along with an entirely new approach to learning and integrating the basic sciences with clinical practice.

2) Definition of Problem-Based Medical Education:

Problem-based learning is best defined as "the individualized learning that results from working toward the solution or resolution of a problem" (3). In this approach, the problem (or case) is not offered as an example to which to apply a previously learned body of facts or principles. In problem-based learning (PBL), the student takes on the case first and through the process of resolving the case is stimulated to learn related basic science and/or clinical facts, principles, or concepts. In this method, the student is actively involved in his/her own education, can shape it to meet personal educational needs, and can integrate information from many sources and fields into a "meaningful" construct or framework for use in solving future cases (Barrows, HS and Tamblyn, RN; 1979). This is an important point because cognitive psychologists feel that learning is most effective if it is tied to information already known by the student, and if material is learned in the context in which it will eventually be applied (Hoock, J; 1988).

Problem-based learning is a process in which a problem or case serves as a stimulus for learning. The process involves an orderly sequence of steps which

are directed towards acquiring and applying the necessary information to deal with and resolve the case, while simultaneously developing skills in self-directed learning. The steps involved in the reasoning process of PBL are (in order): 1) identify problem(s), 2) generate hypotheses (of causes and mechanisms), 3) rank hypotheses, 4) test hypotheses, 5) rerank hypotheses (and decide on tentative diagnos(es), and 6) treat or manage problem(s) -- see figures 1 & 2. Thus, incorporated into the PBL method is the system of clinical reasoning used by physicians and researchers on a daily basis, which includes: 1) information gathering, 2) hypothesis generation, 3) research and investigation, 4) hypothesis revision and problem synthesis (Hoock, 1988) -- see figure 3.

An aspect of PBL which sets it apart from other "problem-solving" methods in medical education is the use of the "ill-structured problem", first defined by Herbert Simon. This is the situation most frequently encountered in clinical practice or research where: "1) all the information necessary is not available at the onset of the problem; 2) as more information becomes available, the nature of the problem may change completely; 3) there is no one "right way" to solve the problem; and 4) one is never sure the problem is solved" (4). Situations like these with a high degree of uncertainty and ambiguity are best resolved using a hypothetical-deductive approach, like PBL (Hoock, 1988).

Another unique feature of the PBL method is the emphasis on student- or self-directed learning . PBL is usually conducted in a small group tutorial setting of five to eight students and one faculty tutor. Student-directed learning means that students are responsible for directing the tutorials themselves and managing their own time outside of tutorial (much of which is

unscheduled). When a tutorial group meets for the first session of a case, the students are initially given the presenting complaint of an actual patient. From this, they work together to identify the problem(s), generate possible hypotheses, and rank and test these hypotheses using their current knowledge. The emphasis is on the underlying mechanisms and causes, and not on the differential diagnosis. The students are given more data about the case when they feel as a group (and the tutor agrees) they have satisfactorily explored the current information. The group next identifies "learning issues" brought up by the case which include central basic science issues which will be studied by all members before the next session and minor topics which individuals will investigate and report on. The second session often begins with discussion and reranking of the current hypotheses based on students' research and the identification of more learning issues after receiving additional information about the case. The beginning of the third session is usually spent discussing the tentative diagnos(es) and treatment plan(s), with the latter portion reserved for starting a new case. Cases take anywhere between 2-4 sessions to complete depending on the length and detail of the case. The role of faculty tutors and tutorial evaluation will be discussed at a later point in this paper.

In PBL, students also develop the ability to self-evaluate (i.e. to know and admit what they don't know) and learn the skills of self-teaching, as well as gaining an understanding that both of these processes must continue throughout their lives as physicians (Hoock, 1988).

As an overall teaching technique, PBL emphasizes: 1) the use of clinical and investigative cases as the basis for education (in order to structure the students' learning in a clinical or relevant context, 2) the development of

cognitive and clinical reasoning/problem solving skills to enable students to become "critical thinkers", 3) the "active" integration of basic science information with clinical cases, including the incorporation of psychosocial, ethical, and other important non-biomedical issues, 4) the development of self-directed learning, self-evaluation, and information searching/researching skills, and 5) a reduction in the amount of factual information conveyed, putting an emphasis on the mastery of basic principles rather than memorization of detail. Numerous studies have shown how little information students actually remember from lectures (Anderson & Graham, 1980; Levine & Forman, 1973; Miller, 1978); in some cases, students will have forgotten up to 90% of the factual information they have learned by the time they graduate (Neuhauser, D; 1982). There is evidence which shows that the small amount of information which can be remembered (from a traditional lecture format) is often not recalled in the clinical context when it is needed (Gonnella, JS et al; 1970). To make matters worse, cognitive scientists have shown that learning a great deal of factual information often makes it harder to remember the important, major concepts (Larkin, JH; 1983).

In summary, whereas in the traditional lecture curriculum, the very effort to "cram all the essential information into the heads of passive students tends to produce the very opposite of the active, inquiring scientific mind that every physician should possess" (5); in PBL programs, students are happier and more excited about learning (especially during the second year). They have more control over their lives, fewer somatic symptoms and illnesses, nearly 100% attendance of (and preparation for) tutorials, and simply more fun learning.

Part II: Goals and Objectives: three programs:

The following section will focus on the goals and objectives of the PBL programs at Harvard University School of Medicine, University of New Mexico School of Medicine, and Tufts University School of Medicine while giving an overview of each program and its current status. In addition, I will comment briefly on historical, political, and/or curricular trends affecting or being affected by these programs which have not been reported in the literature.

1) Harvard's New Pathway: experimental track to overall curricular reform:

a) Overview:

The New Pathway program, or Oliver Wendell Holmes Society (OWHS), began as an experimental alternative track at Harvard Medical School (HMS) in September, 1985 with 24 students. The following fall, OWHS enrolled 38 students. In September, 1987, the concepts, and, in part, the practices of the New Pathway program were extended to the entire first-year entering class of 165 students (6). What had been referred to as the "old" or "classic" pathway and the alternative "new" pathway became united as the "common" pathway. The OWHS, as one of five academic societies of HMS (Harvard Medical Focus, 10/17/87), would continue to exist and offer its students a more psychosocial approach to medicine as well as a two-year longitudinal clinical skills course which the other four societies (arbitrary divisions to make four equal sections of the class, except for students in the Health Sciences & Technology (HST) curriculum), would not receive.

The new pathway approach, now embodied in the common pathway, was, and is, "intended to provide the perspective of a single faculty looking at an entire span of general medical education" (7). When contrasting the new pathway

concept to the "subcontract" approach, which puts discipline-oriented departments in charge of distinct, individually-organized courses, important elements of this new approach emerged:

-- Equal emphasis on attitudes, skills, and knowledge, and careful selection of essential knowledge to avoid information overload.

-- Close student-faculty contact in small groups, and an environment in which students and faculty learn together.

-- Interweaving of clinical and basic science elements throughout the curriculum.

-- Reduction of lecture time, and use of active educational methods such as small group, problem-solving tutorial discussions.

-- Emphasis on topics such as health promotion and disease prevention, and on skills such as information management, critical analysis, self-directed learning, and self-assessment.

-- Approximately one quarter of the student's time over four years available for elective experiences, including an opportunity to pursue a topic in depth leading to a thesis (required of OWHS students only). [Ramos, M and Moore, GT; 1987; OWHS Program Guide, 1987-88].

b) Curriculum:

Currently, the common pathway curriculum is composed of four consecutive interdisciplinary basic science/pathophysiology blocks -- The Human Body; Metabolism and Function of Human Organ Systems; Genetics, Reproduction, and Development; and Identity, Microbes, and Defense -- in the first year and 2-3 consecutive blocks -- Life Cycle; The Nervous System and Human Behavior; and Human Systems -- in the second year. The blocks in year II of the common

pathway are currently being reorganized for first-year students who entered in fall, 1987 (personal communication; Wetzel, M; 1988). Each block attempts to introduce material from several traditional lecture courses in an integrated fashion. For instance, course material for the Human Body block is drawn from the disciplines of gross anatomy, histology, and radiology; topics for the Metabolism and Function block are derived from biochemistry, molecular biology, and physiology (8).

The central learning format is the problem-based tutorial group which is composed of one faculty tutor and six students. Tutorials for all blocks meet an average of three times per week, but each block has a unique format; the Human Body block starts each morning with a tutorial, whereas the Metabolism and Function block has tutorial only two times per week. The tutorials use problems (usually paper patient or investigative cases) as a vehicle to formulate an agenda of basic science and pathophysiology issues to be covered related to the case. Five hours of lecture per week (or less) correlated with the current case is the goal of each block, but some blocks in the common curriculum have expanded to as much as ten hours of lecture/conference per week, for example, the Metabolism and Function block in fall, 1987 (personal communication; Felitti, GI; 1988). Three to five afternoons per week are pruposefully kept as unscheduled time during which students are expected to take electives or engage in self-directed study and researching for tutorials and lectures.

The longitudinal block called Clinical Skills and Patient/Doctor Relationships is offered to OWHS students only and meets one full afternoon every other week for the first 2-4 years. This course focuses on the following key topics (OWHS Program Guide, 1987-88):

-- clinical skills development in history taking and physical exam.

-- the patient/doctor relationship and communication.

-- health promotion and disease prevention.

-- medical ethics, and social/behavioral sciences related to medicine.

Tutorials on topics outlined above, clinical skills sessions, contact with patients, and visits to unique health care sites are the major activities. Two students work with the same clinical preceptor throughout the first two years (and possibly beyond), and tutorials usually involve six students, three preceptors, and a team psychiatrist or social scientist (Ramos and Moore, 1987).

The third and fourth years of the common pathway program will include ten months of required core clerkships, one month of advanced medicine subinternship, two months of advanced basic science and pathophysiology, and the rest of the time in elective work. The areas in which the new pathway approach has had the greatest impact in the clinical years are the new two-month combined obstetrics/gynecology and pediatrics clerkship (with a strong emphasis in epidemiology), a new interdisciplinary ambulatory care clerkship, and an independent thesis project -- the latter two being requirements for OWHS students only.

c) Student evaluation:

In the common pathway program, faculty tutors provide students with ongoing evaluation (at the end of each tutorial or case) and a traditional multiple-choice examination is given at the midpoint and end of each block. Several of the first-year blocks in the New Pathway program also utilized an exercise developed at McMaster University School of Medicine called the "triple jump". A student is presented with a problem, develops a hypothesis and

learning issues/agenda, spends a finite amount of time consulting references and resources, and then presents his/her analysis to an examiner (Ramos and Moore, 1987). It is not known by the author whether the triple jump method of evaluation will be used in blocks of the common pathway program. Common pathway students will be required to pass part I and II (NMBE-1 and NMBE-2, respectively) of the National Medical Boards in order to graduate.

d) History and development:

The development of Harvard's New Pathway program is well documented in Kantrowitz's (et al) book Innovative Tracks, and I will only comment briefly about it here.

It is apparent that since his appointment as HMS Dean in 1977, Dr. Tosteson has assigned a high personal priority to the education of medical students and has been instrumental in promoting workshops, symposia, and faculty-student retreats to redefine the educational objectives of HMS and devise an entirely new curriculum to meet these goals. Early ideas for curricular redesign included the Dean's proposal of a 7-year pathway to the HMS M.D. degree beginning in the third year of undergraduate college (which was eventually rejected), the designation of a planning group of prominent HMS faculty to centrally plan, coordinate, and control a pilot curriculum for a limited number of students, and a 60%-40% balance of shared (featuring problem-solving and case method) and elective (independent, self-directed learning) coursework.

The challenge in creating an innovative track lay in the fact that HMS is a research-oriented institution whose faculty regard its educational traditions with respect and satisfaction. To many faculty, giving permission to one group (the eventual OWHS administration, whose members for the most part were not

from the ranks of HMS basic scientists) to design a new curricular track might lead to their loss of control over the development and implementation of new courses. And, in fact, during the first two years of the New Pathway program, the Metabolism and Function block was developed and taught by individuals who were not full-time faculty within the departments of Biochemistry and Physiology (personal communication; Good, B; 1988). In the face of this enormous challenge, there were several principal groups or individuals whose leadership was critical in bringing the New Pathway program into being (Ramos and Moore, 1987):

1) Dean Tosteson, who was determined that the New Pathway program would be his lasting contribution and legacy to HMS,
2) Original Planning Group, prominent HMS faculty members whose recommendations and support of the program were instrumental in gaining more overall support from basic science faculty,
3) OWHS Administration, a group composed primarily of educators and physicians with administration/education backgrounds (as opposed to basic scientists), and the
4) President of Harvard University, whose report to the Harvard Board of Overseers for 1982-83 criticized the current state of medical education and called for the training of more humane physicians (Bok, D; 1984).

Two aspects of the development of the New Pathway program which differed from that of other medical schools with PBL curriculum were: 1) that this innovative track was developed as a prototype for curricular reform to be integrated into the entire curriculum (in contrast to UNM's Primary Care Curriculum or Rush Medical College's Alternative Curriculum), and 2) that Dean

Tosteson had no intention of promoting the development of more primary care physicians through this pilot ptogram (as opposed to UNM's PCC or Mercer University's PBL program) and was adamant about not giving up Harvard's "foothold" in academic medicine or basic research as HMS redefined its curriculum.

An aspect of the history and development of the New Pathway program which has not been reported in the literature is the political and administrative forces which led to the creation of the common pathway for all students, and the struggles between the OWHS administration and individual basic science departments over control of the development and actual teaching of the new tutorial blocks. I believe this historical/political perspective is crucial in understanding how HMS moved so quickly from the implementation of an innovative track for a small number of students to a new curriculum for the entire class, in an institution where there has been substantial faculty resistance and skepticism about the new pathway approach since the beginning. The following interpretations of these events primarily reflects the views and opinions of Dr. Byron Good -- a faculty member of the Department of Social Medicine at Harvard who has been closely observing these developments over the past several years.

e) Creation of the Common Pathway program:

As has been stated earlier, perhaps the single most important force which pushed ahead the development of a new medical curriculum at Harvard was the vision and commitment of Dean Tosteson [of HMS] to the idea that only by embracing an entirely different concept in teaching philosophy and methodology could meaningful change take place in medical education. Typically in medical schools, small and frequent changes are made in individual courses over a long

period of time. It was Tosteson's belief, however, that it was politically and administratively impossible to affect significant change this way, especially at an institution steeped in a research tradition where the medical education had remained basically static for more than 70 years.

There were two major problems which immediately beset the creation of the new curriculum. First, by its very creation, the "new" pathway was put in direct competition with the "old" pathway implying that the existing curriculum was inferior and medical school was "being taught poorly". This caused a major split between groups of students and faculty who were involved in either program. Second, the philosophy and language used to advertise and describe the program was from the field of education; there was much "education talk about problem-based this and that", but very little substantial "science talk". This caused a great deal of resentment among basic scientists at Harvard who had been teaching medical students for many years. In addition, the individual Dean Tosteson chose to head the development of this program was not a member of the Harvard faculty, but was the founder of a local HMO and an ["EST-trained"] physician and administrator. As a result of these controversial issues, the Dean never successfully engaged the imaginations or support of a large portion of the HMS faculty.

The receptiveness of various basic science departments and faculty to the new pathway approach had much to do with the politics, personalities, and attitudes of these groups [and individuals] towards major curricular change. Whereas a majority of the anatomy faculty strongly endorsed the concepts of PBL, many biochemistry and physiology faculty were opposed to this method of teaching. With a couple of influential faculty (well known for their extraordinary teaching abilities) leading the way, respected members of the

Anatomy department became centrally involved in designing, and later teaching, the interdisciplinary anatomy/histology/radiology block, the Human Body. Control of curricular structure and content remained within the department itself. Conversely, the biochemistry and physiology block, Metabolism and Function, was developed under the auspices of the OWHS administration and taught by faculty and clinicians who were outside of these departments. The block was designed and taught without utilizing the input and talent of well-known, accomplished scientists within the Biochemistry and Physiology departments. The block was not successful during the first two years of the new pathway program -- students claim they learned very little -- and the revised version for the common pathway presently reflects a more traditional lecture approach. Other HMS basic science departments (and their corresponding curricular blocks) lie between the extremes of the Anatomy department which has embraced the PBL approach to medical education and the Biochemistry & Physiology departments which have strongly opposed its implementation.

The transition from the parallel track, New Pathway program to the common pathway curriculum in 1987 was the result of several competing forces. First, Dean Tosteson clearly wanted to apply the successes of the new pathway approach to the entire curriculum; a separate, alternative PBL track would only be seen as a partial victory for the Dean. However, there were many opposing HMS faculty who felt that although the New Pathway curriculum would be difficult to eliminate completely, it could be "contained" to a small program. Even though the Dean wielded tremendous influence and power at Harvard, the outcome was by no means clear. Second, the anatomy faculty decided that teaching courses in two curricula was very inefficient and they could gain more "favor" with the Dean by supporting his single curriculum objective. Their public

recommendation, however, was simply to align the schedules of the two curricula on a block or "vertical" curriculum and allow departments to use any style of teaching they desired. The recommendation was eventually approved by a majority of HMS faculty and [this] led to the creation of the common pathway program and the resolution of several issues.

First, moving to a single curriculum resulted in curricular development at HMS being placed back in the departments' control (where it had been prior to the creation of the New Pathway program). Second, the "new" block curriculum forced departments to create new courses (which often included a combination of PBL and lecture formats). Third, although the common pathway curriculum would have fewer tutorials and more lectures (>5) per week, and be less integrated and less tutorial driven than the New Pathway program, the Dean could assume credit for bringing PBL to the entire class. Fourth, the OWHS administrators were ambivalent about the creation of the common pathway program; although they had succeeded in institutionalizing PBL for the entire class, many felt the transition was premature and they had not gotten the opportunity to refine the New Pathway program to the point where it would be accepted by the faculty with fewer changes. In addition, they were no longer in control of the development of PBL at Harvard and were now functioning as support staff to various departments in the administration and development of the common pathway curriculum.

2) University of New Mexico's Primary Care Curriculum (PCC): Development of a parallel track program:

a) Overview:

The Primary Care Curriculum (PCC) began as an experimental PBL track at the University of New Mexico School of Medicine in September, 1979 with 20

students. For the past nine years, PCC has flourished as a small, parallel track (in an overall class of 75 students) offering its students tutorial problem-based learning, early (longitudinal) clinical skills development, and a rural community health care experience. Like Harvard's OWHS, about twice as many students apply to PCC as are accepted, and acceptances are determined by random stratified selection (to ensure a heterogeneous class by gender and ethnicity). Each PCC student is matched closely with a traditional track student (by age, sex, ethnicity, and GPA) to allow for longitudinal comparative studies -- one of the advantages of a parallel program.

b) Curriculum:

The first six and one-half months is an on-campus phase (Phase 1A: see figure 4) consisting of three eight-week tutorial units (like Harvard's "blocks") -- Intro to Anatomy & Histology; Intro to the Disease Process (Physiology & Biochemistry); and Intro to Microbiology & Pharmacology -- and a longitudinal clinical skills course which meets one morning per week. The central learning format is again the problem-based tutorial group which is composed of one faculty tutor and 4-5 students, meets three times per week, and uses a variety of paper and simulated patient cases. Similar to the experience in tutorials at HMS, PCC students spend a good portion of their tutorial time in the first unit working on group process and decision making; second-year tutorials move faster and students spend more time on content.

In the clinical skills course, PCC students practice history taking and physical exams on fellow students, faculty, and patients, and learn community health assessment skills. During the second half of this course (and in other clinical electives), PCC students spend one-half day per week with a preceptor applying and practicing these skills in a community setting (and begin to

assess family and community risk factors) in preparation for phase 1B.

Phase 1B is a four and one-half month off-campus clerkship where each PCC PCC student works with a primary care physician (preceptor) in a rural, medically underserved area of New Mexico. One-half of each day is spent doing histories and physical exams on clinic patients; the other half is devoted to independent study of basic science learning issues the students' patients illustrate, as well as learning about community-oriented primary care. In addition, they are required to complete a community project which involves investigating, identifying, and analyzing a community health project or issue (Primary Care Curriculum; UNM; 1988). Unlike the tutorial setting where psychosocial issues are barely discussed (true at both HMS and UNM), during the phase 1B experience PCC students learn to appreciate the importance of issues such as alcoholism, child abuse, and occupational health (to name a few) as they become involved in the care and management of real patients in the community. PCC students have the opportunity to spend time with several other physicians in the community to observe the physician's work and lifestyle and his/her relationship with patients and the community. Progress of PCC students, as well as their interaction with their preceptors, is reviewed by university-based faculty members who serve as "circuit riders", each of whom visits several sites every 3-4 weeks. In applying PBL skills in a real-life patient setting, PCC students come back from the phase 1B experience with a renewed desire and motivation to learn the basic sciences (and a greater sense of what they need to know) because of seeing first-hand its importance in diagnosing and treating patients. The experience "provides students with a more realistic basis upon which to orient the rest of their medical school experiences" (9).

During the second year, PCC students return to the campus for phase II consisting of four 8-12 week units in which tutorial case problems are organized according to organ system. Students report that tutorials run more smoothly, more content is covered and in greater depth, case problems are often reinforced by similar patient experiences in phase 1B, and there is less anxiety than before because tutorials are seen as one of several learning environments as students begin to take more responsibility for their own education (personal communication; Hayes, M; 1988). The patient cases and emphasis of the last unit are decided by each tutorial group so that students can address individual areas of weakness. In the spring of the second year, preparation for the NMBE-1 takes a high priority and PCC students form well organized study groups to facilitate their preparation.

The third and fourth years of the PCC program are similar to those of the traditional program (i.e. the traditional clinical clerkships and electives), except that PCC students are required to take a two-month, primary care rural subinternship during the last year. A social medicine pathway for years III and IV will be available to PCC (and some traditional track) students starting in June, 1988, and will strive to encourage and support a hypothesis-generating, PBL approach to patient care and offer a variety of ambulatory and community oriented patient care experiences.

c) Student evaluation:

Unlike HMS's New Pathway program, UNM's PCC does not use traditional multiple-choice examinations to evaluate students' progress. In PCC, the grades are based on the evaluation of faculty tutors, self-evaluation, and peer evaluation in a variety of areas: acquisition and integration of knowledge, scientific reasoning and communication, and group and self assessment skills.

These evaluations are made at the midpoint and completion of each unit.

In addition, at the end of most units, PCC students are evaluated through the use of an Individual Process Assessment (IPA) on their ability to deal appropriately with a simulated patient problem. In this exercise, each student is given two hours to do an appropriate history and physical exam on a simulated patient, an individual trained to portray a particular combination of signs and symptoms (Northrup, DE; 1988). Within the next 48 hours, the student must: 1) prioritize the significant findings and formulate hypotheses, 2) order tests (if necessary), giving reasons why and being cognizant of their cost, 3) list learning issues, and 4) do research on the basic science issues underlying this patient's problems. The student then meets with a faculty member who critiques the student on his/her prior interaction with the patient (by reviewing the videotape of their encounter); evaluates the student's list of hypotheses, learning issues, and use of tests; and orally examines the student's depth of knowledge and ability to think critically about learning issues preselected by the student. Faculty assessment of the IPA is that it is a very effective technique in evaluating an individual's ability to integrate the basic and clinical sciences and clinical skills in a realistic setting and timetable. As an assessment tool of an individual's command of overall content covered during one unit, it is obviously quite limited (especially when the student can choose not to be examined on an area of basic science he/she is not comfortable with).

The third evaluation technique is used to help PCC students study effectively in preparation for the NMBE-1, since unlike traditional track students, they get very little practice taking multiple-choice, Board style exams. Three times during the first two years (see figure 4), the students

are given a two-day comprehensive basic science exam called a "Shelf Board" -- a seven-subject exam similar to the NMBE-1.

3) Tuft's Case-study program:

a) History and curriculum:

Tuft's School of Medicine problem-based learning program was created as part of a major curricular modification at the which was instituted in September of 1985. This reform included: 1) moving towards a more "horizontal" curriculum while retaining an organ systems approach to integrating lecture content between concurrent courses, 2) the introduction of new courses such as epidemiology, ethics, history of medicine, etc..., 3) the construction of a new, state-of-the-art library, and 4) the development of a two-year, longitudinal, PBL case-study sequence required for all students (personal communication, Kennison, RD; 1988). The spirit of change and innovation which gave some faculty (many of whom had felt disenfranchised for many years) the opportunity to get what they wanted also encouraged faculty to be more receptive to new ideas, including problem-based learning. The stimulus for change and introducing PBL at Tufts was Dean Banks, the new Dean, who was very interested in educational reform and who organized a committee which spent 2-3 years designing the curricular modifications and was responsive to the recommendations of the G.P.E.P. report. A further impetus for implementing PBL and designing Tuft's case study program were the Tuft's faculty who attended tutor workshops at McMaster University (where the entire medical school curriculum is based on case study) and Dr. Luis Branda (professor of Biochemistry at McMaster) who was hired as a consultant to help set up the case study sequence (Dean's Rounds, Tufts University SOM, 1986).

Tuft's PBL program differs sharply from those at HMS and UNM in that it is

embedded in a lecture-driven curriculum with one of its main objectives being to help students integrate material learned in lecture; unlike other programs, it is not the method via which students are expected to learn all (or most) of the content in the first two years (Kennison, 1988). Clinical cases are chosen or developed for their integrative potential and there is a strong emphasis in tutorial on the psychosocial, ethical, public health, and economic issues of a case unlike the PBL programs at HMS and UNM. Tutorials groups are composed of six students and a faculty tutor and meet once (for two hours) per week each semester during the first two years. A typical case is written in 5-6 sections, with issues pertinent to 2-3 sections identified, discussed, and/or researched in or between each tutorial session, and takes three weeks (or sessions) to complete (De Golia, P & Hoock, J; 1988). Tutor training involves a one and a half day workshop with occasional follow-up workshops during the semester. Like the PBL programs at HMS and UNM, faculty tutors at Tufts are trained to be effective group facilitators, not expert resources (Kennison, 1988). Of the 120 faculty tutors trained so far, about two-thirds are clinicians and one-third basic scientists.

b) Faculty response:

A basic principle of Tuft's case study program has been to introduce PBL using an "evolutionary" rather than a "revolutionary" approach and watch this method of teaching and learning influence faculty and grow with time. Faculty who helped to develop Tuft's program feel they have produced a model which is more easily adaptable to a majority of medical schools who want to introduce PBL into their curriculum without turning the institution upside down or developing a separate parallel track (Kennison, 1988). The method of putting a sequence of carefully constructed cases (forming an integrating core) within

a more conventional curriculum is unique to Tufts and is considered by Dr. Branda (an acknowledged expert in case-study curricula) to be the best technique of introducing PBL in established programs (Dean's Rounds, 1986). Involving basic science faculty (who lecture in the conventional curriculum) in tutorials as facilitators is one of the most effective ways to show faculty exactly how PBL can be used to introduce concepts and principles to students in a more effective method, and helps to prevent separating faculty into those who teach in the conventional curriculum and those who tutor in the PBL portion. There are PBL spokepersons on every committee involved with planning curricular changes in lecture courses and basic science faculty serve on case development committees which allows for cross-fertilization of ideas and a great deal of integration between PBL and lecture formats in the curriculum (Kennison, 1988). All of these factors have made the PBL approach less controversial and more accepted by the basic science and clinical faculty at Tufts School of Medicine than at most medical schools with PBL programs (as evidenced by the fact that there have been virtually no basic science areas in which it has been very difficult to design an effective, integrative tutorial case).

c) Obstacles and future developments:

Two the the major problems which PBL administrators have experienced with Tuft's case study curriculum include: 1) making sure non-biomedical issues illustrated by the case are addressed within tutorial, and 2) maintaining student interest in PBL during the second semester of year II. Over time, students tend to think of the PBL program as too process oriented and not as content driven as the rest of the curriculum (and therefore expendable). They become nervous they are not learning enough via PBL and begin asking for more content -- all, in part, related to the anxiety created by the NMBE-1 at

the end of the second year (Kennison, 1988). PBL administrators are developing more interesting ways to present patient cases in the second semester of year II (ie, simulated patients, etc...) and are looking at ways to make tutorials (and evaluation of students in tutorials) more content driven and integrated with the lecture curriculum (i.e. such as giving out multiple-choice questions related to each case covering material which may be seen on the NMBE-1). In the spring of the second year, preparing for the NMBE-1 becomes more important than lecture exams which have a greater priority than tutorial evaluations (which are process oriented evaluations like those in UNM's PCC program without the IPAs), and this prioritization by the students (driven by the value placed on each evaluation method) gives each activity a different level of importance and puts PBL last on the list. Interestingly, third year students are very positive about their PBL experiences because the process they have learned in tutorial is very useful for surviving clinical clerkships (Kennison, 1988). Finally, future developments at Tufts include creating an environment on the wards in which a PBL orientation is supported and encouraged, increasing the amount of ambulatory care experience students are exposed to within each clerkship, and evaluating if the current case-study program should be expanded in terms of student time commitment.

Part III: Obstacles and Solutions:

The following section will focus on current obstacles and creative solutions to problems often encountered in the planning and implementing of a PBL program, with specific references to Harvard's OWHS, UNM's PCC, and Tuft's new curriculum.

1) Necessity of political & financial support from the top down:

It cannot be underestimated how important it is to have political and financial support from the Dean of the medical school on down in order to enact major changes within the curriculum, especially faculty-intensive PBL programs. At Harvard Medical School, it was the impetus and committment of the Dean which has been the driving force behind the development of the OWHS. Comments made by administrators of the New Pathway program such as, "without the Dean's support, it [OWHS] would never have gotten off the ground" and "the Dean applied too much pressure [on faculty] at times, and not enough at others" (10) indicate how pivotal a role he has played. At UNM, although the PCC program was originally developed by several faculty (notably Scott Obenshain and Arthur Kaufman) and the Dean has not always agreed with how the program has been implemented, he has always supported the general concept of the program (personal communication; Obenshain, S; 1988). At Tuft's School of Medicine, the Dean has been publicly supportive of PBL and instrumental in developing their case-study program and [gently] convincing faculty to participate (Kennison, 1988).

Equally important is allowing and, at times, encouraging and/or requesting faculty to participate and teach in a newly developed PBL program. Creating such a climate should entail: 1) greater recognition for teaching ability and

individual faculty efforts, and 2) giving teaching an equal emphasis/political weight as publishing in promotional and tenure decisions (Obenshain, 1988). HMS is considering formally redefining its facultys' obligation to teach medical students (ie, should a teaching commitment - excluding time spent teaching residents - come with a clinical appointment?). It is probable that such an obligation to teach medical students at HMS will be defined as a departmental commitment, whereby 3-5% of a department's total number of faculty must teach (personal communication; Wilkerson, L; 1988). This will put a greater strain in terms of teaching on the traditionally smaller basic science departments than the larger clinical departments.

Introducing PBL as part of an overall curriculum change has worked well at several schools and may increase its rate of acceptance and success. Tufts introduced its case-study sequence as one part of a major change to its curriculum in the fall of 1985 (Kennison, 1988). Although Harvard's New Pathway program had existed as a separate track for two years, the completion in October, 1987 of a new teaching facility, the Medical Education Center, architecturally designed for small group learning may have been one of the factors which hastened the conversion of the entire curriculum to a problem-based format (Wetzel, 1988).

2) Resistance from faculty and departments:

Whenever major curricular innovation is introduced, there is, at first, a strong natural reluctance to accept it. Going along with the change implies that the "old" curriculum (which has been refined over many years) is somehow "inferior" to the new method (Wetzel, 1988). How much change is introduced within an undergraduate medical curriculum, how quickly, and to what degree the basic science and clinical faculty are involved in developing the innovation

has a great deal to do with the extent of faculty resistance encountered. At Harvard, where the real impetus for change has been the Dean of the medical school and a small number of department chairmen and faculty, and major changes to the entire curriculum have taken place very quickly (within three years), problem-based learning has been introduced as a result of much political "arm-twisting" from the top down (Good, 1988) and has been met with substantial faculty opposition. The OWHS administration has worked hard to "convert" skeptical faculty as to the efficacy of PBL, at times with the enthusiasm and belief of a religious movement. Conversely, at Tufts, PBL has been introduced as a longitudinal case-study program augmenting (but not displacing) a conventional curriculum, the strategy being to convince faculty of its effectiveness by example -- an "evolutionary" as opposed to "revolutionary" approach to change (Kennison, 1988). At UNM, PBL was introduced in the form of a small, parallel track by a core group of faculty using volunteer faculty, external grant money, and not requiring departments to change established courses and teaching schedules. The result has been a program which has flourished during the past nine years, become institutionalized, and succeeded in introducing many changes into the traditional curriculum to the point where many non-PCC faculty have recommended creating a single, "hybrid" curriculum for all students. Although Harvard's New Pathway program also started out as a small, parallel track using volunteer faculty and outside grant money, it has quickly been expanded to include the entire class (for reasons discussed earlier) thus causing a real need for the immediate recruitment of skeptical department chairmen and faculty; it has yet to be seen just how much of the original problem-based OWHS program will have to be compromised to gain the necessary broad-based faculty support.

A second major issue which results in faculty resistance is the perceived faculty and labor-intensive nature of PBL methods. Certainly, the initial case writing/development and faculty training/role playing to produce successful group facilitators is very time consuming, but after this little preparation is necessary as the tutorials are basically run by the students. While it is true that being aware of the cases which come later in the block and studying in advance about sections of each case which the tutor knows little about will enable him/her to be a better guide for the students, in this setting, the role of the faculty is not one of "expert" and therefore detailed preparation for each tutorial is unnecessary (unlike a lecture). A study at UNM has shown that the total amount of contact (with students) and preparation time spent by faculty per student is only 3% higher in year I of the PCC program as compared to that of their traditional curriculum (Mennin, SP and Martinez-Burrola, N; 1985). Interestingly, while approximately 61% of the total time devoted to teaching-related activities in the traditional curriculum take place in the absence of students, in PCC, 72% of the total time devoted to these activities (and 80% of the time spent on evaluation) by the faculty is spent with students.

3) Difficulties in teaching specific disciplines via PBL methods:

When it comes to actually designing a knowledge-based medical curriculum around a problem-based format, the question of whether some basic science disciplines lend themselves more easily than others to such a format is bound to arise. As was mentioned earlier, Harvard's OWHS anatomy/histology/radiology block, the Human Body, has been their showpiece with respect to a tutorial-driven, well-integrated curricular block with five tutorials and only three hours of lectures per week; it was changed very little when it was

converted to the common pathway from the original new pathway format. Conversely, when the biochemistry/physiology block, Metabolism and Function, was scaled up to include the entire class, it underwent major changes and now has a somewhat more traditional format with two tutorials and ten hours of lecture/conference per week. Although OWHS students claim this block was not well taught in a tutorial format during the prior two years, does this indicate that biochemistry and physiology are difficult to teach via a PBL method, that the cases were poorly designed or faculty poorly trained, that the general anti-PBL viewpoint and politics of these two departments was responsible, or a some combination of all of these? It is interesting to note that at Tufts School of Medicine, the biochemistry cases and tutorials have been some of their most successful, in part, because the biochemistry course director has been very interested in case-oriented teaching and the department had integrated a case-study method into one of their own courses (the "Biochemistry of Disease") prior to the introduction of PBL at Tufts (Kennison, 1988). Steve Emond, a 4th-year medical student and medical education fellow at Harvard who holds a Master's degree in biochemistry, is presently working with members of the HMS Biochemistry department on writing new cases and improving current ones (from the perspective of better guiding students). He is convinced that biochemistry can be taught in a PBL method as well, if not better, than other disciplines (personal communication; Emond, S; 1988). Thus, it appears that creative and innovative case development, good faculty training, and departmental politics may have more to do with how well a particular basic science discipline is taught (and integrated with other disciplines) within a PBL method than the actual content of the discipline. Taking it one step further, some educators at Harvard claim that any basic or clinical science

material can be well taught via PBL methods by one of three types of cases: clinical, investigative, or public health case presentation (Wilkerson, 1988).

4) Problems with developing and running case tutorials:

Although a problem-based medical curriculum may be mandated by top administration (as at HMS) or emerge from a small core of faculty (as at UNM), ultimate success of such a program, especially one that is perceived to be faculty-intensive, will only come from broad-based faculty support and participation -- this is particularly true of non-parallel track programs such as Harvard's common pathway curriculum. There are three areas which need to be addressed in terms of developing overall faculty support: faculty skepticism, departmental commitment, and faculty recruitment and training.

a) Faculty skepticism:

Perhaps one of the most fundamental reasons why faculty (especially basic science faculty) feel uneasy about, or are opposed to, PBL techniques is the heavy responsibility they feel to make sure medical students are exposed to as much information as possible before the clinical years, and the belief that a well-organized lecture is the most efficient way to achieve this. [It has been said that] perhaps faculty take this responsibility too seriously because, in the final analysis, they do not want to be told, "I killed someone today because you didn't teach me this information" (11); when, in fact, medical students will see much of this information again in clinically relevant situations before they are in positions of ultimate responsibility. Second, some faculty do not feel students can learn without being told (ie, "if I don't mention a topic, it will never be learned") and do not trust students to learn on their own. Yet, at best, lectures mainly serve to motivate and, at times, terrify students into studying; the majority of students do not usually recall

more than 2-3 items from a lecture and, in fact, do most of their learning at home, alone or in small groups (personal communication; Umland, B; 1988). PBL programs focus on this learning process and make it explicit, but this means trusting students to learn on their own and this makes some faculty very uneasy (Umland, 1988). Third, many faculty are fearful of a new teaching style, anxious about facilitating small groups, and feel they are not good discussion leaders. Much of this fear and anxiety can be alleviated through appropriate faculty tutor training and role playing, but require that faculty be willing to learn in new areas and make this training a priority. The benefit to be gained from actually experiencing and facilitating a student tutorial is that most faculty come away with a renewed excitement about their own and students' learning [and sense of discovery]. They enjoy the more extensive personal contact and involvement with students (which is simply not possible in a lecture) as they learn along with students and are seen as integral co-members and contributors to the group. Fourth, many faculty are fearful of showing ignorance in areas within their field of endeavor, or outside of their expertise, and claim that Ph.D's cannot facilitate clinical cases and M.D.'s cannot teach the basic science aspects of these cases. Although the issue of whether a "lay" faculty tutor can be as effective as an "expert" tutor is controversial, the main issue should be how capable is the facilitator whatever his or her background. An expert tutor (i.e. a tutor with a background in the area being discussed) may be used as a knowledgeable resource within a tutorial, but this is not the major function of a faculty tutor. What is important is that the tutor be acquainted enough with the content of the case and relevant basic science concepts so as to be able to guide students appropriately, prevent discussions of irrelevant tangents, and detect and

question erroneous factual comments. It is not only appropriate, but probably beneficial, for students to hear faculty say "I don't know the answer to that"; a skilled tutor who has studied the case enough to know that this is an important learning issue or point, would also say, "... but I think it's worth looking up because..."

b) Departmental commitment:

Departmental commitment and endorsement of curricular innovations, such as PBL programs, is very important in the ultimate success and longevity of such programs for several reasons. First, faculty release time and encouragement to participate in precourse tutor sessions (up to two days of workshops) and weekly feedback sessions, as well as the actual tutorials, is crucial because one of the major reasons faculty cite for not getting involved is the large time commitment and lack of department support (Wilkerson, 1988). Unless teaching in a PBL program is considered equivalent and as important as lecturing in the traditional curriculum (at the department level), basic science tutors will be lost when there are conflicts with teaching in the traditional courses because the PBL program is considered expendable; this is particularly true at parallel track schools, such as UNM. Second, as the development of HMS's New Pathway program has demonstrated, having overall departmental support and involvement (from the chairman and influential basic science faculty) in developing and teaching a PBL course is preferable since it causes much less division among faculty than going outside the department to draw on faculty. Third, it cannot be overstated how important it is to give departmental and school-wide recognition of outstanding teaching in a PBL (as well as traditional) curriculum demonstrating to faculty that the quality of their teaching will enhance their chance for promotion. The extensive

faculty-student contact in tutorials allows students to evaluate individual faculty more effectively and critically. Fourth, in running a parallel track or school-wide PBL curriculum, it helps to have a large faculty to draw on because of the faculty-intensive nature of such programs. The large basic science faculty base (and even larger clinical faculty) associated with HMS will probably allow the continuing development of the common pathway PBL curriculum without threatening Harvard's basic science research orientation. A smaller faculty base at UNM has sustained a small parallel PBL track for nine years, in part, due to the efforts of a core group of faculty dedicated to innovative teaching.

c) Faculty recruitment and development as tutors:

Faculty recruitment and training are perhaps two of the most critical areas in initially getting a pilot PBL program started and in expanding it once it has proven successful. It is worth commenting on the differences between the initial faculty participants and the later "conscripted" faculty tutors. Early tutors are more likely to be full or associate professors (without tenure concerns) and MDs or MD/Ph.Ds rather than Ph.Ds; this has been true at both HMS and UNM. Initial participants at HMS often gave the following reasons for becoming involved in the New Pathway program: 1) concern with teaching and liking to teach/interact with students, especially in small groups; 2) intense dissatisfaction with traditional medical school teaching (often stemming from their own medical school experience); and 3) the opportunity to be involved early in something new and exciting (Wilkerson, L and Maxwell, JA; 1987). Although large group meetings and mailers were useful for disseminating information about the new pathway program and the need for faculty tutors, most of the early participants stated that personal contact with a colleague they

knew and respected (who was already involved in the program) was extremely important in their decision to participate (Wilkerson, 1988). In general, there was a great deal of agreement between the faculty tutors' perception of the new pathway program and their own educational values, beliefs, and preferred teaching styles and the intentions of the program's designers (Wilkerson and Maxwell, 1987); those who became involved early on did so because it satisfied personal needs.

Conversely, the recently recruited faculty tutors for the common pathway program, many of whom have been "conscripted" by their departments to teach, are not senior faculty (and therefore are worried about tenure), have made fewer comments about disliking traditional medical education, are less comfortable teaching/interacting with students, especially in small groups, and are more likely to be Ph.Ds than MDs. The fact that this group of faculty tutors is more likely involved because their department chairman "asked" them and is far more skeptical of the efficacy of PBL techniques introduces new challenges: 1) how to get these faculty to understand and accept the underlying philosophy of problem-based learning, 2) how to deal with the [student response to] changes in tutorial structure made by tutors who have different educational philosophies, and 3) how to be supportive to these faculty tutors as they confront their skepticism and develop the interpersonal skills and group awareness necessary to be effective facilitators. PBL administrators at Tuft's School of Medicine have found that recruiting critical people (influential and respected faculty and department chairmen) to become tutors is a very effective method of recruiting other faculty within the same department, but that no one should be pushed or forced to do this if they are not interested (Kennison, 1988).

The OWHS administrator at HMS who coordinates faculty tutor training and development for the common pathway program says that a major portion of her time involves listening to skeptical faculty as they struggle through their first block of tutorials: hearing them out, "handholding", being supportive, and making things as easy as possible for each department and individual tutor during the process (ie, doing all the "scut work"). Tutors often cope with their own inabilities as facilitators by becoming passive members of the group, withdrawing completely, and/or criticizing which only contributes to the dysfunction of the group. However, one skeptical HMS faculty tutor whose group totally fell apart (thus reinforcing his initial negativity) decided to try it again, in part, because he had been able to help a student in his group keep from commiting suicide (Wilkerson, 1988). Tutor burnout is an area all PBL programs must explicitly address in continuing to provide administrative, financial, and peer support for faculty tutors who are asked to tutor in succeeding years.

In becoming effective tutors (as opposed to successful lecturers), faculty must become as aware of group dynamics and process as of the content being covered in the tutorial, and this involves a growing understanding of how groups interact (Wilkerson, 1988). First, tutors must learn how to be quiet and let the students set the agenda and pace of the tutorial; this can be extremely difficulty for faculty for whom to teach means to lecture and control the direction and pace of the class. The facultys' real skill and gift as teachers lies <u>not</u> in their ability to lecture, but in their ability to ask questions, which they do everyday as scientists and researchers, and to assist colleagues and students to think clearly and critically (Obenshain, 1988). Second, tutors need to learn how to facilitate and support good interpersonal

relationships within the group, recognize and resolve conflict, and maintain balance through working with the students to keep participants from either dominating the group or withdrawing from it. Third, faculty should occasionally guide and direct the group and serve as a resource person in clarifying issues [enough] to prevent "bog downs" and discussions of irrelevant tangents. As one faculty tutor at HMS put it, "I'm a curbstone -- the road is wide and there is much deviation, but I won't let students fall into the shoulder" (12). Fourth, tutors need to elicit the students' reasoning process by posing questions, challenging erroneous factual comments, and encouraging the students to learn to do the same with each other (Lucero, S and Christy, J; 1986). Some tutors feel comfortable letting students correct their misunderstandings through reading/researching for the next tutorial session, others have much less tolerance and feel obligated to correct them immediately. Fifth, tutors should be active members of the group, contributing and participating in discussions as well as promoting application, integration, and synthesis of the material and suggesting appropriate resources for researching the case. Sixth, faculty must be willing in a sense to become students again, and explore areas outside of the boundaries of their expertise.

5) Difficulties with student adjustment to the PBL approach:

a) Student selection:

Student selection to PBL programs is often done by stratified random selection (from the pool of accepted medical students who apply) in order to achieve a heterogeneous class. Since there are often twice as many applicants as openings (as with HMS's OWHS and UNM's PCC programs), a certain number of students who are excellent applicants for the PBL program are randomized back into the traditional curriculum. This causes resentment among applicants who

are not accepted but who may have superior records and backgrounds to those that have been accepted. The question could be raised: wouldn't it be preferable for PBL admissions' committees to look for students with a greater ability to work in groups and on their own without external structure and a greater tolerance for ambiguity? Even with stratified random selection, the applicant pool to PBL programs is still self selected. On the other hand, PBL classes include students who are interested in PBL because they are more disciplined or tired of lectures or less disciplined (but see PBL programs as an easier path through medical school); those who are less disciplined and consequently drop out of the program give PBL programs a poor reputation.

b) Student body split:

With the creation of a new, parallel track PBL program, such as HMS's new pathway program, one can expect a split or "sibling rivalry" to occur between students in both programs. The first two cohorts of the New Pathway program received a great deal of public attention, gifts (free personal computers), and special resources (individual reference librarians), as well as the benefits of two exceptional teachers who left their lecture courses to become tutors. This resulted in animosity amongst the classic pathway students who felt neglected and denigrated. Conversely, the OWHS students, although excited and stimulated by their program, most keenly felt the ambiguities and insecurity of participating in an experiment (Ramos and Moore, 1987). Less animosity exists amongst the students in the traditional curriculum at UNM because many innovations from the PCC program have been adapted to their curriculum and PCC has been in existence long enough for it to become institutionalized. Yet it is apparent from experiences at both schools that students in the traditional track lack academic interaction and common experiences with their fellow PBL

students to the degree that myths and stereotypes about problem-based learning abound. Other medical schools starting parallel track programs would be well advised to set up greater academic and social interaction between students in both tracks in order to foster a more collegial cross-track environment.

With a long-standing parallel track program, such as UNM's PCC program, it is possible to: 1) remain flexible and continue to try out new curricular ideas with a small group first and evaluate their success, and also 2) evaluate year-by-year the progress of PBL students versus their matched counterparts in the traditional curriculum. With HMS's evolution to their common pathway program, there is undoubtably less of a split amongst groups of students and faculty, but it becomes impossible to do the type of comparative evaluation possible with a parallel track program.

c) Student preparation: orientation to the tutorial process:

A well-thought out orientation to the tutorial process is essential in order to minimize the anxiety students have about functioning in a small group learning environment. Orientation sessions, sample "practice" tutorials, meetings with second-year students, and student-written tutorial guides are all useful and necessary in helping students to adjust to a new format. However, sending out advance letters describing the tutorial group process has little effect on students (Wilkerson, 1988).

Most medical students are quite adept at learning in a lecture format and many are comfortable with the realities of self-directed and independent study. However, the skills required to learn effectively in a tutorial can be very different. Problem-based learning requires active learning and participation such as sharing thoughts, ideas, and asking questions, and a cooperative, consultative group learning style versus a competitive, isolated approach. It

involves learning about group process dynamics and decision making, setting group goals and resolving conflict, as well as becoming comfortable with learning from other students and working together and sharing resources. For students who have been quite successful for years in an academic system which rewards competitiveness and looking out for oneself, it can take a while to become accustomed to this new learning approach. Unlike lectures, students must attend tutorials and work within a small group, and it is impossible to remain anonymous. There is peer pressure to be prepared for every tutorial session. This requires studying on a constant basis; it can not be put off until before an exam (personal communication; Dudley, L; 1988). There are few lectures and usually no syllabus. The path is not neatly laid out and students must take the initiative to direct their own learning. While many find problem-based learning enjoyable and exciting, it can also be highly anxiety producing. It is important for students to realize that much of their learning of new material will take place outside of tutorial, but discussion of what they have learned will enable them to clarify and retain the information (Atebara, N et al; 1987).

Students evolve and grow throughout the tutorial process, especially in the first year, and find that tutorials in year II run smoothly and are more productive. Students in first-year tutorials are generally more anxious about content and worried about knowledge gaps, have a harder time coming up with more than a few general hypotheses per case, have more of a need to figure out the correct diagnosis quickly (without spending time on the intervening steps), and look routinely to their faculty tutor for guidance and are more uneasy when he or she does not know the answer (Hayes, 1988). Conversely, students in second-year tutorials are less anxious about content (and more content is

subsequently covered) and when asked questions, are more comfortable with not knowing and saying "I don't know". They are also more concerned with learning for themselves (for the wards and to share with others) and less to impress others with their knowledge (Hayes, 1988). With second-year PCC students, less pressure and expectation is placed on tutorials and IPAs as learning environments because of students' focus on NMBE-1 preparation, and these sessions often go extremely well because students are more relaxed.

d) Traditional versus PBL curriculums: students' perceptions:

Students in traditional tracks at schools with parallel track PBL programs appreciate the conventional approach for several reasons (personal communication; Bahmer, S; 1988). First, they like having "expert" faculty telling them what is important, what they "need to know". They like being "spoon fed" because they have so little time; at many medical schools they are paying a sizable tuition and do not expect to teach themselves as required in a PBL program (Dudley, 1988). Second, they appreciate being tested often (with multiple-choice type exams) because it lets them know "how they are doing" and gives them practice for the NMBE-1. In general, they feel less stressed about the Boards than PBL students because they feel they have been exposed to what they need to know (at least once) and recognize where their personal knowledge deficits are. Third, they are more anxious about functioning in a highly interactive learning environment and are extremely apprehensive of evaluation techniques like IPAs. Fourth, they like being "given limits" through the lecture content and syllabi. "Vertical" curriculums, in which students study intensively only 1-2 subjects at a time, allow students to focus on the material at hand, finish it, and move on; the disadvantage is that students tend to use their short term memory and forget what they have learned just

weeks later. Fifth, they appreciate having occasional weekends off between courses when they do not feel guilty about not studying; they perceive PBL students as never having weekends (or free time) off because there is always something they could be studying.

On the other hand, traditional track students feel more isolated, less supported by their peers and faculty, burn out much faster, and exhibit more stress and unhappiness than their PBL counterparts (Moore-West, M and O'Donnell, MJ; 1985). As one traditional track student explained: "My mind refuses to absorb anymore facts... I believe I've actually lost my ability to think. All I do is memorize facts to pass an exam. I feel so bad at times, to realize that I'm not studying to become a doctor, just to pass tests" (13). Second, they feel much less prepared and confident with respect to clinical skills (history taking, physical exam, and presentation skills) than PBL students, and may only have a physical diagnosis course for the first time in the spring of their second year. Third, some students feel that more [informal] group studying (where they get an opportunity to talk through the material with other students) and more visual aids to supplement the material will help increase understanding and retention -- like speaking a language in order to learn it. However, multiple-choice exams test recognition of information, as well as understanding and recall, and some traditional track students feel that studying together is less efficient than cramming alone for covering an extensive amount of material; on the other hand, they are disturbed by how much they have forgotten within a few months (Bahmer, 1988).

Students in PBL programs value the alternative approach to medical education for many reasons, but are also aware of its shortcomings. First, they believe medical students should be motivated and disciplined enough to

take active responsibility in shaping their own education. Second, PBL students study what they think is important in understanding a patient case (just as they will do in clinical practice or research) and are involved in applying basic sciences early on in their medical education. Traditional track students, in contrast, study primarily for exams and believe more in the need to acquire [isolated] facts to apply them later on (Moore-West and O'Donnell, 1985). Some PCC students feel that it would be helpful to be given multiple-choice exams at the completion of each unit -- not to be graded, but to show students where their weaknesses lie (Hayes, 1988). As was mentioned earlier, content exams are given at the middle and end of each block of HMS's PBL program as the primary evaluation method; the question remains, "How much do students study specifically for these exams as opposed to the tutorials?" Also, it is important to PCC students that tutors let them know what faculty objectives and basic science areas they missed in tutorial, so they can prepare appropriately for the NMBE-1; otherwise, they may not be aware of their deficits in knowledge (Hayes, 1988). Third, PBL students have learned to be comfortable in a highly interactive learning environment and are accustomed to reasoning through a question on their feet as well as admitting their ignorance and using it as motivation for learning. Fourth, they learn to feel comfortable with researching and learning on their own and in groups without the structure and "limits" of lecture content and syllabi. They feel more supported by their peers and faculty and exhibit less stress and unhappiness than traditional track students, despite the inherent ambiguity of a PBL program and the increasing pressure from the NMBE-1 for which they have received less direct preparation. For PCC students, Board anxiety is acute throughout the second year because during Phase 1B they realize how much they

need to learn (Moore-West and O'Donnell, 1985; Hayes, 1988). Fifth, PBL students feel they may actually study more hours than traditional track students, but because it is at a more constant level, it produces less anxiety. Leisure time becomes the decision and responsibility of the individual, as will be the case in their professional lives, and is not determined by the structure of the curriculum. PCC students describe the cyclical nature of studying within the traditional track as "bulemic studying" where students binge before an exam and then regurgitate information (personal communication; Peterson, T; 1988).

Somewhere between the end of the second year and the middle of the third year, PCC students feel their knowledge base becomes equivalent to that of the traditional track students. Both groups of students agree that PCC students are better prepared clinically to function comfortably and effectively on the wards. While PCC students excel in the clinical skills of history taking, physical exam, and presentation, they are not as well versed in material requiring rote memorization, such as lists of differential diagnoses or etiologies, as are traditional track students (Hayes, 1988).

e) Tutorial difficulties:

Group variability (i.e. the degree to which a tutorial group functions) can be a major factor in how much students are able to learn from a tutorial block. Personality conflicts, different student agendas, over-zealous tutors, and ineffective group facilitation by the tutor and/or the students can all contribute to a dysfunctional group. Since most of the learning, direction, and motivation for UNM's PCC students centers around the tutorial in the first year, a dysfunctional group during this time is more critical with respect to student learning than in the second year (Hayes, 1988). However, a mildly

dysfunctional group in which the students and faculty tutor take time out from the case to explore and learn more effective interpersonal skills is well worth the effort; it will save much anxiety and limit time wasting.

The pace of tutorial learning is another important issue in evaluating the efficacy of the tutorial approach. Will students with advanced knowledge in an area take the time to teach other students in the group or become impatient at their colleagues' lack of knowledge and understanding of the basic principles? It obviously depends on the student, but developing the patience to teach or explain things, skills crucial to working with patients and colleagues, can start here in the tutorial. Sometimes, in tutorials, [these] students begin to work through an issue for the group and realize that, in fact, they do not know it as well as they had imagined (Hayes, 1988). PBL students feel it is advantageous to have a tutorial group with a varying range of backgrounds; they [quickly] realize that everyone is not going to have knowledge in an area. In addition, small groups can also produce pigeon-holing and labeling of individuals, in which "good" students are always right and no one listens to "poor" students or takes what they say seriously (Moore-West and O'Donnell, 1985). This is a serious problem which the whole group needs to confront in encouraging everyone to come to tutorial prepared and making sure everyone is included in the discussion.

Deciding on the appropriate amount of time and depth to devote to a subject and when to move on to a new topic is a perennial problem for tutorial groups (Peterson, 1988). Sometimes students get bogged down in detail or go around in circles in their discussion and it takes an astute tutor to refocus the discussion and move it along. Like many faculty, PBL students are not always sure how much control students should have in deciding what they want to

learn; most would agree it is beneficial for students to teach themselves and each other within guidelines set by the tutor (Dudley, 1988). As has been mentioned earlier, how and when these guidelines are communicated to students in the tutorial varies in each program.

Quietness in tutorial is a major issue for many tutorial groups at one time or another. Whether a student is naturally quiet (due to personality traits or cultural traditions), intimidated by other(s), has no opinion or interest, or is having problems understanding and remembering the material, the small group tutorial format imposes a certain loss of anonymity which [hopefully] forces such a student to assess his or her reluctance to speak in tutorial. Although other group members may try consistently to engage someone who is quiet in the discussion via eye contact and asking their opinion or assistance, the individual must assume responsibility for showing interest in the material and well-being of the group (at least with the tutor) or his/her silence may be regarded as a failure to contribute, an unwillingness to participate, and a lack of interest or knowledge in the case (Atebara, N et al; 1987). Cultural and language barriers to group participation (especially with foreign students) may be alleviated by offering ESL, group role playing, and study skills classes to incoming medical students in the summer prior to the first year (Wilkerson, 1988); after having problems in tutorial with several Chinese and Korean students, HMS has decided to make these courses available to first-year medical students next summer.

Although PBL students learn to be assertive and comfortable in a highly interactive learning environment which is very appropriate for the wards, they also learn behavior which is not as condoned. In the idealized, insulated learning environment of the tutorial, students are encouraged to ask [lots of]

questions, teach, share, and challenge each other as well as the faculty tutor, and admit their ignorance with the intent of finding out by the next session. As will be discussed later, there is an adjustment to more traditional attitudes and behavior which takes place in PBL students within the first nine months of being on the wards as they adapt to asking fewer questions, not showing their ignorance, and fitting into the medical hierarchy.

f) Tutorial advantages:

One of the major advantages of a tutorial-driven curriculum is the increased faculty/student contact allowing for a greater closeness and collegial relationship between students and their faculty tutors (Wilkerson, 1988). As one second-year OWHS student stated, "I've had dinner at eight faculty homes" referring to the eight faculty tutors she had gotten to know during her first two years at HMS (14). A second advantage is the increase in student-to-student teaching, sharing, and working together, as well as the development of life-long learning skills; when students are teaching each other, it forces them to really understand the material. A third advantage is that PBL students have an easier transition to the small group method of teaching on the wards. They are accustomed to and efficient at using a wide range of information resources such as primary [library] sources, computer literature searches, and other physicians. They have better clinical skills and are often more familiar with the subtleties of the psychosocial model and various interviewing strategies, such as the CAGE format for assessing alcoholics (Dudley, 1988). Being well versed in the case format, PBL students are able to integrate and apply the principles from the cases they studied in the first two years to patients they are seeing on the wards. Finally, they seem under less stress during clerkship rotations, in part, because their

confidence and image as student physicians "has solidified early enough to endure the stresses generated by house staff attitudes" (15).

6) Case Development: problems and successes:

Paper cases form the backbone of PBL curriculum and the success of any tutorial depends on how well these cases are developed and written. A typical case may be from 5-15 pages of narrative and questions, the group discussion of which normally takes 2-3 tutorial sessions. Cases are usually written by clinicians (occasionally by medical students) and based on actual patient cases. Each is reviewed carefully and revised by a case review group to fit the needs of the students. Developing and using cases as a teaching vehicle forces faculty planners to explicitly list and discuss the specific learning issues and objectives for each case and each week of the curriculum (in addition to the entire block) in an attempt to present a coherent, logical sequence which integrates several disciplines (Wetzel, 1988). The following discussion looks at some of the important issues in developing an effective case and the strengths and weaknesses of the case method.

I) Developing a case:

a) Initial patient presentation:

The beginning of the case narrative should be very brief, but tell the initial part of the patient's story in an interesting manner; it should include: the patient's first and last name (fictitious), the presenting complaint (including age, sex, nationality, level of distress, and visual cues), the time and setting in which the symptoms began, and a photograph of the patient. The idea is to capture the students' interest in a group of symptoms associated with a specific person, possibly arising from a particular setting. Like an advertisement, we want to "market" this story; the goal is to

make this patient's initial story interesting enough so that students will recall the patient's name or picture, his/her associated symptoms, and the differential diagnosis when they come across a similar case at a later date. It is important to keep the initial symptom list to a minimum and have the students generate a wide range of hypotheses based on these symptoms before receiving more information; these hypotheses are as important in the students' learning process as the eventual differential diagnosis.

b) History:

The description of the pertinent aspects of the patient's past medical history, family and social history, and review of systems is an ideal place to build information into the case to stimulate discussion of the psychosocial aspects of the patient's illness, including the importance of: 1) familial and racial risk factors, and 2) the social, psychological, and occupational setting of this patient in predisposing him/her to this illness. This is done more in Tuft's case-study program than in either HMS's or UNM's PBL programs.

c) Case objectives:

Case objectives are defined as the basic learning issues the case illustrates and that ideally all students are expected to study. At HMS, tutorial students are presented with the written objectives after the group has had a chance to generate hypotheses and formulate its own learning agenda (Armstrong, E et al; 1987); the list of objectives then serves as a checklist for students letting them know what the faculty expects them to cover in this case, regardless of the learning issues the group decides to pursue. At UNM, there has been much debate amongst the PCC faculty as to whether a list of faculty objectives should be given out to tutorial students, as it poses a possible contradiction to the concept of student-directed learning. In fact,

PCC students would prefer a list of objectives (at the end of the case); it allows them to see what areas their tutorial group did not cover that they may want to pursue on their own. At present, it is up to the discretion of the PCC tutor as to whether to pass out a list(s) of objectives at the end of each case or at the completion of an entire unit (Umland, 1988).

d) Guiding questions:

Guiding questions are placed within the text to prompt students to think and verbalize about specific case objectives and/or learning issues, or to initiate discussion of related issues and topics. They are more frequently used throughout PCC paper cases than those of the new pathway program (where they appear at the end of cases and are considered optional). Guiding questions are an excellent method to get students to think periodically about what the lab values, physical exam findings, etc... mean as the case develops before proceeding to the diagnosis.

e) References and resources:

It is important to include with each case a list of appropriate references from textbooks and primary sources as well as 1-2 resource faculty. This is particularly important for first-year students who tend to use textbooks as their major source of information (Wetzel, 1988). UNM's PCC program puts less emphasis on this than HMS (which may even indicate which readings are required and which are optional), allowing students to find the references which suit their own learning style.

f) Resource materials and exhibits:

It is equally important to list, and make available, materials which will enhance the study of the case (eg, x-ray, CT, and MRI studies, results of diagnostic and lab tests, gross specimens, histopathological slides,

kodachromes, and videotapes). Allowing students to interact with the actual clinical information (not a written summary) and to engage in physical activity (visiting a lab or a community, interviewing and examining a patient with a similar case, etc...) assists students to become more directly involved in the case (Mennin, SP and Waterman, RE; 1988).

g) Tutor guide:

A tutor guide (or version) should accompany each case which expands on the important objectives and guiding questions of the case and indicates particular points for discussion. References for background readings should also be provided as an aid for the tutor in reviewing and refreshing his/her knowledge in areas relevant to the case. At HMS, it is viewed as the tutor's ultimate responsibility to ensure that the essential learning objectives of a case are covered, but he or she should gently guide the group toward this goal and not interfere with the students' process of setting their own learning agenda; at UNM, the responsibility is placed more in the students' hands.

II) Sequence of cases:

Theoretically, students could learn all of medicine from one case. However, from a practical viewpoint, there are several concepts to follow in the design and order of cases within a curricular block. First, the cognitive concept of moving from general hypotheses to specific diagnosis should be explicitly emphasized in the design within a case and in the sequence of cases within a block. This will allow students to practice and refine the cognitive pathways they will use throughout their clinical and/or research careers and which link basic science facts with clinical findings and application. Second, cases should be designed to focus (at least initially) on broad clinical issues or findings such as chest pain, pneumonia,

gastrointestinal bleeding, or abdominal pain (especially in the beginning of a block), rather than specific disease states such as pneumocystis carinii pneumonia in order to give students the chance to explore the pathophysiology, mechanisms, and etiologies of a general class of illnesses (like pneumonia) before narrowing to a specific diagnosis (personal communication; Woolliscroft, J; 1988). A child intuitively learns about an object, a chair, before understanding the concept of "my chair" and later "blue chair"; it is this process of building a structure or framework upon which one can later "hang" specific details that should be made explicit in case design. Third, students should be taught to utilize a framework of broad disease catagories or prototypes such as infectious, endocrine, neurologic, neoplastic, vascular, psychogenic, etc... to build an array of possible hypotheses, etiologies, and mechanisms around any set of initial signs and symptoms. Fourth, cases should stress risk factor analysis in separating patients' clinical presentations into acute, chronic, and healthy, and emphasize the knowledge of risk factors such as occupation, lifestyle, genetics, demographics, etc... as well as age, sex, and nationality, with respect to individual diseases and the acquisition of this information during patient history taking (Woolliscroft, 1988); the importance of this information in differential diagnosis, treatment, and prophylactic (preventive) therapy cannot be overemphasized. Fifth, if one can divide medical students and residents into two catagories: "doers", who rush to order specific tests and "hypothesizers", who rely more on observation, physical exam, and a good history, a carefully structured sequence of cases will enhance the ability of students to become critical thinkers and hypothesizers (Woolliscroft, 1988).

7) Psycho/social/ethical issues in medicine: where in the curriculum?

Much of the recent historical impetus underlying the development of PBL programs in medical education has focused on producing more humane, socially aware physicians (e.g. G.P.E.P. report, Bok's Harvard address, etc...); yet recent PBL programs have had varying success in integrating the psycho/social/ethical issues of medicine into their curriculums. Despite the fact that case-driven curriculums lend themselves more easily than lecture-based programs to integrating these issues, very few medical schools with new PBL programs have truly taken advantage of this.

a) Tuft's case-study program:

Of the three medical schools with PBL programs which I have studied most closely, Tuft's case-study program has been the most active in including and discussing psychosocial, occupational, and environmental issues within the context of each case. A portion of the narrative of every case examines issues from the "biological, behavioral, and social/population perspectives" (16) as they relate to patients and their illnesses, and asks students to analyze these issues and appreciate their importance in establishing an authentic therapeutic patient-physician relationship and effective treatment regimen (Tufts University SOM Problem-based Learning Program 1987-88, Phase One Student Handbook).

b) UNM's PCC program:

The cases used in UNM's primary care curriculum are not presently designed to encourage the discussion of psycho/social/ethical issues within tutorials, but the UNM Social medicine grant (see Part III, 9b) has proposed to modify existing case problems to "reflect a social medicine orientation" (17) within one year. In addition, social medicine tasks and field visits will be developed in conjunction with groups of case problems; for example, during the

first-year case study of AIDS (in the unit integrating immunology and microbiology) students will apply knowledge they are learning by teaching about STDs and AIDS prevention in the Albuquerque Public School system (Social Medicine at the University of New Mexico, Health of the Public Grant Proposal, 1986). The current first-year clinical skills course will also be expanded to create a longitudinal, social medicine/clinical skills experience (similar to HMS's Patient/Doctor block) meeting one-half day per week for the first two years and encompassing the clinical skills of social medicine (e.g. epidemiology, health policy and economics, health promotion and community organization, law and advocacy) into case problems and practical exercises, and dovetailed with the subjects being studied in tutorials. Currently, PCC students are only exposed to the psycho/social/ethical issues related to patient care in their phase 1B rural preceptorship in which they learn about community-oriented primary care and complete a community health project; it is believed that more intense focus on social medicine issues by PCC students before and during their rural experiences will increase student interest in, and improve the quality of, their community projects.

c) HMS's OWHS Patient/Doctor block:

Like UNM, the cases used in HMS's common pathway program are not designed to encourage the discussion of psycho/social/ethical issues within tutorials; neither were the cases in the New Pathway program, although the HMS paper case development guide (1987) specifically states to "build information into the case to stimulate discussion of the psychosocial aspects of the case" (18). The original concept was to address these issues in a longitudinal, 2-4 year course called Patient/Doctor Relationships in which a small group of students would meet one afternoon per week with the same clinical preceptor and a

psychiatrist to learn basic clinical skills and explore the patient/doctor relationship from a social medicine perspective through the use of assigned readings, paper cases, clinical skills sessions, and patient care experiences (OWHS Program Guide, 1986-87). This tutorial course was to help students integrate their biomedical perspective with a sound knowledge base in the social sciences and promote an understanding of their own attitudes, values, and beliefs as developing physicians -- run somewhat between a "seminar and a group therapy session" (19). The so-called Patient/Doctor block was designed to introduce clinical experiences throughout the first two years and replace the Introduction to Clinical Medicine (ICM) course (set up initially to teach students basic clinical skills and physical diagnosis in the last twelve weeks before clerkships began) and electives from three social science departments (such as medical ethics, history of medicine, medical anthropology, etc...) of which students were required to take five courses prior to graduation. This early clinical contact and social medicine orientation was believed by many people to be a central focus of the New Pathway program, when in fact the Dean was actually more concerned with decreasing the number of hours of lecture and promoting a small group active learning process similar to a graduate seminar (Good, 1988). He publicly and vehemently rejected the notion that in creating a PBL program HMS was primarily promoting the development of primary care physicians (generalists) and practioners versus specialists, academic physicians, and scientists. He was offended by the idea that because the new pathway program was, in part, modeled after UNM's PCC program, it would be viewed as a primary care curriculum (Good, 1988).

Whereas the transition from traditional lecture courses in gross anatomy and histology to an integrated tutorial driven block (the Human Body) involved

only one department (both gross anatomy and histology are taught by faculty in the Anatomy department at HMS), the Patient/Doctor block was to replace an interdisciplinary ICM course (taught by clinicians from six different hospitals) and electives from three social science departments -- not surprisingly, the logistical and turf issues posed overwhelming problems (Good, 1988).

First, each of the six teaching hospitals associated with HMS has developed an ICM course, of which its clinicians are quite proud and consequently many [of them] did not see the need to create a new course. Second, the logistics and difficulties of finding clinicians to commit one afternoon per week (for a minimum of two years) to teach in the Patient/Doctor block are far greater than continuing to have physicians teach three times per week for twelve weeks in a course which is scheduled well in advance. Third, faculty from the three social science departments were ambivalent about the Patient/Doctor block; although many of them favored its interdisciplinary, integrated approach, they did not want to relinquish teaching the electives they had designed. In addition, only a small portion of the Patient/Doctor block (if that) would be taught by these faculty. Fourth, unlike the other blocks which encompass and integrate 2-3 traditional lecture courses where the knowledge base is limited and defined, the Patient/Doctor block crosses many departments and has no clearly defined content (Dudley, 1988). Fifth, although a number of OWHS administrators are committed to developing this block for the entire common pathway program (ie, the entire class), many faculty feel it is a very dramatic change and are convinced it will not work.

As HMS's common pathway program is further developed and the control of individual curricular blocks moves back to the various basic science

departments from the OWHS administration, it will be interesting to see what happens to the Patient/Doctor block. In this year's entering class (fall, 1987), only OWHS students are participating in this block. Given the logistical, political, and turf issues associated with replacing ICM and the social science electives with a scaled-up version this block and the fact that the Dean has not made this part of the new curriculum a priority, it is likely that this longitudinal, clinical/psychosocial experience will continue to be offered only to OWHS students (Good, 1988).

8) Clinical Clerkships: "Every day is an IPA":

For reasons already mentioned*, PBL students have an easier adjustment to the small group method of teaching on the wards. They have learned to be assertive and comfortable in a highly interactive learning environment, and are accustomed to reasoning through a posed question on their feet. House officers and attending physicians state they can tell straight away whether students have been trained in a PBL or traditional format by the way they approache and think through a patient problem (personal communication; Mennin, S; 1988). While traditional track students will try to quickly verbalize a list of differential diagnoses or etiologies (almost reflexively), PBL students tend to hypothesize and reason through the problem in a somewhat slower and more deliberate manner. At UNM, some clinical clerkship preceptors have commented that if third-year PCC students have studied a particular patient case in tutorial, they will know as much as first-year residents when they see a similar patient on the wards; conversely, if they have not had such a case, they can reason through it slowly on their feet and will know as much about it as first-year residents the following day (Mennin; Umland, 1988).

However, it has also been noted that after six to nine months on the

* see pages 45-6, 48-50.

wards, it is much harder to tell PCC students from those trained in the traditional track (Mennin, 1988). What has transpired? One rationale is that over time the traditional track students gain more confidence being in an active learning environment and "catch up" to PCC students (personal communication; Wiese, W; 1988); this view is held primarily by faculty who support the traditional program. Another rationale is that PCC students learn to "play the game". While being assertive and confident is very appropriate on the wards, PCC students quickly learn to ask fewer questions, not admit their ignorance or think out loud, and conform to the medical hierarchy (Wiese, 1988). With a primary emphasis in many clerkships being placed on a patient's specific diagnose(s) and treatment plan(s) and the latest research on his or her disease(s), PCC students are not encouraged to use a problem-based, hypothesis-generating approach and they begin to lose this skill. Asking a lot of questions on rounds may be seen by traditional track students as "brown-nosing", and sharing information or going to the blackboard to reason through a question or mechanism can be perceived by others as "showing them up" (Moore-West and O'Donnell, 1985). The process of atrophy may continue to the point where some PCC graduates completely abandon a PBL and community-oriented approach to patient care in residency training and later practice (Wiese, 1988).

In order to create an environment which encourages and reinforces a problem-based approach to learning medicine beyond the first two years, HMS and UNM are both involved in making major curricular changes in the third and fourth years. At HMS, these changes have been pioneered in the new pathway program and in coming years will affect the entire class; at UNM, these changes will include a clinical clerkship track in social medicine (beginning

in July, 1988), part of a recently funded Social Medicine grant. Traditional clinical clerkships during the third year usually incorporate students into ward teams as co-providers of patient care. The primary focus is on tertiary care with an emphasis on rare and esoteric conditions, an unpredictable mix of patients, and no ambulatory care experience (Ramos and Moore, 1987). Students' educational needs are rarely considered and there is often a lack of time for students to read about their patients' cases. The fourth year is traditionally more flexible with time available for electives, required advanced clinical clerkships, independent study, and research.

a) HMS's common pathway: changes in the clinical clerkship program:

In revamping the clinical clerkship experience, several themes are emerging within HMS's common pathway program. First, a "core curriculum" for each clerkship rotation is being defined by an individual cross-institutional committee (personal communication; Neill, J; 1988). The aim is to delineate the broad learning objectives of each clerkship (i.e. which aspects of each discipline should all physicians know?) and make them explicit (i.e. what types of basic patient cases do we want students to learn from?). Included are tutorial paper cases to fill in for patient cases the students may not see on the wards due to the vagaries of patient admissions (Dudley, 1988). Second, decrease the amount of time students spend "on call", minimize the number of patients they care for, and increase the number of hours devoted to didactic learning. This is especially true for the three-month medicine clerkship, only the third month of which will students be asked to function as "sub-interns" and take on more patient care, responsibility, and "scut work". (Neill, 1988). Third, increase clinical faculty/student interaction by having attending physicians spend more time teaching medical students and decrease the amount of

"scut work" done by students. Although some clinical faculty are enthusiastic about working more closely with students, others feel it will prolong rounds (gearing the level of education to both residents and medical students) and take up a lot of valuable faculty time (Dudley, 1988). As was mentioned earlier, HMS is considering formally redefining its clinical facultys' obligation to teach medical students (excluding time spent teaching residents). Fourth, a new eight-week interdisciplinary ambulatory care clerkship (a requirement for OWHS students only) has been developed. A large percentage of people (70-90%) who need medical care can be treated adequately at a community/ambulatory center and do not require hospitalization; yet many physicians are ill prepared to function in a community/ambulatory setting because they have been trained during clerkships and residency in a tertiary care hospital (Obenshain, 1988).

Although there has been resistance from some of the clerkship faculty and directors (i.e. why change a clerkship which is already very good?), for the most part there has been a lot of enthusiasm and a strong interest in improving clinical medical education (Neill, 1988). Where there was once no uniformity or communication between similar clerkship programs at different hospitals, there is now collaboration and excitement among clerkship chairpersons and clinical faculty from similar and different disciplines with respect to coordination of overall approach and content; people are talking to each other for the first time! (Neill; Wilkerson, 1988).

b) UNM's Social Medicine grant:

UNM's social medicine program has been designed to teach and train medical students, residents, attending physicians, and senior faculty how "to interprete and treat health problems of individuals, families, and communities

in their social context" (20). Within this broad mandate, there are specific objectives and changes which have been delineated in developing a clinical clerkship track in social medicine which will be available for approximately one-half of the class. First, the proportion of the students' clerkship time spent in the hospital will decrease while the amount of time in ambulatory clinics and community care will increase -- see figure 5 (Social Medicine at UNM, 1986). Ward services will place greater responsibility on students for reasoning through patient care problems, identifying economic constraints, determining useful social services, and working with a multidisciplinary team in discharge planning and actual home care follow-up and visits. Students will be affiliated with clinics one afternoon per week for the entire third year (as part of continuity care teams of residents and faculty) and acquire skills in ambulatory medicine and develop a patient data base from which to review treatment decisions. Students will have scheduled time each week for community health care experiences which may involve a longitudinal affiliation with a particular site or organization, a long-term follow-up of selected patients seen during rotations, or involvement with a defined population group in the community. As part of community-based interdisciplinary health care teams made up of residents, faculty, and students, one of the primary objectives for students will be to link individual health care with population needs, using skills such as epidemiology, community organizing, field-based data collection and analysis, etc... (Social Medicine at UNM, 1986). Second, PCC students will be exposed to the concepts of social medicine during the preclinical years by modifying and enriching tutorials, the clinical skills course, and the rural 1B preceptorship to address these issues. Third, social medicine track students will be assigned to ward teams with residents and faculty who are interested in

supporting and fostering a PBL environment and process within which to discuss patient cases and basic science issues. Fourth, students in the social medicine track will be closely matched with peers in the traditional track to allow for meaningful evaluation of the new program and to see if PCC students retain and strengthen their PBL skills in the social medicine clerkship environment.

Part IV: Evaluation of PBL programs and future directions:

> "It is often said that evaluation controls the curriculum; what the faculty and administration evaluate is what the students come to value." (21)

1) Evaluation and the NMBE-1:

To a great extent, the above statement is true. Evaluation methods not only control, they "drive" the curriculum; they are the standard by which curricular reforms are measured and they prioritize students' studying time. The ultimate standard by which curricular innovation in the first two years of medical school is judged is the NMBE-1, taken by students at most medical schools at the end of year II. As with students in traditional curriculums, PBL students give preparation for the Boards a high priority in the spring of their second year. However, whereas traditional track students repeatedly receive tests similar in format to the NMBE-1 during their courses in the first two years, PBL students have no comparable preparation. In general, in most problem-based learning programs, PBL students as a group score somewhat lower than their traditional track counterparts, but have the same rate of passing the NMBE-1 as their colleagues. Recently instituted PBL programs such as those at HMS, Tufts School of Medicine, and Rush Medical College have only had one, or at most, two PBL classes which have taken the Boards; so presently there is lack of sufficient data to make any definative statements as to how these particular programs are doing with respect to this criteria. Conversely, through the Longitudinal Project, the PCC program at UNM has followed their graduates over time with respect to numerous criteria. The data shows that with respect to traditional track students, PCC students: 1) receive NMBE-1

scores comparable to those previously described, but outperform the traditional track students on the NMBE-2; 2) decide earlier in medical school what kind of physician they want to be (possibly due to the phase 1B experience); and 3) maintain any initial interest they had in primary care fields throughout medical school, whereas traditional track students show increasing interest in specialization (Mennin, 1988). The PCC experience reinforces and strengthens the prior career choices students have made, whereas the traditional curriculum tends to move students towards internal medicine and subspecialities (and away from primary care and family practice). PCC students receive better clerkship evaluations in the third year than those in the traditional track with respect to the following issues: application of the basic sciences to clinical problems, ability to review current research, clinical skills, ability to work with a team and with peers, enthusiasm for learning, ability to work independently, and level of maturity (Moore-West and O'Donnell, 1985). PCC students also enjoy the advantage of more detailed and personal Dean's letters because there are many more written comments and evaluations of PCC students than their counterparts during the first two years.

One criticism of the Longitudinal Project is that while there has been much evaluation of the "process" of problem-based learning within PCC, little has been done to evaluate the knowledge base and "retention" of PCC students except for utilizing the Shelf Boards and the NMBE-1. While correlation of the successive scores on the Shelf Boards (which are taken every six months during the first two years) with passage of the NMBE-1 is high (West, DA et al; 1985) indicating that these exams can be useful for students preparing for the Boards, well written case-oriented exams could show a much greater depth of knowledge in evaluating the integration and accessibility of PCC students'

knowledge base.

From a more comprehensive perspective, evaluators should be asking several critical questions: what abilities and skills should a medical student possess upon graduation? How can they be assessed and how well do the NMBE-1 and NMBE-2 assess them? A portion of this, in fact, has already been done. In 1981, a proposal was developed by the National Board of Medical Examiners identifying ten tasks and five abilities which the board believed every physician should be able to perform competently upon entering residency (see figure 6). It has been estimated that only 5-6 of the 50 cells in the matrix (cells 1A, 2A, 3A, 4A, 5A, and 8A) can be assessed by multiple-choice, board-style exams, yet this is the type of testing method which is being used to evaluate students' coursework performance and for internal promotion at many medical schools (West et al, 1985). Furthermore, and perhaps most importantly, studies show that grades derived from multiple-choice exams have little or no correlation with later performance as a physician (Wingard, JR and Williamson, JW; 1973). Nevertheless, according to Donald West et al, medical schools are increasingly using the National Boards for internal promotion of students in violation of the stated intent of the exams as "an external evaluation of one component of departmental effectiveness in teaching." (22). Yet, there are techniques for evaluating the other 30-40 cells in the matrix (see figure 7), and PBL programs are in a unique position to take the initiative in utilizing and strengthening these techniques with respect to reliability and validity (or else create new ones).

2) <u>PBL and the cognitive process</u>:

Cognitive psychology has much to offer in terms of assessing the differences between the "cognitive process" implicit in learning in a lecture/

content-driven curriculum versus a problem-based learning program. First, cognitive psychologists have shown that learning information in one context makes it very difficult to recall it in another context (i.e. retention will be very low). Yet, this is what a lecture-driven curriculum accomplishes. Lectures passively give students massive amounts of information about specific diseases usually without showing or eliciting from students the steps from the initial symptoms to the final diagnosis. Consequently, students are, in effect, given the answers before being asked any questions. Learning in such a manner tends to focus on a cognitive structure which begins with the disease (or answer) and ends with the symptoms (or questions). It is not surprising that students find it difficult (and frustrating) to switch in the third year to the reverse cognitive structure: symptoms ⟶ disease; yet this is the cognitive approach they will use throughout their careers whether in practice or research. As James Woolliscroft of the University of Michigan Medical Center describes the medicine clerkship he coordinates, students comment that they learn more during this clerkship than in any other but it is a very painful experience because they are not given any boundaries (i.e. no syllabus, lectures, or required readings, being asked instead to learn everything possible from the patient) and are often asked to explain their thought process (Woolliscroft, 1988). On the other hand, problem-based learning uses the cognitive structure: symptoms ⟶ disease as the very framework/basis for learning the basic sciences and integrating them with clinical cases.

Second, as was mentioned earlier, in addition to controlling the curriculum, evaluation methods prioritize students' studying time and approach. A typical "hierarchy" of studying [and learning] for a first or second-year student in a traditional curriculum might be: 1) for the upcoming test in a

specific class, 2) for the Boards, 3) to learn basic concepts that are the foundation for developing good diagnostic skills as a physician, and 4) for oneself (i.e. subject areas which are of most interest to the student). In reality, students rarely get beyond the first two "levels" because there is not enough time to do more due to the number of lectures and exams in a traditional curriculum. Students are not afforded the opportunity to solidify the basic concepts before going on the wards or researching an area which has stimulated their intellect. In some ways, this hierarchy should be reversed because the information most likely to be retained will be what is learned in the lower two levels. Problem-based learning programs eliminate the first level (where students spend most of their time in a traditional curriculum) and hopefully focus students on the third level.

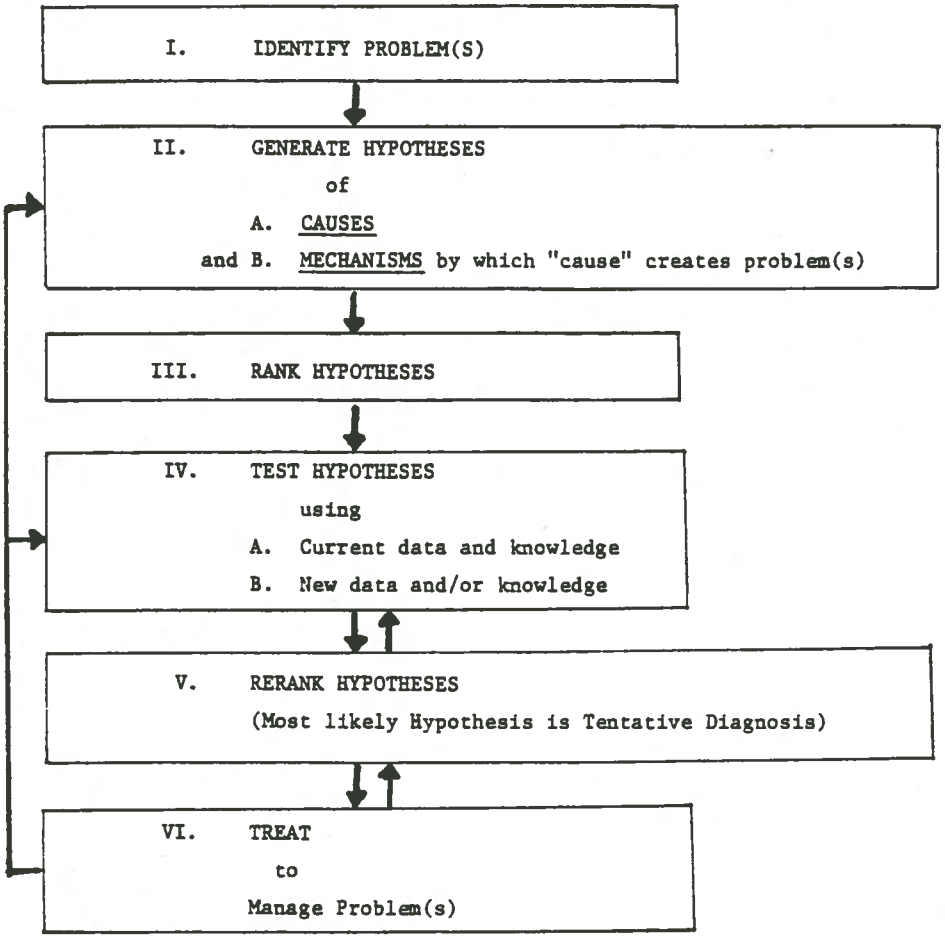
3) Conclusion:

The current upheaval and chaos in medicine and health care in this country provides incredible opportunities for change in the approach to medical education. The current and future development of PBL pathways in the clinical clerkship years is necessary to be able to accurately evaluate the effectiveness of a PBL approach. In addition, developing appropriate evaluation methods to effectively assess the life-long learning skills of PBL students is also very important. Until there are enough medical students who have been through an entire four-year PBL program and appropriate evaluation techniques exist, it will be difficult to truly assess the efficacy of problem-based learning in medical education. With respect to the current evaluation system, symbolized by the National Medical Boards, and its effect on the development of problem-based learning programs, Scott Obenshain, Assistant Dean of Undergraduate Medical Education at UNM, offers these comments:

"Part I of the national boards... values a "thought process" that is the antithesis of medical practice: there is a correct answer for every question, and one must carry all the information in one's head. Medicine, like other sciences, is a group activity, and patients today receive the benefits thereof: the best thinking of many physicians. This shared problem-solving function should be fostered early on, but until the "tyranny of examinations"... is changed we cannot expect that to happen." (23).

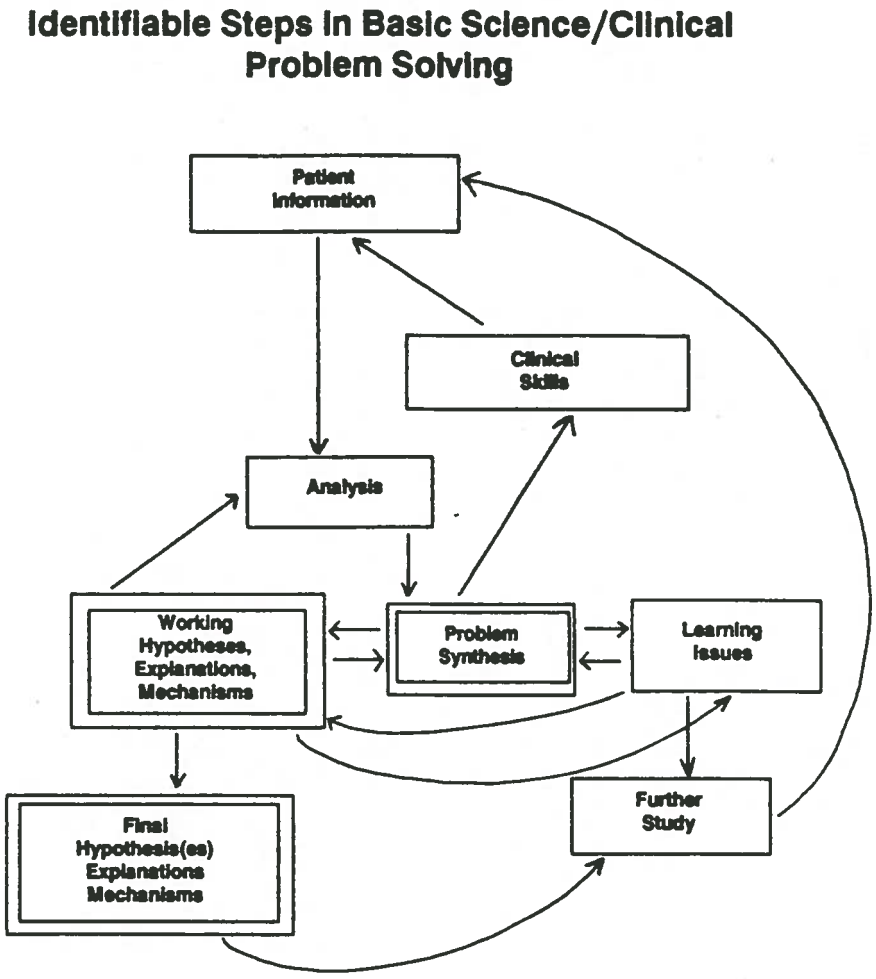
Figure 1

OUTLINE OF THE REASONING PROCESS



From: "Tutor Workshop Booklet". Conference On "Options in Medical Education". February 22-26, 1988. University of New Mexico School of Medicine.

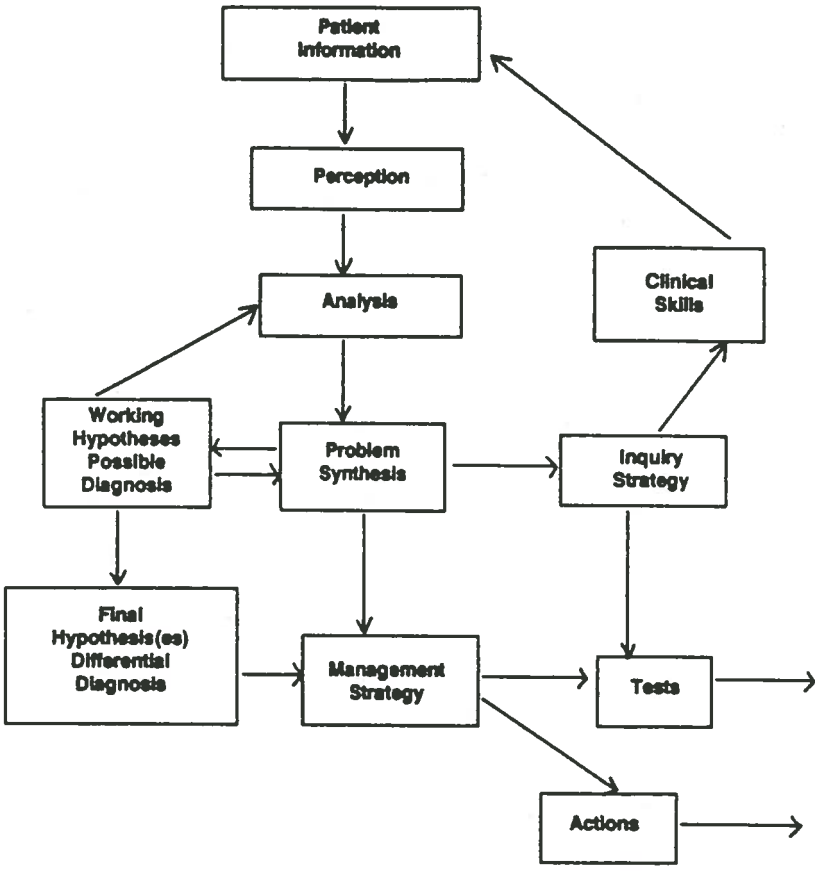
Figure 2



From: De Golia, P and Hoock, J (eds). "An Introduction to Problem-based Medical Education." AMSA. March, 1988. page 14.

Figure 3

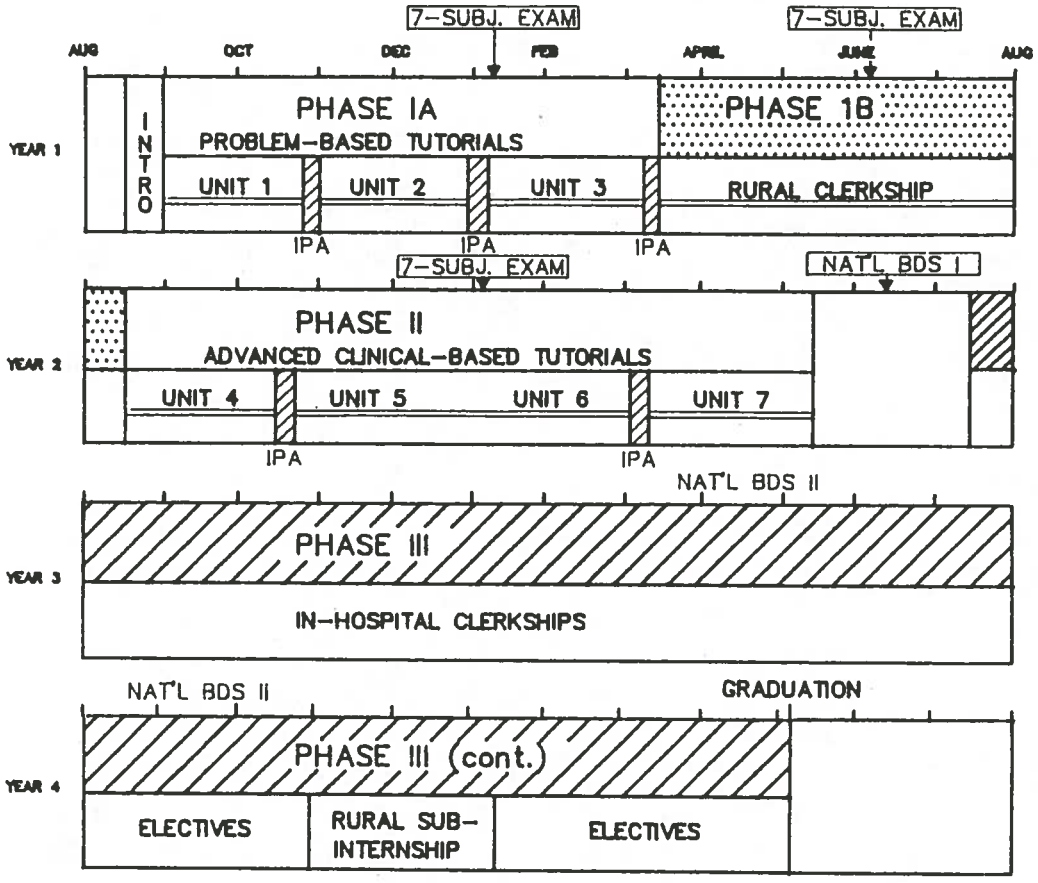
Identifiable Steps in Clinical Reasoning



From: De Golia, P and Hoock, J (eds). "An Introduction to Problem-based Medical Education." AMSA. March, 1988. page 15.

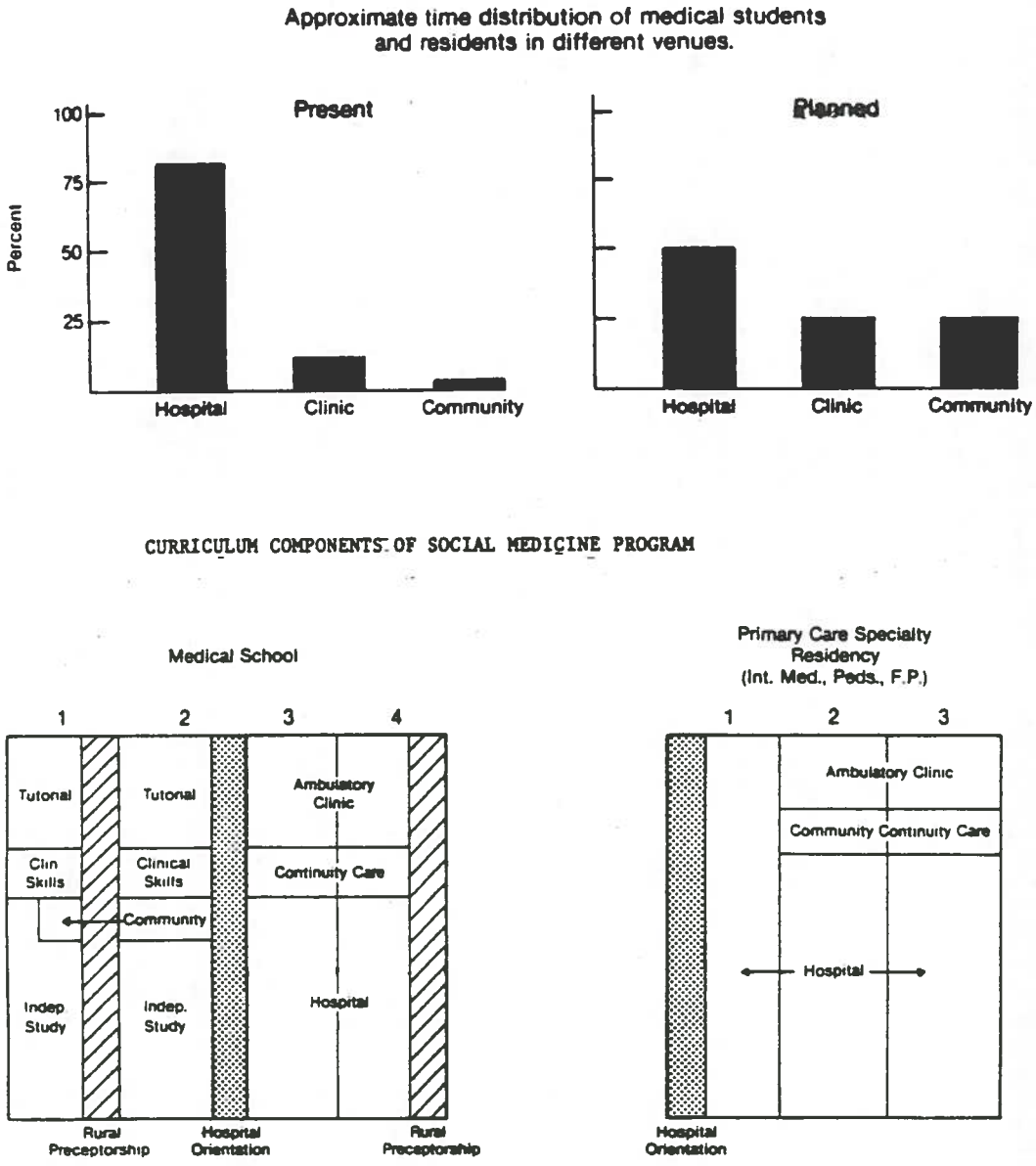
Figure 4

Primary Care Curriculum: 4-year schedule.



From: "Primary Care Curriculum." University of New Mexico School of Medicine. Conference On "Options In Medical Education." February 22-26, 1988. page 30.

Figure 5



From: "Social Medicine at the University of New Mexico: A Program of Cross-Disciplinary Medical Education and Service." Health of the Public Grant Proposal. Submitted by: University of New Mexico School of Medicine. 1986. page 12.

Figure 6

Modified matrix of tasks and abilities deemed necessary for physicians entering graduate medical education.

ABILITIES / TASKS	A Knowledge and Understanding	B Problem-Solving and Judgement	C Technical Skills	D Interpersonal skills	E Work Habits and Attitude
1. Taking a history	MCQ**				
2. Performing a physical examination	MCQ				
3. Using diagnostic aids	MCQ				
4. Defining problems	MCQ				
5. Managing therapy	MCQ				
6. Keeping records					
7. Employing special sources of information					
8. Monitoring and maintaining health	MCQ				
9. Assuming community and professional responsibilities					
10. Maintaining professional competence					

*From AAMC Hoc External Examination Review Commitee (1981). A critical analysis and alternative method, part II. External Examination for the evaluation of medical education achievement and for licensure. Journal of Medical Education, 56, 947.

**MCO refers to multiple choice question examinations.

From: West, DA et al. "Evaluating Student Performance." in Implementing Problem-Based Medical Education, ed. Arthur Kaufman. New York City, N.Y.: Springer Publishing Company, 1985. figure 8.1, page 146.

Figure 7

Evaluation techniques other than multiple-choice examinations which can be used to measure the tasks and abilities deemed necessary for physicians entering residency.

TASKS \ ABILITIES	A Knowledge and Understanding	B Problem-Solving and Judgment	C Technical Skills	D Interpersonal Skills	E Work Habits and Attitudes
1. Taking a history	IPA, PIA, MEQ, OSCE, CS	IPA, PIA, MEQ, OSCE, CS	IPA, PIA, OSCE, SL	IPA, PIA	OSCE
2. Performing a physical examination	IPA, PIA, MEQ, OSCE, CS	IPA, PIA, MEQ, OSCE, CS	IPA, PIA, OSCE, SL	IPA, PIA	OSCE
3. Using diagnostic aids	IPA, PIA, MEQ, OSCE, CS	IPA, PIA, MEQ, OSCE, CS	OSCE, SL		OSCE
4. Defining problems	IPA, PIA, MEQ, OSCE, AR/W, TIB, CS	IPA, PIA, MEQ, OSCE, AR/W, CS	SL	OSCE	OSCE
5. Managing therapy	IPA, PIA, MEQ, OSCE, AR/W, CS	IPA, PIA, MEQ, OSCE, AR/W, CS	SL	IPA, PIA, OSCE	OSCE
6. Keeping records	IPA, PIA, OSCE, AR/W	IPA, PIA, OSCE, AR/W	OSCE, SL		OSCE, AR/W
7. Employing special sources of information	IPA, AR/W, ISG, TIB	IPA, AR/W, ISG	IPA, SL, ISG	IPA	AR/W
8. Monitoring and maintaining health	IPA, PIA, MEQ, OSCE, CS	IPA, PIA, MEQ, OSCE, CS	OSCE, SL	IPA, PIA, OSCE	OSCE
9. Assuming community and professional responsibilities					AR/W
10. Maintaining professional competence	OSCE, TIB	OSCE	OSCE, SL	OSCE	OSCE

KEY

IPA = INDIVIDUAL PROCESS ASSESSMENT
PIA = PATIENT INSTRUCTOR/ASSESSOR
MEQ = MODIFIED ESSAY QUESTIONNAIRE
OSCE = OBJECTIVE STRUCTURED CLINICAL EXAMINATION
SL = SKILLS LABORATORY
AR/W = AUTOPSY REPORT/WRITING SKILLS
ISG = INFORMATION SEARCHING GUIDES
TIB = TEST ITEM BANK
CS = COMPUTER SIMULATION

GLOSSARY & ABBREVIATIONS

attending physicians: physicians with admitting and/or teaching privileges at a hospital who teach residents, fellows, and medical students.

Boards: see NMBE-1.

clinical clerkships: a series of consecutive 2-8 week required and elective blocks spent with different hospital services during the third and fourth years of medical school.

clinicians: physicians who practice medicine in a clinical setting (as opposed to physicians who are primarily researchers).

Common Pathway program: the current medical curriculum at HMS -- involving the entire class (except HST students) -- which has evolved from the New and Old Pathway programs.

house officers, house staff: see residents.

HMS: Harvard Medical School.

HST program: Health Sciences and Technology program in which 25 entering HMS students per year are involved in a separate program with a strong emphasis in quantitative science for the first two years of medical school; jointly operated between HMS and MIT.

NMBE-1: National Medical Board of Examiners (Part 1).

OWHS: Oliver Wendell Holmes Society (equivalent to the New Pathway Program).

PBL students: students in a problem-based learning program.

PCC: Primary Care Curriculum (at UNM).

practice: referring to physicians beyond their training period practicing medicine in the community (i.e. solo practice, group practice, etc...)

residents: physicians-in-training (usually in a 3-5 training or residency program at one or more hospitals).

rounds: visiting and reporting on the current status of hospitalized patients in a team of attending physicians, fellows, residents, and medical students (also called grand rounds).

traditional track students: students in a traditional or conventional track program (referring primarily to UNM's conventional track curriculum).

UNM: University of New Mexico School of Medicine.

wards: hospital wards, as in "on the wards" (usually referring to the third and fourth year of medical school).

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FOOTNOTES

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2) Derek Bok, "Needed: A New Way to Train Doctors," Harvard Magazine, April 1984, pg. 32.

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5) Derek Bok, "Needed: A New Way to Train Doctors," Harvard Magazine, April 1984, pg. 41.

6) Not including the 25 entering students in the Health Sciences and Technology curriculum (HST) -- a separate program during the first two years of medical school with a strong emphasis in quantitative science jointly administered by Harvard Medical School and the Massachusetts Institute of Technology.

7) Myra Ramos and Gordon Moore, "The New Pathway to Medical Education", in Innovative Tracks at Established Institutions for the Education of Health Personnel, ed. Martin Kantrowitz et al (Geneva: World Health Organization, 1987), pg. 200.

8) For a more complete description of each block, refer to OWHS Program Guides 1986-87 and 1987-88.

9) Stewart Mennin et al, "Primary Care Curriculum", in Innovative Tracks at Established Institutions for the Education of Health Personnel, ed. Martin Kantrowitz et al (Geneva: WHO, 1987), pg. 151.

10) Interview with LuAnn Wilkerson, Harvard Medical School, Boston, MA, 13 January 1988.

11) Interview with Scott Obenshain, University of New Mexico School of Medicine, Albuquerque, NM, 23 February 1988.

12) Interview with LuAnn Wilkerson, HMS, Boston, MA, 13 January 1988.

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