

Immigrant Entrepreneurship

Edward Mallinckrodt Sr. (1845-1928)

Industrialist Edward Mallinckrodt Sr. achieved success in the chemical manufacturing and pharmaceutical industries through a combination of factors that included strong connections to Germany, an awareness of the broader business environment, and an ability to formulate innovative responses to technological and economic changes.

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Introduction

Fundamental to the entrepreneurship of chemical industrialist Edward Mallinckrodt (born January 21, 1845 in St. Louis, MO; died February 1, 1928 in St. Louis, MO) was an alertness to market opportunities. In 1867, Edward Mallinckrodt and his two brothers, Gustav (1840-77) and Otto (1847-76), founded G. Mallinckrodt & Co. (incorporated as Mallinckrodt Chemical Works in 1882). Located in St. Louis, G. Mallinckrodt & Co. was one of the earliest chemical manufacturing firms west of Philadelphia. At first, Edward Mallinckrodt concentrated on the preparation of fine chemicals for which there was a strong local demand (or for which such demand could be anticipated). At the same time, however, he also kept an eye on the broader business environment and, over the following decades, formulated innovative responses to external technological and economic changes.

Edward Mallinckrodt's entrepreneurship and career benefitted greatly from his emphasis on market research and innovation. Likewise, his transatlantic connections were a crucial part of his success. As second-generation German immigrants, Edward, Gustav, and Otto Mallinckrodt had been born in Missouri. Unlike most children of immigrants, however, the Mallinckrodt brothers spent a portion of their youth in their father's homeland. In 1850, their father, Emil Mallinckrodt, who had emigrated in 1831, decided to move his American-born wife and children to Germany for five years. Thus, the Mallinckrodt brothers experienced Germany and German culture on a first-hand basis during a formative period in their lives. The connection to Germany remained critical over the years. As young men, Edward and Otto eventually returned to Germany for advanced training in chemistry. At the time, the German chemical industry led the world, and the Mallinckrodt's received an education far superior to any available in America. Throughout his career, Edward Mallinckrodt returned to Germany, time and again, in search of contacts, new developments, and expertise. For instance, as late as 1922, he visited various chemical and pharmaceutical enterprises in Germany, even though Mallinckrodt Co. had already developed a local knowledge base in St. Louis and elsewhere in the United States.^[1]

Beginning in the 1890s, Edward Mallinckrodt invested significant amounts of time and money in a variety of philanthropic pursuits. Among his numerous charitable gifts, those to Harvard University and Washington University in St. Louis stand out because of the very large sums of money involved. In making these

donations, Mallinckrodt hoped to encourage these American universities to provide education on a par with the very best German chemistry programs. His philanthropic efforts did not end in America, however: Mallinckrodt also provided support to relatives in Germany, and his son, Edward Mallinckrodt Jr. (1878-1967), was eventually involved in the revival of chemistry education in West Berlin in the context of the Cold War.

Family and Social Background

As mentioned above, it was Emil Mallinckrodt (1806-92), the father of Edward, who emigrated from the German lands to the United States in 1831. Emil Mallinckrodt had been born into a Westphalian family of aristocratic lineage whose genealogy can be traced back to the thirteenth century.^[2] From their homelands on the Westphalian countryside, the Mallinckrodt had gradually integrated themselves into the city of Dortmund, where they were active in the textile business as well as local politics – occupations that were closely related because of the political privileges granted to the *Wandschneidergesellschaft*, a textile society. From the early seventeenth century until 1832 – a period during which the status of Dortmund changed from a Protestant “free imperial city” (*freie Reichsstadt*) to a city under French and subsequently Prussian rule – several generations of Mallinckrodt served on the city council. Furthermore, during the final eighty-eight years of this epoch, no fewer than three Mallinckrodt served as mayor of Dortmund.^[3]

Unlike other family members, who attempted to influence society through politics, Emil's father, Arnold Mallinckrodt (b. 1768), had sought change through his work as a reform-minded lawyer and publisher. It is against the backdrop of a series of setbacks encountered by Arnold in the quarter century before his death in 1825 that Emil's emigration to Missouri must be understood. In 1796, Arnold had established a local quarterly publication whose scope was gradually expanded from Dortmund to Westphalia in its entirety. However, in anticipation of censorship measures by the French, Arnold ceased publishing his quarterly, the *Westfälischer Anzeiger*, in 1809. After Napoleon's defeat and the subsequent integration of Westphalia into Prussia at the Congress of Vienna, Arnold felt that the time was ripe to reintroduce his newspaper. But, as with Arnold's hopes for liberal reform, the reappearance of the *Anzeiger* proved short-lived: by 1818, the political climate in Prussia had become too repressive for his publication to survive. In fact, after publishing an article that criticized the Prussian army, he was given a prison sentence that he only narrowly escaped through a successful appeal. Eventually, Arnold decided to retreat to the countryside and bought an estate in Schwefe, near Soest. Unfortunately, he was incapable of running the farm effectively, and after he died in 1825, his son Emil inherited his debts.^[4]

In addition to political disillusionment and economic deprivation, family interference in Emil's private affairs strengthened his desire to emigrate. As historian Anita Mallinckrodt has written, “[a]pparently Emil's offer of marriage to a young woman named Lina had been refused, and he was enraged by his family's suggestion that he solve his money problems by marrying someone wealthy, regardless of whether he loved her.”^[5] On account of these various factors, Emil was extremely receptive to the promising picture of Missouri presented in the *Report on a Journey to the Western States of North America* (1829), which had been written by Gottfried Duden, the first German university graduate to relocate to Missouri.^[6] Hence, Emil sold his estate in Schwefe and, together with his cousin Julius Mallinckrodt, moved to Missouri in 1832, in search of individual as well as socio-political freedom.

In Missouri, Emil succeeded in what neither he nor his father had managed to do in Westphalia: he operated a farm profitably. Initially, Emil and Julius settled together on the bank of the Missouri River, roughly fifty miles north of its debouchment into the Mississippi. However, in 1833, after Emil married Eleanor Didier, a sixteen-year-old from a Kentucky family, he and his wife went their own way. In late 1834, they moved to a rented farm in the rapidly expanding city of St. Louis to lower the transportation costs for their agricultural produce. Then, the couple spent the period from 1837 until 1839 in Louisiana, Missouri, where Emil opened a store on the banks of the Mississippi River to supply passing steamboats with groceries, liquor, hardware, and porcelain.^[7] Afterwards, Emil and Eleanor returned to the St. Louis area to work on newly purchased farmland. It was there that Eleanor gave birth to four children during the following seven years: Gustav (b. 1840), Wilhelmina (b. 1842), Edward (b. 1845), and Otto (b. 1847). In 1850, after a devastating cholera epidemic, Emil took his family back to Europe, where Adele, another daughter, was

born. In Cologne, the family visited Emil's cousin Gustav Mallinckrodt, an entrepreneur who had given Emil financial support in times of need.^[8] Emil also took bathing cures in Bonn, Switzerland, and Italy. But the Mallinckrodt's spent most of their time in Dortmund, taking advantage of the hospitality of Emil's only brother and his wife.

In Dortmund, the young Edward Mallinckrodt received his first formal schooling. After the Mallinckrodt's returned to Missouri in the fall of 1855, he continued his education at public schools in St. Louis. Sadly, Edward's mother died in September 1858, when he was just thirteen years old. The following year, his father married Emilie Vollman of Dortmund. Together, Emil and Emilie Vollman had three children, who were half-siblings to Edward: Emil Jr. (b. 1860), Oscar (b. 1861), and Elmira (b. 1866). Except for Oscar, all of the Mallinckrodt brothers would eventually work for Mallinckrodt Co.^[9]

In America, Edward Mallinckrodt learned to be independent at a young age. In the spring of 1863, Edward, then eighteen, was left in charge of the family farm when his father, stepmother, sister Wilhelmina, and three half-siblings traveled to Germany for health and other reasons. (Gustav, Edward's older brother, was already away from home, having joined the Union army after the beginning of the Civil War.) The family farm included orchards and a vineyard, so the responsibility was by no means a small one. Indeed, the magnitude of the task compelled Edward to hire and supervise several farm hands. Through the experience, he learned to delegate work and manage a staff. In addition to running the farm, Edward carried out a program of self-study in chemistry in the evening. His personal correspondence clearly reveals his dedication to the subject; as he wrote to his father in September 1863:

I am still getting alone again, I seldom feel lonesome, in fact, I never allow myself time to feel so; during the day I generally employ myself with work and if melancholy overcomes me in the evening, I take up my chemistry, which soon quiets my troubled mind; it is to me what the bible is to a christian [sic].^[10] [Significantly, Edward's parents had their children baptized only belatedly, most likely out of pressure from friends and acquaintances.]

Edward probably downplayed the loneliness of his existence so as not to worry or disappoint his father. His brother Gustav, however, took note of his relative isolation and expressed concern about it. Indeed, Edward's seclusion was one reason why Gustav encouraged Emil to send Edward to Germany so that the young man could experience student life while getting first-class training in chemistry – the sort of schooling that Gustav regretted having never received himself.^[11] After his father approved the plan, Edward admitted: "I have always had a desire to go to Germany to study Chemistry."^[12] Subsequently, he and Gustav tried to persuade Emil that their younger brother, Otto, also deserved the chance to study chemistry in Germany. Gustav even argued that Otto "could be of great advantage to Edd and I in our proposed business" – the chemical manufacturing firm they were planning to establish in St. Louis.^[13]

In the spring of 1864, Edward and Otto left for Germany. There, they studied at the renowned chemical laboratory of Carl R. Fresenius in Wiesbaden, where they probably remained for three semesters.^[14] Fresenius, a former assistant to famed German scientist Justus von Liebig, was a world authority in analytical chemistry; he also had a track record of training future chemical executives. In 1863, the year before the Mallinckrodt brothers started studying with him, a pharmaceutical *Lehranstalt* had been added to his laboratory. This may have influenced the Mallinckrodt's choice of Wiesbaden, as Gustav thought it desirable to acquire broad expertise within the field. Eventually, the production of pharmaceutical chemicals did indeed become a focal point of the family enterprise.

After his stint at Fresenius' laboratory, Edward started a traineeship at *E. de Haen Chemische Fabrik List GmbH*, the chemical company of Dr. Eugen de Haën, one of Fresenius' former students.^[15] Mallinckrodt's traineeship with de Haën had been organized by S.W. Wiscott, the husband of Edward's older sister, Wilhelmina, who had permanently settled in Germany after returning in 1863. In the contractual agreement that de Haën presented to Wiscott, the former committed himself to sharing with Edward "without reservation all information which can be of use to him."^[16] In return, Mallinckrodt promised that he would not share any knowledge or know-how acquired from de Haën with any another European firm for a period of five years. This restrictive clause is unlikely to have bothered Edward, since he and his brothers had already settled on St. Louis as the future home of their business: by that time, they had "talked so much"

about going into “some manufacturing business ... [and] St. Louis promises many advantages for that branch of industry as do also the vast mineral resources of the State.”[\[17\]](#) Additionally, the Mallinckrodt's choice of Missouri (and America, more generally) as a business location was likely influenced by the prospect that the recently implemented American “war tariffs” would remain in force after the end of the Civil War, thus shielding American industries from foreign competition.[\[18\]](#)

Although the planned venture was a family enterprise, Gustav Mallinckrodt was the driving force behind it. He was fully committed to the project and was also of the mind that his younger brothers needed to devote as much time to it as possible. He felt that, in addition to their studies, Edward and Otto needed to search out contacts and opportunities in Germany. As Gustav suggested to his father in June 1864, “Edd [Edward] & Otto both could perhaps during vacation spend their time profitably in Dortmund & vicinity in viewing coal mines, iron-works etc. & gain more useful information about the manner of production of not only these but also of others.” In a similar vein, Gustav implied that while practical chemical knowledge would be a powerful business asset, his siblings needed to be able to move into virtually any manufacturing field where profit opportunities arose. The following lines, which Gustav wrote to Emil, clearly reveal his entrepreneurial mindset.

The unforeseen demand at time, of certain productions & the unsettled condition of our affairs apparently for years to come in a mercantile point of view, will render the fabrication of one article more remunerative than another at times, therefore the advantage of being fully conversant with anything that may happen to be the most lucrative. Wealth naturally always being the aim of man, he seeks that which brings him most in the least time, more than that for which he has inclination naturally. Practical knowledge also is continuously sought for by capital & we in this country have mostly to look for foreign talent, to supply us with that which we cannot obtain here.[\[19\]](#)

Fortunately for Edward Mallinckrodt, he never needed to enter an industry unrelated to his chemical-pharmaceutical training. Indeed, as it turned out, even the contemporary heir to the firm founded by the Mallinckrodt's is still producing pharmaceuticals in, among other places, St. Louis.[\[20\]](#)

Business Development

Shortly after their reunion in America in the fall of 1867, the three Mallinckrodt brothers formed G. Mallinckrodt & Co. and erected the first company buildings on the [family farm](#). Their father provided further support by offering his land as a security against which they could borrow starting capital of \$10,000 (approximately \$157,000 in 2011).[\[21\]](#) Initially, Edward held the position of plant superintendent. Gustav, who already had several years of relevant business experience through his work for Richardson & Co., a nearby wholesale drug firm, took charge of the general administration, management, and sales. Otto, the youngest brother, conducted chemical analyses and oversaw part of the manufacturing process. At this early stage, this work involved purifying commercial grades of various pharmaceutical, analytical, and/or photographic chemicals as much as producing fine chemicals of these sorts in house.[\[22\]](#)

This division of labor between the three company founders did not last long. Less than a decade after the founding of the firm, Otto and Gustav Mallinckrodt died within a six-month period. In December 1876, Otto died of pneumonia, and in June 1877, Gustav succumbed to tuberculosis. Edward sought solace in work. With the death of his brothers, Edward Mallinckrodt virtually became the sole owner of the family firm: when the Mallinckrodt Chemical Works were incorporated in 1882, it was only for legal reasons that two out of a total of 2,500 shares were not allocated to him.[\[23\]](#) In addition, he now was the undisputed leader of the enterprise, responsible for managerial, administrative, and general policy matters.[\[24\]](#)

As president of the Mallinckrodt Chemical Works, Edward had to make important strategic decisions in response to external changes in the business environment. Innovations in transportation and communication technology, for instance, had paved the way for the creation of a unified national market. Even before the completion of that process, the Mallinckrodt Co. was already being exposed to stiffer competition from East Coast manufacturers and from European chemical firms with distribution networks or facilities in the United States. In 1886-87, for instance, German producers of bromine entered the

American market, selling their product at a price slightly lower than that set by the National Bromine Company (1885-91), a U.S. cartel created at the instigation of Mallinckrodt and Powers & Weightman, the two largest American manufacturers of potassium bromide.^[25] Yet the economic integration of the U.S. also provided Mallinckrodt with opportunities for expansion. For example, European imports could now be delivered more rapidly to St. Louis (although the advent of the railroad saw the Mississippi port city lose significance as a commercial hub in comparison to Chicago.)^[26]

Against the backdrop of integration, Mallinckrodt began selling “[Rodinal](#),” a photographic developer, in the early 1890s as a trade agent of the *Aktiengesellschaft für Anilin Produktion in Berlin* (Agfa). Consistent with historian Yda Schreuder’s insistence on the importance of ethnic ties in the distribution of German-produced chemicals and pharmaceuticals in the U.S., Rodinal was supplied to Mallinckrodt by [Arthur Schwarz](#), a German-American importer based in New York.^[27] To exploit economies of scale and locational advantages vis-à-vis chemical-pharmaceutical companies from New York and Philadelphia, Mallinckrodt also began targeting urban centers in the Midwest and on the American West Coast. Doubtless aware of the good reputation his company had earned for the quality of its early products (e.g. [carbolic acid](#)), Edward Mallinckrodt also expanded to the East Coast.^[28] Thus, in 1884, he opened a sales office in New York. Three years later, he established a factory in Bergen, New Jersey. Then, in 1904, the company opened a warehouse and sales office in Philadelphia; a Canadian office opened in Montreal in 1913. In short, although Mallinckrodt’s local customer base in the St. Louis area always remained important, his firm gradually evolved to become truly North American in scope.^[29]

In addition to the integration of the American and, to some extent, the global economy, Mallinckrodt was forced to respond to another type of external development: namely, to technological changes within the chemical industry and the industries that depended upon it. These changes are well illustrated by the evolution of photographic chemicals, one of Mallinckrodt’s [core products](#) during the period under investigation. The photographic industry underwent a fundamental transformation in the late 1870s and 1880s, due to the commercial introduction of the relatively user-friendly gelatin silver dry plate process. Unlike the “wet collodion” process, which had dominated photographic technology from the mid-1850s onward, this new process involved dry plates that could be prepared in advance by manufacturers. One of the earliest American firms to make them was Cramer & Norden, which was co-owned by Gustav Cramer (b. 1838) and Hermann Norden (b. circa 1833), two first-generation immigrants from Germany. Another German-American, Ludwig Hammer (b. 1834), and an Englishman named Miles A. Seed (b. 1843) followed suit, founding dry plate companies named after themselves and, to differing degrees, exploiting European sources of knowledge and know-how. Significantly, as historian Reese Jenkins has pointed out, by the late 1890s, the enterprises of Cramer, Norden, Seed, and Hammer, all of which were based in St. Louis, were producing “about three-quarters of all the plates used in the Western Hemisphere.”^[30] Mallinckrodt both contributed to and profited from St. Louis’ development into a worldwide center of the dry plate industry – respectively, by expanding its production of photographic chemicals and by having a ready outlet for them. Yet the firm also targeted segments of the photographic industry in which St. Louis played only a secondary role, as in the production of nitrocellulose film.

Edward Mallinckrodt’s alertness to market opportunities, which he no doubt learned from his father and older brother Gustav, can also be seen in his firm’s entry into the anhydrous ammonia and [medical narcotics](#) trades. Ammonia, to begin with, had been among the earliest products prepared by G. Mallinckrodt & Co. However, the compound’s potential as a refrigerant increased dramatically in the 1870s, thanks to work by, among others, German engineer Carl Linde and Eli H. Larkin of Larkin & Scheffer, a St. Louis-based chemical company. Within two years of Larkin’s invention of a high-pressure container in which liquid anhydrous ammonia could be stored, the Mallinckrodt Co. constructed an ammonia cylinder plant with a capacity that was considered daringly high by a former Mallinckrodt employee who was familiar with the industry.^[31]

The move was prescient: within ten years of Larkin’s invention, the number of ice plants in the U.S. proliferated, and Mallinckrodt Co., which had since become the country’s largest producer of anhydrous ammonia, was well placed to respond to the booming demand.^[32] Despite his leading position, Edward Mallinckrodt decided to forge an agreement with his primary competitors, just as he had done with respect

to potassium bromide. In 1889, the Mallinckrodt Chemical Works, Larkin & Scheffer, the De La Vergne Refrigerating Machine Company, the Delaware Chemical Company, and Theodore J. Goldschmid merged their interests and founded the National Ammonia Company, of which Edward Mallinckrodt became the first president. It has been suggested that these firms merged to guarantee their customers stable supplies of ammonia.^[33] It could also be argued, however, that they joined forces to maintain high profit margins in an increasingly competitive industry.^[34] Internationalization was another strategy for reaching these goals. Here, it should be mentioned that, within a decade of its creation, National Ammonia established a subsidiary in faraway Australia, where, as was the case in both Japan and in Central and South America, it had been [competing with European producers](#) for market share.^[35]

It is important to mention that, on other occasions, the Mallinckrodt Co. did indeed miss out on important opportunities. Chloroform, for instance, had been a money-maker in the company's early years and decades of existence. But the company largely gave up on this anesthetic around 1890, as it could not compete with rivaling enterprises that produced chloroform from acetone rather than alcohol, as Mallinckrodt did. Likewise, Edward Mallinckrodt failed to grasp the importance of a radically new invention by Herbert H. Dow (1866-1930) that covered the electrolytic production of bromine from brine. Dow had offered Mallinckrodt an interest in the invention, but the latter declined. This decision was unfortunate, for the Mallinckrodt Co. and other industry incumbents eventually came to depend on two entrant firms co-founded by Dow: the Midland Chemical Company (1892) and the Dow Chemical Company (1895).^[36]

All in all, though, Edward Mallinckrodt's record as owner-entrepreneur of the Mallinckrodt Chemical Works was impressive. Clearly, the firm was sufficiently innovative to combine a focus on a limited number of product lines – namely, pharmaceutical, analytical, photographic, and technical chemicals – with an increase in size and profitability. From the late 1870s until the turn of the century, the number of workers employed by the Mallinckrodt Co. rose from 50 to 400. By the time of Edward Mallinckrodt's death in 1928, that number had increased to roughly 1,000, despite the relatively conservative management practices favored by the company since the end of the First World War.^[37] Parallel to this growth in staff, the annual sales of the Mallinckrodt Co. grew from slightly less than \$500,000 in 1882 (\$11.3 million in 2011) to \$1.5 million in 1904 (\$39.1 million in 2011) and then to \$7.2 million in 1915 (\$166 million in 2011). Significantly, in this final year, profits amounted to no less than \$2.25 million (\$52 million in 2011), a record high in the firm's history.^[38]

As the company grew, Edward Mallinckrodt was forced to delegate important decisions to non-family members. Here, it is important to note that two of his closest advisors, Henry W. Huning (b. circa 1852) and Oscar L. Biebinger (b. 1859), were also second-generation immigrants from Germany. Huning first joined the Mallinckrodt Company in 1868 and eventually rose to the position of vice-president. Biebinger entered the firm's employ in the 1880s. He succeeded Edward Mallinckrodt as company president in 1924.

German heritage was by no means a prerequisite for a career at the Mallinckrodt Company, however. In fact, at least after the turn of the century, a Harvard degree seems to have been a key stepping stone to a leadership position. Edward Mallinckrodt had sent his son, Edward Mallinckrodt Jr. (1878-1967), to Harvard in the 1890s, and he repeatedly served on the visiting committee that annually evaluated the state of Harvard's chemistry department. After graduating from Harvard in 1901, Edward Jr. joined the family firm and convinced several other Harvard-trained scientists to do the same.^[39] One of these men, Arthur C. Boylston (b. 1881) of Massachusetts, presided over the firm after Biebinger's death in 1941.^[40]

A similar evolution can be observed with regard to the knowledge sources upon which the Mallinckrodt Company relied. In the nineteenth century, German connections were of primary importance. For instance, the firm's early and long-time focus on the manufacture of pharmaceutical and analytical chemicals of high purity was consistent with the training that Edward and Otto Mallinckrodt had received at Fresenius' Wiesbaden laboratory.^[41] In the mid-1860s, when Edward and Otto studied there, an American equivalent to that institution simply did not exist. What is more, when Edward Mallinckrodt wanted to introduce new products, he typically sought to acquire access to inventions from external sources as opposed to focusing on basic in-house research. The company's venture into the manufacture of cocaine and [morphine](#), for example, started from purchased processes, which Mallinckrodt chemists then successfully improved.^[42] That this venture involved transatlantic knowledge transfers is hardly surprising, especially in light of Germany's worldwide dominance in the production of fine chemicals and Mallinckrodt's contacts with

German enterprises such as the *Chininfabrik Braunschweig*.

When it came to transatlantic knowledge transfers, the entry of [Edward Mallinckrodt Jr.](#) and his Harvard acquaintances represented a turning point in the firm. Edward Jr. had originally intended to pursue an academic career, but ended up joining the company instead. He appears, however, to have sought middle ground by strengthening Mallinckrodt's commitment to original scientific research. For example, the [chemistry of ether](#) was one of Edward Jr.'s personal specialties, and at Mallinckrodt he was able to shape a research program in this area. The program lasted for several decades and indirectly contributed to Mallinckrodt's involvement in the Manhattan Project during the Second World War, when the company took up the production of uranium. Edward Jr. also initiated research projects with a number of American universities. Besides Harvard, these included Columbia, Cornell, and the universities of Missouri, Virginia, and Cincinnati, among others.[\[43\]](#)

There are also indications that, as the years progressed, the Mallinckrodt Company began to broaden its customer base and grow beyond its German-American core. According to Edward Mallinckrodt Jr., within the city of St. Louis, the Mallinckrodt Company had once been perceived as a German firm. In a 1964 interview, he stated that it used to be said in St. Louis that “you won't get anywhere at the chemical plant” without knowing German.[\[44\]](#) This was likely attributable to the company's relatively large number of German-American employees, and to the influence of managers such as Henry Huning and Oscar Biebinger, who held positions of influence. Additionally, in the nineteenth century, many of the Mallinckrodt Company's customers were German-American, which meant that language fluency would have been an asset for employees. For instance, as we have seen, Mallinckrodt supplied photographic chemicals to German immigrants such as Gustav Cramer, Hermann Norden, and Ludwig Hammer, who helped turn St. Louis into a worldwide center of the photographic industry. In the retail and wholesale drug trade German-Americans played a major role, too. By the early 1850s, for example, roughly half of the pharmacies and twenty percent of the wholesale drug firms in St. Louis were run by ethnic Germans. The latter percentage increased in the following decades, when the German-American [Meyer Brothers Drug Company](#) emerged as one of the few survivors of an industry shake-up.[\[45\]](#) That the Mallinckrodt Co. attached great importance to the local pharmaceutical trade is evident from the fact that Gustav Mallinckrodt agreed to head the St. Louis College of Pharmacy as early as 1870, while his firm was still struggling to secure a sufficiently broad customer base.[\[46\]](#) Yet, as the Mallinckrodt Co. expanded in the late nineteenth and early twentieth centuries, its dependence on German-American customers seems to have diminished. Clearly, by the First World War, Mallinckrodt was considered an American company. Unlike with other firms run by German-Americans, its loyalty to the U.S. was not questioned during the conflict. In fact, the American war effort benefitted from the fact that a domestic producer like Mallinckrodt could provide large supplies of, among other things, ether and morphine.[\[47\]](#)

Social Standing, Networks, Family and Public Life

By the end of the 1880s, Edward Mallinckrodt Sr. had become relatively well known in American chemical circles, but he was not yet a member of the financial-economic elite in St. Louis. That changed in the next decades, when Mallinckrodt began to hold an increasingly large number of executive positions outside of the chemical industry. His election to the board of directors of the Union Trust Company of St. Louis in 1891 marks the beginning of this process.[\[48\]](#) There, he met local businessmen-philanthropists such as Robert S. Brookings (1850-1932) and William K. Bixby (1857-1931), with whom he would develop close friendships in the following years and decades. In this way, he became part of “a group which profoundly influenced the industrial, commercial, and financial development of the city [of St. Louis]” – among other things, through investments in real estate development and railroad finance.[\[49\]](#) Above and beyond this, Mallinckrodt also took a special interest in education and medicine. In 1902, for example, he joined the boards of Washington University and St. Luke's Hospital, both in St. Louis. Mallinckrodt would serve on the former until his death in 1928. Throughout this period, the university was led by Mallinckrodt's friend Brookings, the founder of the Brookings Institution.[\[50\]](#) Mallinckrodt presided over St. Luke's Hospital from 1920 until his death.

It was no coincidence that Mallinckrodt expanded his social network through this sort of work-related

commitment. In more informal, leisurely settings, Mallinckrodt depended on the social skills of his wife, Jennie (“Jane”) Anderson (1855-1913), whom he had married in 1876. Anderson came from an Ohio family, without any known German ancestors, and English was probably the couple’s sole language of communication.^[51] In the words of historian William Haynes, Anderson “exerted a profound, if subtle, influence upon the natural reticence and seriousness which even as a boy had been noted in her husband.”^[52] Mallinckrodt’s close relationship with his wife made her death in 1913 all the more tragic.

The Mallinckrodt had only one child, Edward Jr. Earlier studies have tended to emphasize differences rather than similarities between him and his father. This is legitimate when it comes to their style of business leadership. After his election as chairman of Mallinckrodt’s board of directors in 1928, Edward Jr. maintained an active involvement in the company’s research programs and was reluctant to introduce changes in domains other than R & D.^[53] Edward Sr., by contrast, primarily left his mark in the commercial and financial realms. Still, the characterization of Edward Sr. as a Gilded Age “merchant prince,” mainly interested in “profits and expansion,” seems exaggerated in light of his early passion for chemistry and his philanthropic contributions to numerous educational and medical institutions.^[54] Indeed, this description of Mallinckrodt may say more about general perceptions of business monopolies in late nineteenth- and early twentieth-century America than about this particular industrialist’s personality and priorities.

A commitment to philanthropy was one thing that Edward Sr. and Edward Jr. had in common. In St. Louis, Edward Sr. provided financial assistance, above all, to St. Luke’s Hospital and the Medical School of Washington University. At the latter institution, he invested in the development of pediatric, pharmaceutical, pathology, and radiology facilities. Edward Sr. also supported institutions affiliated with the medical school, such as the St. Louis Children’s Hospital, as well as various non-medical projects at Washington University (which, it should be mentioned, was also supported financially by German-American brewing magnate [Adolphus Busch](#)). To be sure, there was a strategic side to these investments, most obviously because both Washington University and the local hospitals were important customers of the Mallinckrodt Company. Still, the gifts were more about charity than strategy, as Edward Sr.’s investments were out of proportion with the commercial returns that could be expected.

As will be clarified below, Edward Jr. arranged for his largest philanthropic donations in his will. Yet, in the half century leading up to his death in 1967, he had already made regular financial contributions to Harvard, particularly to support the physical sciences. Edward Jr. had also advised his alma mater on how to approach other potential donors. Here, he was able to draw on personal experiences dating back to at least 1909, when he got involved in a protracted fundraising campaign aimed at providing Harvard with new chemical laboratories. In 1923, these efforts received an important boost in the form of a gift by Edward Mallinckrodt Sr. of no less than \$500,000 (\$6.59 million in 2011). Among other pieces of evidence, a letter from Edward Sr. to Lawrence Lowell, then president of Harvard, shows that the former had discussed the matter with his son.^[55] Yet, Edward Sr. was not just yielding to the wishes of his younger namesake. His donation was surely motivated by his respect for Lowell and for longtime Harvard professor Theodore Richards, the first American laureate of the Nobel Prize in Chemistry. In addition, by requiring that the new laboratory be designated as the “Edward Mallinckrodt Building” or “Edward Mallinckrodt Hall” – a common demand of businessmen-philanthropists – Mallinckrodt ensured that his name would be immortalized.^[56] Finally, Mallinckrodt held an elitist-competitive stance on the organization of higher education: he thought it better to have one American university with world-class chemical facilities than to have several universities with decently equipped ones. That way, ambitious American chemistry students would no longer need to travel to Germany for study purposes, as Edward Sr. and his brother Otto had done in 1864.^[57]

Another similarity between father and son was that both maintained contact with relatives in Germany and financially supported these family members after, respectively, the First and the Second World Wars. To be sure, the primary allegiance of both Mallinckrodt was to the United States. In 1920, for example, Edward Sr. became very dismayed by the “bitter attitude” of one German cousin towards America and indicated that he preferred not to discuss the First World War with him to keep peace within the family.^[58] At the same time, however, Edward Sr. suggested that his confidence in the ability of the German people to recover from their losses had remained “unshakable.”^[59] Moreover, in 1923 he strongly condemned the French-Belgian occupation of the Ruhr and claimed that “[e]xcept for my help our German relatives would

not be able to live.”^[60] That Edward Jr., a third-generation immigrant, also worried about family in Germany is remarkable given his relatively weak personal connection to the country. Nonetheless, in the aftermath of the Second World War, Edward Jr. carried out “a sort of private relief effort on behalf of many people in Germany connected in some way with the old family to which my grandfather on my father’s side [i.e. Emil Mallinckrodt] belonged.”^[61] Among other things, he invested in the education of several distant relatives, some of whom came over to the U.S. to study.^[62] Moreover, in late 1954 and 1955, Edward Jr. tried to raise funds to improve the chemical facilities at the Technical University of Berlin. He had done so at the request of his friend James Conant (1893-1978), the American Ambassador to West Germany and a former president of Harvard.^[63] In a Cold War setting, this initiative aimed “to make within the next years chemistry at the Technical University of Berlin something of a visiting card of the West vis-à-vis the East, as all of us wish it to be.”^[64] However, aside from Edward Jr. and George W. Merck (1894-1957), a second-generation German immigrant and the former president of Merck & Co., very few American chemical-pharmaceutical industrialists showed enthusiasm for the project out of concern for competition from German firms.

Concluding Remarks

This essay has identified Edward Mallinckrodt Sr.’s keen awareness of commercial opportunities as one key aspect of his entrepreneurship. As we have seen, such opportunities were often derived from changes in the business environment. The integration of the American economy, for example, gave the Mallinckrodt Co. access to new customers, while simultaneously exposing the St. Louis-based firm to more intense competition from East Coast and international manufacturers. As a second-generation immigrant from Westphalia, Edward Mallinckrodt Sr. possessed family and ethnic ties to Germany, whose chemical industry led the world in the late nineteenth century. These ties represented a different type of opportunity, but they also helped shape Mallinckrodt’s business. At the start of his career, for instance, a German brother-in-law arranged an important traineeship for him with a chemical industrialist based near Hannover. Back home in St. Louis, German-Americans accounted for a disproportionately large share of Mallinckrodt’s early customers. It would be wrong, however, to view Mallinckrodt’s German background and connections as mere business assets. Rather, they were part of his identity and the driving force behind charitable contributions to his German relatives. Even Edward Jr. honored his German roots: more than 110 years after his grandfather’s migration from Westphalia to Missouri, Edward Jr. provided generous support to several distant family members.

Nonetheless, Edward Mallinckrodt Sr. was an American citizen, first and foremost. Already, Edward’s father, Emil Mallinckrodt, had married an American woman and had been “full of ... an immigrant’s nationalism” by the 1840s.^[65] The Civil War dealt a blow to this enthusiasm, but Emil’s sons were more optimistic about the future of the country than he was.^[66] Moreover, Edward Mallinckrodt’s philanthropy was mainly dedicated to scientific causes in the U.S. As demonstrated, his donations were largely aimed at supporting the development of higher education in St. Louis, at Harvard, and elsewhere in America. Finally, unlike European technical-scientific knowledge, European markets were relatively unimportant to the development of the Mallinckrodt Co. and of National Ammonia, the second firm led by Edward Mallinckrodt.

Although Robert Brookings and other philanthropist friends of Mallinckrodt tried to persuade him to dedicate all of his time to charitable causes, Mallinckrodt could not let go of his business enterprises. In fact, Mallinckrodt died relatively shortly after having authorized the sale of National Ammonia to E. I. du Pont de Nemours and Company, thus concluding a process of amalgamation that had begun in 1924.^[67] In view of this, it is somewhat ironic that Mallinckrodt repeatedly urged his son not to let work dominate his life. Thus, in an emotional letter written less than half a year before his death in February 1928, Edward Sr. advised his younger namesake:

once more ... not to overburden yourself with so many increasing unnecessary responsibilities, not to be so absorbed & to give so much time to things of minor importance to determine to take daily recreation, to keep your health up to 100% par, to give up night work, to devote yourself to Bessie [Edward Jr.’s wife Elizabeth] & your children, the bringing of

whom is of itself a very great responsibility. Confine yourself to the important things of life, let other matters go & don't let other people impose upon you & unload so much work on you. ... You have so much to live for & must take care of yourself. You have abundant means & can shape your own life & that of your family. The family trust alone will take care of all of you in comfort, including your grandchildren, so I again implore you to change your mode of living.^[68]

In the same letter, Mallinckrodt confessed to his son that his wife had seen “your tendency to overwork & for this reason wanted me to sell the [Mallinckrodt Chemical] Works.” Considering how far the enterprise had come since its founding in 1867, it seems understandable that Edward Sr. had not honored his wife's wish. Having been launched with no more than \$10,000 in capital, the Mallinckrodt Co. had developed into one of America's largest manufacturers of fine chemicals by the early twentieth century.^[69] It had introduced high-quality products in parts of the U.S. that had remained relatively undersupplied, while always retaining a strong local base in St. Louis – the city to which Edward's father had been attracted.

More remarkable is the fact that Edward Mallinckrodt Jr. eventually weakened his family's control over the Mallinckrodt Co. by willing the majority of his stock to Harvard and Washington University.^[70] Surely, Edward Jr. did not anticipate that Harvard would sell its Mallinckrodt shares to company outsiders and thus set in motion the sequence of takeovers and divestments that characterized the recent history of the firm, up to the creation of Mallinckrodt Pharmaceuticals in 2013. On the other hand, both he and his father would have been pleased to see how Harvard and Washington University used these unusually generous bequests to fund a whole range of research projects, departments, and professorships. The total value of the donation is said to have amounted to almost \$125 million, a sum that easily eclipses the Mallinckrodt's earlier charitable investments, including Edward Sr.'s financing of the Mallinckrodt Chemical Laboratory at Harvard in the interwar years.^[71] In combination with these previous contributions, this bequest seems to guarantee that Edward Mallinckrodt Sr. will be remembered not only as a successful chemical entrepreneur, but also, like his son, as a committed philanthropist.

Notes

- ^[1] Edward Mallinckrodt Sr., “Report of Interviews with European Manufacturers During the Summer of 1922,” in Edward Mallinckrodt Jr. Papers, The State Historical Society of Missouri (hereafter EMP), series 6, box 17, folder 975.
- ^[2] Anita M. Mallinckrodt, *From Knights to Pioneers: One German Family in Westphalia and Missouri* (Carondale, IL: Southern Illinois University Press, 1994).
- ^[3] *Ibid.*, 178; and Christoph Franke, *Wirtschaft und Politik als Herausforderung: die liberalen Unternehmer (von) Mallinckrodt im 19. Jahrhundert* (Stuttgart: Franz Steiner, 1995).
- ^[4] Mallinckrodt, *From Knights to Pioneers*; Franke, *Wirtschaft und Politik als Herausforderung*, 29-30; Wilhelm Ribhegge, *Preussen im Westen: Kampf um den Parlamentarismus in Rheinland und Westfalen, 1789-1947* (Münster: Aschendorff, 2008), 65.
- ^[5] Mallinckrodt, *From Knights to Pioneers*, 109.
- ^[6] *Ibid.*, 111.
- ^[7] Mallinckrodt, *From Knights to Pioneers*, 173-74.
- ^[8] On Gustav Mallinckrodt (1799-1856), see Franke, *Wirtschaft und Politik als Herausforderung*.
- ^[9] Mallinckrodt, *From Knights to Pioneers*; and George Dumas Stout, *Edward Mallinckrodt: A Memoir* (St. Louis, 1933), 32-3, in EMP, series 1, box 2, folder 55.
- ^[10] Edward to Emil Mallinckrodt, 18 September 1863, as quoted in Dumas Stout, *Edward Mallinckrodt*, 32-3.

- [11] Gustav to Emil Mallinckrodt, 1 March 1864, in EMP, series 1, box 3, folder 90.
- [12] Edward to Emil Mallinckrodt, 28 February 1864, as quoted in Dumas Stout, *Edward Mallinckrodt*, 41.
- [13] Gustav to Emil Mallinckrodt, 1 March 1864, in EMP, series 1, box 3, folder 90.
- [14] Eugen de Haën to S. W. Wiscott, 23 January 1866, in EMP, series 1, box 2, folder 54.
- [15] Susanne Poth, *Carl Remigius Fresenius (1818-1897): Wegbereiter der analytischen Chemie* (Stuttgart: Wissenschaftliche Verlagsgesellschaft, 2007), 75 and 101-02.
- [16] De Haën to S. W. Wiscott, 23 January 1866; and William Haynes, *Chemical Pioneers: The Founders of the American Chemical Industry* (New York: D. Van Nostrand Company, Inc., 1939), 158.
- [17] Gustav to Emil Mallinckrodt, undated [circa Jan. 1864], as quoted in Dumas Stout, *Edward Mallinckrodt*, 45.
- [18] Gustav to Emil Mallinckrodt, 5 June 1864, in EMP, series 1, box 3, folder 91; and Bennett D. Baack and Edward John Ray, "The Political Economy of Tariff Policy: A Case Study of the United States," *Explorations in Economic History* 20 (1983): 73-93.
- [19] Gustav to Emil Mallinckrodt, 5 June 1864, in EMP, series 1, box 3, folder 91.
- [20] This company, Mallinckrodt Pharmaceuticals, highlights this continuity on its website. See www.mallinckrodt.com/Company/Story (consulted September 2014).
- [21] Dumas Stout, *Edward Mallinckrodt*, 49-50. All current values (in 2011 USD) are based on Samuel H. Williamson, "Seven Ways to Compute the Relative Value of a U.S. Dollar Amount, 1774 to present," [MeasuringWorth](http://MeasuringWorth.com), 2011, using the Consumer Price Index.
- [22] Paul Krueger, "Fine Chemicals Since 1867: The History of the Mallinckrodt Chemical Works," in EMP, series 6, box 18, folder 1027. Many photographic chemicals were also used for medical purposes; see, for instance, Tanya Sheehan, *Doctored: The Medicine of Photography in Nineteenth-Century America* (University Park, PA: Penn State Press, 2011), 126-27.
- [23] Mallinckrodt Chemical Works, "Articles of Incorporation," in EMP, series 6, box 17, folder 960. Edward's father Emil and George Goerlich, a German-American bookkeeper, each received one of the two remaining shares. They also became board members of the company.
- [24] History Factory, *Mallinckrodt 125th Year Anniversary: Quality, Integrity, Service* (Washington, DC: The Factory, [1992?]), 11; Mallinckrodt, *From Knights to Pioneers*, 377; Dumas Stout, *Edward Mallinckrodt*, 49-50; and Haynes, *Chemical Pioneers*.
- [25] Margaret C. Levenstein, "Do Price Wars Facilitate Collusion? A Study of the Bromine Cartel before World War I," *Explorations in Economic History* 33 (1996): 107-37.
- [26] Wyatt Belcher, *The Economic Rivalry Between St. Louis and Chicago, 1850-1880* (New York: AMS Press, 1968); William Cronon, *Nature's Metropolis: Chicago and the Great West* (New York: W.W. Norton, 1991), 295-309.
- [27] Yda Schreuder, "The German-American Pharmaceutical Business Establishment in the New York Metropolitan Region," *Environment and Planning A* 30 (1998): 1743-56.
- [28] Dumas Stout, *Edward Mallinckrodt*, 53.
- [29] Anonymous, "Fine Chemicals Since 1867: The History of the Mallinckrodt Chemical Works," in EMP, series 6, box 18, folder 1027.

[30] Reese V. Jenkins, *Images and Enterprise: Technology and the American Photographic Industry 1839 to 1925* (Baltimore: Johns Hopkins University Press, 1975), 221.

[31] F. W. Frerichs, "Manufacture of Cylinders for Shipment of Liquid Anhydrous Ammonia and Apparatus for Withdrawing Samples of Ammonia from Cylinders," *Refrigeration Engineering* 1 (1914-15): 50-70 (here 68-9). Mallinckrodt must have been aware that St. Louis-based companies such as Anheuser-Busch had been heavily investing in artificial refrigeration; see Timothy J. Holan's essay on Adolphus Busch in this project.

[32] History Factory, *Mallinckrodt 125th Year Anniversary*, 13.

[33] Dumas Stout, *Edward Mallinckrodt*, 61.

[34] "Reply of the National Ammonia Company of St. Louis, Mo.," in Committee on Finance, U.S. Senate, *Opinions of Collectors of Customs Concerning Ad Valorem and Specific Rates of Duty on Imports* (Washington, DC: U.S. Government Printing Office, 1894), 104-07.

[35] Haynes, *Chemical Pioneers*, 162; Dumas Stout, *Edward Mallinckrodt*, 61; and Paul Krueger, "Chapter 11: The Beginnings," 21, in EMP, series 6, box 18, folder 1025.

[36] Dumas Stout, *Edward Mallinckrodt*, 53-4; Haynes, *Chemical Pioneers*; Krueger, "Chapter 11," 18; and Levenstein, "Do Price Wars Facilitate Collusion?"

[37] It was not until the 1960s that the Mallinckrodt Co. regained a strong focus on growth and expansion; see History Factory, *Mallinckrodt 125th Year Anniversary*.

[38] Dumas Stout, *Edward Mallinckrodt*, 55; Paul Krueger, "Chapter 8: Where the Money Flows," 50, in EMP, series 6, box 18, folder 125; and Anonymous, "Fine Chemicals Since 1867," 2 and 4.

[39] Haynes, *Chemical Pioneers*, 160; Dumas Stout, *Edward Mallinckrodt*, 55 and 70; and <http://www.ancestry.com> (consulted December 2013).

[40] Three other Harvard graduates who joined Mallinckrodt in the early twentieth century were Frederic W. Russe, Wilfred N. Stull, and Harold W. Simpkins. See Haynes, *Chemical Pioneers*, 160-61.

[41] Anonymous, "Some Historical Highlights," 3, in EMP, series 6, box 18, folder 1028.

[42] Krueger, "Chapter 11," 23-4, and "Chapter 14," 48.

[43] Paul Krueger, "Chapter 9: The Atomic Adventure," in EMP, series 6, box 18, folder 1025; and professional correspondence of Edward Mallinckrodt Jr. in EMP (series 4).

[44] Edward Mallinckrodt Jr., "Reminiscences, Told to PA Krueger, 17 Jan. 1964," in EMP, series 1, box 2, folder 40.

[45] Edward Kremers and George Urdang, *History of Pharmacy: A Guide and a Survey* (Philadelphia: J.B. Lippincott Company, [c. 1940]), 294 and 314. The Meyer Brothers Co. had moved its headquarters to St. Louis in 1862. Ethnic Germans were also well-represented in the pharmaceutical trade in New York, Cincinnati, and other U.S. cities. See, for instance, Schreuder, "The German-American Pharmaceutical Business Establishment in the New York Metropolitan Region."

[46] Anonymous, "Gustavus Mallinckrodt," *Meyers Brothers Druggist* 26 (1905): 227; and Krueger, "Chapter 11," 17.

[47] History Factory, *Mallinckrodt 125th Year Anniversary*, 100.

[48] Previously, according to George Dumas Stout (*Edward Mallinckrodt*, 63), Mallinckrodt "still banked, as his father had, with the German Savings Institution, which was identified with the German population."

[49] Dumas Stout, *Edward Mallinckrodt*, 64.

[50] Notably, after Brookings' retirement in 1928, Edward Mallinckrodt Jr. asked the president of Harvard whether he knew a suitable successor. See Lawrence Lowell to Edward Mallinckrodt Jr., 28 May 1928, in EMP, series 4, box 13, folder 774.

[51] Edward himself had been raised primarily in English. A thorough integration into American society was characteristic of the relatively well-educated "Latin farmers" who had migrated from Germany to Missouri after the appearance of Gottfried Duden's book. See Walter D. Kamphoefner, *The Westfalians: From Germany to Missouri* (Princeton, NJ: Princeton University Press, 1987), 117.

[52] Haynes, *Chemical Pioneers*, 160. See also Dumas Stout, *Edward Mallinckrodt*, 56-57.

[53] Krueger, "Chapter 14."

[54] History Factory, *Mallinckrodt 125th Year Anniversary*, 19. Mallinckrodt probably acquired this reputation as a corollary to the market dominance of the National Ammonia Co.; see, for instance, George Shankle, *American Nicknames: Their Origin and Significance* (New York: Wilson, 1955), 280 (indicating that the press sometimes described Mallinckrodt as the "ammonia king").

[55] Edward Mallinckrodt Sr. to Lawrence Lowell, 26 June 1923, in EMP, series 4, box 13, folder 774.

[56] Isaac Orr to Lawrence Lowell, 26 June 1923, in EMP, series 4, box 13, folder 774; and Daniel A. Wren, "American Business Philanthropy and Higher Education in the Nineteenth Century," *The Business History Review* 57 (1983): 321-46. Today, the building is still known as the Edward Mallinckrodt Chemical Laboratory.

[57] Dumas Stout, *Edward Mallinckrodt*, 66-70; Harvard University, *An Appeal for Funds to Erect New Chemical Laboratories* (Boston, 1912), in EMP, series 4, box 14, folder 802; Haynes, *Chemical Pioneers*, 149; and correspondence in EMP, series 4, box 14, folders 802, 804, and 825.

[58] Letters between Edward and Otto Mallinckrodt, 7 February and 22 April 1920, in EMP, series 1, box 2, folder 57.

[59] Otto to Edward Mallinckrodt, 22 April 1920.

[60] Edward Mallinckrodt Sr. to Edward Mallinckrodt Jr., 29 July 1923, in EMP, series 1, box 2, folder 57.

[61] Edward Mallinckrodt Jr. to James Conant, 16 January 1953, in EMP, series 4, box 13, folder 755.

[62] E.g. Edward Mallinckrodt Jr. to Donald K. David 1953, 5 November 1953, in EMP, series 4, box 13, folder 744.

[63] Correspondence in EMP, series, box 13, folder 755.

[64] Ulrich Haberland to James Conant, 2 August 1954, in EMP, series 4, box 13, folder 755.

[65] Mallinckrodt, *From Knights to Pioneers*, 239.

[66] *Ibid.*, 359-60; and Edward to Otto Mallinckrodt, 22 April 1920.

[67] Dumas Stout, *Edward Mallinckrodt*, 61-62 and 77-78; Haynes, *Chemical Pioneers*, 162-63; and David A. Hounshell and John K. Smith Jr., *Science and Corporate Strategy: Du Pont R and D, 1902-1980* (Cambridge and New York: Cambridge University Press, 1988), 185-86.

[68] Edward Mallinckrodt Sr. to Edward Mallinckrodt Jr., 17 September 1927, in EMP, series 1, box 2, folder 57.

[69] Paul Krueger, "Chapter 12: From the Golden Era through World War I," 29, in EMP, series 6, box 18,

folder 1026.

[70] History Factory, *Mallinckrodt 125th Year Anniversary*, 75-76.

[71] *Ibid.*, 112-13.

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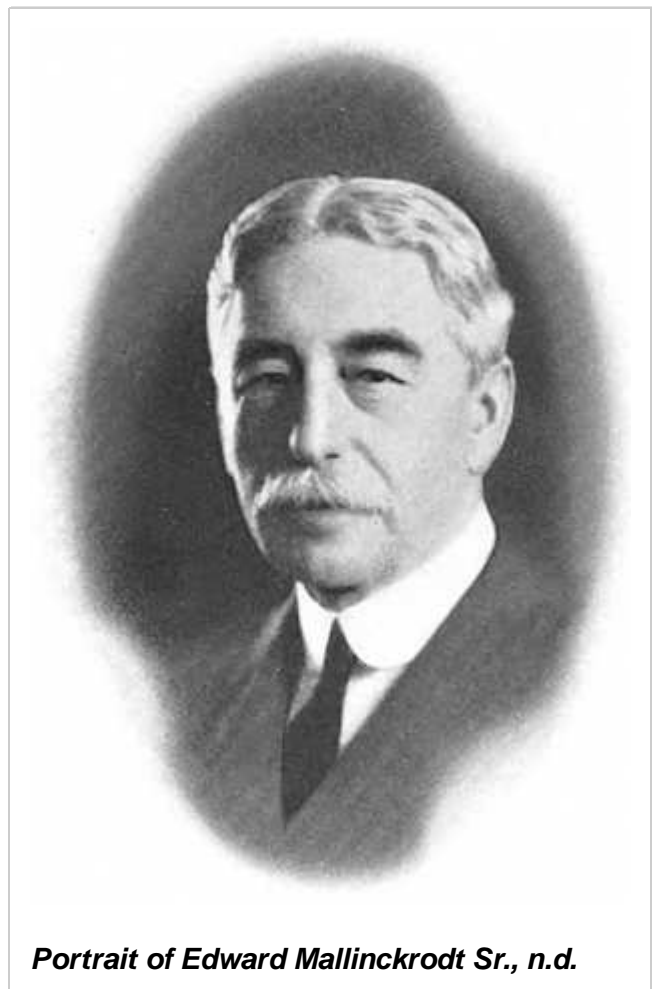
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