August Karl Gustav Bier (1861–1949)

In the late nineteenth century, August Karl Gustav Bier was a surgeon in Germany who studied spinal cord anesthesia, later called spinal block. Bier found that, depending upon the amount of anesthesia introduced into the spinal cord, a large area of the human body could be numbed to various degrees. Bier established a procedure to numb individuals from the lower legs to the upper abdomen, with the individual's numbness ranging from them feeling pressure on their body to them feeling nothing at all. Bier's spinal block was one of the first instances of regional anesthesia, or numbing a large area of the body, as opposed to only local anesthesia, or numbing a small area of the body. Bier's development of spinal anesthesia led to improved pain management during major surgeries, including cesarean sections and amputations.

Bier was born on 24 November 1861 to Christiane Becker and Theodor Bier in Waldeck, Germany. Bier had three siblings, a sister, who died at age one, and two brothers, Julius and Ludwig, who both died of tuberculosis later in life. In 1870, when he was nine years old, Bier began his schooling at the Gymnasium Fridericianum in Korbach, Germany, where he focused on the study of animals and forests, as well as sports and medicine.

Bier graduated from high school in 1881 and was accepted to medical school at the Humboldt University of Berlin in Berlin, Germany. He studied at the University of Berlin before transferring to the University of Leipzig in Leipzig, Germany, and finally to the University of Kiel in Kiel, Germany. Bier graduated medical school at the University of Kiel in 1886. Following his graduation, he worked as a general practitioner in the small town of Gettorf, Germany, just outside the city of Kiel. While practicing medicine in Gettorf, he began his medical residency at the surgical clinic at the University of Kiel. While in residency, Bier studied under Friedrich Von Esmarch, a surgeon. Esmarch created a technique to keep an airway open in unconscious patients, which helped prevent major complications when using chloroform anesthesia, a common practice at the time. Under Esmarch's mentorship, Bier learned how to perform surgery and teach medicine to students. In 1888, Bier became a senior lecturer at the University of Kiel in Kiel, Germany. The same year, Bier published a thesis in which he argued against the practice of suturing through all the membranes of the intestine in favor of avoiding the mucous membrane layer, which helped prevent wound ruptures along a surgical incision.

In 1894, Bier accepted a position as professor at the University of Kiel. As a professor, Bier began researching hyperemia, or the accumulation of excess blood in the blood vessels supplying an organ or area of the body. Bier proposed that hyperemia could be an effective therapy for tuberculosis, an infectious bacterial disease which most commonly affects the lungs but can also affect other parts of the body.

In early 1898, while at the University of Kiel, Bier worked with Heinrich Quincke, a surgeon, who developed a procedure to remove cerebrospinal fluid from the spinal canal using a needle, also called a lumbar puncture, as a method to diagnose numerous diseases. At the time, Quincke was studying the physiology of cerebrospinal fluid, the fluid that surrounds the brain and spinal cord. While working with Quincke, Bier considered the effects of using the lumbar puncture technique to administer anesthesia. Bier hypothesized that a small injection of anesthetic into the spinal canal could suppress pain sensations enough to perform major surgery.

In August 1898, Bier injected a cocaine solution, a common anesthetic at the time, into the spinal column of one of his patients prior to surgery. Bier's patient, a thirty-four-year-old man, had tuberculosis, an infectious disease that primarily affects the lungs but infrequently can travel through the bloodstream and affect the bones. Bier's patient had tuberculosis in his lower leg that required

partial amputation of the leg. On 16 August 1898, Bier injected a cocaine solution into the man's spinal canal and waited twenty minutes before beginning the amputation. According to Bier, the man reported having no feeling in the lower half of his body, remained conscious throughout the operation, and informed Bier that he had not felt any pain. Bier also noted that the patient could not move his limbs throughout the procedure. Following the successful surgery and use of spinal anesthetic, Bier repeated the anesthetic technique on five other patients prior to surgery. All of Biers patients reported vomiting and severe headaches that lasted for a week following the spinal anesthetic. Bier hypothesized that those side effects resulted from circulatory trauma to the central nervous system or excessive loss of cerebrospinal fluid.

Following his first six successful spinal blocks, Bier and his surgical assistant August Hildebrandt proceeded to administer the spinal anesthesia to each other to confirm the post-surgical side effects of nausea and headaches. Hildebrandt administered the spinal anesthesia to Bier, but was not successful in numbing Bier's lower half. However, Bier successfully administered the spinal anesthesia to Hildebrant and Hildebrant was not able to feel the lower half of his body, and so they ate, drank wine, and smoked cigars in celebration. Following the procedures, both Bier and Hildebrant experienced severe headaches that lasted almost a week. Bier's results demonstrated that a small amount of cocaine anesthesia administered to the spinal canal could numb over half a patient's body so that major surgery could be performed painlessly.

In 1899, Bier became director of the surgical clinic at the University of Greifswald in Greifswald, Germany. In 1903, Bier was given a full professor appointment at the University of Bonn, in Bonn, Germany. In 1905, Bier married his first patient, Anna Esau, and together they had five children. Anna took care of the family's finances and children so Bier could focus on medicine.

In 1907, following the death of the head surgeon at the University of Berlin, Ernst von Bergmann, Bier became the director of the surgical clinic at the University of Berlin. Bier also made several innovations in surgeries. In 1908, Bier developed the use of intravenous regional anesthesia, known in 2017 as the 'Bier block.' Bier injected anesthetic into the vein of a limb below a tourniquet, which allowed the anesthetic to numb a specific limb and not spread throughout the body. The technique was successful and commonly used for short surgeries involving the arm, wrist, or hand.

During World War I, Bier joined the German Army as a consulting surgeon. While serving in the war, Bier found that shrapnel and grenades often caused severe head trauma and introduced a new idea of a steel helmet to alleviate the risk. In December 1915, Bier along with military physician Friedrick Schwerd developed a helmet prototype that protected the head as well as ears and neck. After a series of successful field trials, 30,000 helmets were issued to the German Army in January 1916. Bier also developed new theories about the benefits of physical exercise to aid in recovery of illnesses and sustain health. Bier was the director of the Akademie für Sport und Leibeserziehung, or Academy for Exercise and Physical Training, in Berlin.

In 1932, Bier retired with his wife to their family estate in Sauen, Germany, a twenty-room mansion built on 500 acres of woods. During his retirement, in the mornings, Bier took seven-kilometer walks to Sauener Lake, where he swam daily. He rode horses, went hunting, and experimented with plant grafting, a technique used to join parts from two or more plants so that they appear to grow as a single plant. Near the end of World War II in the 1940s, Bier and his wife were evacuated from their estate because the Russian army planned to convert it into a military hospital. However, the Russian professor who inspected Bier's mansion prior to its conversion recognized Bier as one of her former teacher from her studies in Berlin. As such, she arranged for Bier and his wife to return to their home, where they lived under Russian military protection throughout the remainder of the war.

Throughout his life, Bier received several awards for his work in medicine. In 1931, he received the Hohenzollern Royal House Medal. In 1936, Adolf Hitler awarded him the Alderschild Medal, which represented the highest scientific distinction within the German empire. In 1937 Hitler awarded Bier the German National Prize for the Arts and Science. Hitler created the German National Prize for the Arts and Sciences to replace the Nobel Prize, which he had forbidden German citizens to accept.

In 1947, Bier's wife died and Bier's own health was failing as well. In January 1949, Bier caught

the flu and two months later was diagnosed with pneumonia. He died on 12 March 1949, at the age of eighty-seven, and was buried next to his wife on his estate in Sauen.

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