The Freer elevator is an instrument commonly used in the field of neurosurgery, although it can just as frequently be seen in the fields of orthopedic, otolaryngological, and general surgery. This instrument’s versatility makes it one of the most commonly used macrodissectors, rivaling the Penfield dissectors. The Freer’s shape lends itself to many uses, including elevation of the periosteum or nasal septal mucosa,13 resection of renal tumors, and removal of intervertebral disc fragments,29 among others. A common misconception among surgeons unfamiliar with the history of this instrument concerns the meaning of its name. Most incorrectly assume that “Freer” refers only to the function of the instrument and not to its eponymous origin, an error further confounded by similar instruments named for their function, like the McDonald freer.11,26 We endeavor to provide a historical perspective on this instrument and its inventor, Dr. Otto “Tiger” Freer.25

Biographical Sketch

Otto “Tiger” Freer (Fig. 1) was born on August 8, 1857, in Chicago, Illinois, to Dr. Joseph Warren and Katharine Gatter Freer.23,24 Otto’s family had lived in the area around Chicago since the early days of the state’s founding. In 1841 Elias Freer, Otto’s paternal grandfather, had moved his wife and 10 children from the French Huguenot village of New Paltz, New York, to 240 acres of farmland in Will County, Illinois, for which he paid cash. By 1850, the federal census stated that Elias had moved his family to Northfield, Cook County.

Joseph Warren Freer, Otto’s father, was born in 1816 and moved with his 9 brothers and sisters to the farm in Will County, where he completed his high school education. In 1843, county records reflect that he purchased 40 acres with the intention of continuing the family farming tradition; however, this would not ultimately be his fate. In 1846, at 30 years of age, Joseph Warren lost his first wife to poor medical care, an event that would forever change his career plans. Determined to help prevent such tragedies, he set out for Chicago seated on a load of wheat to become a physician. On arrival, he called on the founder of Rush Medical College, Dr. Brainard, and asked to be taken as his pupil. Dr. Brainard accepted and mentored

Prashant Chittiboina, M.D., M.P.H., David E. Connor Jr., D.O., and Anil Nanda, M.D., M.P.H.

Department of Neurosurgery, LSU Health Sciences Center, Shreveport, Louisiana

Every neurosurgeon develops his or her own standard approach to common intracranial pathologies in terms of the order in which different stages are performed and which instruments are used to perform individual tasks. The majority of the basic steps in performing a craniotomy are learned through repetition and practice during residency training. Significant amounts of energy are devoted to mastering technical skills and developing an operative rhythm. What often receives little attention is the historical origin of the instruments that make the work possible. The Freer elevator represents a particularly interesting example. To people unfamiliar with the accomplishments of turn-of-the-century laryngologist Otto “Tiger” Freer, it can be assumed that the name of the instrument in one’s hand is simply named for what it can do, that is, to “free” the nasal mucosa from the bony and cartilaginous septum during the trans-sphenoidal approach. The technique this master surgeon spent his life and career perfecting is now repeated almost daily by skull base neurosurgeons approaching pathologies from the inferior frontal lobe to the foramen magnum.

In reviewing his life and work, the authors of this paper discovered an interesting creative process that led to the design of the eponymous instrument. Additionally, they discovered important advances toward the development of the transnasal approach and in our understanding of the anterior skull base. They present a historical perspective on the life and accomplishments of Dr. Freer and the ubiquitous surgical instrument that he invented and popularized.

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Keywords

- Otto “Tiger” Freer
- Freer elevator
- eponymous tool
- surgical instrument
Joseph Warren Freer was selected as Rush’s first demonstrator of anatomy. By the 1860 census, Joseph Warren and his wife, described as “a fine German woman,” and 3-year-old Otto were living in the 8th Ward of Chicago. In 1861 Joseph Warren briefly enlisted as a surgeon in the Union army but lasted only 6 months before he was mustered out. He returned to Rush and helped guide the college through several cholera epidemics and the Great Chicago Fire of 1871, in which the medical school and hospital were completely destroyed. At this time Dr. Joseph Freer became president of Rush Medical College. Over 200 doctors were without homes, instruments, specimens, or books. Hastily erected military barracks served as their homes, and clinics were held at the Cook County Hospital and lab work was performed at the Chicago Medical School (later to become Northwestern University), both of which survived the blaze. Joseph Warren served as president until his death in 1877, only 2 years prior to his son Otto’s graduation from medical school.

Otto was most likely inspired by his father’s accomplishments when he applied to Rush Medical College in 1876 after graduating from Central High School. He received his M.D. degree in 1879 and then spent a semester each at the Universities of Munich, Vienna, and Heidelberg. Otto interned at the Cook County Hospital and went on to specialize in laryngology at the German Hospital of Chicago from 1894 to 1905 and held the position of associate professor at Rush Medical College. He was also credited as an organizer and eventual chairman of the Henrotin, or “Gold Coast,” Hospital.

Following his father’s death in 1877, Otto took some of his family into his household, including his mother, his brother, a teacher at the Chicago Art Institute, and his sister, a school teacher. Otto’s mother passed away in 1903, and his brother, Frederick, in 1908. Otto continued to live with his sister, listed as an artist, until 1912, when he married Martha Agnes Rand Lee, an accomplished poet and the second daughter of the late William H. Rand of Rand McNally & Company. He moved to a new home with Agnes and their daughter, Alice Lee, where they remained until their deaths. Otto’s obituary states that he died on April 21, 1939, of “heart disease, chronic myocarditis and paralytic ileus” at the Henrotin Hospital.

Dr. Otto T. Freer became a distinguished member of the American Laryngological Association, the Chicago Medical Association, the Ann Arbor Medical Club, the American Medical Association and was listed in the Who Was Who in America, Vol. 1, 1897–1942. He served as the American Medical Association secretary from 1903 to 1905, when he was elected chairman (Fig. 2).

Dr. Freer was a prolific writer with many seminal publications and is listed as coauthor of the definitive text Diseases of the Nose and Nasopharynx. Along with Dr. Gustav Killian of Germany, Freer is credited with popularizing submucosal resection of the nasal septum. Both improved upon the technique popularized by Ephraim Fletcher Ingals in 1882 (Ingals procedure). A ship manifest lists Dr. Otto T. Freer as returning from Germany in 1885, where he may have studied under Ingals. It was while perfecting these procedures that he devised a new set of instruments. The eponymous Freer elevator was first described for use in submucosal resection of the nasal septum. In a discussion of surgical nuances, Dr. Freer addressed the importance of maintaining the integrity of the cribiform plate and minimizing trauma during surgery. Later in his career, Dr. Freer studied and published on anterior skull base structures including the frontal sinuses and the ethmoidal plate. He was able to dedicate time to the study of the anterior skull base under the tutelage of Professor Basil Harvey of the University of Chicago. He noted that X-rays would be a useful adjunct to surgical planning in this region. His contributions in developing transnasal surgery are recognized by Cottle and Loring in a historical review of nasal surgery.

### The Freer Elevator

During the late 19th century, American surgery was undergoing a dramatic resurgence. Dr. Freer and his con-
Dr. Otto “Tiger” Freer: inventor and innovator

Dr. Freer's innovative designs were first produced by Sharp and Smith of Chicago. Started in 1876 by J. Perrine Sharp and H. D. Smith, the company's original offices were located at 100 Randolph Street. It is safe to assume that cheaper imports and the inability to patent their devices led to the company's eventual dissolution in 1900, as there appears to be no record of their business activities after this time. Sharp and Smith were able to manufacture the devices according to the exacting standards of Dr. Freer. He described the nuances required in designing new instruments while detailing septal surgery with minimal trauma. In Dr. Freer's paper, one can clearly see the manufacturer's name engraved as “Sharple & Smith” on the handle of the Freer angular cartilage knife. A complete set of instruments used by Dr. Ingals is featured in the 1889 product catalog published by Sharp and Smith. Since Dr. Freer was the foremost in popularizing the Instrument Design and Production in America, we can assume that he may have commissioned the design and production of these instruments with Sharp and Smith. Unfortunately, no records of the catalog that advertise the Freer instruments are available from later years.

Since its introduction, the Freer elevator has gained wide acceptance among a variety of surgical specialties. Dr. Freer initially described a series of elevators as “flat knives with rounded, paddle-shaped . . . blades” whose original application was in correcting deflections of the nasal septum. In developing these devices, he drew heavily from dental instruments. His intention was to develop simple, cheap instruments that could be produced in varied shapes to perform surgeries “by the same narrow passage—the nostril.” Although the instruments designed by Freer are not seen in the early (circa 1889) catalogs of Sharp and Smith, by 1915 they appeared prominently in the surgical instrument catalog of the Kny-Sheerer Company of New York City. In this catalog, four versions of the Freer elevator are advertised. The instruments are sharp and dull versions on a short or a long handle. The elevator was typically designed to be one sided in this era. By 1917 the instruments designed by Dr. Freer, including the elevator, were considered essential for surgery of the ear and nose. They are prominently cataloged as “essential to the conduct of the Nation’s medical activities” as determined by the Committee on Standardization appointed by the Council of National Defense (http://archive.org/details/listofstaplemedi01unit). In this catalog, two versions (sharp and dull) are highlighted. The instrument has evolved over the years. Most modern versions are double ended with blades at both ends. Today, the instrument is available as the Freer septum elevator, or Freer mucoperichondrium elevator (Fig. 3). Its modern iterations range from 17 to 19 cm in length with sharp or blunt double-ended blades. The blades generally have a gentle curve and range in width from 4.5 to 5 mm. The shaft of the instrument has crenellations in the metal along with one set of studs to improve handling.

Primary use of the Freer elevator was intended to involve submucosal dissection within the nasal cavity. In addition, the shape of the instrument lends itself to palpation of bony landmarks, like the posterior lacrimal crest, through a limited opening. In this manner it serves to extend the tactile sensorium of the surgeon. Dr. Freer’s technique for elevating the nasal mucosa continues to be used today by skull base neurosurgeons performing multiple complicated procedures through the corridor of the nose. The addition of the operative microscope and later the endoscope has expanded the application of submucosal dissection from the simple repair of nasal septal deflections to tumor resection, CSF fistula repair, and even aneurysm clipping.

In general, the Freer is best used to perform dissection at the interface between a hard structure and soft tissue. In this manner, the Freer has been used to dissect the

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**Fig. 3.** Photographs of the Freer instrument in its modern iterations. A: Various sizes of the Freer elevator found in modern operating room sets. The length of these instruments range from 17 to 19 cm. B: Close-up of the edge reveals the gently curved blades that are useful in many surgical maneuvers. C: A close-up of the shaft reveals the commonly found studs to assist in handling.
nail bed from the nail or to strip periosteum from bone. In some cases, the use of two Freer instruments has been described. In urological surgery, two Freer instruments have been used together to retract soft tissues prior to the resection of renal tumors. Two instruments have also been used to create a soft tissue tunnel beneath the rib. In cranial procedures, the Freer has been used for dissection and for manual reduction of displaced bony elements. In spinal procedures, the surgeon’s tactile field through a small opening. The instrument is also extensively used by neurosurgeons in both spinal and cranial surgeries. In this case again, the instruments are used to extend the surgeon’s tactile field through a small opening. At our institution, the Freer elevator is an essential element of both the cranial and spinal surgical sets. In addition to its usage in nasal septal flap elevation, we have used the instrument variably to elevate the dura from the sphenoid wing, to protect the dura during extradural anterior clinoidectomy, to perform periorbital dissection, to dissect scar tissue planes in redone spine procedures, and to tease out disc fragments during microdiscectomy.

Conclusions
Among the many accomplishments in the career of Dr. Otto “Tiger” Freer, one could argue that the most important and lasting has been the invention and popularization of the Freer elevator. It is a ubiquitous instrument that has been embraced by surgical practitioners in many fields. We recognize the innovative spirit of this great physician from the turn of the last century.

Disclosure
The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

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Dr. Otto “Tiger” Freer: inventor and innovator
