

Special Features ■

Presentation of the Morris F. Collen Award to Reed McArthur Gardner, PhD

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Election to the fellows college of the American Medical Informatics Association (The American College of Medical Informatics [ACMI]) recognizes significant and continuing contribution to the field of medical informatics. The College awards its highest accolade once a year, when appropriate, in recognition of lifetime achievement and singular contribution to the field. This award, the Morris F. Collen Award, recognizes those individuals, who, like Dr. Collen, have not only been noteworthy pioneers in the field, but whose professional and personal contribution and conduct over a lifetime are worthy of approbation and emulation.

The College has recognized Dr. Reed McArthur Gardner as the 2005 recipient of the Collen Award. Reed's career has evolved with the field, from his earliest days as a hardware engineer building data acquisition devices for clinical decision support systems to his work as an evaluator of hospital information systems. Reed demonstrates persistence, integrity, and a passion for his work. He is a pioneer in biomedical instrumentation and standards, an unrelenting investigator, and a dedicated and demanding educator and mentor and is viewed by his colleagues as an unselfish collaborator and wonderful person to work with. He is fittingly recognized with this highest honor in the field of medical informatics.

Reed Gardner was born in October 1937 in St. George, UT, to Wayne C. and Bessie McArthur Gardner. He was the fourth

of five children. Reed's father, a sheep rancher, taught him the joy of work and accomplishment. Reed recounts, "My father taught me how to work. For example, he gave me 'doggie,' or orphan, lambs to raise, which I fed with a bottle until they were large enough to join the sheep herd. Then, when the lambs were sold in the fall, Father put the money into a college fund for me." Tragically, at the age of 11, Reed lost his father, who died during a winter storm on the range. From then on, his mother took over as manager of the family sheep business, as well as continuing to raise her family. Reed's humble origins and the challenges of growing up in rural Utah infused him with a strong work ethic and helped to shape his lifelong pattern of getting things done.

After high school, Reed attended Dixie Junior College and earned an associate's degree in pre-engineering. It was there that he met Jackie Christensen, the future Mrs. Reed Gardner. With some trepidation, he approached the next step in his education, which was to attend the University of Utah in Salt Lake City (the "U"), where he completed a bachelor's degree in electrical engineering. Reed's dormitory at the U was Wasatch Hall, a remodeled Army barracks at the nearby Fort Douglas. Reed's present office in the Department of Medical Informatics is in the newly completed Health Sciences Education Building located 100 feet from the old barracks.

Reed was quite concerned about how well he would perform academically after coming from a "rural" junior college, but he need not have been. The seeds of his prolific research and publishing activity were evident even then. In his final year, Reed received a National Science Foundation undergraduate research fellowship; he also traveled to Corvallis, OR, where he won the regional IEEE paper contest. He graduated from the University of Utah with honors. To date, Reed has produced over 350 scholarly publications.

More significantly, however, was an event that would forever change the direction in which Reed was headed. During his years at the U, he spent two summers as an intern with Hewlett-Packard and, as a result, anticipated a career in industry. However, Reed's senior thesis professor introduced him to medical informatics pioneer and now fellow Collen

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Figure 1. Reed McArthur Gardner, PhD.

Award recipient, Homer R. Warner. Not only did Reed decide to stay at the U and obtain a Ph.D., but he worked with the distinguished Dr. Warner for the next four decades of his academic career.

In the early 1960s, Homer Warner computerized the heart catheterization laboratory at the then Latter-day Saints (LDS) Hospital. Reed received a National Sciences Defense Act Fellowship, and started work as one of the first Ph.D. candidates in Dr. Warner's newly formed Department of Biophysics and Bioengineering.

His Ph.D. thesis was concerned with the measurement of changes in aortic diameter of the descending thoracic aorta from an angiogram. He developed a method, basically a track-and-hold circuit, that would allow him to make these diameter measurements 100 times a second. We could then look at the effect of pressure-volume relationships in the aorta for the first time—a very exciting period for us. We used loops of analog tape recorded to play over and over again these angiograms and Reed then did an analysis of these angiograms in a variety of physiological states.

—Homer R. Warner

In 1968, Reed completed his Ph.D. and joined the faculty of the department. He is always the first to note that the work at LDS Hospital was a team effort, but Reed was the "hardware man" and a critical member of this team. Where special hardware did not exist or was too expensive, Reed built it. Reed and engineering colleagues built the biosignal acquisition hardware to capture heart rate and physiological wave forms, oxygen saturation, respiration rate, and blood pressure as well as the hardware to transmit and display these signals remotely throughout the hospital.

Early decision aids provided by systems built with Reed's hardware and colleague T. Allan Pryor's software anticipated the HELP (Health Evaluation through Logical Processing) system.

Reed's contribution was primarily facilitating the use of physiological signals that could be fed through an analog digital



Figure 2. Reed Gardner (right) with colleagues Homer Warner (left) and Allan Pryor (center) in a data center of the early HELP (Health Evaluation through Logical Processing) System.

converter into the computer. We did this first in the cardiovascular laboratory, and then we went down into the operating room and he trained the anesthetist to use these signals to follow the physiological states of patients during the operation. Soon after that we moved those same kind of physiological measurements into the intensive care ward. I remember Reed built a very fancy terminal for us for the ten-bay ICU that had lights on it that would alert us when the patient developed a threatening physiological state of some kind. It would plot a graph of the variable that was changing in an undesirable fashion and by pressing an interrupt, we could interrupt the computer and it would plot a graph of that for us. It was very sophisticated for its day.

—Homer R. Warner

Everything was new...there was no opportunity to go out to the marketplace and say I think I'll buy this because I want to perform this function. Every idea had to be conceived of, developed, and implemented internally within our laboratory. And Reed had the responsibility of developing that hardware which allowed us to accomplish that.

—T. Allan Pryor

Reed's contributions were vital to the development of the HELP system. HELP acquired and stored patient data. In later years, HELP would be known for its clinical decision support system, but early on, the important data collected and used in HELP were largely gathered from bioinstrumentation built or integrated by Reed. Over time, Reed contributed to hardware for bedside blood pressure monitoring, pulmonary function testing, and monitoring and charting of mothers during delivery.

Recognized for his knowledge in signal acquisition and processing, Reed was a consultant to industry and in demand around the world. In 1969, Reed, Allan Pryor, and their families traveled to Kiel, Germany, to install a computerized heart catheterization laboratory in a children's hospital where Reed served as a guest professor. Reed served on the National Aeronautics and Space Administration's (NASA) first Life Sciences Committee, which studied the monitoring and telemetry of the astronauts as they experienced the weightless state in outer space for several days. The committee also



Figure 3. Reed Gardner in a computer-equipped intensive care room at LDS Hospital. Reed helped develop the IEEE standard for communication between bedside instruments shown here and the HELP system and helped develop the patient care documentation and decision support used at the bedside by caregivers.

made recommendations about what medical capabilities should be included in the future space station. Reed would later spend a five-month sabbatical at NASA. In 1975, he traveled to the Soviet Union for the National Cancer Institute as a member of a review committee to observe bioinstrumentation and bioengineering activities during the height of the Cold War.

The growth of HELP opened up new directions for Reed. During the early years of the HELP system, Reed recognized the need for greater standardization in signal acquisition and device interfacing. He played a key role in the development of IEEE standard 1073, the Medical Information Bus (MIB). The MIB provided a standard for bedside device manufacturers to use, so that data from bedside monitors, intravenous pumps, ventilators, and so on could be transmitted directly to hospital information systems like HELP.

Reed played an integral role in the long-standing partnership of the University of Utah academic program and Intermountain Healthcare, of which LDS Hospital is still a part. Reed served as Director of Clinical Computing Services at the University of Utah from 1971 to 1985, but LDS Hospital served as the laboratory for his research over the next 35 years, first in the catheterization laboratory, then in the intensive care units, and eventually throughout the entire LDS Hospital. As the range of his activity grew, Reed transitioned from the role of a hardware developer to that of a system evaluator, focusing first on the evaluation of the specific instrumentation or monitoring system, then evaluating the impact of these systems on the process of care itself, and ultimately, determining the impact of the entire hospital information system. In succeeding years, Reed and his students carried out many LDS Hospital-based studies that evaluated information systems' role as an intervention for controlling hospital-acquired infections, detecting and preventing adverse drug events, alerting for life-threatening laboratory findings, managing ventilators

for patients with ARDS (adult respiratory distress syndrome), and computer-assisted blood product ordering by physicians.

In 1985, mentor and colleague Homer Warner moved from LDS Hospital to the University of Utah. At this time, Reed and Allan Pryor took the helm of Medical Biophysics and Computing, which later became Medical Informatics, at LDS Hospital. During the succeeding years, Reed and AI alternated as head of the LDS Hospital Medical Informatics Department and the Intermountain Healthcare component of the University of Utah academic department.

Reed's colleagues speak of his commitment to the profession and his willingness to give back. Reed has served in leadership positions in a broad range of organizations that have intersected with his career.

Within the informatics community, he chaired AMIA's 1995 Symposium on Computer Applications in Medical Care, served eight years on the board of AMIA, and served as AMIA President (Chairman of the Board) from 1996 to 1997. He also was a board member of the Joint Health Information Technology Alliance. He served as a member on the National Library of Medicine, National Center for Health Services Research, and Agency for Healthcare Research and Quality study sections. In addition to his "pure informatics" activities, Reed has been involved in numerous medical organizations, for example, serving as the President of the Utah Heart Association, Vice President of the American Thoracic Society, and President of the American Lung Association of Utah. He has also served in multiple editorial capacities for several medical and informatics-related journals including Editor-in-Chief of the *International Journal of Clinical Monitoring and Computing* and on the editorial board of the same journal, as well as on the boards of the *Journal of Bioengineering*, *Heart & Lung*, the *American Journal of Critical Care*, the *Journal of Clinical Monitoring*, *Methods of Information in Medicine*, the *International Journal of Medical Informatics*, and *Journal of the American Medical Informatics Association*. Perhaps more significant is his time in the less glamorous roles, such as many years spent chairing standards committees of national organizations. In addition to his contribution to the development of the MIB standard, Reed was recognized in 1997 by the U.S. Food and Drug Administration with the Commissioner's Special Citation for his contribution with Dr. Randy Miller for developing public policy about reliability and functionality of clinical information systems.

We found Reed spending considerable amounts of his time working with a lot of these organizations to share not only the information that we were developing, but also bringing to us and throughout the world that information and standards that were being developed worldwide.

—T. Allan Pryor

In 1996, Reed once again followed in the footsteps of his mentor, Homer Warner, and moved from LDS Hospital to the campus of the University of Utah to become Chair of the Department of Medical Informatics. Under Reed's leadership, the University of Utah became a National Library of Medicine Medical Informatics training site. Reed applied the same themes of standardization and measurement to his work as department chair. During his tenure, the academic program has been structured to provide a common, standard core of

medical informatics training, supplemented by a rich set of specializations. Reed has constantly looked for measurable ways to enhance the experience of students and to improve the quality of the academic program.

Reed is a gifted mentor who loves teaching in the classroom as well as working with students one-on-one. Reed's role as mentor and trainer goes back long before he became chair, as he has supervised 14 Ph.D. and 25 master's degree students. A number of these students have gone on to become faculty members at such prestigious institutions as Yale, Duke, Vanderbilt, Harvard, Oregon Health & Sciences University, Columbia, and the University of Utah or to work for outstanding health care institutions such as Partners Healthcare, Eclipsys, Emtek, 3M, Kaiser Permanente, and Intermountain Healthcare. Reed is proud of the productivity of his former students. All have been infected with his work ethic and drive. Like Reed, they are active in the field of clinical information systems design and health services research, including operations and evaluation.

He's done a tremendous job and many of his students have gone on to achieve fame in their own right and Reed's probably as proud of them as any other accomplishment and he should be because he's made a tremendous contribution that'll be around long after he's gone.

—Homer R. Warner

Reed teaches all his students to ask good questions and then collect data that help in answering those questions. This drive to find out what is really happening in the hospital or within the clinical information system itself is what sets Reed's students apart. After all the data have been collected, analyzed with care, and interpreted, Reed's concern with carefully documenting the effort really comes to the forefront. Reed is truly egalitarian when it comes to making sure the data are accurate, the writing is clear, and the references are correct before any manuscript is submitted with his name attached. All students suffer equally under his editorial red pen.

While Reed can be hard on his students and colleagues alike, after all the fighting is done, he has always been the first to suggest a lunch date, on him, at his favorite restaurant in downtown Salt Lake City, Snappy's, where they melt the cheese on the cheeseburgers by scooping up hot grease from the grill and pouring it on top of the cheese.

The picture of Reed Gardner would be incomplete without mention of his life outside of informatics. Truly there is no distinction. Those who know Reed personally know that he never hesitates to introduce colleagues to his personal love of the outdoors, the mountains, and his first love, the high mountain desert of Southern Utah. Reed's commitment to his students is mirrored in his commitment to shaping young men through the Scouting program. He loves sharing the outdoors with his family as much as with others and teaching lessons that prepare one for the rigors of life. Similarly, his contributions to professional organizations are only one facet of his commitment to serving others. Throughout his career, Reed has actively served in various lay ministry positions in his church. More recently, he has combined his research interests with humanitarian work, as he joined colleague

Dr. Bill Tierney in sub-Saharan Africa developing computerization to benefit medical education and patients with acquired immunodeficiency virus.

Reed Gardner does not seek celebrity. He has the largely quiet temperament of, as he likes to say, a St. George sheepherder. But that does not mean he is humble. Reed is an extremely proud father of five children and recounts their contributions to health care through careers in nursing and medicine. Shelly and Allison are registered nurses, Barry is an emergency department physician, Scott is a physician's assistant, and David and his wife are both physicians in residency training. All earned undergraduate degrees from the University of Utah. He takes similar pride in maintaining the 130-year-old adobe family homestead in St. George that has walls 15 inches thick to block the summer heat and winter cold!

Though he does not seek celebrity, he is impassioned in his quest for answers. Reed wants to know what works, why or why not, and he asks the necessary tough questions. No student from the Utah Informatics program has ever escaped, or forgotten, Reed's most famous question, that must be answered before any degrees are conferred—"so what?" Reed Gardner has unquestioned integrity in pursuing the answer, whatever the question may be, and he is willing to challenge all assumptions, even his own.

Reed is such a gentle guy that you really wouldn't use the word fierce to describe him...but I found him to be fiercely honest when dealing with matters of science and intellectual integrity; he was never afraid to be self-critical or critical of the systems he was building.

—Gilad J. Kuperman

The product of Reed's passion and commitment is a track record of accomplishment that has not been duplicated in scale. He is the first to say it has been a team effort and the work of many colleagues. His modesty comes from recognizing the breadth of the field of informatics and the significant challenges yet remaining. His quiet manner meshes well with his unique ability to remain humble despite noteworthy recognition, yet these personal characteristics belie his fierce internal desire to move forward and make measurable improvements.

Reed has always, it seemed to me, managed to contribute to the field by knowing ahead of time where the problems lie that we will be happy ten or 15 years later that he worked on...things that were very, very difficult to even imagine at the time he started that work. In our congratulations to Reed, I think we all remember the equanimity and the dignity with which he has always been a smiling and wise presence in our field, a wonderful person to work with.

—Donald A. B. Lindberg

It is with great pleasure and respect that the American College of Medical Informatics recognizes the accomplishments and lifetime achievement of Reed McArthur Gardner. In recognition of the significance of these contributions to the field of medical informatics, the college presents the 2005 Morris F. Collen Award and offers its warmest congratulations to Reed and his family.