Computerization of medical record data elements began in the mid 1960's. Although there were initial efforts at many scattered locations, concentrated activity took place at only a few academic centers and institutes. Medical record computerization failed to keep up with the intensity of program development in banking and manufacturing industries since the financial benefits were much less direct for patient records in electronic form. Third party payors did not allow (nor have since) itemization of charges for a computerized record, hence most development was conducted only through government or private foundation grants. The payoff to improved record systems were difficult to measure in immediate dollars and cents; however most people involved in development sensed the worth of their efforts for improved patient care.

The time-series nature of medical records presented challenges in software design that other industries had ignored. Financially-oriented applications had dollar balances which were "brought forward". As much as one or possibly two years of transaction detail might have been saved in archived files with only a small subset of the database on-line. Medical records applications had historical, physical and diagnostic findings as their "balance forward" as well as transactions including medical and surgical therapies and laboratory and radiological studies results. It has been necessary to develop records capable of storing large amounts of textual data and yet have a structured format which permits maintenance of the many relationships present in medical data.

Although there was not the same magnitude of computer development effort in medical records as in other industries, medical software did favor interactive systems more so than business. Something about the logistical flow of data in medical environments lead developers to concentrate on realtime, online systems rather than the traditional batch processing on large computers with keypunch cards. Currently, computer applications in other fields are "catching up" with the airlines registration systems and yet medical records software has, in many instances, already crossed that bridge.

Information systems in any field can be restricting in that they force compliance with procedural rules which must be followed in order to interact successfully with the system. Although other fields might have been behind medicine in using interactive computing, they had already experienced the increased discipline necessary to conduct daily activities with the computer. Medicine still has this enforcement of discipline to learn. Interactive, medical record software can bring a jolt to a health care delivery setting where providers are not used to having any controls on the manner in which they process data for decisions about patient care.

The Medical Record (TMR) is an interactive medical information system which provides support for all processes related to delivering and managing the care of the patient. Design of this system occurred primarily in an academic setting over the past ten years. During this time it has kept pace with new hardware, new operating systems, and new concepts. In its home setting, Duke University Medical Center, TMR has continued to expand to multiple specialties. Outside of Duke, it has expanded to general purpose and specialty clinics, and has recently been installed in an inpatient setting, to function both as a hospital system (HIS) as well as an ambulatory information system.

TMR consists of a group of functional program modules whose specific data collection and presentation is controlled through a user-defined dictionary. A complete list of problems, diagnoses and procedures, with appropriate dates provides the focal point of the medical record. Subjective and physical findings; all therapies, present and past; and all studies are recorded along with numeric, textual or coded results. Narrative SOAP notes permit individualization of records, while an accounting module provides flexibility for various methods of payment, discounting, adjustments, control of accounts. Reporting data may be viewed from an orientation by source, problem, time, specific encounter, and revenue or cost center.

TMR software is upward compatible with the full range of Digital Equipment Corporation's micro to large mini-computers (11 and Vax series) and runs in most of the DEC operating systems as well as Unix.

The papers in this session have been selected to share both design and user experience in TMR.
The paper by Hammond provides insight into the size and growth of computerized medical records and how the system manages records that grow indefinitely in size. This paper also discusses functions that were added to meet the custom requirements of various user groups.

The paper by Stead is also a development paper which presents differences, problems and solutions in the evolution of TMR from an outpatient system to an inpatient system.

The University Health Services Clinic has been one of the longest users of TMR. This user has suffered through many iterations of design of TMR over the past ten years. During this period, the clinic was under the direction of several administrators, thus the present administrators had no opportunity to decide whether to use this computer system or not. They chose to go through the exercise of evaluating a system that had been in place for several years to see the impact of not having that system and to determine if the cost was worth the benefits. The paper by Ms. Kozel discusses this experience.

California Primary Physicians is the first non-Duke implementation of TMR. This group has now been operational for three years and functions daily in a mode of almost total computer dependence. Dr. Bernes, the presenter, has used data collected by the computer in rather unique ways, to manage and expand this clinic.

The final paper, by Dr. Casagrande, discusses the implementation of TMR in an inpatient setting, a research cancer hospital. The TMR dictionary has become the heart of the system and as such, is critical to the effectiveness of the implementation. Dr. Casagrande discusses the development of the dictionary for that setting.