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Surgical History

Emil Zuckerkandl, M.D. (1849–1910): Bridging Anatomic Study and the Operating Room Table

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In the mid-19th century, the Vienna School of Anatomy was at the epicenter of the rapidly growing field of anatomy. One of the school's most distinguished professors, Hungarian-born anatomist Emil Zuckerkandl was instrumental in transforming anatomy from a descriptive science to one of practical and clinical value. A prolific researcher interested in nearly all areas of morphology and most famously, the chromaffin system, Zuckerkandl's discoveries from more than a century ago still provide a foundation for surgeons to this day.

Emil Zuckerkandl (Fig. 1) was born on September 1, 1849, in Raab, Hungary to a Jewish family. He had two brothers, Victor Zuckerkandl, an industrialist, and Otto Zuckerkandl, a urologist. Interested in medicine, Emil Zuckerkandl matriculated at the University of Vienna in 1867. There, he was a popular and influential member of his class. With his keen observational skills and dexterity with dissection, Zuckerkandl soon became the favorite student of Joseph Hyrtl, an anatomist and professor at the Vienna School of Anatomy. Zuckerkandl also greatly admired his teacher, praising Hyrtl for "[speaking] like Cicero and [writing] like Heine."[1]

Under Hyrtl's mentorship, Zuckerkandl rose to prominence, initially serving as Hyrtl's demonstrator and assistant. Already an accomplished researcher by 1870, Zuckerkandl left Vienna on Hyrtl's recommendation to pursue a prosectorship at the University of Utrecht in Amsterdam. In 1873, Zuckerkandl returned to Vienna to assume the assistant in pathological-anatomical chair position and completed his medical degree the following year. After he received a promotion to Professor Extraordinarius in 1879, Zuckerkandl left Vienna in 1882 for a professorship in Graz, Austria. However, this position was short lived; Zuckerkandl returned to Vienna in 1888 when he was appointed the First Chair of Anatomy at the Vienna School of Anatomy.[1, 2]

In 1889, Zuckerkandl married Berta Szeps, a well-known Austrian journalist. The daughter of Moritz Szeps, editor-in-chief of the Vienna "Morgenpost," and the sister-in-law of French Prime Minister Georges Clemenceau, Szeps was an influential figure in Vienna Jewish society. Zuckerkandl and Szeps shared a deep interest in culture and the arts, and their home was a salon for the Austro-Hungarian Empire's leading creative thinkers, including sculptor Auguste Rodin, painter Gustav Klimt, and composer and conductor Gustav Mahler. Zuckerkandl also paid frequent visits to Vienna's Albertina Museum, developing a "connoisseurship about prints and drawings that grew as much from his interest in anatomical representation as his aesthetic impulses."[1, 2]

As an anatomy professor and researcher, Zuckerkandl made numerous contributions to the field of surgery. He was among the first to make anatomy "subservient to the patient, to relate it to clinical medicine."[2] Zuckerkandl is credited for stating, "anatomy is the war map for the operations of the physician," and his

FIG. 1. Portrait of Emil Zuckerkandl, year unknown. Reprinted from Shoja et al.[1]

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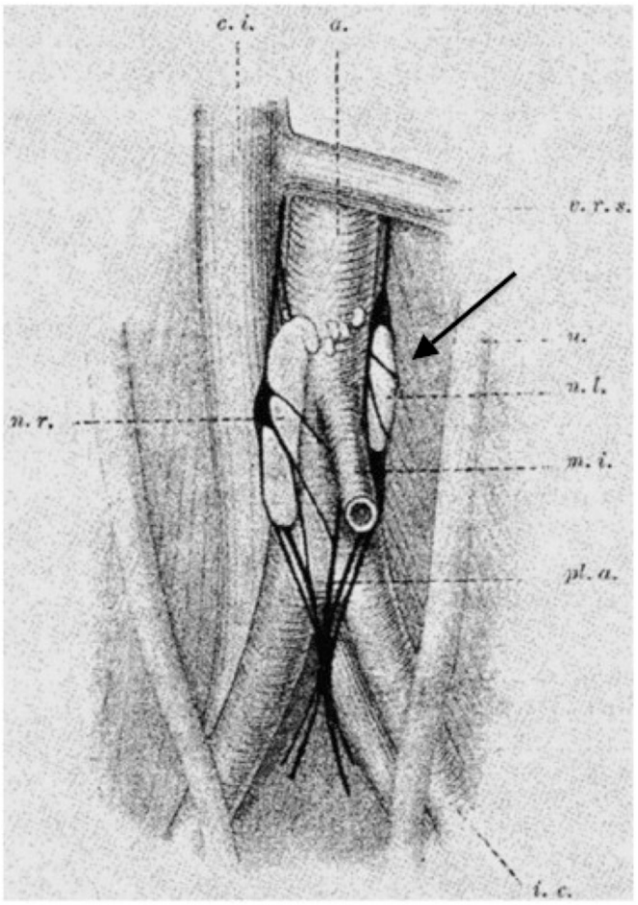

FIG. 2. Zuckerkandl's original sketch of his "Nebenorgane" (n.l., see arrow), the periaortic paraganglia between the inferior mesenteric artery (m.i.) and aortic bifurcation. For reference, see aorta (a.). Reprinted from Shoja et al.[1]

FIG. 3. Bronze monument constructed by Anton Hanak in 1923 portrays Emil Zuckerkandl demonstrating the muscles of his forearm. Reprinted from Ober et al.[2]

concept of applying anatomy to patient care and disease coincided with the creation and rise of several surgical subspecialties, including otorhinolaryngology and urology.[1, 2]

Throughout his tenure, Zuckerkandl studied several organ systems, including the nasal cavity, facial skeleton, auditory organs, teeth, blood vessels, brain, and chromaffin system. He authored more than 160 publications, as well as revised multiple editions of the *Atlas of Descriptive Anatomy of Man*, a preeminent 2-volume reference with more than 600 illustrations.[1] Among his many accomplishments, Zuckerkandl identified the posterior renal fascia—Zuckerkandl's fascia—and the posterolateral projection of the thyroid gland—Zuckerkandl's tubercle— a crucial landmark for detecting the recurrent laryngeal nerve during thyroid surgery.[2]

Today, Zuckerkandl is best remembered for identifying and describing the body's largest complex of extra-adrenal chromaffin cells or paraganglia (Fig. 2). Although Zuckerkandl first noticed these complexes in 1901, he mistakenly characterized them as lymph nodes.[2] After consulting with Alfred Kohn, a scientist studying the embryologic development of paraganglia in Prague, Zuckerkandl realized he had found a novel entity. Grossly, these groupings of tissue appeared to Zuckerkandl as "encapsulated light brown organs joined by an isthmus, on the anterior surface of the aorta, just between the origin of the inferior mesenteric artery and the bifurcation of the iliac arteries," and he noted their close proximity to the periaortic network of autonomic nerve fibers.[1, 2] In his systematic research that followed, Zuckerkandl dissected and measured these tissues in 27 newborn infants and 37 embryos between 5 and 8 months of gestational age. From this work, Zuckerkandl established the direct relationship between developmental age and tissue size, with sample lengths ranging from 3 to 11 mm in embryos and 7 to 20 mm in newborns. On average, subjects contained between 12 and 26 of these structures. Zuckerkandl named this new entity "Nebenorgane," or *auxiliary organ*;

40 years later, posthumously, the structures were renamed the "Organs of Zuckerkandl" (OZ).[1, 2]

Today, the OZ are considered the homeostatic regulators of fetal blood pressure and vascular tone, secreting norepinephrine into the circulation until the adrenal medulla and sympathetic nervous system assume this function at 1 year of age. The OZ grow until age 3, begin to atrophy at age 5, and by age 14, undergo dissolution with only microscopic remnants persisting into adulthood. Although rare, this residual OZ tissue can transform into either nonfunctional or catecholamine-secreting tumors, shifting the OZ from their benign role in normal development to the precursors of life-threatening disease requiring surgical excision.[1, 3]

Although not a practicing physician, Zuckerkandl was a pioneer of clinical anatomy. Upholding the philosophy that anatomic study should underpin clinical and operative care, his extensive research on a variety of systems is still widely used by surgeons today. Sadly, while actively serving as the First Chair of Anatomy in Vienna, Zuckerkandl died on May 28, 1910 at age 60 from complications of coronary artery disease. A monument sculpted by Anton Hanak now housed at the University of Vienna honors Zuckerkandl's legacy and contributions to both teaching and medicine (Fig. 3).[2]

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