The original problem-based curriculum at McMaster University, featuring small learning groups with a faculty tutor, was established thirty years ago. As a newly created school, McMaster began with this revolutionary problem-based curriculum after a reasonably luxurious four-year opportunity to set it up. A few years later two more new schools, widely spaced across the globe one at Maastricht University in the Netherlands and the other at University of Newcastle in Australia, undertook problem-based learning curricula. There was much cross-fertilization between all three schools. Many faculty from Maastricht and Newcastle spent months to years at McMaster as they were planning their curricula.

Over twenty years ago the University of New Mexico School of Medicine created another problem-based learning revolution by establishing an alternative, problem-based curriculum emphasizing rural, primary care. It was designed for a small number of students and ran parallel with their traditional curriculum. The initial development of this curriculum was financed by an external grant from the Kellogg Foundation and required changes in curriculum design and teaching that were quite different from their traditional curriculum. Promoting this new method for teaching students among the faculty was a new and difficult challenge for the small, dedicated, alternative curriculum faculty at New Mexico. They were pioneers in creating the change from traditional to problem-based curricula. Subsequently, other medical schools such as Harvard, Bowman Gray, Rush and Southern Illinois University established alternative, parallel curricula and faced the challenge of faculty and curriculum conversion.

Over the last decade, many new and developing countries around the world have also initiated problem-based curricula. More recently, several schools including Harvard and Sherbrooke University in Canada have converted their entire, previously conventional, curricula to problem-based learning. The University of Kentucky School of Medicine developed a problem-based learning curriculum in surgery and more recently problem-based learning has been incorporated in psychiatry and surgical clerkships at Southern Illinois University. A 1991 Curriculum Directory of the Association of American Medical Colleges suggested that over ninety medical schools in the USA are now considering problem-based learning in some form or other or in some part of their curricula. At this point problem-based learning cannot be considered as an experimental method in medical education. It has probably been more thoroughly studied and evaluated than have the traditionally accepted educational methods used in medical school. Those teachers who have undertaken the change to problem-based learning usually have done so on the basis of a personal educational philosophy that was in line with problem-based learning or out of concern...
for their school's curriculum and teaching methods. To many faculty, medical students seem bored and dissatisfied with their experience in medical school and consider the basic science years as a difficult and irrelevant hurdle that has to be passed to become a doctor. There is too much emphasis on memorization of facts for their own sake, and students seem to readily forget what they were taught later in their clinical years. External pressure to rid the curriculum of the need to provide comprehensive coverage of the content in all disciplines basic to medicine and to make the first two years of medical school more relevant to the practice of medicine has come from medical school deans, university presidents and, more recently, from the Liaison Committee for Medical Education during its review of medical schools. This pressure has also provided impetus towards problem-based learning. Often a personal encounter with problem-based learning either as an observer in an educational workshop or visiting a problem-based school has also stimulated medical teachers' interest in changing to problem-based learning.

The many studies that have been carried out to evaluate the effectiveness of problem-based learning are fraught with problems that make them difficult to interpret. There are uncontrolled variables in the educational setting that could affect student performance independent of problem-based learning. Many studies have insufficient numbers of subjects. They use limited or inappropriate assessment tools such as scores on the National Board of Examiners United States Medical Licensing Examination (USMLE) step I that do not measure the educational objectives addressed by problem-based learning. In some programs there is a possible bias produced by admission policies (do the "better", older, more mature students tend to volunteer for problem-based learning?). A number of reviews of the literature dealing with the evaluation of problem-based learning have been published.1[viii],1[ix],1[x] The results of these papers will be discussed in more detail in Chapter XIX. Now that problem-based learning curricula have increased significantly, and larger numbers of physicians are now going into practice that are products of problem-based learning, there are studies underway that will continue to provide additional data.1[xi]

Many early studies compared the scores achieved on National Board of Medical Examiners Part I (now replaced by the USMLE Step I) taken after completing the first two basic science years. Overall, no truly significant differences have been found with these scores. However, this examination does not measure competencies or skills that are important or central to the rationale for employing problem-based learning. The results only assure the skeptic that problem-based learning is doing no harm in terms of the range and extent of knowledge that students in both curricula can recall.

The many teachers and the increasing number of schools that have adopted problem-based learning have done so on the basis of the logic behind its use and the fact that it
has provided an exciting and motivating way for students to learn. Many students contemplating entering medical school are now selecting schools on the basis of whether they offer a problem-based learning curriculum. As mentioned previously, medical students have become jaded and bored with preclinical years made up of endless lectures by a parade of faculty and the need to memorize endless facts for their own sake just to pass examinations that ask for regurgitation of memorized facts. Students are required to memorize incredible amounts of information to survive.1[xii]

Unfortunately most of the reviewers who have attempted to synthesize the results of studies evaluating problem-based learning do not realize how difficult it is to generalize from reports and studies from individual schools that claim to use problem-based learning. In fact, most medical teachers are unaware of the many marked differences that are present in these schools and how erroneous it can be to generalize about problem-based learning from observations or reports from a particular school. PBL curricula can differ remarkably in curricular design, the extent of the curriculum that is problem-based (all years, first two years, alternative, parallel track or entire curriculum), the problem formats used by students (printed cases, vignettes, simple to complex simulations), the role of the tutor, the size of the student group, the degree to which conventional curricula compete with problem-based learning, the kinds and number of subjects or disciplines that are not included in the problem-based learning curriculum (anatomy and biochemistry, for example, are often taught in a conventional manner in some schools with problem-based learning), the degree to which students are given responsibility for their learning as opposed to the teacher, the stress put on self-directed learning or clinical problem solving, the methods used for student assessment (multiple choice questions versus performance-based assessments), and the use of grades versus pass-fail decisions. The results of a detailed questionnaire by Kelson and Distlehorst sent to all schools who claim to be using problem-based learning underline the fact that problem-based learning can be a meaningless term unless what goes on in a curriculum is clearly defined.1[xiii]

This book will build the case for a well developed and researched type of problem-based learning that has evolved through twenty-five years of design application assessment and redesign. It represents problem-based learning in its more rigorous and pure form. Understanding this particular species and the rationale for all the elements in its design, should give you sufficient background to design a problem-based learning curriculum based on sound educational principles. One that reflects both the particular objectives and expectations you, or your school, has for the medical students it graduates and the resources within your school.

The basic sciences of education are educational psychology and cognitive science. The information from these fields is as essential to educational practice as are the basic sciences of anatomy, physiology, etc. to the practice of medicine. In the light of
these sciences, it could be considered educational malpractice to expose students to all the information you may feel is essential from your discipline and then test them at the end of the course to see if they are able to regurgitate a sufficient amount of that information in an oral or written test. Many studies have shown that the students will forget most of what you have asked them to memorize and will not be able to apply what they can recall in practice. This is not only educational malpractice, it is tragically inefficient when you consider how much energy faculty put into teaching and students put into studying during these preclinical years to result in such a small yield.

The particular way in which students are asked to learn has a strong influence on how well they will be able to recall and apply what they have learned in the real clinical world outside of the medical school. If your major concern as a teacher is only that students do well on written tests of recognition and recall, the educational approach just described will accomplish that. However, if you expect your students to:

- Become independent
- Reason their way through patient problems
- Recall and apply what they have been taught in medical school to the care of their patients
- Recognize when their skills and knowledge are not adequate to the clinical task they are confronting and
- Acquire new information and skills as they need it, and, as medical research moves ahead, keeping contemporary in their knowledge and skills

Then the conventional medical education approach, described previously, is inappropriate.

Over the last thirty years there has been a growing body of research in these sciences basic to education that provides information essential to well thought out educational practice. Much of this information is incorporated in the problem-based learning method described here. Schmidt, Norman and Myers have provided overviews of the many studies in psychology and cognition that have underlined the scientific basis for problem-based learning in general.1[xiv],[xv],[xvi]

The first chapters will elaborate further on the background for a well designed problem-based learning curriculum by considering the goals of undergraduate medical education, the challenge patient problems present, the nature of the physician's clinical
reasoning process, how that process is associated with knowledge needed to are for patients, and the importance of self-directed learning for an effective career in medicine. The remaining chapters will deal with the design of an effective problem-based learning curriculum


