

NINA STARR BRAUNWALD, M.D.

Nina Starr Braunwald was born in Brooklyn, NY, in 1928. She received her baccalaureate and MD degrees from New York University. In 1952, she became the first female surgical intern at Bellevue Hospital, where she went on to complete a junior residency in surgery in 1955. She then transferred to Georgetown University, where she became a senior resident in general surgery. She served as Chief Surgical Resident at Georgetown University Medical Center from 1957-1958. While at Georgetown, she conducted research with Charles Hufnagle, a pioneer in the new field of cardiac surgery, and received an MS from Georgetown University in 1957. In 1958, she joined the staff at the National Institutes of Health (NIH) as a member of the National Heart Institute (now the National Heart, Lung and Blood Institute). Here, she trained as a cardiac surgeon under the direction of Dr. Andrew G. Morrow. With Dr. Morrow's encouragement and support, she began an academic career as the first woman to be board certified in cardiac surgery. She served as a Staff Surgeon at the National Heart Institute (1958-1965), and then advanced to the post of Deputy Chief of the Clinic of Surgery, a position she held from 1965–1968.

During her time at the NIH, Dr. Braunwald conducted groundbreaking research in cardiac surgery, focusing primarily upon the development of artificial heart valves. She designed and fabricated a flexible polyurethane mitral valve with Teflon chordae tendinea that she implanted into dogs. In 1960, at the age of 32, she led the operative team that implanted this artificial mitral valve into a 44 year old woman with severe mitral regurgitation. The patient had an uneventful recovery and did well clinically for several months. Unfortunately, the patient died suddenly four months following her surgery, presumably from a cardiac arrhythmia. This landmark operation, which took place on March 11, 1960, was the first successful human heart valve replacement.⁽¹⁾ After her work with the polyurethane valve, Dr. Braunwald developed a totally cloth-covered mechanical prosthesis – the Braunwald-Cutter valve – which was successfully implanted into thousands of patients in the last 1960s and early 1970s. Through the years of its use, Dr. Braunwald continued to study ways to improve the function of the Braunwald-Cutter valve, focusing upon anticoagulation and populating the cloth components with native cells as a way to prevent thrombosis and embolic complications. Dr. Braunwald also applied these principles to develop a stented aortic homograft for mitral valve replacement.^(2,3) An active laboratory investigator until her death in 1992, Dr. Braunwald pioneered the use of tissue culture techniques to develop nonthrombogenic cell layers and polymer surfaces to provide optimal surfaces for prosthetic valves and circulatory assist devices.⁽⁴⁻⁷⁾ Her work resulted in more than 110 peer-reviewed articles in outstanding journals including *Circulation*, *The New England Journal of Medicine*, the *Journal of Thoracic and Cardiovascular Surgery*, and *Surgery*.

In her career at the NIH, Dr. Braunwald was a very active clinical surgeon. As a pioneer in this new field, she exhibited considerable operative skills, expert judgment in the operating room, and coolness under the extreme pressure that cardiac surgeons were subjected to in the early years of the field. In addition to successfully implanting the first heart valve in the mitral position, Dr. Braunwald developed techniques for repair of ventricular septal defects,^(8,9) management of pulmonary artery hypertension,^(10,11) and aortic valve replacement for both adults and children. She was also interested in the effect of exogenous electrical stimulation of the central circulatory system upon management of arrhythmias, heart failure, and angina pectoris. Her clinical work in this regard contributed in a highly significant way to the development of implantable

cardiac pacemakers.⁽¹²⁻¹⁴⁾ Following a great surgical tradition, Dr. Braunwald used experimental animal models to develop surgical techniques that addressed problems of human cardiovascular physiology. She brought these new methods to clinical testing, achieving considerable success. Finally, she continued throughout her entire career to study and refine the methods that she developed, continuing to conduct new research to address complications and to improve long-term clinical outcomes.

In 1968, Dr. Braunwald left the NIH to accompany her husband, Eugene Braunwald, to the University of California, San Diego (UCSD), upon his appointment as Chief of Medicine at that institution. At UCSD, she was appointed to the position of Associate Professor of Surgery, a post she held from 1968-1972. During that time, she also served as the Acting Director of the UCSD Division of Cardiac Surgery. In 1972, when Dr. Eugene Braunwald became Chief of Medicine at the Peter Bent Brigham Hospital, Dr. Nina Braunwald relocated to Boston, where she was appointed as an Associate Professor of Surgery at Harvard Medical School. While at Harvard, she was a Staff Surgeon in the Division of Cardiac and Thoracic Surgery at Brigham and Women's Hospital, a Staff Surgeon in the Division of Cardiac Surgery at Boston Children's Hospital, and a Consultant in the Division of Cardiac Surgery at the West Roxbury Veterans Administration Medical Center.

Dr. Nina Braunwald was nationally and internationally recognized for her work in cardiac surgery. She was the first woman elected to membership in the American Association of Thoracic Surgeons. She served in the Medical Device Applications Committee of the National Heart and Lung Institute, and the Panel on the Review of Cardiovascular Devices for the US Food and Drug Administration. She was also a member of the NIH Surgery and Bioengineering Study Section, and a member of the Advisory Council on Surgery of the American Heart Association. Dr. Braunwald frequently presented work at international venues of the Transamerican Society of Artificial Internal Organs, and the International Society of Biomaterials. In the early 1960s, Dr. Braunwald received considerable public attention, with articles in *Time* and *Life* magazines describing her as one of the country's "movers and shakers." She was named "Woman of the Year" in 1964 by the Maryland Federations of Business and Professional Women, "Outstanding Woman in the Field of Medicine" by *Who's Who of American Women* in 1965, and received the Annual Excellence Award of 1966 by the National Board of the Women's College of Pennsylvania.

Dr. Braunwald was the mother of three accomplished daughters, yet despite the many challenges she faced, she was not a strident feminist and cared little about titles or income. Her career was characterized by the pursuit of excellence in her chosen field, despite substantial societal impediments to progress for women. Later in her career, she became increasingly concerned with the serious problems faced by women in academic surgery. She served on the Joint Committee for the Status of Woman at Harvard Medical School, where she was the Chairperson of the Day Care Subcommittee. Following her death, she was honored by the Thoracic Surgery Foundation for Research and Education with the establishment of the Nina Starr Braunwald Career Development Award. This award recognizes Dr. Braunwald's commitment to support the early academic development of women in cardiac surgery. As such, the award includes two years of research funding support, and is given yearly to a promising young woman in the field of academic cardiac surgery. In addition, the Association of Women Surgeons provides an annual Nina Starr Braunwald Award to a surgical leader who has

demonstrated exceptional support of a role for women in academic surgery. Dr. Braunwald's contributions were also acknowledged by President Barak Obama during his speech to the nation during the Fall 2009 announcement of A Recovery and Reinvestment Act Funding for the NIH. In this, he stated, "...at our best we've never allowed our fears to overwhelm our hopes for a brighter future. That's been at the heart of the work of the National Institutes of Health for decades.... It was here that Dr. Nina Braunwald -- the first woman ever to be board-certified in cardiothoracic surgery -- conducted some of the earliest operations to replace heart valves. It was here, in the years after President Roosevelt's visit, that polio vaccines would be tested to end a scourge that affected millions, including obviously the President that helped make the research possible..."

Summary

Dr. Nina Braunwald conducted her career in an exceptionally focused manner, choosing an academic path that allowed her work to improve the care of patients with common, often fatal, cardiac disorders. Among her many research accomplishments, she designed, fabricated, and successfully implanted the first prosthetic mitral valve for the treatment of severe, life-threatening mitral regurgitation. She pioneered the field of tissue engineering as a method to reduce complications from implanted cardiac devices, and she was instrumental in developing technical and physiological data permitting the development of implantable cardiac pacemakers. Remarkably, she achieved these successes during a time in our society when women were often not welcome as surgeons.

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