

Virginia Apgar (1909–1974): Apgar score innovator

Siang Yong Tan¹, MD, JD, Catherine Allday Davis²

Born in New Jersey, United States, on 7 June 1909, Virginia Apgar was set on becoming a physician ever since she was in high school. She was inspired by her father's hobby in scientific projects such as building telescopes, and by an older brother who was afflicted with and subsequently died of tuberculosis. Apgar attended Mount Holyoke College in Massachusetts and graduated in 1929 with a degree in zoology. During college, she had to take on odd jobs to support herself, including rounding up stray cats for a research laboratory and playing the cello and violin in the college orchestra.

A NEW FIELD Apgar began medical school in 1929, right before the Great Depression, at the College of Physicians and Surgeons at Columbia University, New York, and graduated with honours, placing fourth in her class. From 1933 to 1936, she was a surgical intern and resident at Columbia Presbyterian Hospital, New York, under the famous Dr Allen Whipple, who dissuaded her from continuing in a specialty that was historically known to be tough on women physicians. Instead, he suggested that she enter the new field of anaesthesiology. At that time, anaesthesia in the operating room was administered by specialised nurses, as no doctors were formally trained in that discipline. Apgar initially learned the practical basics from these nurses, and subsequently sought training under two of the most influential anaesthesiologists of the time. For six months, she worked with Dr Ralph Waters at the University of Wisconsin in Madison, Wisconsin, who started the first department of anaesthesiology in the United States. For another six months, she was a resident with Dr Emery Rovenstine at Bellevue Hospital in New York City. Dr Rovenstine was a prominent teacher, practitioner and activist between 1935 and 1960, and made significant contributions to the field of regional anaesthesia.

In 1938, Apgar returned to Columbia University, hoping to direct the soon-to-be-established anaesthesiology department, but the job eventually went to her friend Dr Emanuel Papper from Bellevue Hospital. She had a difficult time recruiting residents to the field, as it was not yet considered a full-fledged medical specialty. Prestige aside, the pay was also significantly lower. Undeterred, Apgar developed programmes of study for residents and medical students aimed at increasing interest and skill in the field. She herself became board-certified in anaesthesiology by the American Society of Anesthesiologists in 1939, the second woman to achieve this. Columbia University's

College of Physicians and Surgeons officially started an academic department of anaesthesia research in 1949 and named her its first woman full professor.

KEEPING SCORE It has been said Apgar always maintained that “women are liberated from the time they leave the womb” and that her gender had never impeded her medical career. Her research interest was in the area of obstetrics; this culminated in 1953 with her introduction of the Apgar score for assessing the health of newborn babies. Apgar was aware that while infant mortality trends had been declining over several decades, neonatal deaths within the first 24 hours of birth had not. Like everyone in the delivery suite, she could readily distinguish newborns who were well from those in imminent or actual distress. However, what separated this obstetric anaesthesiologist from others was her careful tabulation of relevant

objective observations into what eventually became famously known as the Apgar score. The score, an easily performed test at the bedside, was as useful as it was simple, classifying each newborn into one of three categories: 0 for distress, 1 for compromise and 2 for optimum status. It assessed how well a newborn was doing in five areas (i.e. colour, heart rate, reflex response, muscle tone and respiratory effort) using a reverse acronym or backronym: **A**ppearance, **P**ulse, **G**rimace, **A**ctivity, **R**espiration. Each item was given 0, 1 or 2 points. For instance, a newborn who scored 0 in colour would be blue,

a 1 would be mostly pink/normal with blueness to extremities only, and a 2 would be all pink/normal. A total score of 10 points, which was rarely achieved, constituted a perfect, ideal score.

Apgar first presented her results to the medical community in 1952 and published the findings the following year. Initially, the use of the five-part scoring system met with some resistance because of its newness and possible appearance of simplicity. However, the Apgar score was tested on thousands of newborns between 1952 and 1958, and by the 1960s, many hospitals throughout the world were using it in a consistent fashion. Apgar had initially envisioned the score being used at one minute of life, which it still is, but another evaluation, at five minutes, eventually came into standard use. In 1959, the National Collaborative Perinatal Project studied the relationship between Apgar scores and eventual longer-term disability, examining more than 17,000 children through the age of seven. Completed in 1966, the study confirmed that the scores were an important practice tool for showing which babies were at particularly high risk of death or significant disability that necessitated intervention at birth. However,



¹Emeritus Professor of Medicine, University of Hawaii, ²Research carried out during senior medical student elective, John A Burns School of Medicine, University of Hawaii, Honolulu, USA.

Correspondence: Prof Tan Siang Yong, 2226 Liliha Street, Suite B-104, Honolulu, HI 96817, USA. siang@hawaii.edu

there was no linear correlation between five-minute Apgar scores and longer-term disability.

OTHER CONTRIBUTIONS Apgar was also interested in the effect of anaesthetic agents on the transition of the newborn from life inside the uterus to life outside it. With the help of two colleagues, Dr Duncan Holaday and Dr Stanley James, Apgar learned new methods of testing blood gases and levels of anaesthesia in the blood of newborns. She found that low Apgar scores were often related to low blood oxygen content and highly acidotic blood. Further studies revealed a relationship with the level of anaesthesia in the mother, particularly in those exposed to cyclopropane. These results prompted the discontinuation of the use of the agent in obstetrics. In 1959, after obtaining a master's degree in public health from Johns Hopkins University, Apgar became active in the National Foundation for Infantile Paralysis, now known as the March of Dimes. She became the director of the division of congenital malformations. A tireless fundraiser and public educator, she was credited with achieving significant public awareness and impressive financial growth for the March of Dimes. Dr Julius Richmond, former Surgeon General of the United States, said Apgar has "done more to improve the health of mothers, babies and unborn infants than anyone in the 20th century".

MUSICIAN EXTRAORDINAIRE Apgar never married and was an avid fisherman, philatelist and musician, performing in several orchestras on the cello and violin. A patient once taught her how to build musical instruments, and she promptly proceeded to make a cello, violin, mezzo violin and viola. Another story about her has been named the 'phone booth caper'. It was reported that in 1957, Apgar and a friend were coveting a piece of curly maple that was part of a phone booth shelf at Columbia. After repeated legitimate attempts to procure the item failed, they set about to steal it. As the story goes, the replacement piece was too long and required shortening with a saw in the women's bathroom. Apgar, described as being in her hospital uniform, stood guard outside the room to keep others from entering.

HONOURS AND LEGACY Apgar received many awards both in her lifetime and posthumously. In 1961, she won the American Society of Anesthesiology Distinguished Service Award, and was honoured by the American Academy of Pediatrics and the American College of Obstetricians and Gynecologists for her pioneering work. Apgar also received the Gold Medal for Distinguished Achievement in Medicine from her alma mater, Columbia's College of Physicians and Surgeons, the first woman to be so honoured by her medical school. In 1973, the year before her death, Apgar launched her popular parenting book, *Is My Baby Alright?*, with co-author Joan Beck. She was named Woman of the Year in Science and Research by the *Ladies' Home Journal* magazine. Along with her book, Apgar published over 60 scientific articles as well as numerous newsmagazine columns.

Apgar's legacy, more than medical accomplishments, is a testament to her attitude towards life and living. Her colleague Dr James said it best at her memorial service, "Learning was the focal point of her life. Her curiosity was insatiable. She never became rigid. This rare quality enabled her to progress through life without becoming walled in by tradition or custom. It kept her young and vital. She started flying lessons a few years ago and even wanted to fly under the George Washington Bridge". Apgar died of cirrhosis of the liver on 7 August 1974. In 1995, she was inducted into the National Women's Hall of Fame in the United States for achievement in science.

BIBLIOGRAPHY

- Apgar V. *Is my baby all right? A guide to birth defects*. New York: Pocket Books, 1973.
- Apgar V. A proposal for a new method of evaluation of the newborn infant. *Curr Res Anesth Analg* 1953; 32:260-7.
- Calmes SH. Virginia Apgar: a woman physician's career in a developing specialty. *J Am Med Womens Assn* (1972) 1984; 39:184-8.
- James LS. Fond memories of Virginia Apgar. *Pediatrics* 1975; 55:1-4.
- Pearce JM. Virginia Apgar (1909-1974): neurological evaluation of the newborn infant. *Eur Neurol* 2005; 54:132-4.
- National Library of Medicine. Dr. Virginia Apgar. *Changing the Face of Medicine*. Available at: https://cfmedicine.nlm.nih.gov/physicians/biography_12.html. Accessed June 18, 2018.
- Wikipedia. Virginia Apgar. Available at: https://en.wikipedia.org/wiki/Virginia_Apgar. Accessed June 2, 2018.