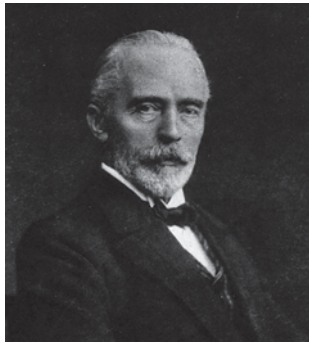

Emil Theodor Kocher

1841–1917

Mathias Worni and Julie Ann Sosa



Emil Theodor Kocher (From National Institutes of Health, unknown photographer)

Emil Theodor Kocher was an outstanding personality, self-critical, systematic, modest, laborious and driven by a tremendous thrive for innovation. His capacity to link a clinical observation to its hitherto mostly unknown physiological basis was his fundament to revolutionize the surgical field and influence innumerable young surgeons across the world. Albeit described as a reserved personality, he entertained long lasting friendship with most great surgeons at his time including William Halsted, **Harvey Cushing**, and **Theodor Billroth**. Those and many more connections together with his scientific and surgical achievements helped to leverage the Inselspital—founded in 1354 and later transformed to the University Clinic of Bern—to worldwide fame at the end of the 19th century. It goes without saying that the receipt of the Nobel Prize was the culmination of his success awarding his greatest accomplishment, mastering thyroid surgery and more importantly understanding its physiology. When he died the entire Swiss government attended his funeral and all children of the city of Bern, the capital of Switzerland, had a day off school. It is impressive to observe how lasting Kocher's heritage is in "his" Inselspital and in our collective memories. Prof. D. Candinas

Emil Theodor Kocher was born on August 25, 1841, in the capital of Switzerland, Bern. As the son of the chief engineer of the canton of Bern, Jakob Alexander Kocher, the young Kocher grew up in a peaceful, culturally sophisticated, and religious atmosphere. He was characterized as a quiet, unassuming, but sometimes mischievous boy. After finishing secondary school, he trained without interruption at the University of Bern, from which he graduated and obtained his doctorate in 1865 [1]. He started his surgical career after medical school in Bern, but his talent and purposefulness took him to advanced studies at academic centers such as Zurich, Berlin, London, Paris, and Vienna. There, he learned under famous teachers, including Hermann Askan Demme (1802–1867), Georg Albert Lücke (1829–1894), Theodor Billroth (1829–1894), and Bernhard von Langenbeck (1810–1887). As associate professor, he returned to Bern, where he worked as a surgical assistant under Professor Georg Lücke. It was no surprise that in 1872 he was promoted to full professor of surgery; at this time, he also became director of the University Surgical Clinic in Bern as the position became vacant. He was only 31 years old when he was appointed to this job. He held the position until his death on July 27, 1917, 45 years later; this was an unprecedented feat. Even for those early years, selection as chair of a surgical department at age 31 was an outstanding honor. Whenever Kocher was invited to consider other lofty academic surgery positions around Europe, including Prague, Vienna, and Berlin, he deferred [2]. Throughout his career, he remained committed to his beloved hometown of Bern, where he found ideal conditions for his work. He was a humble man and reserved by nature; however, by report, he was very warm with patients, who uniformly loved him [3].

It was still very early in his medical and surgical career when Kocher described a new method for reducing shoulder dislocations and first received the attention of Theodor Billroth, who would become one of his critical mentors. Kocher intensively studied the pathologic anatomy of the shoulder and was then able to demonstrate his newly developed reduction technique on a patient with an old subcoracoid dis-

J. A. Sosa (✉)

Department of Surgery, Section of Endocrine Surgery, Duke University Medical Center, DUMC #2945, Durham, NC 27710, USA
e-mail: julie.sosa@duke.edu

M. Worni

Division of Advanced Oncology and General Surgery, Duke University Medical Center, Durham, NC 27710, USA

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location. During a conference, all attempts to reduce the patient's shoulder by multiple physicians, including Billroth, failed. Kocher then volunteered to give his newly developed technique a try in front of multiple visiting physicians—and it worked on the first attempt! He called his technique for reducing shoulder dislocations the “Kocher method” [4]. His method was soon widely accepted, as it was shown to be simple, safe, and applicable for chronic and acute dislocations.

Kocher started his surgical career shortly after the appreciation of antiseptic treatment of wounds. He was heavily influenced by Sir Joseph Lister (1827–1912), a pioneer of antiseptic surgery. Kocher steadily supported the transition to using sterile technique, as he understood its immense importance and benefit for most patients. He was also one of the first surgeons who worked in a completely aseptic fashion. He benefited from close collaboration with Ernst Tavel (1858–1912) from the University of Bern, who was famous for his bacteriological studies [1]. They summarized their findings in the second edition of “Vorlesungen über chirurgische Infektionskrankheiten” (lectures on surgical infectious diseases), which was published in 1895 [5]. The University Clinic in Bern, Inselspital, remained for many years an international centerpiece among physicians who favored the antiseptic approach.

Aside from extensive work on antiseptic treatment, Kocher started to publish widely on a diverse set of topics in general surgery. One early publication included experiments about hemostasis (by torsion of the arteries); this pleased **Billroth**, especially, and it was published in *Langenbecks Archive*, Vol II [1]. Kocher also performed studies on gunshot wounds, as he had to give courses to military doctors. He worked on acute osteomyelitis (1878) and the theory of strangulated hernias (1877). He developed a new theory of hernia strangulation that was called the “dilation theory”; this received attention in the field of ileus research. He published regarding a new technique for gastric resection, describing pylorotomy with subsequent gastroduodenostomy. In addition, Kocher advanced the surgical procedure initiated by Kraske, where part of the coccyx was removed during rectal surgery to facilitate additional removal of a portion of the sacrum (1874), and he described gallstone excision from the lowest portion of the bile duct. One of the most important procedures he described in detail was the mobilization of the duodenum and pancreatic head from its posterior attachments and neighboring organs, including the inferior vena cava. This helped to advance many surgical procedures, including surgery on the duodenum, extrahepatic bile duct, pancreas, and stomach. This crucial step of early mobilization is employed as part of many larger upper gastrointestinal (GI) operations, and it is named the Kocher maneuver, or Kocher mobilization.

The list of his contributions seems to be endless, as he also published on simplified cholecystectomy procedures, ileus treatment, vertebral column fractures, traumatic epilepsy, brain damage, and trepanation. Most surgical specialties have benefited from the findings, inventions, and descriptions of Kocher. He also was respected by his peers because he reported his own patient outcomes regularly. His transparency regarding his own outcomes was novel. Importantly, Kocher for the first time demonstrated an association between increased (surgeon) volume and improved (patient) outcomes. Indeed, Kocher's outcomes following thyroidectomy improved dramatically over the course of his prolific career. Until his death at age 76 years, he was able to keep up with the same pace and rigor that he did when he started his surgical and scientific career.

While any of these achievements might have led to a durable legacy, Theodor Kocher is still best known and remembered for his advancements with regard to the physiology, pathology, and surgery of the thyroid gland. Thomas Wharton, an English anatomist, first named the thyroid in 1656; unfortunately, he believed that its purpose was “to fill the neck and make it shapely.” Kocher's research on the thyroid gland significantly moved our understanding forward, and for this he was awarded the Nobel Prize in Physiology or Medicine in 1909. He was the first surgeon to receive the Nobel Prize in the field of science. His pioneering work

“...gave a comprehensive exposition, which has been of fundamental importance to the latter development of thyroid surgery as well as to other important areas of our knowledge of this gland. Through Kocher's exposition, it became quite clear that complete extirpation of the thyroid is reprehensible. A portion of the gland which is capable of functioning must be left behind at the operation.”

While debate today continues about the relative merits of total thyroidectomy versus thyroid lobectomy, Kocher established the importance of not performing total thyroidectomy in an era prior to the evolution of exogenous thyroid hormone supplementation or replacement. But it was not just Kocher's exposition about surgical approach that advanced the field of thyroidology forward, but also his studies

“...into the causes of endemic occurrence of goiter in certain regions and into the cretinism connected with disturbances in thyroid function.”

The money he received for this prize (200,000 Swiss francs) was fully donated by him to his University (of Bern) to build a Research Institute for Biology. The Theodor Kocher Institute of the Medical Faculty of the University of Bern is active today, addressing molecular mechanisms involved in inflammation, with a special focus on studying immune cell migration during immune surveillance and inflammation [6].

In the 1850s, thyroid surgery was only performed for vital indications, as operative mortality rates were often higher than 40%. The principal reasons for fatal outcomes were uncontrollable bleeding and/or infectious complications. Indeed, in the early days, thyroid surgery was considered such a dangerous operation that it was prohibited in France. It is worth noting, for example, that Lücke, the predecessor of Kocher, operated on ten goiters from 1866 to 1872, and nine of his patients succumbed to complications from their surgeries. Many voices were raised against thyroidectomy, and thyroid surgery had a reputation for being a thankless, dangerous, and reckless pursuit [7]. Samuel Gross, a surgical contemporary of Kocher's who worked in the USA, wrote in 1866:

If a surgeon should be so adventurous, or foolhardy, as to undertake thyroidectomy, I shall not envy him... Every step he takes will be environed with difficulty, every stroke of his knife will be followed by a torrent of blood, and lucky will it be for him if his victim lives long enough to enable him to finish his horrid butchery... No honest and sensible surgeon, it seems to me, would ever engage in it. [8]

Using advanced surgical techniques described by Kocher and Billroth, in particular, the mortality rate was significantly reduced over the coming years. Kocher's first paper on thyroid gland pathology and surgery in 1874 reported his series of 13 patients, and only 2 of these patients died. He described a technique where he first ligated the major arteries and veins to the thyroid gland; in turn, he identified the recurrent laryngeal nerve. After achieving this control, the external capsule of the gland was split, and the isthmus was removed. This helped to avoid profuse bleeding and spared the recurrent laryngeal nerves [3]. Most of the surgeries were performed under ether anesthesia and using local infiltration of cocaine. Kocher reported his surgical mortality rate in 1883 at the German Congress of Surgery; by that time, he had performed 101 goiter operations with an associated mortality rate of only 13%, which was groundbreaking for his time. In this surgical series, 18 patients developed the typical presentation of myxedema and altered mental status; all of this subset had undergone total thyroidectomy. Kocher closely followed his patients in the postoperative setting, and he found that those who underwent total thyroidectomy died within 7 years after surgery. Patients who underwent intended total thyroidectomy but who did not die were seen to develop a new, but smaller goiter. In autopsy studies, no thyroid tissue was found in the patients who died. This led Kocher to describe the cretinoid pattern, which he named "cachexia strumipriva"; this was first thought to be related to chronic asphyxia due to damage to the trachea and only later related to profound hypothyroidism [1]. In 1893, Kocher reported that ingestion of raw thyroid tissue could im-

prove the severe symptoms of "cachexia strumipriva," and others subsequently confirmed this finding. In turn, Kocher changed his earlier view that the thyroid gland's main purpose was just to regulate blood flow to the brain [9].

In 1889, Kocher published a series of 250 goiter resections and described precisely the surgical procedure he called "enucleation resection," including the typical transverse collar incision of the skin; today, this is still referred to as a Kocher incision. He also described why it is necessary to leave a minimum amount of healthy thyroid tissue behind to allow for continued thyroid function, and why it is essential to preserve the function of the recurrent laryngeal nerves as well as the parathyroid glands. However, in Kocher's time, the function of the parathyroid glands was still unknown. For many years, the Kocher operation (advocating for less than total thyroidectomy) was standard of care; only recently has there been a shift toward total thyroidectomy for the purpose of reduced risk of recurrence. Only with the later development of exogenous thyroid hormone supplementation and replacement has total thyroidectomy been rendered safe.

Tetany and hypoparathyroidism were not yet understood in Kocher's time, but his (relatively) bloodless technique permitted him to have fewer complications postoperatively compared to his contemporaries [1]. Kocher was renowned for his purposeful and precise style of performing thyroidectomy. With fastidious technique and integration of advanced antiseptic surgical methods, Kocher was able to reduce his perioperative mortality rate to 0.5% by 1912 [10]. By that time, he had performed more than 5000 thyroid operations, making him perhaps the earliest "high-volume" endocrine surgeon, and the first surgeon who demonstrated that with increasing experience, patient outcomes are optimized.

Kocher also was interested in the etiology of the development of goiters, and he performed a large study examining thousands of schoolchildren living in the canton of Bern; in this study, he described a total goiter prevalence rate that ranged from 20 to 100% [11]. He realized that there were significant geological differences regarding the prevalence of goiter and cretinism, and further studies focused on its etiology with the aim being to provide prophylaxis for the Swiss population. Shortly before his death, Kocher recommended that iodine supplementation be provided at a population level in order to prevent goiters. However, he was convinced at that time that iodine deficiency was not the cause of the development of goiters but rather an entity that could antagonize the real, unknown goitrogen. It was not until 1914 that thyroxine was identified by Kendall, and later, in 1926, first synthesized by Harrington in London.

Over the course of his career, Kocher published 249 scientific articles and books, operated on thousands of patients, and trained new generations of surgeons. His way of teach-



Fig. 1 Kocher Park with House of University, Bern. (Photograph courtesy of Bruno Worni)



Fig. 2 Street sign of the Kochergasse. (Photograph courtesy of Bruno Worni)

ing is still contemporary and has applications for the purpose of ensuring the highest quality surgical care. Fausto Chiesa summarized his strategy in an editorial around four points: (1) the importance of meticulous and repeated observations; (2) the knowledge of anatomy, pathology, and surgical techniques; (3) the accuracy, care, and patience that are necessary during surgical procedures (It is more important to be safe than fast!); and (4) the critical audit of results [12].

His fame and reputation as the first premier high-volume thyroid surgeon is robust today; rarely does a day go by when surgical trainees do not learn about the importance of the Kocher maneuver during pancreaticoduodenectomy, or perform a Kocher incision during thyroidectomy, or utilize or pass a Kocher clamp. His name and spirit continue to live



Fig. 3 Bust of Kocher in front of the Inselspital, Bern. (Photograph courtesy of Bruno Worni)

in the city of Bern in the Theodor Kocher Institute, the Kocher Park (Fig. 1), Kochergasse (Fig. 2), as well as in two Kocher busts, one placed in front of his so loved Inselspital, the University Clinic of Bern (Fig. 3).

Acknowledgments Daniel Candinas, MD FRCS, Chair of the Department of Surgery, University Clinic of Bern, Inselspital, Switzerland.

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