In memoriam: Gerald Buckberg, MD: Mentor, educator, surgeon, and artist

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Gerald Buckberg, MD

Dr Gerald Buckberg died on September 20, 2018. He was a pioneer in cardiac surgery whose career of achievements was recognized by the American Association for Thoracic Surgery (AATS). He was awarded the AATS Scientific Achievement Award in 1994. He was the sixth recipient of this award, joining Drs Kirklin, Shumway, DeBakey, Cooley, and Carpentier. In 2002, he was honored with the Society of Thoracic Surgeons Lifetime Achievement Award.

Dr Buckberg was multitalented with a wide range of interests. He was a Distinguished Professor of Surgery at the David Geffen School of Medicine at the University of California, Los Angeles (UCLA). He was a National Institutes of Health–funded investigator throughout his career. He remained an active faculty member until his recent and fatal illness. Among his many awards are the Longmire Legacy Award in 2007, the Gibbon Award for Outstanding Contribution to Science and Practice of Extracorporeal Circulation, and the Lifetime Achievement & Chairman's Award from the UCLA Division of Cardiac Surgery.

Gerald Buckberg was born and raised in New York City. He often referenced his youth saying, “This is not bad for a guy from the Bronx.” He received his Bachelor of Science degree in 1957 from The Ohio State University. He studied Medicine at the Cincinnati College of Medicine, graduating in 1961, first in his class, receiving the S. F. Hoffheimer Award.

Dr Buckberg was an intern at the Johns Hopkins Hospital in Baltimore, Md, in 1967 and completed his residency at UCLA under Dr William Longmire, Jr. He served in the US Air Force from 1967 to 1969.

His research years (1969–1971) were spent at the Cardiovascular Research Institute at the University of California, San Francisco. He worked in the famed

laboratory of Dr Julien Hoffman. Dr Hoffman introduced him to a book authored by Claude Bernard entitled *An Introduction to the Study of Experimental Medicine*. The book became his research “Bible.” Its influence on his research career was profound. It was required reading for all his research fellows.

UCLA recruited him back to join the faculty in 1970 as an Assistant Professor, and thus began his illustrious career as a cardiac surgeon, innovative investigator, and teacher. Cardiac surgery at this time was plagued with the problem of protecting the myocardium while the surgical repair of the cardiac structures was performed. Dr Buckberg's research laboratory began rigorous basic studies of myocardial injury and methods to improve myocardial protection. He established the pathophysiology and investigated the ideal constituents of cardioplegic solutions (blood cardioplegia) and techniques for its administration (redosing, antegrade and retrograde via the coronary sinus). His studies advanced protection strategies for resuscitating injured and ATP-depleted hearts (warm substrate enhanced “hot shot”). This opened the door to operations after acute myocardial infarction. In addition, his studies on reperfusion injury identified the best cardioplegia solution constituents, and strategies to minimize postischemic reperfusion injury were seminal.

Dr Buckberg's experimental and clinical studies changed the world of cardiac surgery. He standardized the solutions, established the superiority of blood versus crystalloid cardioplegia, he demonstrated the additive benefit of retrograde administration to antegrade cardioplegic delivery and the importance of controlled reperfusion. Thus, the safety and duration of aortic crossclamping, especially on preoperatively injured myocardium and patients in cardiogenic shock, was forever changed. These principles and

techniques have been adopted worldwide. The impact of this work has influenced the entire field of cardiac surgery. He has indirectly saved more lives than the impact of an individual surgeon would have during a clinical career.

In 1992, Dr Buckberg introduced the concept of “unintended reoxygenation injury,” when cyanotic newborns are started on cardiopulmonary bypass to correct a congenital defect, causing cyanosis. These studies taught us that avoiding too much oxygen and adding antioxidants could minimize injury. He provided the first evidence of a new biochemical pathway that causes this damage. This pathway is offset by the cardioplegic solutions used routinely in daily clinical practice that were developed at UCLA.

In 1998, Dr Buckberg organized an international team of cardiologists and surgeons focused on the treatment of congestive heart failure by altering ventricular geometry. The reconstructive endoventricular surgical techniques (Reconstructive Endoventricular Surgery Returning Torsion Original Radius Elliptical Shape to the Left Ventricle [RESTORE]) reduce the volume and reshape the dilated spherical ventricle to the normal elliptical shape. The basis of this structural alteration is linked to the concept of the helical heart spatial configuration. Dr Buckberg studied experimentally and advocated that ventricular shape, twisting, and septal motion were essential for normal filling, muscle contraction, and left ventricular ejection. This concept was built on the contributions from colleagues Dr Vincent Dor in Monaco and Dr Torrent-Guasp from Spain.

At the AATS meeting in 2001, Dr Buckberg delivered the Basic Science Lecture on the “Helix and the Heart.” He illustrated these novel concepts on cardiac structure and function. He demonstrated the embryological development of the heart from a simple tube that folds, producing an external wrap and an internal spiral helix. These concepts provided a paradigm shift in conventional thinking creating new reconstructive approaches to heart failure.¹

In 2003, Dr Buckberg was appointed Faculty Associate at Caltech to study the helical heart in their Bioengineering Option. This appointment is uncommon and is given to individuals who will collaborate on innovative studies that expand the basic efforts at Caltech to interface with major disease entities.

In 2007, Dr Buckberg received an Honorary Doctor of Science degree from both The Ohio State University and the University of Cincinnati to recognize his distinguished career. This award citation states “His relentless pursuit of truth has guided his thinking and teaching. He has passed this gift onto many of his trainees, who have become expert cardiovascular surgeons and scientists. His seminal work on myocardial protection is a great example of how the process works from bench to bedside.”

Dr Buckberg’s curiosity and uncompromising passion are characteristics of innovative scientists asking new

questions, developing new hypothesis and elegant experimental designs to rigorously answer the questions. Negative results prompted modified hypothesis and new experiments until the breakthrough was achieved.

Dr Buckberg was not afraid to challenge traditional views. His determination to understand the heart’s structure and function led him to confront the world with fresh new ideas on how the heart works. He designed elegant yet simple experiments in the laboratory to explore and discover new truths. In the process, he made both friends and enemies. Editorials were often heated and critical; however, controversy and adversity only increased his determination to seek scientific proof.

Several personal characteristics led to his success. Gerry Buckberg’s creativity mixed with positive thinking, self-confidence, a willingness to always learn something new, independence, and an unparalleled intellectual capacity allowed him to achieve what others could not. He discovered the secrets of life in finding positive aspects even in miserable situations others considered hopeless. He never thought of yesterday, only of tomorrow. He had an unparalleled will to win. His competitive spirit was in part forged as a competitive athlete.

Aside from his scientific achievements, he was an accomplished artist. Perhaps this is why he always saw things that were often not apparent to others. He painted for decades, went to art classes, and won awards for his paintings. In 1966, he won first prize for “beginner’s oils” from the Los Angeles Physician’s Art Society. There were times in his life when painting was his best way of expressing himself.

In addition to art, he also loved sports, especially swimming. He took swim classes every morning at 5:45 AM in the UCLA pool. He was one of the fastest long-distance (10 miles) swimmers in his age category. For 11 successive years, he took part in the “Pacific Ocean Race” for the “10-mile swim.” Even though he swam very fast during these competitions, there was a 1-legged man in his age group who was always ahead of him. He took his second-place position and always expressed great admiration for the other man.

After many years of intensive swimming and winning many national and international contests, he was awarded “All American Swimmer,” a very highly prestigious recognition. In addition, he trained as a runner intensively over the years and participated in marathon races.

Dr Buckberg’s heroes gives further insight into his personality. His heroes included his parents, Julien Hoffman, Claude Bernard, Auguste Rodin, and Albert Einstein.

Albert Einstein was a genius who was completely independent of external influences, shunned superficial signs of power, and was scientifically honest. Albert Einstein said, “Try not to become a man of success, but rather to become a man of value.” This statement made a great

impression on Dr Buckberg and explains some of his behaviors during his lifetime.

As mentioned, at the AATS meeting in 2001, he delivered the Basic Science Lecture about the “Helix and the Heart.” There were several-minute standing ovation after the talk. However, after the last sentence, he simply left the stage. Francis Fontan asked him why he did not remain at the podium to enjoy the response. Dr Buckberg replied that his message was complete when the talk was over. Francis Fontan commented on this by saying, “You gave them your mind but took your body away.”

Two other proverbs by Albert Einstein that Dr Buckberg admired are the following:

“Imagination is more important than knowledge. Knowledge is limited; imagination encircles the world.”

“The true value of a human being is determined primarily by how he has attained liberation from the self.”

Dr Buckberg was a genius and one of the most productive surgeon investigators of our generation. He was innovative.

His skills as an investigator developed and influenced cardiac surgery, elevating him to the pinnacle of our profession. He changed our concepts and the practice of cardiac surgery. He was always true to his mantra that “life is not much fun unless you probe the unknown.” He created knowledge and trained a generation of surgeons and scientists.

In 2018, Dr Buckberg published his autobiography, entitled *Solving the Mysteries of Heart Disease*.² Through his own words, all can experience the life and career of this remarkable man.

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