

[Virginia Apgar \(1909-1974\)](#) ^[1]

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Virginia Apgar worked as an obstetrical anesthesiologist, administering drugs that reduce women's pain during childbirth, in the mid-twentieth century US. In 1953, Apgar created a scoring system using five easily assessable measurements, including heart rate and breathing rate, to evaluate whether or not infants would benefit from medical attention immediately after birth. Apgar's system showed that infants who were previously set aside as too sick to survive, despite low Apgar scores, could recover with immediate medical attention. Additionally, Apgar researched the effects of anesthesia used during childbirth and advocated for the prevention and management of [birth defects](#) ^[5]. Apgar's work led to a decrease in infant mortality rates in the mid-twentieth century and into the twenty-first century, and hospitals around the world still used the Apgar score at one and five minutes after birth.

Apgar was born on 7 June 1909 in Westfield, New Jersey, the youngest of three children, to Helen May Apgar and Charles E. Apgar. Apgar's father worked as an insurance executive but dabbled in amateur inventing and astronomy. As a child, Apgar learned to play violin and attended primary school. According to physician Selma H. Calmes, Apgar's experience with an inventive father and chronically ill brother contributed to her decision to pursue medicine. After graduating from her hometown's Westfield High School in 1925, Apgar enrolled in Mount Holyoke College in South Hadley, Massachusetts, that same year.

At Mount Holyoke, Apgar majored in zoology, the study of animals. Aside from her studies, she worked several part-time jobs and participated in extracurricular activities, including playing seven sports, writing for the college newspaper, acting in theatre performances, and playing violin in the orchestra. After graduating in 1929 with a bachelor of arts in zoology, Apgar entered medical school at [Columbia University](#) ^[6] College of Physicians and Surgeons in New York City, New York. She was one of nine women in an incoming class of ninety.

In 1933, Apgar graduated fourth in her class and began a two-year internship with the surgical department at Presbyterian Hospital, later called Columbia-Presbyterian Medical Center, in New York City. However, Apgar switched her area of focus at the suggestion of her mentor, surgeon Allen Whipple. Because most surgeons were male, Whipple encouraged her to pursue anesthesiology, the study of administering drugs that reduce sensitivity to pain. In 1936, though already a physician, Apgar attended a training course for nurse-anesthetists at Presbyterian Hospital. She then participated in two residency programs in 1937, one at the University of Wisconsin in Madison, Wisconsin, and the other at Bellevue Hospital in New York City.

After finishing her anesthesiology training, in 1938 Apgar became the director at Presbyterian Hospital of the hospital's new anesthesiology division. That appointment established her as the first woman to head a division at Presbyterian Hospital. Her job entailed recruiting and training anesthesiology residents, as well as training other medical residents who rotated through her division. Apgar was also involved with the hospital's anesthesia research. Her early research included studying curare, a nerve poison from the bark of a South American tree, as an anesthetic, and the use of the [hormone](#) ^[7] norepinephrine in surgery.

In 1949, the anesthesiology division at Presbyterian Hospital became a full department, but Apgar did not take the position of department chair. Instead, she became the first woman to hold a full professorship at [Columbia University](#) ^[6] College of Physicians and Surgeons. Apgar continued teaching medical students as well as researching obstetrical anesthesia, or anesthesia used during childbirth.

In 1953, Apgar published a paper on the system she had devised to score an infant's health directly after birth. In the paper, Apgar noted that the methods of evaluating newborn infants at that time were highly subjective. Her system, later called Apgar score, required a nurse or physician to score the infant in five categories within sixty seconds after birth. Those five categories for evaluation were: the infant's heart rate, how well the infant breathed, how well the infant responded to stimuli, how well the infant's muscles worked, and the color of the infant. According to Apgar, the nurse or physician scored each category as zero, one, or two, and the individual category scores were added to obtain the infant's total score. Total scores ranged from zero to ten, with zero indicating that the infant was in very poor condition and ten indicating that the infant was in excellent condition.

After developing her scoring system, in the mid-1950s Apgar worked with other researchers to test how the scores varied based on other aspects of childbirth, including labor, delivery, and maternal anesthesia. With her colleagues at Columbia University, pediatrician L. Stanley James and anesthesiologist Duncan A. Holaday, Apgar published several reviews of the scoring system. The team evaluated the performance of the Apgar score at other hospitals and proposed potential revisions.

One adjustment was for the medical staff to perform a second evaluation at five minutes after birth. Apgar and her team determined that scoring infants again enabled medical personnel to see if the infants improved due to the treatments they had received. Infants who received oxygen because of poor breathing rates often had higher scores in that category at five minutes after receiving treatment. Apgar and her team also discussed the Apgar score as a way to assess an infant's need for

resuscitation. According to the researchers, infants with scores of zero to four received immediate medical attention, such as oxygen to help them breathe. Infants with scores from five to seven also received medical attention to improve their conditions. Infants scoring eight, nine, or ten were in excellent condition and did not receive any medical attention.

Apgar participated in other research during the 1950s about childbirth. With James, Holaday, and other researchers, she compared how general anesthesia versus regional anesthesia affected women and neonates following childbirth. Apgar also called for increased study on how best to administer oxygen to infants after birth. She collaborated with New York psychologist Frances F. Schachter to determine whether or not lack of oxygen at birth impacted intellectual development of children later in their lives.

After creating and testing the Apgar score, Apgar took a sabbatical in 1958 to enroll in a master of public health program at Johns Hopkins School of Public Health in Baltimore, Maryland. She graduated from the program in 1959, and in June of that year, she left her positions at the College of Physicians and Surgeons and the Presbyterian Hospital. She accepted a position at the National Foundation for Infantile Paralysis, which later became the March of Dimes, now headquartered in White Plains, New York. The foundation was expanding from its initial focus on polio to also address [birth defects](#)^[5] prevention. At the foundation, Apgar led a division devoted to congenital malformations, or defects present at an infant's birth. In that position, she traveled the country to speak about early detection of [birth defects](#)^[5], working to increase public support for research in that area. During her term, which also included roles in medical research and medical affairs, the annual donations to the foundation doubled.

Throughout the 1960s, Apgar advocated for the prevention of [birth defects](#)^[5] and infant mortality in her writings and research. In 1960, she worked with former colleagues at Presbyterian Hospital, James and physician Frank Moya, to research how specific conditions during [pregnancy](#)^[8] could cause the brains of fetuses to develop abnormally or accumulate fluid. In her 1966 "The Drug Problem of Pregnancy," Apgar summarized many of the [birth defects](#)^[5] that resulted from the use of common drugs during [pregnancy](#)^[8], including the malformation of limbs, misshapen lips or roofs of mouths, deformed genital areas, and other anomalies.

Apgar argued, with statistician Gabriel Stickle, that [birth defects](#)^[5] were the leading cause of death in the first year of life. By the mid 1960s, half a million fetuses each year died due to defects present at birth, over sixty thousand individuals died from [birth defects](#)^[5] after birth, and about fifteen million individuals had [birth defects](#)^[5] that affected their daily lives. In the 1968 article, Apgar and Stickle proposed a [birth defects](#)^[5] registry to provide more accurate data, and they advocated for more research into [birth defects](#)^[5] and for treatment to assist the children with medical and social problems.

In addition to her work with the March of Dimes, Apgar continued to teach. From 1965 to 1974, she lectured on [teratology](#)^[9], the study of [birth defects](#)^[5], at Cornell University School of Medicine, later called Weill Cornell Medicine, in Ithaca, New York. During that period, Apgar also co-authored a book with Joan Beck, a journalist for the *Chicago Tribune*, titled *Is My Baby All Right?* Published in 1973, the book addressed how [birth defects](#)^[5] arise and how they can be treated. That same year, Apgar began lecturing on medical genetics at Johns Hopkins School of Public Health.

Outside of her work, Apgar played the violin, and ventured to make violins and other string instruments with a friend. She also gardened, fly-fished, golfed, collected stamps, and in her fifties, began taking lessons in flying airplanes. Towards the end of her life, Apgar received numerous recognitions for her work, including honorary doctorates from the Woman's Medical College of Pennsylvania in Philadelphia, Pennsylvania, in 1964 and Mount Holyoke College in 1965. In 1973, [Columbia University](#)^[6] College of Physicians and Surgeons awarded her the Alumni Gold Medal for Distinguished Achievement, and the American Society of Anesthesiologists bestowed on her the Ralph M. Waters Award the same year. Also in 1973, the *Ladies Home Journal* elected Apgar as Woman of the Year in Science. Apgar did not retire, even when facing progressive liver disease in the later years of her life. Apgar died 7 August 1974 at Columbia-Presbyterian Medical Center in New York City, where she had worked for many years.

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