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Interconnections and Independence: Heinrich Wieland (1877–1957) and His Era

*Elisabeth Vaupel**

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Dedicated to Professor Herbert Mayr on the occasion of his 60th birthday

Prologue

Heinrich Wieland (1877–1957; Figure 1), recipient of all the honors the scientific world had to confer—memberships in academies, honorary doctorates, and above all the 1927 Nobel Prize for Chemistry—was one of the most important chemists of the first half of the 20th century. Nevertheless, even today—50 years after his death—there exists no comprehensive, critical biography of the man that takes not only his scientific efforts into account, but addresses also the political, social, economic, intellectual, and cultural environments of his time. His various obituaries pay tribute in a comprehensive and informative way to Wieland's accomplishments, but largely ignore the many events of the day that influenced his life and his work: under the German Empire, the Weimar Republic, the Nazi dictatorship, and finally the early years of the Federal Republic.[1] But dramatic political and societal upheavals and radical value shifts Wieland experienced did in fact have their effects on every aspect of life, including the systems of science and research, so it becomes very interesting to ask how he, a member of the traditional upper class, adapted to the many drastically differing environments to which he was subject. Moreover, a biography taking account of the times would help clarify impulses that were responsible for research themes Wieland chose to pursue. Wieland's life and work take on a new contextual significance when viewed against the background of the times and embedded in the broader framework of the history of chemistry.

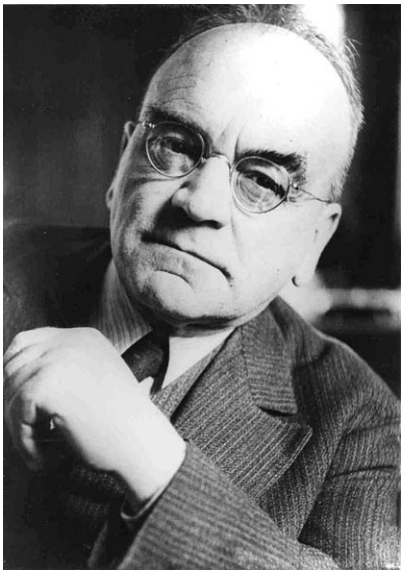


Figure 1. Heinrich Wieland, around 1940.

[*] Priv.-Doz. Dr. E. Vaupel
Deutsches Museum
Museumsinsel 1, 80306 Munich
Fax: (+49) 892-179-513
E-mail: e.vaupel@deutsches-museum.de

The Years of the German Empire (1877–1918)

Origins

Heinrich Wieland was born in Pforzheim (Baden) in 1877, six years after the establishment of the German Empire (Reich), the eldest child of an entrepreneurial family that certainly was not lacking in means (Figure 2). Many of his forebears were protestant ministers. He was indoctrinated at home in such middle-class virtues as industriousness, determination, thrift, and a business-like way of thinking, with an education and up-bringing typical of both the era and that particular stratum of society. This included attending a humanistic secondary school (Gymnasium), acquiring a good grasp of French, and taking piano lessons—all the while exposed to the values and norms of a family with a liberal cast. Among traits highly regarded in this home were straightforwardness and humanity, and any discrimination on racial or religious grounds would have been considered unacceptable

Figure 2. Wieland (left) in his family circle, around 1897.

In his father's gold and silver refinery, Heinrich was exposed to everyday life in a medium-sized chemical enterprise (Figure 3). The father, Theodor Wieland (1846–1928), was a pharmacist with a doctorate in chemistry,[2] so Heinrich was also able to interact with him in professional conversation. In choosing to study one of the natural sciences, Theodor Wieland would have been reacting to the onset of industrialization in Germany in the mid-19th century, in the course of which many formerly agricultural regions were being radically transformed: into modern industrial landscapes, especially in Prussia and Saxony, but also parts of Baden. The first German coal-tar dye works appeared in the 1860s—companies like Hoechst, Bayer, and BASF—creating a

Figure 3. Advertisement for Dr. Theodor Wieland's metal refinery in Pforzheim, late 19th century.

growing demand for academically trained chemists. Chemists were also needed in the pharmaceutical/chemical drug and extract industries, as well as metal works close to home in Baden and Württemberg. Upon completion of his studies, Theodor Wieland found a job in a gold- and silver-refining facility in Pforzheim, which he purchased after the Franco-Prussian War (1870/71). Like many metal refineries of the time, the business profited handsomely from the post-war political situation. In defeat, France was required to pay 5 billion francs in war reparations to the newly-established German Empire, the existence of which was proclaimed in the Palace of Versailles. This meant that after 1871 a great deal of money flowed into Germany, leading to an enormous economic upswing, followed unfortunately by the slump known as the "Gründerkrise" ("crisis of the founders"). Despite the economic turbulence, and primarily because of a boom in the mechanical and electrical engineering and chemical industries, the German Empire by 1913 had grown to be the leading export nation on the European continent.

Establishment of the German Empire had among other consequences a standardization of the various local monetary systems. The mark, with a basis in gold, was introduced in 1873. Currency conversion meant that all the gulden and taler minted under the former German confederacy became invalid, and thus had to be melted down for extraction of the precious metal content—a lucrative undertaking for the many firms engaged in precious-metal recovery. Wieland's company also succeeded in negotiating long-term contracts with the Pforzheim jewelry industry, which flourished to a perceptible degree after establishment of the empire. Theodor was a versatile, alert businessman who responded rapidly to technical developments in chemistry, electrochemistry, and metallurgy. He soon began dealing in chemicals alongside his metal-recovery work, trading in photochemicals, preparing the platinum-rhodium mesh BASF required as a catalyst for oxidizing ammonia—obtained by the Haber–Bosch procedure—to nitric acid, in the Ostwald process, and later becoming involved in dental technology. Thanks to his father's company, Heinrich Wieland could rely even in economically difficult times on adequate supplies of platinum crucibles and especially of catalysts for his own chemical needs when such import-dependent metals as platinum and palladium were otherwise virtually unavailable in Germany.[3] This privilege presumably played a role in the fact that Wieland was very interested in the mechanisms of oxidation processes.[4]

Theodor Wieland married in 1873. His wife Elise also came from the family of a protestant minister. The marriage produced five children, including three sons, all of whom became scientists. The eldest was Heinrich Wieland, who after outstanding work in high school (Gymnasium) embarked on the study of chemistry. The middle son Eberhard carried on his father's precious-metal recycling business. The youngest, Hermann (1885–1929; Figure 4), had a superb record in secondary school, studied both medicine and chemistry, and eventually became a professor of pharmacology, first in Königsberg and later in Heidelberg.[5] Heinrich enjoyed a particularly intimate relationship with this brother, who unfortunately died at the early age of 44. The two worked closely together on scientific projects, especially in 1921 when both were at the University of Freiburg.

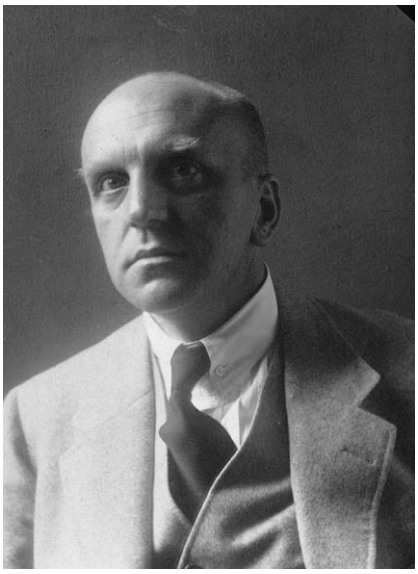


Figure 4. Hermann Wieland (1885–1929).

Academic Work

Heinrich Wieland began studying chemistry in the fall of 1895 at the University of Munich, moving to the University of Berlin for the winter semester of 1897/98 and in the subsequent semester to the Stuttgart Institute of Technology where he received training in chemical engineering.[6] He returned in the summer of 1899 to Munich, whose university chemical laboratories were already among the most highly regarded places in Germany for chemical education. Wieland received his doctorate in 1901 under Johannes Thiele (1865–1918; Figure 5), head of the Organic Division, with a dissertation entitled "Versuche zur Darstellung phenylierter Allene. Neue Reaktionen von Ketonen der Diphenylpropanreihe und des Desoxybenzoins" (Attempts to Prepare Phenylated Allenes. New Reac-

Figure 5. Wieland's doctoral adviser Johannes Thiele, shown delivering a lecture.

tions between Ketones in the Diphenylpropane Series and Deoxybenzoin).

Beginnings of a Career, and Collaboration with Boehringer Ingelheim

In 1902 Wieland started to work on a habilitation project (to qualify for university teaching) with the title "Über Additionen mit den höheren Oxyden des Stickstoffs an die Kohlenstoff-Doppelbindung" (Concerning Additions of the Higher Oxides of Nitrogen to the Carbon–Carbon Double Bond), which he completed in 1904 at the age of 27. In those days the only income available to teachers with the rank of "Instructor" (Privatdozent) was a form of individual tuition, together with laboratory fees, so the only ones who could afford to prepare for a professorship had wealthy parents or outside income as industrial advisers or consultants. Wieland had a consultancy contract with the chemical/pharmaceutical firm J.D. Riedel in Berlin, and after 1 January 1907 also a contractual relationship with the C.H. Boehringer firm in Nieder-Ingelheim am Rhein (from 1939, simply Ingelheim) (Figure 6).[7] The founder and sole

Figure 6. The C.H. Boehringer chemical/pharmaceutical factory in Ingelheim am Rhein, early in the 20th century.

proprietor of the company, Albert Boehringer (1861–1939), was married to Helene Renz (1867–1946), one of Wieland's second cousins.[8] Family relationships thus played a key role in forging the cooperation between Wieland and C.H. Boehringer that was to become so important, and which persisted throughout Wieland's life, even after ownership of the company passed on to the second generation; that is to the brothers Albert (1891–1960) and Ernst Boehringer (1896–1965),[9] and their brother-in-law Julius Liebrecht (1891–1974).

In 1908 Heinrich Wieland married Josephine Bartmann (1881–1966; Figure 7), whom he had known since 1900.

Figure 7. Josephine Wieland with the three oldest children. Wieland kept this photograph with him in Dahlem.

Wieland's parents were at first not enthusiastic about this daughter-in-law, who was not entirely up to his (or their) social standing—"Josie" was the daughter of a mover, who had worked his way up from life on a farm. Thus, at the civil marriage ceremony (which was not accompanied by religious rites) only Heinrich's favorite brother Hermann was present.

The first of Heinrich und Josephine's four children was born in 1911: eldest son Wolfgang (1911–1973), who studied pharmacy and food chemistry, becoming after World War II an analytical chemist at Boehringer Ingelheim. Two years later, Theodor (1913–1995) came into the world. He opted for an academic career and became a professor of organic chemistry with the same interests as his father.[10] After two more years, Eva was born. She began a study of chemistry, but then married one of her father's doctoral candidates, Feodor Lynen (1911–1979), winner in 1964 together with Konrad Bloch of the Nobel Prize for Medicine and Physiology. Feodor became known for his work on "activated acetic acid" and fatty-acid metabolism. Like Theodor, he was indebted to his famous father-in-law for a wide range of scientific impulses. As Heinrich Wieland expressed it: "*Es ist für mich eine Genugtuung, dass die Essigsäure, die wohl zuerst von mir ins biologische Rampenlicht gerückt worden ist, von einem Familienmitglied und im Münchener Institut in ihrer hervorragenden Schlüsselstellung aufgeklärt worden ist.*" ("*It is a source of satisfaction to me that acetic acid, first brought into the biological limelight by me, has had its exceptionally central role clarified by a member of my own family, and at the Institute in Munich.*")[11] Witty reference was made to Wieland's "scientific Paladins, Theodor und Feodor".[12] Finally, five years after Eva, Wieland's youngest son put in his appearance: Otto Heinrich (1920–1998). He came to be a physician with scientific ambitions, occupying himself at the Munich-Schwabing Hospital with biochemical–physiological problems that touched to some extent on the work of his father and his brother Theodor.

Adolf von Baeyer (1835–1917), the renowned director of the Munich institute, benevolently paved the way for Heinrich Wieland's professional advancement. From an early date he in fact supervised the research of what became a host of doctoral candidates, numbering in the end more than 230.[13] Wieland permitted his co-workers to pursue a variety of research themes: on the one hand investigations related to fulminic acid and the chemistry of organic radicals, arising from studies undertaken by his own adviser Thiele, one of the first to work on theoretical organic chemistry. Others pursued topics in natural products chemistry, which came into full flower thanks to Emil Fischer (1852–1919) in Berlin und Richard Willstätter (1872–1942) in Munich after the turn of the century, when dyestuff chemistry had already passed its peak. Wieland was always a passionate hiker and skier, as well as a member of wildlife-conservation and alpine societies, and throughout his life was interested in natural products that displayed powerful physiological effects. His striking interest in poisons presumably resulted in part from his close relationship with the Boehringer firm,[14] founded in 1885 as a manufacturer of organic acids but with a product range by the early part of the 20th century extending out to include important alkaloids with pharmaceutical applica-

tions: morphine, codeine, cocaine, and atropine, among others. Boehringer Ingelheim was always involved with substances of pharmaceutical value, which in those days were ordinarily derived from plant or animal sources, only gradually becoming available through chemical synthesis.

In 1914 Wieland was promoted to associate professor (Extraordinarius) for special topics in organic chemistry, and director of the Organic Division of the State Laboratory in Munich. For the first time—and from then on—he had access to the consistent income of a civil servant, still supplemented by individual tuitions and laboratory fees.

World War I

World War I broke out in 1914. From a number of standpoints this proved to be the "ultimate catastrophe" of the 20th century, changing life in Europe fundamentally, and for decades. World War I marked the end forever of the spiked helmet, military headgear with plumage waving in the breeze, and attacks signaled by the blare of trumpets. It also ushered in history's first experience with technological mass warfare, in which performance standards of key industries would prove decisive in establishing which combatant would field the most and the most effective materials of war. Technical developments also changed fundamentally how war was waged: modern communication tools like the telephone, telegraph, and radio were the source of entirely new planning strategies. Introduction of airplanes and zeppelins, submarines, tanks, and poisonous gas created new battlefield venues, and for the first time—representing another characteristic of modern warfare—the civilian population on the home front found itself heavily affected by the war's events.

Germany in August 1914 was in the grip of a patriotic fever unimaginable today, a spirit that seemed to sweep away all political resistance. Kaiser Wilhelm's appeal that he "no longer recognized political parties, only Germans" was profoundly effective. In the Reichstag, even the Socialists, denounced by some as "unpatriotic fellow travelers", voted for the issuance of war bonds, the sole exceptions being Karl Liebknecht (1871–1919) und Rosa Luxemburg (1870–1919). Supporting unconditionally the path toward war, 93 well-known German artists and scientists inscribed their names on an "appeal to the cultural world." Signatories to this call included the chemists Emil Fischer, Fritz Haber (1868–1934), Wilhelm Ostwald (1853–1932), Richard Willstätter,[15] and Adolf von Baeyer. Thus, two of his famed colleagues in Munich—but not Wieland himself—had expressed support for the embarrassing call, becoming mouthpieces for German war propaganda. The pamphlet was published in October 1914 in all the major newspapers, and it was translated into ten foreign languages. Through six theses, each beginning with a vehement "It is not true", the 93 signatories denied German responsibility for the outbreak of war, for the outrageous infringement on Belgian neutrality, for German atrocities perpetrated against Belgian civilians, for the desolation of Louvain, and for a disregard of human rights.[16]

To keep his Institute from being abandoned completely in the wake of mobilization, Baeyer prepared a petition of indispensability for Wieland, who was nearly drafted as a male nurse. The petition was honored, perhaps in part because Wieland declared himself prepared to take part in defensive measures "on the home front", and to carry out critical defense research in the State Laboratory.[17]

As a scientist Wieland was by this time recognized well beyond the boundaries of Germany. He fairly bubbled over with ideas and creativity, displaying a diversity in his field rivaling that of Adolf von Baeyer, Emil Fischer, or Richard Willstätter. He is rightly regarded as one of the last to command an encyclopedic overview of the entire field of chemistry.[18] Wieland tackled during this period all three of the principal areas of research with which he is identified: the chemistry of organic nitrogen compounds, investigation of natural products, and oxidation processes in living cells.[19] He also maintained close contact with Ingelheim in order to keep Boehringer supplied with ideas and suggestions for improvements.[20] In Ingelheim they actually often felt the need to slow Wieland down, since it was nearly impossible to keep up with his proposals. Until 1917 Boehringer had neither a scientific laboratory of its own nor a pharmacological research facility, and for a very long time compared to other pharmaceutical companies pursued no innovative research whatsoever on its own. The only available laboratory served exclusively for quality control of incoming drugs and materials produced within the plant. Well into the 20th century, Boehringer made up for its deficiency as a pharmaceutical firm lacking its own research arm by meeting regularly with the two Wieland brothers, who served in a sense as the company's "external directors of research": Heinrich for all chemical/pharmaceutical and technical problems, and Hermann for pharmacological and toxicological questions, although Hermann was not an official adviser to the company until 1920. Prior to that such matters were referred to his predecessor at the University of Strassburg, the pharmacologist Edwin Stanton Faust (1870–1928). Heinrich Wieland was indebted to the latter for encouraging him to work on the characterization of toad poisons with cardiotonic activity.[21] There can be absolutely no doubt that, without the Wieland brothers, Boehringer would never have developed into what it is today: next to Bayer-Schering, the largest pharmaceutical company in Germany.

Wieland's widespread regard in the years immediately preceding the war is apparent in the fact that during this time he was offered two professorships: a chair in applied medicinal chemistry at the University of Vienna in 1915, which he declined, and the chair in organic chemistry at the Technical University (TU) in Munich in 1917. This he accepted, thereby becoming—at the early age of 40—a full professor.

Chemical Weapons

A certain complication was introduced in March 1917, six months before his call to the Munich TU, when Wieland was assigned by the Prussian War Ministry, until war's end, to the Kaiser-Wilhelm-Institute (KWI) for Physical Chemistry and Electrochemistry in Berlin-Dahlem, known as the "German

Oxford". This order came as a consequence of the new "Law Regarding Emergency Service for the Fatherland", adopted by the Reichstag on 2 December 1916, and according to which all German males ages 17–60 (assuming they had not been drafted into the army) were declared subject to service.[22] Wieland's summons to Dahlem arrived in January 1917, and had been agreed to by the founder and director of the KWI, Fritz Haber (1868–1934). When war first broke out, Haber had transformed his entire institute into a site for war research.[23] At the time, Wieland might have argued for a different posting, following the example of Max Born (1882–1970), who showed that no chemist would be forced into an involvement with chemical warfare against his express wishes.[24] If, like Otto Hahn and Richard Willstätter,[25] Wieland chose to accept Haber's "offer", the move would have been motivated by loyalty to the fatherland, respect for such a universally recognized authority as Haber, and fascination with the idea of belonging to an elite corps entrusted with so challenging a set of scientific and technical problems. Despite the temporary separation from his family—Wieland was by that time already the father of three young children—military service in Dahlem offered at least one other major advantage: in this way he avoided the risk of the front lines, something he presumably could appreciate given that his brother-in-law had fallen in 1915 and his brother Hermann was wounded in 1916 (Figure 8).

In World War I, technology and science, especially chemistry, had an entirely new role to play. The German Empire was economically unprepared for war. Conduct of such a war in fact became possible only through strict government control of the economy and the rationing of important raw materials and foodstuffs through the "Military Raw Materials Division" of the Prussian Ministry of War, established by Walther Rathenau (1867–1922), president of the board of directors of AEG.[26] Rathenau staffed his new agency in short order with high-ranking industrialists and scientists, including Walther Nernst (1864–1941), Emil Fischer (1852–1919), and Richard Willstätter (1872–1942). The "Schlieffen-

Figure 8. Advertisement for an exhibition about all sorts of substitutes ("Ersatz") in Vienna, which highlighted the important role of the chemist in the First World War.

Plan" had actually anticipated a swift military conclusion to war in the West, but as early as 1915 the originally anticipated "Blitzkrieg" (lightning war) had turned into a crippling "Sitzkrieg" (stationary war). With the opposing armies now dug down in their trenches, an urgent search was initiated for some effective way to end what had become a munitions-hungry immobile conflict, and to reinstitute movement along the front. Fritz Haber, with his Haber–Bosch process, had not only developed a new approach to the manufacture of explosives and ammunition, but also become interested in how various basic chemicals (e.g., chlorine), easily obtained from German raw materials, might play a role in the manufacture of irritants and poisonous gases. The first chemical weapons were ready for German deployment as early as the spring of 1915, touching off an unprecedented chemical arms race and adding a wholly new dimension to warfare itself. International law had in fact prohibited chemical weapons since 1899, but with minor exceptions, scientists, industrialists, and the military showed few scruples about ignoring international law. Haber subscribed to the motto "Humanity in times of peace, but the fatherland in wartime", comparing himself proudly with the ingenious Archimedes, who during peacetime discovered important laws of physics, but in the war against the Romans was said to have used his talents to set Roman ships afire with the aid of large burning glasses (focusing mirrors).[27]

For a young, ambitious academic scientist like Wieland, on the very threshold of a career, it was a great honor to be called to Haber's famous Institute with its outstanding facilities and financial backing. During at least part of World War I there were as many as 200 chemists and other scientists working at the KWI,[28] including some of the best in the country: the chemists Walther Nernst, Richard Willstätter, Emil Fischer, Paul Friedländer (1857–1923), Otto Hahn (1879–1968), and Alfred Stock (1876–1946); together with physicists James Franck (1882–1964), Gustav Hertz (1887–1975), Hans Geiger (1882–1945), Wilhelm Westphal (1863–1941), and Erwin Madelung (1881–1972); but also well-known biologists, physicians, toxicologists, meteorologists—an elite troop marshaled in a truly interdisciplinary fashion. A similar situation presented itself on the opposing side as well: weapons research was being conducted in France by such famed chemists as Victor Grignard (1871–1935) and in Britain by the physical chemist Sir Harold Hartley (1878–1972), while the Americans relied primarily on younger talent, including Roger Adams (1889–1971), later to become editor of *Organic Reactions*, and James B. Conant (1893–1978), future president of Harvard University and the first United States ambassador (after the Second World War) to the Federal Republic of Germany.

The Bavarian Ministry of Culture considered it important that Wieland actively pursue his war-related research at the KWI in Berlin while still continuing to hold classes at the TU in Munich. He was therefore given permission for the duration of the war to work ten days a month in Dahlem "on the side" so he could fulfill his Munich responsibilities during the remainder of the month.[29] In March 1917 Wieland assumed leadership at the KWI of the relatively small "Department D", with its nine scientists and five assistants (as of September 1917), charged with "Synthesis of New

Chemical Weapons".[30] Most of his coworkers were colleagues from Munich, including Wilhelm Prandtl (1878–1956), director of the Inorganic Division of the State Laboratory, Rudolf Pummerer (1882–1973), who later became Wieland's successor as director of the Organic Division in Munich, and Kurt H. Meyer (1883–1952), Wieland's deputy in Dahlem, after the war a successful polymer chemist who was named director of the central laboratories at BASF. Most evenings, these four—well provisioned with beer and wurst—got together to play cards (skat or doppelkopf).

Wieland's department busied itself with the development and testing of mustard gas, which Haber had dubbed "Lost" in honor of the chemists *Lo*mmel and *St*einkopf. The substance had been known since 1860, but its use in a weapons context had first been suggested by this pair in 1916. Germany's first deployment of Lost on 12/13 July 1917 at Ypres constituted a dramatic escalation in the war, and a qualitative change in gas warfare—compared with such previously employed weapons as chlorine or phosgene. The insidious substance sent fear and panic spreading all along the front. Lost was a liquid at room temperature that could produce a fog of fine droplets, leading to serious skin injuries (Figure 9), irritation of the eyes with possible temporary blindness, and also damage to the respiratory tract. In the long term it was a carcinogen that caused cell damage. The substance was capable of dispersing in such a way that entire landscapes were transformed into dangerous "yellow zones" that became "off limits". One of the most notorious victims of this particular poison was private Adolf Hitler (1889–1945), who in October 1918 was involved in one of the last World War I mustard-gas attacks, as reported by the British. Wieland's assignment was to work his way through the literature of mustard-gas like compounds, optimize the synthetic pathways, and if possible identify even more effective derivatives. These were to be subjected to toxicological testing, after which the chemical industry would examine the technical feasibility of their manufacture.[31] As department head, and through meetings at the War Ministry, Wieland became acquainted with representatives of the various companies preparing these chemical weapons on a large scale, as well as with important civil servants in the ministry, high-ranking military officials, and all the key scientists at work in Dahlem.[32] During his years at the KWI Wieland put together a number of useful networks, and cultivated friendships that would last the rest of his life, as with Otto Hahn and Carl Neuberg (1877–1956).

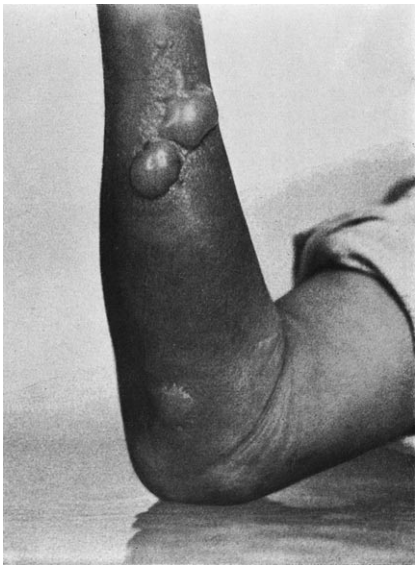
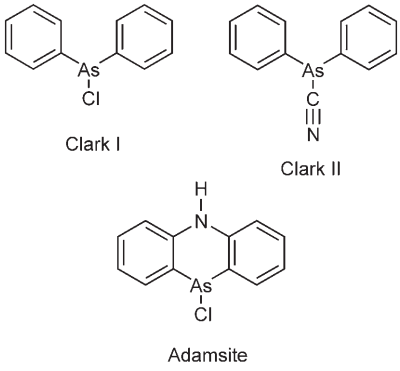


Figure 9. Typical skin damage attributable to the chemical weapon Lost.

Wieland of course worked very closely with "Toxicological Department E" at the KWI, directed by the famed Würzburg toxicologist and chemical weapons researcher Ferdinand Flury (1877–1947),[33] with whom Wieland's beloved brother Hermann also worked. Hermann had volunteered for the army in 1914, and in 1916 as a military medical officer was wounded in Flanders.[34] Flury and Hermann Wieland studied toxicological and pharmacological properties of the various mustard gases prepared by Heinrich Wieland and his associates, publishing papers on them in a 1921 "Chemical Weapons" volume of the *Zeitschrift für die gesamte experimentelle Medizin* ("Journal for Comprehensive Experimental Medicine").[35] Intimate contact with the dangerous mustard gases in Dahlem presumably contributed to Hermann Wieland's early death. Brother Heinrich was a witness to the insidious effects of these compounds within his own department; in a letter to his wife on 14 July 1917 he wrote: "*Auch Meyer hat sich als Folge seiner Beschäftigung einen Ausschlag zugezogen, der ihn seit gestern außer Betrieb gesetzt hat. So ist meine stolze Abteilung zur Zeit auf drei Köpfe herabgesunken …*" ("*Meyer has also developed a rash from his work, which since yesterday has put him out of commission, so my proud department has been reduced temporarily to three members …*").[36]

A targeted search was also carried out in Wieland's department for substances that could render ineffective such protective measures as the enemy might be taking against the gases.[37] The first representative of the new generation of chemical warfare agents, developed like mustard gas by the Germans, was deployed on 10 July 1917 in Belgium: diphenylchloroarsine or Clark I



(an abbreviation for *Chlor*ar*sin*kampfstoff—chloroarsine weapon), soon to be followed by the more effective diphenylcyanoarsine, or Clark II. Wieland wrote to his wife: "*Unsere neuen Kampfstoffe scheinen gut zu sein. Bei dem Erfolg in Flandern am 10. [Juli] sind sie zum ersten Mal angewandt worden. Aber nichts darüber reden!*"("*Our new weapons appear to be good. They were used for the first time in the successful campaign in Flanders on 10 [July]. But don't say anything about it!*").[38] The new substances, called "blue-cross weapons" after the grenades containing them, were solids which—pulverized into extremely fine particles—made their way through gas masks packed with activated charcoal, leading to their nickname "mask breakers". Powerful nasal and throat irritants, the substances caused soldiers to tear off their gas masks, leaving them defenseless against the real poison gases. Haber soon intro-

duced the idea of so-called "colored-cross-firings", in which opponents were shelled first with "mask breakers" (i.e., blue-cross weapons) and then with the more toxic yellow-cross or green-cross agents.[39]

Wieland's group conducted a thorough search for other nebulizable irritants of the Clark type, studying systematically compounds in the aromatic arsine category. This included synthesizing and testing a great many organoarsenic compounds. Since those were the days of salvarsan and other arsenic-containing medications, considerable general scientific interest existed regarding such substances. Immediately after the lifting of defense secrecy regulations in 1920 and 1923, Wieland published this work in *Liebigs Annalen*.[40] His papers show that during the war he had already discovered diphenylaminochloroarsine ("Adamsite"), named by the Americans in honor of Roger Adams,[41] one of their own "Chemical Warfare Service" experts, who near the end of the war had synthesized the material himself, albeit too late for deployment.[42]

One looks in vain through documentation Wieland left behind for evidence of his having reflected critically on his KWI weapons research. He left no autobiographical self-portrait that might offer a key to better understanding his character, nor any meditations regarding (subsequent) insight he might have gained into this part of his life. The question that for us has become so central after the experience of two devastating world wars, namely how a chemist could allow himself to be involved in developing such insidious substances, with their inescapable effects: this is a question that apparently never presented itself to Wieland, or for that matter to most of his colleagues, at least not then. We know only from one letter to his wife that—by July, 1917, anyway—he, like many others, was war-weary and longed for peace: "*Heute ist Hindenburg schon wieder hier, aber ich fürchte, der gute Mann soll den Reichstag zur Fortsetzung des Krieges aufstacheln. Mir käme ein Verständigungsfrieden jetzt gerade recht.*" ("*Hindenburg is here today yet again, but I'm afraid the good man will spur the Reichstag on to continue the war. For me, some sort of negotiated peace now would be the proper course.*").[43] In January 1918 Wieland was singled out for the King Ludwig Cross, established for "meritorious military service in the homeland", which had also been awarded to Willstätter in August 1917.[44] According to the criteria of the times, Wieland was a hero who had made an important contribution on the home front to defense of his country. In September 1918, shortly before the war ended, Wieland received a call to the University of Strassburg to become successor to his own mentor, Thiele, who had died in April. Rather like Hermann Wieland, the latter became a victim of his work in Dahlem on chemical weapons, which completely destroyed his already poor health.[45] Wieland accepted the Strassburg offer, effective with the summer semester of 1919, but requested that his taking office be postponed until war's end because the laboratories there were utterly unsuited to working on chemical weapons, and only at the TH Munich, with modern facilities opened as recently as 1905, could he "*continue to be of service in defense of the country in exceptionally well-suited laboratories*".[46] After the German capitulation, however, a call to Strassburg became meaningless, since according to the Versailles Treaty the surrounding territory (Alsace-Lorraine) became once again a part of France.

The economic problems with which the German Empire was confronted at war's end were immense, despite the fact that—unlike after World War II—there had been no significant destruction of the homeland itself. High unemployment, hunger, and misery in general provided a backdrop for the political changes associated with the revolution of 1918. In November of that year Wilhelm II abdicated, departing the country under cover of darkness and fog. Constitutional monarchy was superseded by the Weimar Republic.

In the Weimar Republic (1919–1933)

When the war was over, Wieland received several academic offers in short order: first from Karlsruhe in 1919 to serve as successor to Carl Engler (1842–1925). This Wieland declined, but utilized to negotiate a raise. In 1920 Fritz Haber tried hard to attract Wieland—whom he had apparently come to treasure as a competent and enjoyable companion—to Berlin as successor to Emil Fischer. After considerable deliberation, Wieland declined this prestigious invitation to follow in Fischer's footsteps in a decision he found very difficult, but again he used the opportunity to better his financial situation. 1921 brought a call to the University of Freiburg, which Wieland accepted, perhaps in part because his brother Hermann was there as assistant to the famous pharmacologist Walther Straub (1874–1944),[47] although in that same year Hermann left for a professorship in pharmacology at Königsberg.

Heinrich Wieland spent four happy years back home in Baden, and from a scientific standpoint they were extraordinarily fruitful ones (Figure 10). As successor to Ludwig Gattermann (1860–1920) he revised the latter's famous laboratory "cookbook" so thoroughly that his brother Hermann scarcely recognized it, and wrote in astonishment and wonder: "*Vielen Dank … vor allem auch für den 'Gattermann', der eigentlich kein Gattermann mehr ist. Ich habe die allgemeinen Kapitel durchgelesen und auch sonst da und dort herumgeblättert: was müssen das für Chemiker werden, die wenigstens die Hälfte von dem wissen, was drin steht oder pflichtmäßig nachgelesen und gelernt werden soll!*" ("*Many thanks … especially for the 'Gattermann', that in actuality is no longer a Gattermann at all. I read the general chapters, and paged around in other places here and there as well: what*

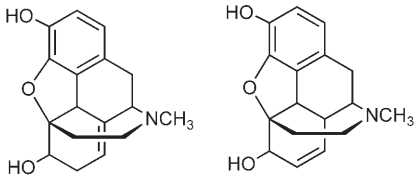
Figure 10. Heinrich Wieland surrounded by his family in the garden of his villa in Freiburg.

sort of chemists must they become who know even half what is in there, or are required to read and learn it!").[48] Much of Wieland's groundbreaking work on the components of toad poisons with their cardiotonic activity, on bile acids, and on lobelia alkaloids was also accomplished during the years in Freiburg. His cooperative efforts with Boehringer were at the same time so lively that, thanks to his industrial connections, Wieland was able deftly to steer the Freiburg institute through the economically difficult inflation years: Boehringer paid for chemicals, apparatus, and even personnel.[49]

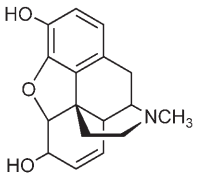
When after the First World War the left bank of the Rhine, including Ingelheim (located roughly 20 km north of Mainz), was occupied by French troops, Albert Boehringer took part in "passive resistance" against the hated occupation. In a letter to his wife written during the war, Wieland actually mocked Boehringer's incorrigible "ur-German" attitude, which made such an unpleasant impression on the French that in 1923 they expelled him from Ingelheim.[50] He then went to Hamburg, where in 1925 he established a new branch of the company. Because of its proximity to the harbor, Boehringer relocated all his alkaloid production here (morphine, codeine, cocaine, atropine, strychnine, etc.), and especially the manufacture of opiates. Preparation of finished pharmaceutical products also moved to the metropolis on the Elbe. As a result, all those departments with which Wieland was closely related were now located in Hamburg, so it made sense that in 1931 Boehringer made him a member of the board of directors of that branch. In those days it was not permissible for corporate officers to accept board positions. Exceptions were possible only when no income was associated with the position.[51] In Wieland's personnel files there appears an official acknowledgement, issued by Boehringer himself, that no financial considerations whatsoever were to be involved in Wieland's post on the board of directors.

Morphine and the Strychnos Alkaloids

Even during his days as an associate professor, Wieland had worked on some of the alkaloids in the Boehringer manufacturing program. At the latest in 1911, but probably since shortly after signing his consultancy contract in 1907, he studied morphine, which was in fact explicitly mentioned in this contract as a topic for research. The pharmaceutically valuable substance was a constituent in Boehringer's pain reliever Laudanon, first marketed in 1912. This consisted of an extract of all the opium alkaloids, and was intended to simulate Hoffmann-La Roche's classic pain reliever Pantopon, available to the public since 1909.[52] Determining the structure of morphine proved a challenge for the very best chemists of the day, finally emerging from a host of individual steps.[53] One of these bits of information was contributed by Wieland: He managed to correct



L. Knorr 1907 H. Wieland 1925



R. Robinson 1924/1925

the Knorr-Hörlein formula of 1907 in one important respect, a change that survived in the morphine molecular formula ultimately announced in 1925 by Sir Robert Robinson (1886–1975).

Determining the structure of morphine was significant from both scientific and commercial standpoints. Especially in wartime, when opium supply from the Middle East was unreliable, and in the context of efforts before and after the First World War to formulate an international treaty regulating traffic in narcotics, chemists dreamed of preparing synthetically a morphine-like pain reliever that would not be subject to opium-law limitations.[54] The fact that research on pain relievers, sleep aids, and anesthetics—both general and local—was a high priority around the turn of the 20th century is suggested by the fact that Wieland and his colleagues Emil Fischer and Richard Willstätter were all active simultaneously in this area. Thus, Fischer and Joseph von Mering (1849–1908) synthesized the barbiturates Veronal and Luminal, marketed by Bayer Elberfeld. The local anesthetic Psicain stemmed from Willstätter and Merck Darmstadt, whereas the latter's general anesthetics Voluntal and Avertin were produced by Bayer. Wieland's own considerable interest in the subjects of pain reduction and anesthesia is apparent from his bringing out the first technical journal on anesthesia, *Der Schmerz* (*Pain*), one of whose editors was his brother Hermann.

Hermann Wieland's own special attention to the modes of action of anesthetic gases[55] was derived in part from his work at the KWI, but more particularly from the fact that after the war he became involved with a new inhalatory anesthetic: Narcylen, a highly purified form of acetylene that Boehringer added to its product list in 1923 at the suggestion of its two scientific advisers.[56] In conjunction with the Dräger Works in Lübeck (Figure 11), with which the Wieland brothers had had contact during their time at the KWI

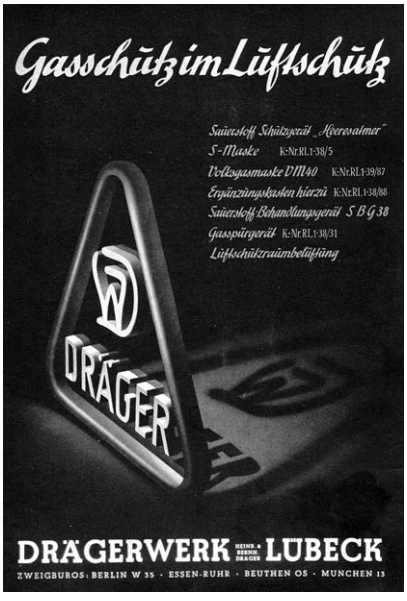


Figure 11. Advertisement for the Dräger works, which during the First World War produced gas masks for the German army. The Wieland brothers came to know the owners of the company while they were in Dahlem, and utilized this contact to develop with Dräger a new device for administering anesthetics.

(Dräger made gas masks for the German army during the First World War), a corresponding anesthesia device was designed and built, albeit an expensive one that was also complicated to use (Figure 12).[57] Unfortunately, operating

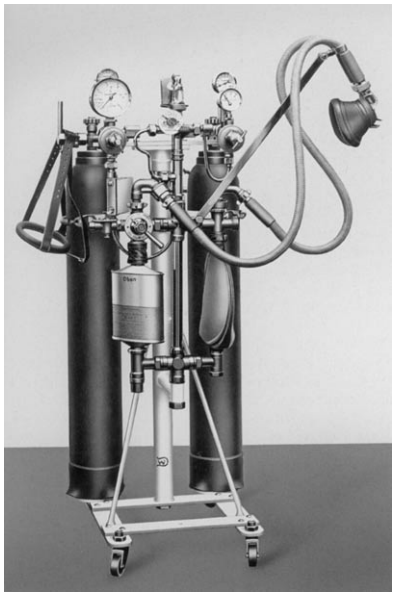


Figure 12. The Narcylen anesthesia apparatus developed by Hermann Wieland and gynecologist Carl Jospeh Gauß (1875–1957), grandson of the famous mathematician, in conjunction with the Dräger works in Lübeck.

rooms were soon plagued by serious explosions in conjunction with use of the new anesthetic, so it was abandoned in the late 1920s. Narcylen is one of the few examples where a piece of advice from the Wielands turned out to be a poor investment for Boehringer. Another example related to the preparation Panitrin (chemically: papaverine nitrate), the vasodilating effect of which was to be exploited for treatment of tinnitus, hearing deficiencies, or dizziness, by injection—in the vicinity of the ear—under the periosteum (!), a thin layer of connective tissue covering the bone. Nevertheless, thanks to its pair of talented, imaginative advisers, as well as to the many Wieland students who found employment in Ingelheim, the firm got along in general very well indeed.

Wieland's contacts with Boehringer also encouraged him to work on the strychnos alkaloids. Strychnine itself is a convulsive poison par excellence.[58] It found early medicinal use for increasing

Figure 13. Label for strychnine distributed by Boehringer Ingelheim.

secretion in the stomach, for alleviating certain vision problems, etc. (Figure 13). Its analeptic activity—assuming proper dosage, of course—made it a valuable stimulant in the treatment of collapse. Though costly, strychnine's high toxicity also led to its being a popular agent for dealing with rat and mouse infestations. It was especially the latter application that led Boehringer to import "poison nuts" (Strychnos nux vomica) on a large scale from Ceylon, and to then put them through a complex processing operation.[59] From 1000 kg of nux vomica one could isolate about 9 kg of strychnine und 16 kg of brucine.[60] It was obvious that the steady flow of nux vomica would probably be disrupted in case of war, the very time when large quantities of rodenticides would be required to prevent epidemics by limiting rodent populations on the battlefield, in dugouts and trenches, but also in destroyed urban areas. For that reason, research on pest control agents became a major concern for applied chemistry starting in the 1920s. This refers not only to inorganic phosphorus- and thallium-based rodenticides, but also to organic substances like strychnine, whose complex structures became interesting intellectual challenges for talented, ambitious organic chemists. With this background it is easy to understand why the very best chemists of the day embarked on structural studies of strychnine itself, and why, starting in 1929, Wieland took an interest not only in strychnine, but also in companion alkaloids that accumulated in the mother liquor when strychnine was isolated commercially. One such alkaloid was vomicine, the subject of very active investigation in Wieland's laboratory until 1949. Wieland re-entered the strychnine arena in the course of his work between 1937 and 1947 on the curare arrow-poison alkaloids, an especially timely research undertaking from a medical standpoint during the Second World War.

Return to Munich

In 1925 Wieland returned to Munich—this time for good—as full professor at the University (Figure 14, 15)

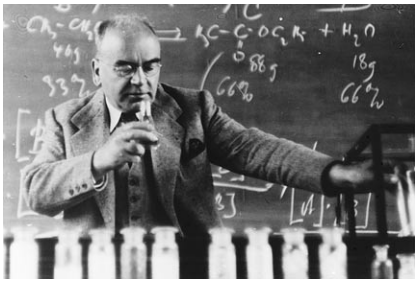


Figure 14. Wieland during a lecture, around 1935.

Figure 15. Wieland together with his colleagues Georg-Maria Schwab and Otto Hönigschmid in a beer garden, early 1930s.

He was able to negotiate conditions for his appointment with considerable confidence, not least because he had in the meantime also received a call to Heidelberg. In the end he was awarded 150% of the "ultimate basic pay" for a full professor and designated a "privy councilor" (Geheimrat). Next to Berlin, Munich at that time had the largest and most highly respected chemistry teaching laboratory in Germany. He succeeded Richard Willstätter in the position, while Hermann Staudinger took over at the institute in Freiburg.

Willstätter was from a Jewish family, and in 1924/25 he pointedly took leave of all his teaching and research responsibilities at the university (Figue 16).[61]

Figure 16. Richard Willstätter, Wieland's predecessor as professor and director of the Chemical Institute at the University of Munich.

The factors involved in this sensational step were complex: apart from overwork and tragic, fateful blows within his family there can hardly be any doubt of the role played by hopelessness with respect to right-wing radicalism in Munich after the Hitler revolt ("Putsch") of 1923. Growing anti-Semitism and nationalism upset and wounded him deeply. Foreboding political developments attracted the attention not only of Willstätter, but for example also Thomas Mann (1875–1955) and the family of his parents-in-law, the Pringsheims. Wieland on the other hand reacted far less sensitively to the threatening situation, a harbinger of the future, at least relative to some of his contemporaries—those with family circumstances that caused them to be affected more directly. Wieland expressed very clearly in a letter to Willstätter his failure to understand the latter's resignation, showing that, like so many in Germany at the time, he underestimated the seriousness of the current trend, or at least was able to make light of it: "*Sie hätten die persönliche Verstimmung und Ihre Überzeugung hinter den Fachinteressen zurückstellen müssen. Es kommt auch hier [an der Universität Freiburg] vor, dass die Fakultät einen unanständigen Beschluß fasst und mich überstimmt. Dann bleibe ich einfach eine Weile weg und ziehe mich in die geschützte Burg meines Laboratoriums zurück. […] Sie sind auch vollständig im Unrecht mit dem, was Sie über den Antisemitismus denken. Es gibt in Deutschland überhaupt keinen Antisemitismus von irgendeiner Erheblichkeit.*" ("*You should have put aside your personal resentment and your convictions in the interest of your discipline. Indecent resolutions have also been passed by the faculty here [at the University of Freiburg], and I have been outvoted. Then I simply stay away for awhile and withdraw into the protected fortress of my laboratory. […] You are entirely wrong in what you are thinking about anti-Semitism. In Germany there is absolutely no anti-Semitism of any significance.*")[62]

Wieland's Nobel Prize belongs to this second Munich Period, the award having taken place in November 1928, retroactive to the year 1927, for "Investigations into the Constitution of the Bile Acids and Related Compounds" (Figure 17). From June 1928 until May 1930 Wieland was president of the German Chemical Society, in the midst of the world economic crisis, and he was repeatedly invited to speaking engagements abroad: in 1929 to Spain, for example, and in 1931 to both England and the United States. He took advantage of the highly regarded Silliman Lectures at Yale University in New Haven (Connecticut), on his first and only visit to the USA, to present his work on biological oxidation.[63] According to Wieland's famous dehydrogenation theory, biological "combustion" took place not through direct introduction of oxygen, but rather in the stepwise enzymatic dehydrogenation of a substrate.[64] This work, which in the 1920s subjected him to vehement attacks from Otto Warburg (1883-1970), assured Wieland a permanent place as one of the founders of modern biochemistry.[65]

Fluent in French, Wieland was a member in 1927 of a delegation that traveled to Paris to celebrate the centennial of the birth of Marcelin Berthelot (1827–1907), who in those days was considered in France to be the "Lavoisier of the 19th century". The visit by this German delegation, which included Haber, Nernst, Willstätter, Neuberg, and other first-rate scientists, was an important step in the restoration of relations between German and French chemists after the First World War. In conciliatory speeches, academics were charged with the responsibility to act as "bearers of peace".[66] Later in that same year, however, several scientists were again convened, this time in the context of a secret rearming of the German army with chemical weapons, to advise high-level officers on questions of research toward protection against harmful gases, as well as on military application of these gases (Figure 18). The

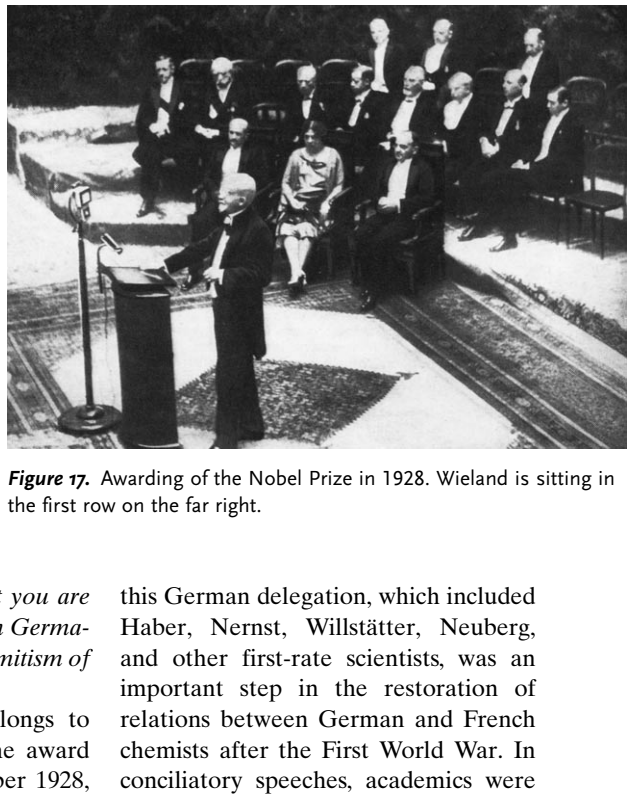


Figure 17. Awarding of the Nobel Prize in 1928. Wieland is sitting in the first row on the far right.

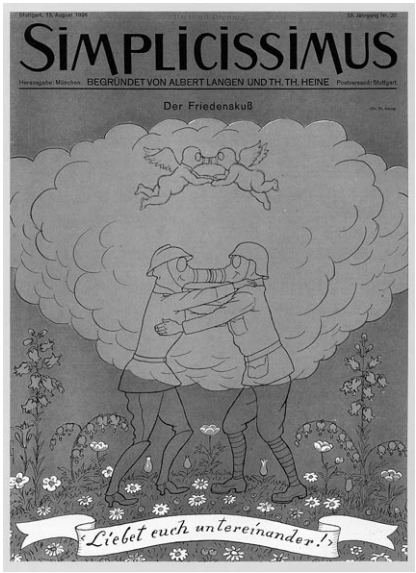
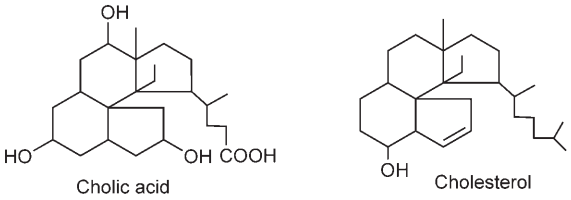


Figure 18. Rearmament with chemical weapons was definitely a subject of critical public discussion in the late 1920s.

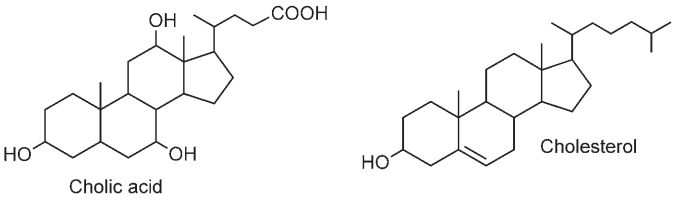
advisory panel included Wieland, who apparently was regarded as an expert in such matters as a result of his work at Dahlem, but also thanks to his lobeline studies, discussed below. Nevertheless, in contrast to true weapons experts like Ferdinand Flury, Wieland took part in these annual meetings only once, namely in 1927.[67]

Bile Acids

Wieland published his first work on bile acids in 1912.[68] It was one of the many coincidences in Wieland's research career that he began at almost the same time to study toad poisons. Skin secretions from certain toads contain substances that resemble the bile acids to the extent that they are also steroids—which, there was no way for Wieland then to realize, however.[69] What triggered the work he initiated on bile acids around 1919 was presumably the fact that the J. D. Riedel chemical company in Berlin, with which he had a consulting contract, started in 1908 to market two new bile-acid preparations: Ovogal, which was supposed to stimulate bile secretion,[70] and Mergal, an antisyphilitic agent.[71] Riedel, the leading marketer of pharmaceutical bile-acid preparations at the beginning of the 20th century,[72] was extremely interested in basic research in this area,[73] and supported Wieland "over a long period of time with cholic acid, not knowing he also had a contractual relationship with Nieder-Ingelheim."[74] Wieland was the first to recognize the physiological role bile acids play in digestion, namely emulsifying water-insoluble materials like dietary fats to make them absorbable and thus useful to the body. At that time, three bile acids were known: cholic acid, desoxycholic acid, and taurocholic acid. The latter was particularly puzzling until Wieland recognized it as being not a single pure substance, but rather a molecular compound—in modern terminology an inclusion compound or clathrate—comprised of desoxycholic acid and a fatty acid. Desoxycholic acid can also form molecular compounds of this sort with other substances, the broader category of "taurocholic acids". When Wieland and his student Hermann Sorge published these findings in 1916[75] their paper created a sensation in the pharmaceutical industry. Since bile acids modify the physical properties of water-insoluble compounds, hope was raised that Wieland's "taurocholic acid principle" might have therapeutic application by conferring water solubility on active, water-insoluble substances, thereby increasing their absorption potential. Entirely new forms of administration might exist for a host of water-insoluble active agents: brand new Galenic formulations. Because of his bile-acid studies, Wieland as early as 1916 was regarded behind the scenes as a potential Nobel Prize candidate: "*Herr Professor Wieland, together with his assistant Herrn Dr. Hermann Sorge, has published a lengthy, theoretically extremely interesting paper on his observations, for which someday in the context of his earlier significant work a Nobel Prize might beckon.*"[76]



Heinrich Wieland 1928 (Nobel Prize address)



Heinrich Wieland 1932

The "taurocholic acid principle" was also the basis for Wieland's idea to prepare a molecular compound between desoxycholic acid and camphor. Camphor had for ages been a cherished remedy for respiratory and circulatory complaints, but with the disadvantage that the virtually water-insoluble, oily solution used to inject it was poorly absorbed, and thus often both ineffective and painful. Wieland immediately patented his new molecular compound, convinced he at last had found a highly absorbable cardiac preparation.[77] He persuaded Boehringer at once to begin industrial-scale production of bile acids and bile-acid preparations. Hermann Sorge, Wieland's former assistant, was hired in 1917 to run the newly-built bile-acid facility (one of many Wieland students to find positions with Boehringer), which after the war was supplied with beef bile by imports from the South American firm "Liebig's Extract of Meat Company". The competition kept a close eye on what was going on in Ingelheim: "*Angeblich sieht Herr Kommerzienrat Boehringer schon ganze Eisenbahnwaggons Cholsäure seinen Fabrikhof verlassen, ähnlich wie aus der kleinen Milchsäurefabrikation ein Riesenartikel bei ihm geworden ist.*" ("*Apparently Herr 'Counselor of Commerce' Boehringer already envisions freightcar-loads of cholic acid leaving his factory yard, much the way lactic acid has grown in his hands from a small-scale product into an article of mass production.*").[78] And: "*Schließlich ist nicht außer Acht zu lassen, dass sowohl die Firma Riedel durch Mergal etc., wie auch ich [Merck] durch mein Choleval an Gallepräparaten sehr interessiert sind, und dass wir darauf bedacht sein müssen, dass uns das manchmal ziemlich rare Rohmaterial nicht von anderer Seite fortgenommen wird.*" ("*Finally, we cannot ignore the fact that, through Mergal, etc., not only is the Riedel firm very interested in bile preparations, but I [Merck] am as well because of my Choleval, and we must see to it that others don't make off with the often scarce raw material.*")[79]

In 1920 when, after the First World War, sufficient camphor could once again be imported into Germany from Formosa, Boehringer introduced Wieland's molecular compound of desoxycholic acid with camphor as a cardiovascular agent under the trade name Cadechol (Figure 19). Cadechol, Boehringer's very first ever finished pharmaceutical product, for a long time was a great success. However, Riedel had

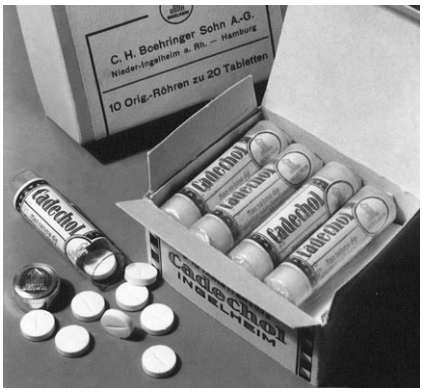


Figure 19. Boehringer's successful preparation Cadechol, used for oral camphor therapy in the context of circulatory problems.

"know-how" similar to Boehringer's, and therefore came out soon with a competing product, Camphochol, a molecular compound of camphor and apocholic acid that was not protected under Wieland's patent. Boehringer's once so successful product lost even more market share when Knoll in 1925 introduced Cardiazol (pentamethylenetetrazole) as a therapeutic agent. This marked the beginning of a new era in the treatment of cardiovascular disease, dealing a deathblow over time to traditional camphor therapy, and thus to Cadechol.[80]

In the years following market introduction of Cadechol, Wieland busied himself with applying his "taurocholic acid principle" to other active ingredients: Perichol, introduced by Boehringer in 1922, contained camphor and the anticonvulsant papaverine. Other attempts to apply the "taurocholic acid principle" as a way of improving resorption of pharmaceutically active agents proved disappointing, however. These included Euxanthin, introduced by Boehringer in 1928 and containing camphor together with theophylline, as well as Necaron, a silver cholic acid compound for treatment of gonorrhea. The preparation Bilival, brought out by Boehringer in 1923, was a sole exception: a molecular compound of lecithin and sodium cholate for the treatment of biliary duct problems, which still dominated the market as late as 1981. Astonishingly, it was Wieland's brother Hermann who first called into question the supposed therapeutic efficacy of the "taurocholic acid principle", stripping away the basis for further development of bile-acid preparations. In the minutes of meetings of the Boehringer board of directors in September 1923, shortly after the introduction of Bilival, there appears the following revealing comment: "*Prof. Heinrich Wieland regt an, die cholsäuren Salze der Alkaloide, besonders des Chinins, zu prüfen. … Prof. Hermann Wieland hält wenig davon, vor allem weil es weder am Tierversuch noch am Menschen bislang festgestellt werden konnte, daß durch Gallensäure eine Resorptionsbeschleunigung eintritt.*" ("*Prof. Heinrich Wieland suggested testing the cholic acid salts of alkaloids, especially of quinine. … Prof. Hermann Wieland thinks little of the idea, primarily because it has to date not been possible to demonstrate either in animal experiments or with humans that cholic acid actually increases the rate of resorption.*").[81]

The Nobel Prize

As Wieland said in his Nobel Prize address, had Cadechol not proven such a huge success—at least prior to the appearance of Knoll's Cardiazol—he would never have pursued work on the chemistry of the bile acids. Astonishing as it may seem, there was a time when discovering that combining poorly soluble, physiologically active substances with cholic acid as a way of making them marketable was of groundbreaking chemical significance, and worthy of a Nobel Prize, but it can actually be documented in Wieland's case. At first, the bile acids appeared to Wieland to be profoundly boring; as he himself expressed it: "*Das Problem erscheint in experimenteller Hinsicht wenig reizvoll. Kein Stickstoff, der der Bearbeitung der Alkaloide Anregung und Mannigfaltigkeit verleiht. Nur Kohlenstoff, Wasserstoff und wenig Sauerstoff, alles in traditioneller Bildung, die keine überraschenden Bilder erwarten lässt. Als langer, unsäglich ermüdender Marsch durch eine dürre Strukturwüste stellt sich die Aufgabe dar.*" ("*The problem looked rather unappealing from an experimental standpoint. None of the nitrogen that provides stimulus and variety in working with alkaloids. Only carbon, hydrogen, and a little oxygen, all in traditional forms, offering no reason to anticipate surprising pictures. The assignment would appear to represent a long, unspeakably exhausting march through an arid structural desert.*")[82] Wieland's studies might well have come to a standstill at the very beginning, because without help from the pharmaceutical industry his institute budget would not have allowed him to pay for the necessary quantities of starting materials: his experiments required large amounts of bile acids, which Boehringer put at his disposal, supplemented with material his students isolated from beef bile in the course of required "Gattermann (laboratory manual) experiments".[83]

In those days, figuring out the structure of an organic substance was similar to solving a complex puzzle. Precise analyses, considerable patience, and powers of reasoning were prerequisite to deducing structures for the bile acids, making use only of hydrolyses, pyrolyses, oxidation and hydrogenation reactions, and tests for the few functional groups present. It was advantageous that Wieland's own work had already shown substances containing the ring system present in the bile acids were actually very common in the animal and plant worlds. Thus, results he had obtained while studying the sterines and cardiotonic toad poisons provided val-

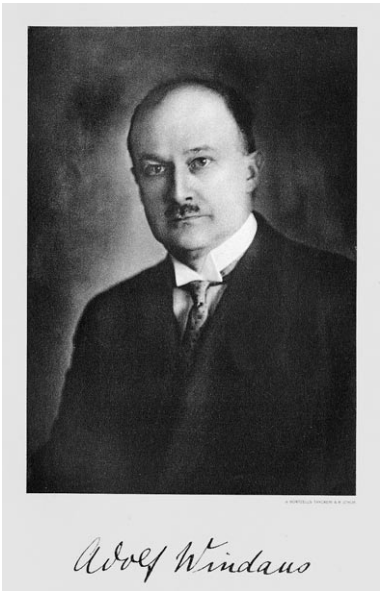


Figure 20. Wieland's good friend Adolf Windaus shared with him not only a major research area—steroid chemistry—but in the Third Reich a similar lack of sympathy for the National Socialist regime.

uable support in the search for constitutional formulas for the bile acids. Of further assistance was the cholesterol work of Wieland's friend and colleague at Göttingen, Adolf Windaus (1876–1959; Figure 20).[84] It had been clear since 1919 that the bile acids and cholesterol must share a common ring system—that of the steroids. Because Wieland und Windaus had approached the structure of this tetracyclic framework from two different directions, the Nobel Prize committee's decision to honor both with the Nobel Prize simultaneously was a wise one, where Wieland retroactively received the 1927 prize in 1928, and Windaus was awarded the one for 1928.

By 1928, Wieland's efforts toward establishing a constitution for the bile acids had produced a structural formula with one serious drawback: there was no sensible way to accommodate a fugitive ethylene (C_2H_4) group. The formula Wieland utilized for the steroid skeleton in his Nobel lecture was not yet secure, as Wieland himself realized. He and his student Elisabeth Dane (1903–1984) corrected it in 1932 [85]. An instrumental method which at that time was brand new, X-ray structure analysis, had shown that cholesterol and the bile acids could not have the sort of compact structure originally envisioned, but must instead be based on a more extended tetracyclic framework.[86]

Not long after Wieland and Windaus had clarified the constitution of the steroid framework, this basic structure was found to be present in a great many physiologically active substances: the vitamin-D-complex, the sex hormones, the corticosteroids, and cardiotonic glycosides from the foxglove (*Digitalis purpurea*), the sea onion (*Scilla maritima*), and certain arrow poisons, such as strophanthine. This was the main reason why Wieland, and especially his student Bernhard Witkop, also studied arrow poisons, why Elisabeth Dane pursued the latest leads in the areas of hormone and cancer research, and why Wieland maintained such close scientific contacts with the Kaiser-Wilhelm-Institute for Medical Research in Heidelberg. Cancer research was carried out there, as was research on hormones and vitamins—of high priority during the Third Reich, and supported at the highest levels. This was also where Wieland's son Theodor met the qualifying requirements ("Habilitation") for teaching at a university, under the guidance of Richard Kuhn (1900–1967), a former Willstätter student.

The National Socialist Dictatorship (1933–1945)

Chemistry in the Third Reich

The chemical industry, from which had arisen around the turn of the 20th century a host of famous pharmaceutical firms, was an important pillar of the German economy (Figure 21). Its products, exported on a large scale throughout the world, were of great significance not only because they were a source of capital, but also because of Germany's shortage of raw materials. This applied with respect to World War I and the years of the Weimar Republic, but especially during the Third Reich. The rearmament economic plan spelled out in 1934/35 by the Hitler government was predicated on self-sufficiency, and the chemical industry was to play a central role. Chemical syntheses were expected to compensate for German shortcomings in raw materials. Germany—unlike England or France—was in no position to fall back on supplies imported from colonies. In the run-up to the Second World War, chemists in particular were called upon to "fight" for Germany with their research (Figure 22). They were expected to synthesize materials essential to the war effort like gasoline, rubber, spun rayon, plastics, pharmaceuticals, insecticides, fertilizers, and a host of "substitute" ("Ersatz") items, starting with the few raw materials Germany did have in abundance: coal, water, chlorine, and lime. Since chemistry in particular was of such economic importance because of its close involvement with industry, the political situation meant preferential support—during the First World War, in the years leading up to the Second World War, and even more intensively during the Second World War itself—was directed toward applications-oriented research. Ample research funding was therefore available for projects that promised to be of immediate politico-economic value to the state.

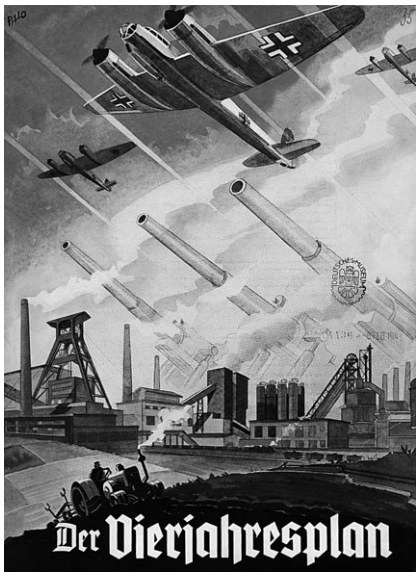


Figure 21. Cover page of the 1941 publication *The Four-Year Plan*. It underscores the importance to the war effort of chemistry and the chemical industry, which was urgently needed by Hitler to provide gasoline, munitions, fertilizer, insecticides, and many other products.

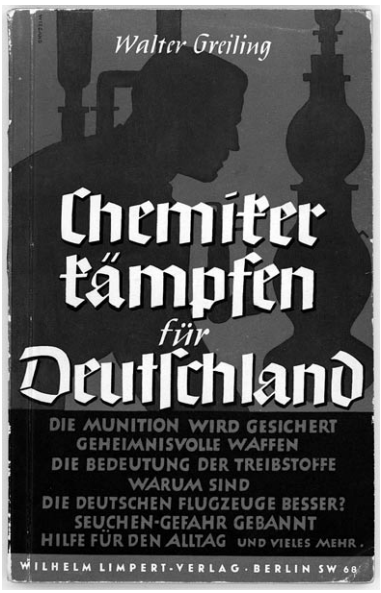
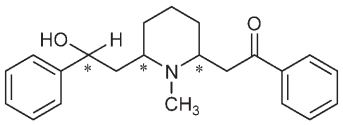


Figure 22. The title of a well-known book from 1940 intended to make young people in National Socialist Germany enthusiastic about chemistry, showing what an important economic and societal role chemists played in those days ("Chemists Fight for Germany: Ammunition Supplies are Assured; Mysterious Weapons; The Significance of Fuels; Why Are German Airplanes Better?; Warding off the Threat of Epidemics; Everyday Help; and Much More.

From a historical standpoint, Wieland's work related to lobeline is particularly interesting, in part because of its economic significance, but also because the field is one he approached in truly comprehensive fashion: from isolation of the substance, through structure determination, and all the way to synthesis.

Lobelia Alkaloids

Wieland began studying lobeline, another alkaloid of pharmaceutical interest for Boehringer, before the outbreak of World War I. Lobeline is found in the medicinal plant *Lobelia inflata* (Figure 23), derived originally from Northeastern America and named for the Flemish physician Matthias Lobelius (1538–1616). Its effects resemble those of tobacco, so it was also known as "Indian tobacco" and in German due to its nauseating taste as "Brechkraut" (roughly: "vomiting herb"). The Indians valued the plant as an emetic for use after overly sumptuous banquets, and for treating dropsy and syphilis. In 1807 the American faith healer Samuel Thomson (1769–1843) discovered that Indian tobacco was an effective remedy for respiratory system disorders, and for asthma. Thomson and his healing sect, known as the "medical botanists", had many followers in the United States, so the material soon became common in therapy there. "Herba Lobeliae" appeared in the US Pharmacopeia as early as 1820, and a few years later it was included in the German Pharmacopeia as "Tinctura Lobeliae inflatae", though its value as an antiasthmatic agent was always controversial.[87]



Lobeline

Figure 23. *Lobelia inflata*, also known as Indian tobacco.

Chemical investigation of the substances present in lobelia began in the mid-19th century. The earliest analyses revealed little, however, since they were not based on pure compounds. In 1889, Heinrich Dreser (1860–1924), later the first pharmacologist at the Bayer facilities in Elberfeld,[88] subjected the alkaloid mixture to animal studies.[89] He was able to verify that crude lobeline indeed heightened and accelerated respiration. Hermann Wieland came to the same conclusions in his habilitation research on sensitivity of the respiratory center toward narcotics and convulsants.[90] Clearly lobeline was a substance with pharmaceutical value, and it made sense to attempt to isolate and purify the active alkaloid.

Through his own studies of materials present in lobelia, initiated prior to the First World War, Heinrich Wieland had been able to show that crude lobelia was actually a mixture of alkaloids. In 1914, Boehringer Ingelheim patented a procedure developed by Wieland with which the physiologically active alkaloid could be separated from other plant contents.[91] In 1916 Wieland began structural work on lobeline, but these efforts had to be interrupted in 1917 when the supply of raw material from the United States dried up as a consequence of US entry into the war and the onset of "unrestricted submarine warfare". He was able to resume work only after the war ended and drug shipments from the United States began once again to reach Germany.

In 1921, Boehringer introduced "Ingelheim" Lobelin to the market in the form of a readily soluble salt isolated from plants by the Wieland process. It was offered as a solution suitable for direct injection, and at two different active-ingredient concentrations. The low-dosage variety was intended for intravenous application, the higher for subcutaneous or intramuscular use. Both Wieland brothers supported the introduction of this new preparation with publications. They had even negotiated with Boehringer the right to publish their lobeline findings ahead of the people at Ingelheim, an indication they were paying close attention to protecting their own personal interests. Heinrich Wieland published his isolation procedure,[92] and brother Hermann reported that the purified alkaloid provided the same respiratory stimulation and intensification benefits as the previously utilized "crude lobeline", but in contrast to the latter showed no emetic properties, and was not beneficial with respect to asthma.[93] The latter properties were therefore due to alkaloid impurities in the crude material.

Lobelin's success surpassed all expectations, and for years it was Boehringer's best-selling product, becoming one of the most widely used respiratory analeptics available. As a substance that in small doses stimulated the respiratory center it was superb for first-aid applications, as well as for resuscitation in cases of life-threatening respiratory paralysis, such as from high-voltage electrical shock, lightning strikes, injuries with major loss of blood, drownings, unforeseen problems accompanying anesthesia, and poisonings due to carbon monoxide, hydrogen cyanide, or sleep aids. Lobelin's reputation benefited from several serious mine explosions in the early 1920s in which numerous miners' lives were saved thanks to administration of the Boehringer product.[94] The Reichsgesundheitsamt (Reich Public Health Office) granted Lobelin provisional certification in 1925—supported in 1926 by a decree of the Reichsarbeitsministerium (Reich Ministry of Labor)—as the only injectable preparation authorized for lay usage, assuming that a physician had provided ambulance personnel with technical instruction in injection technique.[95] As a result, Lobelin during the 1920s became a standard fixture in the first-aid cabinets of many companies (Figure 24). During the Second World

Figure 24. First-aid kit containing Lobelin ampoules, 1939.

War it assumed a permanent place in first-aid kits for all military medical detachments, everyone of course being conscious of the possibility of gas warfare. The toxicologist and arms expert Otto Muntsch (1890–1945)[96] saw to it that the army film bureau produced a film entitled "First Aid and Artificial Respiration" ("Erste Hilfe und künstliche Atmung"), which demonstrated the technique of subcutaneous Lobelin injection, and was to be used in the training of military orderlies.[97]

Because of Lobelin's great pharmaceutical significance it was studied extensively in the 1920s and 1930s. To begin with, its constitution needed to be clarified. This was accomplished in Wieland's research group in 1929 after a number of false starts. More precise characterization of the companion alkaloids was also considered important, as was investigation of their physiological activity and, finally, synthesis of lobeline. Synthesis was envisioned as ensuring independence not only vis-à-vis poor harvests and the usual uncertainties associated with plant extracts—such as variable alkaloid content—but also from the standpoint of foreign drug import altogether. Self-sufficiency was an important politico-economic goal in Hitler's four-year plan. Wherever possible, drug syntheses were to be sought based on German raw materials, or drugs developed starting with plants that could be cultivated either in Germany or in German-occupied territory.

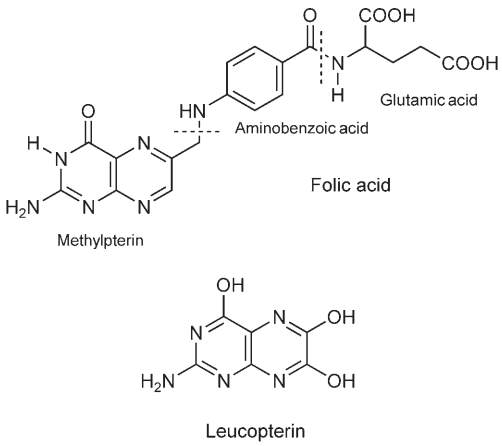
Wieland and his student Irmgard Drishaus succeeded in 1929 in achieving a total synthesis of lobeline.[98] They were thus able to verify the proposed structural formula, which had been established through selective degradation of the alkaloid.[99] This scientifically rewarding but commercially impractical synthesis was joined in the same year by one developed at Boehringer by Georg Scheuing and Ludwig Winterhalder.[100] These two former Wieland students started with the readily available and inexpensive 2,6-diethylpyridine (lutidine), which they condensed with benzaldehyde. In 1931 the two also acquired a patent for yet another process, one based on oxidation of a different—inactive—alkaloid (lobelanidine), present in substantial quantity in the lobeline mother liquors.

Unfortunately, scale-up of the Scheuing–Winterhalder synthesis to commercial scale proved laborious. Two steps entailed intricate separations of stereoisomeric compounds.[101] By early 1937 Boehringer had solved all the problems and began marketing synthetic L-lobeline under the trade name "Lobeton".[102] That meant the company was no longer at all dependent upon lobelia imported from America. Moreover, total synthesis of a substance so important for first-aid purposes, and in the context of a potential war, represented a significant contribution toward fulfillment of Hitler's four-year plan. The following appeared in the Boehringer house newspaper regarding one of the firm's most important products: "*In dem schweren Kampf, den unsere Wehrmacht an allen Fronten führt, bedarf sie der Unterstützung durch die Heimat. Die Heimat aber schafft nicht nur in den Rüstungsbetrieben für sie. Der Bedarf nach einem Mittel, das geeignet ist, die bedrohende Atemlähmung von unseren Soldaten fernzuhalten, ist angesichts der Vollmotorisierung der Heere und der damit verbundenen Gefahr der Gasvergiftungen ganz besonders groß. Für die kämpfende Truppe verschärfen sich noch diese Gefahren durch die Feindeinwirkung. So leistet unser Betrieb mit seiner ganzen Belegschaft durch die Herstellung von Lobelin … seinen Beitrag zum Schutze des Lebens unserer Soldaten und damit für den Kampf der Heimat zur Erringung des Endsieges*", ("*Homeland support is required in the difficult battles the German armed forces are engaged in on every front. But more than just the arms industry is involved at home. In view of the full motorization of the army and attendant risks of gas poisoning, the demand becomes especially great for some agent that will protect our soldiers from the threat of respiratory paralysis. Enemy activity increases this risk to our fighting forces even more. Through the manufacture of Lobelin, our company, with all its personnel, … is making its contribution to protecting the lives of our soldiers, and thus to the homeland's struggle to achieve ultimate victory*".).[103]

Lobelin remained on the market in the Federal Republic of Germany until 1980. Thanks to further developments in the field of respiratory devices, first-aid workers and emergency rooms by then had available to them more efficient ways of treating respiratory arrest. Other developments contributed as well to Lobelin's loss of importance: the days of serious barbiturate poisoning were over, thanks to newly-developed sleep aids. Until the early 1950s, poisonings from household gas led the suicide statistics in Germany, but these numbers fell dramatically as kitchens came to rely increasingly on natural gas or electric stoves for cooking purposes.

Pterins

Unlike Wieland's work on the bile acids and lobeline, both of which originated in practical questions, his study of the pterins started out as strictly basic



research. Quite unexpectedly, and in the context of the Third Reich, the compounds suddenly proved of great interest in vitamin research. [104]

At the suggestion of a former Wieland student, Clemens Schöpf (1899–1970), who had been collecting butterflies since childhood, and perhaps also as a consequence of the cabbage butterfly plague of 1926, Wieland developed an interest at this time in a seemingly eccentric theme: wing pigments of the cabbage and brimstone butterflies. Together with his student Robert Purrmann he was soon able to isolate two pigments, and in 1940 to establish their structures: the white leucopterin from the wings of cabbage butterflies and the yellow xanthopterin from the wings of brimstone butterflies.[105]

Since 100000 cabbage butterflies yield only 18 mg of butterfly wing pigment, Wieland needed enormous amounts of subject material, so he asked the Bavarian Ministry of Culture for help in procurement. Pupils in rural Bavarian schools had routinely been called upon to participate in "caterpillar actions" as an aid in pest control, and by 1930 at the latest the school administration agreed that these children should help in collecting butterflies for the Chemical Institute. Wieland paid one pfennig for every five cabbage butterflies or for a single brimstone butterfly. Already by 1931 the Ministry began refusing to support the action, however, at least with respect to the brimstone butterfly, which—in contrast to the cabbage butterfly—could not really be viewed as a pest. Wieland then turned for help to ministries in the other German states, and to Austria. Prussia promised help, but when reports appeared in Bavarian newspapers with headlines like "Prussian Butterflies for Munich", animal-welfare activists and anti-vivisectionists mounted protests against the butterfly collecting. These opponents actually found themselves in something of an "upwind position" due to preliminary discussions then underway toward formulation of the National Socialist animal-welfare laws of 1933.[106] Wieland's collecting guidelines, according to which insects were to be killed by "squeezing their heads between the fingers", came to the fore once again during discussion of the National Socialist Wildlife Conservation Act of 1935, and were criticized as "barbaric".[107] It is well worth noting in this context the irony that at the same time—albeit without arousing public protest—the inhumane Nuremberg laws were being formulated, which downgraded Jews to second-class citizenship. In any event, the Bavarian Ministry of Culture declined all further support of Wieland's work. But stubborn as he was, Wieland a few years later, when the animal-welfare and wildlife-conservation debates of the early 1930s had subsided, was not discouraged from turning once again for help of the same sort to the authorities responsible for his work.

It is interesting that Wieland concurrently needed vast numbers of toads for his toad-poison research (Figure 25).

Figure 25. Toads are collected and "milked" to recover a valuable secretion exhibiting cardiotonic activity.

Obtaining these posed no problems, however. Unlike the butterflies, there was no need to kill the toads; they were simply "milked" and then set free again: "*In the period from 3 April until 13 April, 27000 toads were captured in the district of Freiburg i. Br., supplying the secretion necessary for our studies. Collection involved pressing on the large gland located behind the eye with strong, broad-tipped tweezers. The spray emitted was collected on enamel plates, to which had been attached thin layers of absorbent cotton. It is necessary to wear safety goggles during this operation since the secretion is a powerful eye irritant. … After removal of the secretion the toads were set free back at the collection site. The animals suffer no harm whatsoever through extraction of the poison.*"[108]

In November 1933 Wieland delivered a lecture to the Munich Chemical Society about his butterfly research. On that occasion he acknowledged that school children had captured the necessary large number of butterflies until this was forbidden. Two weeks later a letter of denunciation was received at the Bavarian Ministry of Culture in which it was claimed Wieland said in his lecture: "*Leider hat die neue Regierung mit dem schönen Usus des alten Kultusministeriums gebrochen, und wir können unsere Arbeiten nicht fortsetzen. Wir haben uns deshalb veranlasst gesehen, uns an ausländische Regierungen zu wenden. Hoffentlich sind diese nicht so human.*" ("*Unfortunately, the new government has broken with the nice practice of the old Ministry of Culture, and we are unable to proceed with our work. For that reason we have felt it necessary to appeal to foreign governments. Hopefully these will not prove to be so humane.*")[109] Even though the matter was set aside, accompanied by a written statement from Wieland, and was not further pursued, the denunciation itself gives some sense of public attitude during the consolidation phase of the Third Reich. One could always anticipate denunciations, and as a consequence of every piece of trivia.

Scientific reports regarding effects of liver and yeast extracts with respect to certain types of anemia stimulated attempts at isolating the alleged antianemic agents. In the course of this work, active agents were discovered around 1940 bearing structural similarities to the pterin skeleton. It thus became apparent that, with his pterins, Wieland had set foot upon a field one could imagine being related to a very timely research topic: vitamins, which especially in time of war enjoyed high funding priority in the context of "public nutrition".[110] In order to stay at the forefront of the search for the alleged "anti-anemic factor", Wieland stepped up his pterin research, and in 1940 sought targeted support from the chemical/pharmaceutical industry. The "*General*bevollmächtigte des Ministerpräsidenten Generalfeldmarschall Hermann Göring für Sonderfragen der *chemi*schen Erzeugung" ("General Commissioner for Minister President General Field Marshall Hermann Göring for Special Questions Involving Chemical Manufacture"), the so-called "GeBeChem" Carl Krauch (1887–1968), who was serving simultaneously as chairman

of the IG Farben board of directors and head of the department "Research and Development" in the Reich Agency for Economic Development, lent his support to Wieland's pterin research and negotiated with him a corresponding contract.[111] As a result, the project was officially classified as "of military importance" despite the fact that what lay behind it was simply "normal" chemical research.[112] The so-called "pterin contract" was signed by Boehringer–Ingelheim, Bayer–Elberfeld, and Wieland, with the three contractual partners agreeing to work jointly toward "syntheses of pterins and their therapeutic utilization".[113] Both leucopterin and xanthopterin were successfully synthesized in 1943. In a search for the alleged "anti-anemic factor", scientists in the United States in 1941 stumbled across folic acid, the structure of which was soon determined, facilitated by the fact that the basic skeleton of folic acid was related to that of the pterins, already known thanks to the efforts of Wieland and his co-workers. A total synthesis of folic acid was then achieved in the United States as well, in 1945, through which the vitamin became relatively readily accessible.[114]

The University of Munich

After 1933, major changes occurred in the institutional framework of German universities.[115] The most far-reaching measure toward National Socialist reconfiguration of the higher education landscape, and the most consequential, was the April 1933 "Law for Reconstitution of the Professional Civil Service". In several waves of layoffs, all civil servants classed as non-Aryan or politically undesirable were dismissed as employees of the state. Wieland was forced to watch as this purge, to which nationwide over 600 higher education teachers fell victim, also struck colleagues in his own institution: the physical chemist Kasimir Fajans (1887–1975) was dismissed in 1935 on racial grounds, and he emigrated via England to the United States; Wilhelm Prandtl (1878–1956) was forced into retirement in 1937 because he was regarded, through his wife, as "related to the Jews"; and the physical chemist Georg-Maria Schwab (1899–1984) in 1938 lost the right to teach because he classified as a "first-degree half breed".

Also affected were all students defined by the Nuremberg laws as Jews. Following the "pogrom" of November 1938, the so-called "Reich Crystal Night" ("Reichskristallnacht"), Jews were no longer allowed to set foot in the universities. After 1940—that is to say, shortly after the outbreak of war—study was increasingly restricted for so-called "half breeds" as well, in that applications on their part for admission or continued study required explicit approval from the Ministry of Science. As one aspect of ensuring conformity throughout higher education, rectors of the universities no longer were elected from within the university, but rather were appointed by the Ministry, although they did retain a considerable amount of latitude. It was thus up to the rector to decide which applications were to be passed along to party headquarters, regional authorities, and the Ministry, where each such request had to be accompanied by a detailed testimonial regarding the "personality and appearance" of the candidate—those who looked "Aryan" or were closely related to soldiers at the front could then be treated leniently. From 1940, the rector of the University of Munich was the indologist Walther Wüst (1901–1967), a member of the "SS-Ahnenerbe" ("SS Ancestral Heritage Society") and a committed National Socialist who had his party membership above all else to thank for his position.[116] To persuade him in a particular case to interpret the anti-Semitic edicts and laws generously, a university instructor had to recommend personally that some "half-breed" be permitted to continue his or her studies, something most professors in their haste to be submissive were unwilling to risk. Wieland was apparently a major exception, for among the few "half-Jewish" students receiving permits to continue studying at the University of Munich, most—the total number has been estimated to be about 25—came from Wieland's Institute, and because of his many third-party research projects he was even able in many cases to cover their expenses.[117] Wieland allowed a few so-called "half-breeds" to study without being registered at all, assuring them he would see to it that their academic accomplishments would be "legalized" after the war.[118]

Another important step in the rush toward organizational conformity and centralization in German higher education was establishment in 1934 of the "Reich Ministry for Science, Pedagogy, and Adult Education", under the leadership of the former senior secondary-school teacher ("Studienrat") Bernhard Rust (1883–1945). The Rust Ministry among other things intervened heavily in the curricular offerings of the universities. It was for example decided in June 1937 that from then on lectures should be offered in military chemistry to all students of medicine, pharmacy, and chemistry, and that chemistry students would be required to carry out relevant laboratory experiments.[119] As of April 1938 "the most important information related to chemical weapons" was to be "appropriately taken into account" in examinations.[120] As Institute Director, Wieland was required to submit to such directives if he wished to avoid the risk of denunciation.

Denunciations and Solidarity Gestures

Denunciations occurred often enough in any case. The following example of such a document apparently came from individuals occupying subordinate academic positions at Wieland's Institute, and was addressed to Counselor of State (Staatsrat) Ernst Boepple (1887–1950), cofounder of the German Worker's Party, forerunner of the National Socialist (Nazi) Party, and also of the anti-Semitic "Deutscher Volksverlag" ("German People's Publishing House"), who in the Bavarian Ministry of Culture was an advocate of ideological conformity in higher education. It read (in translation):

"*The undersigned most obedient National Socialist chemists wish hereby to call attention to a serious state of affairs at the University persisting from the time when self-interest came before communal interest. In many university institutes, e.g. the chemistry laboratories of the University, the Director collects the laboratory fees paid for sessions he never personally conducts, to which he pays not the slightest attention, and in which he*

absolutely never makes an appearance. It must be conceded that a portion of these fees is refunded to associate professors, who for their part often leave the actual teaching to assistants. In the laboratories in question, assistants' salaries are broken down into small pieces so that the Director can appoint numerous (unworthily compensated) aides to relieve him of all duties. In the case in point the Director, Herr Prof. Wieland, is a competent scholar, but he makes himself utterly impossible as far as we are concerned through his frequent carping about the government and the Third Reich. He also earns more than double wages, since apart from his salary he receives income from the Boehringer am Rhine Chemical Factory."[121]

Presumably because it bore fictitious signatures this denunciation was never pursued, although its reference to Wieland's dual income could well have served as a handle for further investigation—possibly with unpleasant consequences for Wieland, who apparently had never reported his consulting work with Boehringer as a source of part-time income. Other denunciations that came his way also failed to have grave consequences, including one warning that actually became a matter of record: a result of his allowing Carl Ernst Hofstadt, a "first-degree half-breed", to continue working in the laboratory without the express permission of the rector.[122] Wieland was also denounced for the fact that in the Chemical Institute there was an equipment and chemicals stockroom belonging to the firm Bender & Hobein, which was classified as "Jewish";[123] it was alleged as well that in a lecture he made remarks critical of the regime; and an officer who was granted leave to study in 1943 reported he had the impression that "Jewish half-breeds" constituted "the majority of the male students in Wieland's Institute".[124] The many denunciations show at the very least that Wieland was not regarded by students who were committed National Socialists or others loyal to the regime as representative of the Third Reich. He most assuredly did not number among the fellow travelers and opportunists, of whom in Germany there were so many in those days.[125] He repeatedly made it clear through ironic, ambiguous remarks, and non-conformist behavior—which never developed into open revolt, however, and surely was never "life-threatening", despite published claims to the contrary[126]—that he had not allowed himself to be taken in ideologically by the National Socialists, but had instead tried insofar as possible to maintain his autonomy.

Wieland was certainly no anti-Semite, and he was a master of the solidarity gestures that expressed in an impressive way his political and human position. His circle of friends and colleagues included a great many men from Jewish families, including Carl Neuberg, Markus Guggenheim, Fritz Haber, and Richard Willstätter. He continued to list the latter as a co-editor on the title page of *Annalen* until 1938, when others had long since—and at their own initiative—converted over to not citing their Jewish colleagues, and thus ignoring them. When on the morning of 10 November 1938, following the "Reichskristallnacht", it was reported to Wieland that one of the three busts on display in the foyer of the State Laboratory, that of Willstätter, had disappeared, he made a point of demonstratively removing those of Baeyer and Liebig as well. Immediately following the pogrom ushering in the last and murderous phase of persecuting the Jews, he visited Willstätter at the latter's home—most assuredly not without personal risk—to console his increasingly excluded and isolated colleague.[127] After the "Reichskristallnacht", all those classified as Jews by the Nuremberg Laws lost what few rights they still had: Jews were no longer permitted to go to the theater, movies, restaurants or bars, museums, or public parks; their driver's licenses were revoked, and their telephones disconnected; they were not allowed to have pets, and it was forbidden for them to use public transport—all this and much more such chicanery.

Wieland behaved even more courageously when the "half-Jew" Hans Leipelt (1921–1945), having studied at Wieland's Institute since the winter semester of 1941, was arrested in October 1943. Along with a female colleague, Leipelt had copied in bulk the last flyer of the resistance group "Weiße Rose" ("White Rose"), and was therefore accused along with a number of fellow students of high treason. In the fall of 1944 Wieland, for whom walking had by then become difficult, traveled to appear as a witness for the defense at the trial held before the People's Court (Volksgerichtshof) in Donauwörth, a solidarity gesture of enormous psychological value for the accused, but one that had no effect on the outcome: Leipelt was sentenced to death and executed in January of 1945.[128]

The fact that Wieland's oft-demonstrated opposition in the end had no ominous consequences for him, and that all the disparaging letters of denunciation were simply set aside and not pursued, was hardly something to be taken for granted. Less well-known professors elsewhere had been held to strict account. An example is the Berlin chemistry professor Wilhelm Schlenk (1879–1943),[129] a friend of Wieland's since student days. A skirmish with the physicist Johannes Stark (1874–1957)—a committed National Socialist and outspoken defender of an anti-Semitic "German physics" who from 1934 to 1936 was president of the German Research Society (Deutsche Forschungsgemeinschaft)—was in part responsible for Schlenk's being transferred for disciplinary reasons in 1935 from Berlin to Tübingen.[130]

Negotiating Space

Why was Wieland given so much latitude, which he skillfully utilized to permit "half-Jewish" students—"half-Aryan", to use his terminology—to remain in his laboratory, even as this became increasingly difficult because of ever more restrictive regulations? To this question a number of responses might be offered:

The most obvious and certainly most important is that Wieland, as winner of a Nobel Prize, enjoyed considerable national and international renown. The university administration and the ministerial bureaucracy took great pride in this (Figure 26) even after Hitler in January 1937 forbade all "Reich Germans" from accepting Nobel Prizes.[131] Because of this prohibition, Wieland's Nobel Prize was completely ignored in the official congratulatory notices issued in 1942 on the occasion of his 65th birthday. On the other hand, symbolic

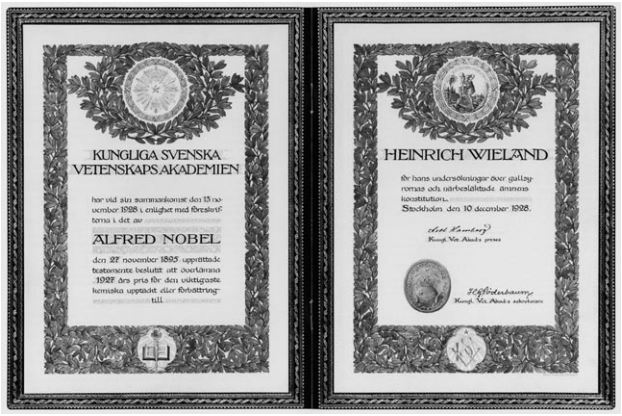


Figure 26. Wieland's Nobel Prize certificate.

of the esteem in which he was still held by the National Socialist regime, "the Fuehrer" awarded him on this same occasion the—at the time especially highly regarded—Goethe Medal for the Arts and Sciences.[132]

But a Nobel Prize is not the only factor explaining Wieland's "immunity". The situation is much more complex: Wieland maintained excellent contacts with the chemical/pharmaceutical industry, especially with Boehringer Ingelheim and with Bayer through Heinrich Hörlein (1882–1954), who since 1933 had represented the pharmaceutical branch in the central committee of the IG Farbenindustrie.[133] Wieland would also have made use of his contacts with companies regarded as "essential to the military effort", since the pharmaceutical industry was indispensable not just as a supplier for the medical branches of the air force, the army, and the navy, but also as the source of medications for the civilian population.

Another likely "protective factor" would have been that his research group was working on numerous projects classed as "vital to the war effort". As early as 1938 Wieland reported to the University administration that: "*Seit dem vorigen Jahr sind drei Laboratorien unseres Instituts mit chemischen Arbeiten im Rahmen des Vierjahresplans beschäftigt.*" ("*Since last year, three laboratories in our Institute have been involved in chemical work in the context of the Four-Year Plan.*")[134] Wieland and his co-workers dedicated themselves, especially in the final years of the war, to a host of problems supported not only by the Deutsche Forschungsgemeinschaft (German Research Society), but also by the air force—which always had considerable money—as well as the Reichsforschungsrat (Reich Research Council),[135] and the Reichsamt für Wirtschaftsausbau (Reich Office for Economic Development). The latter, for example, supported Wieland's pterin research and efforts related to hormone synthesis.[136] Certain projects had in fact even been designated as urgent,[137] and thus classified as "especially vital to the war effort", meaning that within the system, Wieland was untouchable and indispensable. The research grant awarded to Wieland's co-worker Hans Behringer (1911–?) for "Attempts to Add Thioacids to Acetylene"[138] had to do with chemical-weapons research on derivatives of "Lost", a topic that enjoyed very high priority in the Third Reich (Figure 27). The project was thus especially well suited to protecting coworkers from service at the front. Incidentally: Behringer's postwar publications contain nothing whatsoever that would suggest chemical weapons development.[139] Another research grant, highly relevant in the final stages of the war and authorized by Richard Kuhn, director of the "Organic Chemistry" division of the Reichsforschungsrat (Reich Research Council), was concerned with penicillin research, an area in which Wieland was able to claim a certain expertise thanks to his biochemical activities and studies related to mold constituents. With this project Wieland's Institute became a member of the "Penicillin Working Group" of the "Office for Medical Science and Research".[140]

Figure 27. Angel of peace associated with the manufacture of poison gas. Drawing by Olaf Gulbransson (1934) with the text: "Now I'll try it with chemistry! Maybe I'll succeed in making a poison gas that will bring peace as a by-product."

Beyond this, Wieland took advantage of the fact that during the First World War he had been honored for service on the home front, at that time establishing beyond any doubt both his patriotism and his will to defend the Fatherland through the medium of research. In the "Card Catalogue of all Teachers in Higher Education", assembled in Berlin in 1934, he wrote under the heading "Military Service": "*Ich habe von März 1917 bis November 1918 die Abteilung f. Synthese von Gaskampfstoffen am Kaiser Wilhelm-Institut für Chemie in Berlin-Dahlem geleitet.*" ("*From March 1917 until November 1918 I directed the Section for Synthesis of Gas Warfare Agents at the Kaiser-Wilhelm-Institute for Chemistry in Berlin-Dahlem.*")[141] No one could accuse him with what in 1934 his successor in Freiburg, Hermann Staudinger, was charged during the consolidation phase of the Third Reich, namely "*that he had never supported his Fatherland with weapons or any other service.*" [142]

Wieland had put together a deftly assembled collegial network, and because of close contacts with important functionaries and representatives of the Third Reich in government, science, and industry he was almost untouchable. He maintained good collegial relations, for example, with Richard Kuhn, head of the "Organic Chemistry" section of the Reich Research Council, who from 1938 to 1945 was also president of the German Chemical Society and thus a central

figure in the distribution of research funds; with the "GeBeChem" ("*Ge*neral*be*vollmächtigter *Chem*ie": Plenipotentiary for special questions regarding chemical production in the Four-Year Plan) Carl Krauch, responsible among other things in the context of the Four-Year Plan for coordinating chemical weapons production; and with Johannes Heß (1877–1951), the Defense Economic Chief as well as Director of the Wacker Works in Burghausen.[143] In the event of conflict he would always have been in a position to activate this network on his behalf. Wieland himself avoided taking on official functions or assuming offices in disciplinary societies, associations, or government agencies. He could afford without any problem to follow this course, in contrast to younger colleagues who were anxious to further their careers: He had, after all, already reached the pinnacle of his vocation before the advent of the Third Reich, thus enjoying the great advantage of being part of a generation that had long since "arrived" professionally.

The Postwar Period (1945–1957)

Wieland's experiencing of liberation by the Americans and of the early postwar years was characterized by depression and resignation (Figure 28).

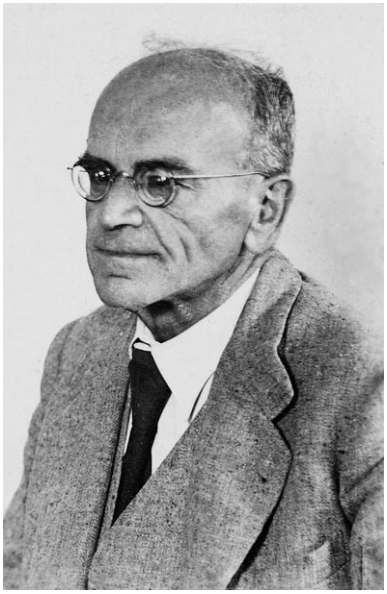


Figure 28. Heinrich Wieland's passport picture at the end of the war in 1946. He had lost 55 (English) pounds.

He and his family survived the war without any deaths to mourn, and in the end he was of course relieved by the transition from "the last century of the Third Reich" to the "merciful years of the Fourth":[144] but "*our only consolation comes from the fact that finally we are rid of Hitler and his criminal society for good.*"[145] Chemical activity was virtually out of the question at the University by the autumn of 1944 with destruction of the Chemical Institute, a scattering of his research group, and the political situation in general (Figure 29);

Figure 29. The Chemical Institute of the University of Munich after the bombing in 1944.

moreover, after the capitulation research was for the time being absolutely forbidden by the Americans. As one consequence of denazification measures, most of his co-workers and students saw their duties suspended. Studying chemistry on a regular basis at the University of Munich became possible again only after 1947. Wieland had in the meantime succeeded in requisitioning for the chemists a portion of the Zoological Institute, which had survived the bombings.

Wieland himself was driven out of his house in Starnberg by the American troops, and forced to accept restricted accommodations in a neighboring house with the family of his daughter, Eva Lynen. Never a member of the National Socialist Party or any Party organizations, he nonetheless was required for still unexplained reasons until February 1946 to spend his days under house arrest.[146] He was greatly offended by this: "*Für mich persönlich war die Befreiung durch die Amerikaner eine grosse und ununterbrochene Enttäuschung. Es ist mir bis heute noch nicht klar geworden, wodurch ich mir diese wenig erfreuliche Behandlung zugezogen habe.*" ("*For me personally, liberation by the Americans was a huge and continuous disappointment. Even today it has not become clear to me why I was subjected to this hardly pleasant treatment.*").[147]

"Persilscheine": Clean Bills of Health

During the Third Reich, Wieland profited from his collegial networks. When the war ended, many of his contemporaries, classified in the ccurse of the denazification measures as "belastet" ("tainted"), therefore turned to him—the "untainted" one—with requests for so-called "Persilscheine" (see below). Wieland increasingly found what he called these "delousing" efforts,[148] or "decontamination",[149] (his terms for denazification) to be both ludicrous and unjust, because the work was "*unfortunately carried out in a purely schematic way*".[150] With one exception he always responded generously to such requests, perhaps in part because he had close relatives who encountered problems with denazification in the immediate postwar period.[151] The various "eidesstattlichen Erklärungen" ("statutory declarations") he prepared, referred to popularly—with some justice—as "Persilscheine" [translator's note: "Persil" was among the most popular brands of laundry detergent; a "Schein" is merely a certificate] were formulated in very refined and quite differentiated ways, so one can easily discern from them who he in fact felt to be more "tainted" and who less. His letter of recommendation for the former Rector of the University of Munich, Walther Wüst (1901–1967; Figure 30), is especially interesting. In Wieland's declaration, a masterpiece of the subtle art of formulation, there appears not a word of the fact that the Rector had made continued study possible for some of Wieland's half-Jewish students through the issuance of "exceptional permits". This suggests that Wieland actually experienced real difficulty with Wüst in cases otherwise undocumented, and that in the end he came to regard the Rector's "cooperation" as merely a matter of course. This 1948 "recommendation" also makes clear that Wieland, ordinarily regarded as modest, was ac-

Figure 30. Rector Walther Wüst, surprisingly not dressed in his SS uniform while delivering a ceremonial speech in honor of Wieland's 65th birthday.

tually quite self-conscious, and when necessary exercised a firm command over the art of self-expression (in translation):

"*Regarding the political stance of the former Rector of the University of Munich, Prof. Dr. Walther Wüst, I can … make the following assertion: Prof. Wüst was named Rector by the Ministry exclusively on political grounds. Under normal circumstances, choice of him as Rector would never even have been discussed. From my own experience I can say that Prof. Wüst displayed no aggressive or intolerant posture with respect to those of different minds politically. I personally have never seen Dr. Wüst in an SS-uniform during the Nazi period because I strictly avoided participating in official functions. I also do not know whether he was an active recruiter for the Party or its organizations. To my knowledge Prof. Wüst never seriously rebelled in the academic interest of the University against orders from upper Party offices. However, I do not wish to refrain from noting here that he did intervene on behalf of the defendant in the case of Prof. K[arl] v. Frisch, who through a ministerial injunction based on the Nuremberg Laws was supposed to lose his position.*"[152]

Contemporary Witnesses

Wieland's legacy includes countless letters from co-workers and colleagues who, after the war, expressed their admiration and recognition for the upright position he was able to maintain under the Third Reich. In June 1945 his colleague Arnold Sommerfeld (1868–1951) wrote to him, "*Sie sind uns immer das Vorbild des aufrechten Mannes gewesen, der nie schlapp gemacht hat […] Ich muss gestehen, dass* ich *mehrmals im Leben schlapp geworden bin u. nicht die nötige Widerstandskraft aufgebracht habe*" ("*You were always for us a shining example of an upstanding man, one who never broke down […] I must confess that I have broken down several times in my life, and failed to muster the necessary powers of resistance*".)[153] Wieland's atypical behavior was a clear consequence of his liberal education, in which values like straightforwardness, honesty, and upholding ethical norms were always stressed. Other contributing factors were an unflinching, often obstinate character, with an ability to get his way, along with a proper measure of native shrewdness and tactical skill when dealing with a bureaucracy. Wieland's nature is presumably described quite aptly by two Jewish contemporaries. First Willstätter, who saw similarities between Wieland and Wilhelm Schlenk, mentioned above, and said:

"*Schlenk ist von ähnlichem Wesen wie Wieland: Er ist ein gescheiter, fleissiger und pflichttreuer Mann von einfacher, gerader Art.*"("*Schlenk is by nature similar to Wieland: he is a clever, diligent, and loyal man of a simple, straightforward sort.*")[154]

A second noteworthy letter stems from the biochemist Carl Neuberg (1877–1956), who was forced to emigrate to the United States because of his Jewish heritage, but regularly sent care packages to Wieland in the early postwar period, writing to him in 1947 (in translation):

"*If I ever come to Germany—even just as a visitor—my first steps would lead to you. Funny as it may sound, I actually have a certain nostalgia for you. I need to explain that: the great sympathy I have for you comes in no sense exclusively from admiration of your accomplishments. You were the first among the greats in our discipline who—unlike Emil Fischer, Wallach, and to some degree also Willstätter, for example—lacked the affectations of a pope. It would be unnatural for you not to have been self-assured, but you always had endless, sympathetic human modesty, and under an often coarse shell a hidden warm-heartedness.*"[155]

Wieland's stance during the Third Reich warrants great respect even fifty years after his death. It is remarkable that Wieland always gauged very realistically the extent of his room for negotiation. He had a sure sense of what he could allow himself, based on the "protective factors" cited above, without running incalculable risk to himself or his family. He used his latitude and his networks wisely and cleverly to the benefit of relatives, students, co-workers, and colleagues. His example shows how much, in the end, one individual, one human being, can achieve even under the most difficult of circumstances. Unlike most of his contemporaries, Wieland put politically difficult times behind him with dignity, not bending morally and making only minor concessions to the prevailing political circumstances. This integrity—in conjunction with his versatility as a chemist—permits him from an increasingly great historical distance still to stand out as an impressive personality, even if it does become necessary at a few points to deconstruct the "mythical" Wieland German chemistry so badly needed at war's end in the interest of presenting at least a few heroic figures. As expressed so aptly in the 13th scene of Bert Brecht's (1898–1956) drama "Life of Galileo" from the year 1938/39: "*Unhappy the land that has no heroes!*", to which Galileo responds: "*No. Unhappy the land that needs heroes.*"

I am deeply indebted as so often in the past to Prof. Dr. Dr. h.c. Fritz Eiden, Munich, und Prof. Dr. Otto Krätz, Starnberg. They invested a great deal of time in helpful discussions, suggestions, stimuli, additions, corrections, and perusal of the manuscript. I wish also to thank Friedrich Ihloff of Pullach for tracking down interesting archival material.

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[1] R. Pummerer, *Geist und Gestalt*, *Biograph. Beiträge z. Gesch. d. Bayer. Akad. d. Wissensch.*, *Vol. 2: Naturwissenschaften*, C. H. Beck, Munich, **1959**, pp. 192–209. This obituary is the only one that mentions Wieland's time at the Kaiser-Wilhelm-Institute in Dahlem. All the others exclude this phase of Wieland's life by simply omitting it; see: B. Witkop, *Angew. Chem.* **1977**, *89*, 575–589; *Angew. Chem. Int. Ed. Engl.* **1977**, *16*, 559–572; B. Witkop, *Med. Res. Rev.* **1992**, *12*, 195–274; B. Witkop, *Justus Liebigs Ann. Chem.* **1992**, I–XXXII; R. Huisgen, *Naturwissenschaften* **1957**, *44*, 317–318; C. Schöpf, *Angew. Chem.* **1959**, *71*, 1–5; R. Huisgen, *Angew. Chem.* **1959**, *71*, 5–6.

[2] U. Wieland, *Was ist eine Scheideanstalt und der Werdegang von Dr. Th. Wieland, Pforzheim, während drei Generationen (1871–2001)*, unpublished private manuscript in possession of the Wieland Company, Pforzheim, **2002**; A. Wankmüller, *Beitr. Württemberg. Apothekergesch.* **1973**, *10*, 42–46.

[3] Regarding platinum supplies, see: *Chem. Ind.* **1921**, *44*, 26. Before the First World War, about 90% of the world platinum reserves were in Russia; see: *Chem.-Ztg* **1938**, *62*, 639–640.

[4] This major research area for Wieland had its origins in 1912 with investigations he carried out on catalytic hydrogenations with palladium; see: H. Wieland, *Ber. Dtsch. Chem. Ges.* **1912**, *45*, 484–493.

[5] P. Diepgen, *Unvollendete. Vom Leben und Werken frühverstorbener Forscher und Ärzte aus anderthalb Jahrhunderten*, Thieme, Stuttgart, **1960**, pp. 99–102; B. Behrens, *Der Schmerz. Zs. z. Erforsch. d. Schmerzes u. seiner Bekämpfung*, **1929**, *2*, 83–85; E. Oppenheimer, *Klin. Wochenschr.* **1929**, *8*, 1286–1287.

[6] See: P. Dorsch, *Der Nobelpreisträger Heinrich Wieland und das Chemische Institut der Universität München (1925–1950)*, LMU Munich, Diss. phil., **2000**.

[7] Contract between C. H. Boehringer-Ingelheim and the pharmacologist and toxicologist Prof. Dr. Edwin Stanton Faust (Straßburg) and instructor Dr. Heinrich Wieland (Munich) from 4 February 1907, Boehringer Ingelheim corporate and family archives: "*Die genannten Herren werden aufgefordert von der Firma C. H. Boehringer Sohn, vierteljährlich aufzugeben, über was sie gearbeitet haben. Arbeiten die Herren über Morphium und Derivate oder über Cocain und Derivate, so gehen die Unkosten darauf ohne weiteres auf die Abteilung 'A'. Arbeiten die Herren über neue Sachen, so ist es einer jeweiligen Abmachung vorbehalten, ob diese Arbeiten auf die Firma C. H. Boehringer Sohn oder auf die Abteilung 'A' gehen. Herr Privatdozent Dr. Hch. Wieland erhält vom 1. Januar a.c. ab die Bestätigung, dass er 5% vom Reingewinn des Cocainbetriebes und zwar M 900,- garantiert, erhält. Diese M 900,- werden der Cocainfabrikation belastet.*" ("*The parties named are called upon to report quarterly to the firm of C. H. Boehringer Sohn regarding what they have worked on. If the parties work on morphine and its derivatives or cocaine and its derivatives, expenses are to be charged directly to Department 'A'. If the parties work on new things, then a decision will be reserved for a corresponding agreement as to whether the work will be charged to the firm of C. H. Boehringer Sohn or to Department 'A'. The instructor Dr. Hch. Wieland will receive from 1 January of the current year an acknowledgement that he is to receive 5% of the net profit from cocaine sales, with M 900,- guaranteed. This M 900,- will be charged to the cocaine-manufacture account.*") The fact that these terms remained in effect until Wieland's death is evident again from a memorandum preserved in the Boehringer Ingelheim company and family archives and written by Ernst Boehringer, in Constance, 18 May 1950, where it states: "*Ich stelle mit einigem Schrecken fest, dass Geheimrat Wieland vom Jahre 1946 ab praktisch keine Bezüge hatte, seit der Währungsreform DM 464,70 erhalten hat. Mir ist diese Feststellung ausserordentlich peinlich. … Herr Dir. Schmidt hat die Anregung gegeben, den Vertrag mit Geheimrat Wieland, der auf einen 2%igen Gewinn abgestellt ist, zu revidieren. Ich werde bei meinem jetzigen Besuch, das Einverständnis der Firma voraussetzend, Herrn Geheimrat Wieland mitteilen, dass wir beabsichtigen, ihm feste Bezüge oder einen gewissen Anteil vom Umsatz zu geben. … Für das Jahr 1949 schlage ich vor, einen Betrag von DM 12.000,- zur Auszahlung bringen zu lassen.*" ("*I find somewhat to my amazement that, from the year 1946 on, privy councilor Wieland has drawn essentially no salary, and since the currency reform has received DM 464,70. For me this discovery is extraordinarily distressing. … Herr Dir. Schmidt has suggested to revise the contract with privy councilor Wieland which is predicated on a 2% profit share. In the course of my current visit, assuming the firm agrees, I will notify privy councilor Wieland that we indend to provide him with a fixed salary or a certain percentage of sales. … For the year 1949 I suggest paying the sum of DM 12.000,-.*")

[8] *Ber. Dtsch. Chem. Ges.* A **1939**, *72*, 89.

[9] In the summer of 1924, Ernst Boehringer began work toward a doctorate in the field of alkaloid chemistry under Willstätter in Munich. After the latter's resignation he continued his research under Heinrich Wieland, completing it in 1926; see: *Arzneimittelforschung* **1965**, *15*, 191; *Deutsche Apoth.-Ztg.* **1961**, *101*, 1028ff.; *Arzneimittelforsch.* **1961**, *11*, 811; *Pharm. Ind.* **1956**, *18*, 353; *Pharm. Ztg.* **1961**, *106*, 1004.

[10] B. Witkop, *Naturwiss. Rundsch.* **1983**, *36*, 261–275.

[11] H. Balmer, *Gesnerus* **1974**, *31*, 249 (H. Wieland to M. Guggenheim, Starnberg, 29 March 1951).

[12] See ref. [11], p. 239 (M. Guggenheim to H. Wieland, Aeschi, 1 January 1954).

[13] See the list of Wieland's doctoral students in the Boehringer Ingelheim corporate and family archives and in the archives of Hoechst AG, Frankfurt, legacy of Michael Erlenbach.

[14] See: R. Kuhn, *Angew. Chem.* **1940**, *53*, 309–313.

[15] R. Willstätter, *Aus meinem Leben*, 2nd ed., Verlag Chemie, Weinheim, **1958**, p. 306.

[16] J. v. Ungern-Sternberg, W. v. Ungern-Sternberg, *Der Aufruf "An die Kulturwelt!"*, [Historische Mitteilungen Beih. 18], Franz Steiner, Stuttgart, **1996**.

[17] Central Bavarian State Archives, Munich (Bayerisches Hauptstaatsarchiv München; BayHStA), MK 44525; Historical Archives of the Technical University of Munich (Historisches Archiv der TU München; HATUM), personal records of Prof. Wieland.

[18] R. Huisgen, *Angew. Chem.* **1959**, *71*, 5–6.

[19] C. Schöpf, *Angew. Chem.* **1959**, *71*, 1–5.

[20] See: Minutes of board meetings from August 1917 through May 1926, Boehringer Ingelheim corporate and family archives.

[21] See: E. St. Faust, *Die tierischen Gifte*, Vieweg, Braunschweig, **1906**. Wieland's first publication on toad poisons makes reference to this book; see: *Ber. Dtsch. Chem. Ges.* **1913**, *46*, 3315–3327.

[22] *Deutsche Wirtschaftsgeschichte. Ein Jahrtausend im Überblick* (Ed.: M. North), C. H. Beck, Munich, **2005**, p. 301.

[23] H. Wieland to the Senate of the University of Munich, Munich, 10 May 1917: "*Durch Entschließung des K. Pr. Kriegsministeriums vom 18. März bin ich 'bis auf Weiteres' als Leiter der synthetisch-präparativen Abteilung an das für Kriegszwecke arbeitende Kaiser-Wilhelm-Institut für physik. Chemie*

in Dahlem berufen worden. Bei der mündlichen Vorbesprechung mit Geheimrat Haber, die am 4. Januar in Berlin stattfand, habe ich mich ausdrücklich nur auf Kriegsdauer verpflichtet. Es besteht die Möglichkeit, dass ich schon vorher entbehrlich werde." ("*Through a decision of the Royal Prussian Ministry of War on 18 March I am called upon to serve, 'until further notice', as head of the synthetic-preparative department at the Kaiser-Wilhelm-Institute for Physical Chemistry in Dahlem, which is engaged in wartime activities. In a preliminary verbal discussion with privy councilor Haber, held on 4 January in Berlin, I expressly committed myself only for the duration of the war. The possibility exists that I may become expendable even sooner.*"), Munich University Archives (Universitätsarchiv München, UAM) OC-IX-268.

[24] See: M. Szöllösi-Janze, *Fritz Haber (1868–1934). Eine Biographie*, C. H. Beck, Munich, **1998**, p. 329.

[25] O. Hahn, *Mein Leben*, Bruckmann, Munich, **1968**, p. 121.

[26] L. Burchardt, *Tradition* **1970**, *15*, 169–196.

[27] F. Haber, *Chem. Ind.* **1920**, *43*, 350–352.

[28] F. Flury, *Gasschutz Luftschutz* **1937**, *7*, 57–63, esp. 58.

[29] See: HATUM, personal papers of Prof. Wieland. It becomes apparent here that Wieland, during his time as an associate ("ausserordentlicher") professor at the University of Munich, was formally suspended to permit him to attend to his official business in Dahlem, while as full ("ordentlicher") professor at the TH Munich he was allowed to fulfill his Dahlem responsibilities only as a secondary job "on the side". Wieland notified the rectorate at the TH München regularly, in writing and in advance, on which days of the month he would be "absent for military service". Wieland's civilian income as a professor was to be offset by his Dahlem earnings, which would be paid by the Kaiser-Wilhelm-Institute und the Prussian Ministry of War. After lengthy negotiations, Wieland was eventually able to ward off any reduction in his Munich earnings.

[30] See: M. Szöllösi-Janze (see note [24]), p. 349. Based on this source, Division D was presumably established toward the end of 1916.

[31] See: Hoechst corporate archives, Frankfurt, Wk 020.

[32] See: D. Martinetz, *Der Gaskrieg 1914/18. Entwicklung, Herstellung und Einsatz chemischer Kampfstoffe*, Bernard & Graefe, Bonn, **1996**, pp. 34–35.

[33] See: O. Muntsch, *Gasschutz Luftschutz* **1937**, 7, 129; *Süddeutsche Apothekerztg.* **1947**, *87*, 120f.

[34] Like his brother Heinrich, Hermann Wieland was honored during the First World War. In 1917 he was awarded the Iron Cross, Second Class, and in 1918 the badge for being wounded; see: the Freiburg University archives (Universitätsarchiv Freiburg) B 24/4085.

[35] See: F. Flury, H. Wieland, *Z. Gesamte Exp. Med.* **1921**, *13*, 367–483; F. Flury, H. Wieland, *Z. Gesamte Exp. Med.* **1921**, *13*, 523–575.

[36] H. Wieland to J. Wieland, Berlin, 14 July 1917, Archives of the Deutsches Museum, Munich (Archiv Deutsches Museum München; ADMM), NL 57.

[37] J. Meyer, *Der Gaskampf und die chemischen Kampfstoffe*, 2nd ed., Hirzel, Leipzig, **1926**, pp. 405–432.

[38] See: note [36].

[39] Blue-cross weapons are nose and throat irritants, green-cross weapons are lung toxins causing suffocation, and yellow-cross weapons are corrosive skin toxins.

[40] H. Wieland, W. Rheinheimer, *Justus Liebigs Ann. Chem.* **1921**, *423*, 1–38; H. Wieland, A. Kulenkampff, A. Bloemer, H. Wesche, *Justus Liebigs Ann. Chem.* **1923**, *431*, 30–40.

[41] G. B. Kauffman, *CHEMTECH* **1989**, *19*, 602–607.

[42] R. Hanslian, *Der chemische Krieg*, 2nd ed., Mittler, Berlin, **1927**, p. 58.

[43] H. Wieland to J. Wieland, Berlin, 13 July 1917, ADMM, NL 57.

[44] R. Willstätter, *Aus meinem Leben*, Verlag Chemie, Weinheim, **1958**, p. 441.

[45] E. Wedekind, *Chem.-Ztg.* **1918**, *42*, 217.

[46] H. Wieland to the Rectorate of the TH Munich, 14 September 1918, HATUM, personal papers of Prof. Wieland.

[47] After Hermann Wieland's early death, Wieland's most important contact in all matters pharmacological and toxicological was the former's one-time superior in Freiburg, Walther Straub, who was called to Munich shortly before Wieland was. Regarding Straub, see: H. Gremels, *Naunyn-Schmiedebergs Arch. Exp. Pathol. Pharmakol.* **1947**, *204*, 1–12.

[48] H. Wieland to H. Wieland, Königsberg, 3 August 1925, ADMM, NL 57.

[49] Minutes of the board meetings (see note [20]) in the Boehringer Ingelheim corporate archives; for 25/26 March 1920 appears: "*… auf Vorschlag von Herrn Prof. Wieland soll solange die Konjunkturverhältnisse es gestatten, jährlich der Betrag von M 6.000 für Studierende der Chemie, die an dem von Herrn Prof. Wieland geleiteten Institut arbeiten, ausgeworfen werden. Diese Summe wird zur freien Verfügung von Herrn Prof. Wieland gestellt mit der Maßgabe, daß er sie zur Unterstützung geeigneter Studierender verwenden wird …*". ("*… at the suggestion of Prof. Wieland, so long as permitted by the economic situation, the sum of M 6.000 will be paid out annually to chemistry students working at the Institute led by Herrn Prof. Wieland. This sum will be put at the free disposal of Herrn Prof. Wieland with the stipulation that he will use it for supporting suitable students …*".) Out of gratitude for this financial support, Heinrich Wieland arranged for Albert Boehringer to receive an honorary doctorate from the University of Freiburg on the occasion of his 60th birthday; see: *Chem. Ind.* **1921**, *44*, 356. This honorary doctorate is referred to in a letter from R. Willstätter to H. Wieland, Munich, 20 July 1921, ADMM, NL 57, where it states: "*Die Absicht Ihrer Fakultät, Herrn Böhringer anlässlich seines 60. Geburtstages zum Ehrendoktor zu ernennen, ist zu begrüssen. Ich bin dagegen, den Dr. h.c. für finanzielle Leistungen zu verleihen. Aber dieses Bedenken kommt bei Herrn Böhringer nicht in Frage. Denn er ist ein Mann von Verdienst, er hat als Industrieller Bedeutung und Originalität, nicht nur durch seine grossen Leistungen auf dem Gebiet der Alkaloidfabrikation, vielleicht noch mehr durch die Begründung der Milchsäureindustrie. Auch muss man ihm dafür dankbar sein, dass er Ihnen in den Jahren, ehe Sie an die Spitze eines Instituts getreten waren, die Ausführung Ihrer Arbeiten über physiologisch wichtige Stoffe erleichtert hat.*" ("*The plan for your faculty to honor Herrn Böhringer with an honorary doctorate on the occasion of his 60th birthday is a welcome one. I am opposed to awarding honorary doctorates for financial benefits. But this reservation is not applicable to Herrn Böhringer. Because he is a man of merit, he is an industrialist of significance and originality, not only from his great achievements in the field of alkaloid production: perhaps even more for his establishment of the lactic acid industry. One must also be grateful to him for the fact that, in the years before you ascended to the pinnacle of your Institute, he facilitated your work on physiologically important substances.*")

[50] *100 Jahre Boehringer Ingelheim 1885–1985*, Boehringer Ingelheim, Ingelheim, **1985**, p. 20.

[51] See note [44], p. 347.

[52] Laudanon contained 50% morphine, 30% narcotine, 5% codeine, 10% papaverine, 2.5% thebaine, and 2.5%

narceine. Other Boehringer preparations from the opioide group included the cough medicine Codyl, introduced in 1927, und Acedicon, introduced in 1929.

[53] See F. Eiden, *Kultur & Technik. Das Magazin aus dem Deutschen Museum*, **2004**, *27*, pp. 50–56.

[54] See: Minutes of the board of directors meeting at Merck Darmstadt on 27 December 1928: "*Herr Schumacher berichtet, dass Boehringer-Ingelheim gerüchtweise an neuen Verbindungen des Morphins arbeiten, die zunächst nicht unter das Opiumgesetz fallen würden.*" ("*Herr Schumacher reported that, according to rumor, Boehringer-Ingelheim is working on new morphine compounds that at present would not fall under the opium law.*"), Merck corporate archives, Darmstadt E3/1.

[55] H. Wieland, *Naunyn-Schmiedebergs Arch. Exp. Pathol. Pharmakol.* **1922**, *92*, 96.

[56] C. J. Gauss; H. Wieland, *Klin. Wochenschr.* **1923**, *2*, 113 – 162.

[57] *Die Geschichte der Dräger-Narkoseapparate*, Drägerwerk AG, Hamburg, **1996**, p. 30; L. Brandt, *Illustrierte Geschichte der Anästhesie*, Wissenschaftliche Verlagsgesellschaft, Stuttgart, **1997**, pp. 132 – 136.

[58] F. Eiden, *Kultur & Technik. Das Magazin aus dem Deutschen Museum*, **2003**, *26*, pp. 24–30; R. Huisgen, *Angew. Chem.* **1950**, *62*, 527 – 534.

[59] C. Boehringer, *Ein Menschenalter kolonialer Erfahrungen auf der Insel Ceylon*, Dachsel, Leipzig, **1930**.

[60] F. Chemnitius, *Chem.-Ztg.* **1926**, *50*, 845 – 846.

[61] F. Litten, *Der Rücktritt Richard Willstätters 1924/25 und seine Hintergründe. Ein Münchener Universitätsskandal?* (= *Algorismus*, Heft 32), Institut für Geschichte der Naturwissenschaften, Munich, **1999**.

[62] H. Wieland to R. Willstätter, Freiburg, 30 June 1924, cited according to note [44], p. 348. It is also conceivable, however, that Wieland intentionally played down the significance of anti-Semitism in this letter to persuade Willstätter to remain. He had apparently told his father about Willstätter's plans to resign and the reasons behind them, whereupon the latter responded: "*Die Angelegenheit Willstätter bringt neue Bilder an den Horizont; ich habe aber … gewettet, daß er bleiben wird, wenn und nachdem er ein Vertrauensvotum erhalten hat. Das kommt von dem blöden Antisemitismus, der politisch ausartet.*" ("*The Willstätter affair brings new pictures to the horizon; but I have … wagered that he will stay, if and after he receives a vote of confidence. This comes from the stupid anti-Semitism, that is getting out of hand politically.*"), see Th. Wieland to H. Wieland, Pforzheim, 1 July 1924, ADMM NL 57. The increasingly political dimensions of anti-Semitism were thus indeed touched upon in discussions within the Wieland family.

[63] Regarding Wieland's theory of biological oxidation see note [4]; C. Oppenheimer, *Chem.-Ztg.* **1926**, *50*, 991 – 992; C. Oppenheimer, *Chem.-Ztg.* **1928**, *52*, 709 – 711; H. Wieland in *Handbuch der Biochemie des Menschen und der Tiere*, *Vol. 2* (Ed.: C. Oppenheimer), 2nd ed., Fischer, Jena, **1925**, pp. 252 – 272; H. Wieland, *Über den Verlauf der Oxydationsvorgänge*, Enke, Stuttgart, **1933**; P. Werner, *Otto Warburgs Beitrag zur Atmungstheorie: das Problem der Sauerstoffaktivierung*, Basilisken-Presse, Marburg, **1996**.

[64] W. Franke, *Naturwissenschaften* **1942**, *30*, 342 – 351.

[65] R. E. Kohler, *From Medical Chemistry to Biochemistry*, Cambridge University Press, Cambridge, **1982**, p. 36; *Ein Genie irrt seltener. Otto Heinrich Warburg. Ein Lebensbild in Dokumenten* (Ed.: P. Werner), Akademie Verlag, Berlin, **1991**; U. Deichmann, *Flüchten, Mitmachen, Vergessen: Chemiker und Biochemiker in der NS-Zeit*, Wiley-VCH, Weinheim, **2001**, p. 276.

[66] Berthelot celebration, Paris, from 23 to 26 October 1927, *Chem.-Ztg.* **1927**, *51*, 886.

[67] F. Schmaltz, *Kampfstoff-Forschung im Nationalsozialismus*, Wallstein, Göttingen, **2005**, p. 50; M. Szöllösi-Janze (as in note [24]), p. 466.

[68] H. Wieland, F. J. Weil, *Hoppe-Seyler's Z. Physiol. Chem.* **1912**, *80*, 287 – 297.

[69] H. Behringer, *Die Chemie* (= *Angew. Chemie, N.F.*) **1943**, 56, 83 – 90; 105–108; H. Wieland, Sitzungsber. math.-phys. Kl. Bayer. Akad. Wissensch. 1920, Munich, **1921**, 329–343.

[70] DRP 176945. The active ingredient was a molecular compound of bile acids with protein, which was supposed to break down into its components in the intestine.

[71] DRP 171485. The active ingredient was a molecular compound of cholic acid and mercury oxide.

[72] Regarding specialization of the Riedel company on bile acid preparations and thus on the processing of animal raw materials, see: H. Hörlein, *Chem. Ind.* **1952**, *4*, 731 – 736, esp. 732.

[73] *Riedel's Berichte u. Riedel's Mentor* **1908**, *52*, XXXVII-XLI: "*Durch die Einführung der Cholsäure bezw. einiger ihrer Verbindungen … in die Therapie ist das Studium dieser Substanz dem Vordergrund des physiologischen Interesses wieder näher gebracht …*". ("*Through introduction of cholic acid and some of its compounds … into therapy, study of this substance is brought more nearly into the foreground of physiological interest …*").

[74] Riedel to Merck regarding new procedures: Prof. Wieland, Berlin, 13 July 1916, Merck Darmstadt corporate archives K1/262.

[75] H. Wieland, H. Sorge, *Hoppe-Seyler's Z. Physiol. Chem.* **1916**, *97*, 1 – 26.

[76] See note [74].

[77] DRP 317211 from 11 February 1916.

[78] See note [74].

[79] Merck to Boehringer Mannheim, Gehe, Knoll, Riedel, Darmstadt, 17 July 1916, Merck Darmstadt corporate archives K1/262.

[80] *100 Jahre im Dienst der Gesundheit 1886–1986*, Knoll AG, Ludwigshafen/Rh., **1986**, pp. 76 f.

[81] See note [20], p. 62, meeting of 24/25 September 1923 in Freudenstadt.

[82] H. Wieland in *Les Prix Nobel en 1928/Les Conférences Nobel*, Stockholm, **1929**, 1 – 12, esp. 3. The Nobel Lecture has also been published: H. Wieland, *Z. Angew. Chem.* **1929**, *42*, 421 – 436.

[83] L. F. Fieser, M. Fieser, *Steroide*, Verlag Chemie, Weinheim, **1961**, p. 58.

[84] K. Dimroth, *Chem. Unserer Zeit* **1976**, *10*, 175 – 179.

[85] H. Bußmann, *Stiefmütter der Alma Mater? 90 Jahre Frauenstudium in Bayern – am Beispiel der Universität München*, Kunstmann, Munich, **1993**, pp. 136 f.

[86] P. Karlson, *Naturwiss. Rundsch.* **1982**, *35*, 484 – 486.

[87] W. Graubner, G. Peters, *Lobelin und Lobeliaalkaloide (Handbuch der experimentellen Pharmakologie*, *Vol. 11*), Springer, Berlin, **1955**, p. 48; H. Stenzl, *Pharm. Zentralhalle* **1924**, 65, 730 – 731; F. Kalthoff, *Sueddtsch. Apoth.-Ztg.* **1936**, *76*, 985 – 989.

[88] H. Schadewaldt, F.-J. Morich, *100 Jahre Pharmakologie bei Bayer 1890–1990*, Bayer AG, Leverkusen, **1990**, p. 21.

[89] H. Dreser, *Arch. Exp. Pathol. Pharmakol.* **1890**, *26*, 237 – 266.

[90] H. Wieland, *Arch. Exp. Pathol. Pharmakol.* **1915**, *79*, 95 – 117.

[91] DRP 336335 from 5 April 1914; DRP 340116 from 3 September 1914; DRP 362380 from 22 September 1916.

[92] H. Wieland, *Ber. Dtsch. Chem. Ges.* **1921**, *54*, 1784 – 1788.

[93] H. Wieland, *Z. Kinderheilkd.* **1921**, *28*, 218 – 242.

[94] H. Stenzl, *Z. Berg-Huetten Salinenwes. Preuss. Staate* **1923**, *71*, 182 – 183; [Anon.], *Glückauf* **1924**, *60*, 182 – 183; Dr. Dollinger, *GWF Gas-Wasserfach* **1926**, *69*, 561 – 566.

[95] *Draeger-Heft* No. 107, January **1926**; *Draeger-Heft* No. 108, March **1926**; Draeger-Heft No. 133, December **1928**.
[96] I. Kästner, S. Hahn, **1999**. *Z. Sozialgesch. 20. u. 21. Jahrhunderts* **1994**, *9*, 42 – 50.
[97] See: brochure "Leben bedrohende Zustände": *Lobelin "Ingelheim"*, C. H. Boehringer Sohn, Nieder-Ingelheim, **1935**.
[98] H. Wieland, I. Drishaus, *Justus Liebigs Ann. Chem.* **1929**, *473*, 102 – 118.
[99] H. Wieland, O. Dragendorff, *Justus Liebigs Ann. Chem.* **1929**, *473*, 83 – 118.
[100] G. Scheuing, L. Winterhalder, *Justus Liebigs Ann. Chem.* **1929**, *473*, 126 – 136.
[101] F. Kalthoff, *Sueddtsch. Apoth.-Ztg.* **1936**, *76*, 985 – 989.
[102] *Sueddtsch. Apoth.-Ztg.* **1937**, *77*, 4. In 1938 the first building devoted exclusively to research at Boehringer Ingelheim was designated as the "Heinrich-Wieland-Bau" out of gratitude for Heinrich Wieland's contribution to the chemical synthesis of Lobelin.
[103] K. Fürst, *Boehringer-Zeitung* **1944**, No. 2, 5.
[104] P. Werner, *Dahlemer Archivgespräche* **1997**, *2*, 140 – 157.
[105] H. Wieland, R. Purrmann, *Justus Liebigs Ann. Chem.* **1940**, *544*, 163 – 190; H. Wieland, A. Tartter, R. Purrmann, *Justus Liebigs Ann. Chem.* **1940**, *545*, 209 – 219; R. Purrmann, *Die Chemie (= Angew. Chem. N. F.)* **1943**, *56*, 253 – 258.
[106] F. Uekoetter, *The Green and the Brown. A History of Conservation in Nazi Germany*, University Press, Cambridge **2006**, p. 56; BayHStA Mk 40393.
[107] BayHStA Mk 40393.
[108] H. Wieland, W. Konz, H. Mittasch, *Justus Liebigs Ann. Chem.* **1934**, *513*, 1 – 25.
[109] Dr. Reinicke to the Ministry of Culture, Munich, 21 November 1933, BayHStA Mk 40393. The original text of the passage is as follows: "*In der Zeit vom 3. bis 13. April 1934 wurden im Bezirk Freiburg i. Br. 27000 Kröten gefangen, die das für die Untersuchung erforderliche Sekret lieferten. Die Entnahme erfolgte in der Weise, dass die großen, hinter den Augen sitzenden Drüsen der Tiere mit breitbackigen kräftigen Pinzetten ausgedrückt wurden. Der herausspritzende Strahl wurde auf Emailledeckeln, die mit einer dünnen Watteschicht überbunden waren, aufgefangen. Bei der Ausführung dieser Operation muss eine Schutzbrille getragen werden, da das Sekret die Augen sehr stark reizt. … Nach der Entnahme des Sekrets wurden die Kröten jeweils wieder am Fangort in Freiheit gesetzt. Die Tiere erleiden durch den Entzug der Giftstoffe keinen Schaden.*"
[110] *Vitamine als Mythos. Dokumente zur Geschichte der Vitaminforschung* (Ed.: P. Werner), Akademie Verlag, Berlin, **1998**.
[111] BayHStA Mk 44525.
[112] U. Deichmann in *Geschichte der Kaiser-Wilhelm-Gesellschaft im Nationalsozialismus. Bestandsaufnahme und Perspektiven der Forschung*, *Vol. 1* (Ed.: D. Kaufmann), Wallstein, Göttingen, **2000**, pp. 231 – 257.
[113] Bayer Leverkusen corporate archives 19A.340.2, contract of 25 November 1940.
[114] A. Albert, *Fortschr. Chem. Org. Naturst.* **1954**, *11*, 350 – 403; W. Sneader, *Drug Discovery. A History*, Wiley, Chichester, **2005**, pp. 234 – 235.
[115] *Die Universität München im Dritten Reich. Aufsätze Teil 1* (Ed.: E. Kraus), Utz, Munich **2006**; M. Grüttner in *Geschichte der Kaiser-Wilhelm-Gesellschaft*, *Vol. 2* (Ed.: D. Kaufmann), Wallstein, Göttingen, **2000**, pp. 557 – 585.
[116] M. Schreiber, *Walther Wüst – Dekan und Rektor der Universität München 1935–1945*, Utz, Munich, **2007**.
[117] F. Litten, Gesellschaft Deutscher Chemiker, Fachgruppe Geschichte der Chemie, Mitteilungen No. 14, **1998**, 78 – 109, esp. p. 86.
[118] G. Freise, H. Hamm-Brücher, *Chem. Unserer Zeit* **1977**, *11*, 143 – 149.
[119] *Gasschutz Luftschutz* **1937**, *7*, 282. In the catalogue of the University of Munich the corresponding events, presented by university teachers like Schittenhelm, Anton, Hahn, Klages, and Thaler, are listed under the rubric "Military Sciences" ("Wehrwissenschaften").
[120] *Deutsche Wissenschaft, Erziehung und Volksbildung* **1938**, *4*, 209; *Der deutsche Chemiker* **1938**, *4*, 33 (= Suppl. to *Angew. Chem.* No. 33 from 20 August 1938).
[121] H. Müller and P. Schmitt to Counselor of State Böpple, Munich, 17 May 1935, BayHStA Mk 44525. The original text of the passage is as follows: "*Die gehorsamst unterzeichneten nationalsozialistischen Chemiker wollen hiermit auf einen schweren Misstand an der Universität aufmerksam machen, der aus der Zeit weiter besteht, in der Eigennutz vor Gemeinnutz ging. In vielen Hochschulinstituten z. B. im chemischen Laboratorium der Universität, bezieht der Direktor die Kolleggelder für praktische Übungen, die er niemals selbst abhält, um die er sich nie im geringsten kümmert, in denen er überhaupt niemals zu sehen ist. Es ist einzuräumen, dass ein Teil der Kolleggelder den beteiligten a.o. Professoren abgetreten wird, die ihrerseits häufig den Unterricht den Assistenten überlassen. Die Assistentengehälter im genannten Laboratorium werden in kleine Bruchteile zerlegt, damit der Direktor zu seiner völligen Entlastung zahlreiche (unwürdig bezahlte) Hilfskräfte anstellen kann. Im gegebenen Fall ist der Direktor, Hr. Prof. Wieland, ein tüchtiger Gelehrter, aber er macht sich durch vieles Nörgeln gegen unsere Regierung und das III. Reich bei uns unmöglich. Auch ist er mehr als Doppelverdiener, da er ausser seinem Gehalt ein Einkommen von der Chem. Fabrik Boehringer a. Rh. bezieht.*"
[122] Note [117], p. 88.
[123] BayHStA Mk 69824.
[124] Note [117], p. 81.
[125] D. Nachmansohn, R. Schmid, *Die große Ära der Wissenschaft in Deutschland 1900 bis 1933. Jüdische und nichtjüdische Pioniere in der Atomphysik, Chemie und Biochemie*, Wissenschaftliche Verlagsgesellschaft, Stuttgart, **1988**, p. 216.
[126] See official declaration on the part of Heinrich Wieland, Munich, 20 May 1947, BayStA, Tribunal Record 693 (Johannes Heß). To this is attached an undated newspaper clipping that appeared in the NZ in honor of Wieland's 70th birthday in which it states: "*Er ließ in seinem Institut zeitweise einige Dutzend 'Nichtarier' studieren und setzte sich verschiedentlich unter Lebensgefahr bei der Gestapo für ihr Verbleiben und ihre Existenz ein.*" ("*At times he allowed several dozen 'non-Aryans' to study at his Institute, and on several occasions put himself in mortal danger from the Gestapo in the interest of their remaining, and their very existence.*").
[127] B. Witkop, *Ann.* **1992**, XX.
[128] G. Freise in *Hochverrat? Die "Weiße Rose" und ihr Umfeld* (Ed.: R. Lill), Universitätsverlag, Constance, **1993**, pp. 135 – 157; M.-L. Schultze-Jahn, "*… und ihr Geist lebt trotzdem weiter!". Widerstand im Zeichen der Weißen Rose*, Metropol, Berlin, **2003**; *Hans Leipelt und Marie-Luise Jahn – Studentischer Widerstand in der Zeit des Nationalsozialismus am Chemischen Staatslaboratorium der Universität München* (Ed.: H.-U. Wagner), Garnies, Haar/Munich, **2003**.
[129] T. T. Tidwell, *Angew. Chem.* **2001**, *113*, 343 – 349; H. Wieland, *Bayer. Akad. Wiss. Jahrb.* **1944–1948**, p. 251.
[130] U. Deichmann, *Flüchten, Mitmachen, Vergessen. Chemiker und Biochemiker in der NS-Zeit*, Wiley-VCH, Weinheim, **2001**, p. 167.

[131] See: Decree of the Führer and Reich Chancellor regarding endowment of a German National Prize for the Arts and Sciences, 30 January 1937, *RGBl.***1937**, *I*, 305. Hitler's ban was a reaction to the successful 1936 awarding of the 1935 Nobel Peace Prize to the left-liberal pacifist Carl von Ossietzky, imprisoned in the Papenburg-Esterwegen concentration camp.
[132] *Völkischer Beobachter* No. 156 of 5 June 1942.
[133] F. Mietzsch, *Angew. Chem.* **1952**, *64*, 294–295.
[134] Wieland to the administration of the State Scientific Collection, Munich, 23 February 1938, UAM OC-IX-268.
[135] H. Wieland to the Ministry for Instruction, Munich, 14 September 1944, BayHStA Mk 69824.
[136] H. Wieland to the Deanship of the Scientific Faculty of the University of Munich, Munich, 3 February 1940, 8 February 1940, 4 November 1940, UAM OC-IX-168.
[137] BayHStA Mk 69824.
[138] Research grant to Dr. Hans Behringer, Munich, 4 May 1942, UAM OC-IX-268.
[139] H. Behringer, *Justus Liebigs Ann. Chem.* **1949**, *564*, 219–234.
[140] I. Pieroth, *Penicillinherstellung. Von den Anfängen bis zur Großproduktion*, Wissenschaftliche Verlagsgesellschaft, Stuttgart, **1992**, pp. 142, 146; Bundesarchiv Berlin R 26 III 6, 17, 21, 169, 438; Bundesarchiv Koblenz 15687.
[141] "Card Catalogue of All Teachers in Higher Education" ("Kartei aller Hochschullehrer") with reports of the universities for creating a file in compliance with the circular of 13 December 1934 from the RMWEuV, Bundesarchiv Berlin R 4901/13280. Interestingly, Wieland retouched his entry in a questionnaire from the US Military Government of Germany, where he responded to the query of whether he had served in the military with "none"; see: BayHStA Mk 44525.
[142] R. Safranski, *Ein Meister aus Deutschland. Heidegger und seine Zeit*, 5th ed., Fischer, Frankfurt, **2006**, p. 308.
[143] J. Hess, who had problems with denazification in the postwar period due to his position as director of defense economics, was provided by Wieland with a very friendly "Persilschein"; see: BayStA, Spruchkammerakte München (Munich Trial Court Dossier) 693 (Johannes Hess).
[144] H. Wieland to R. Schwarz, Munich, 8 January 1947, cited in B. Witkop, *Liebigs Ann. Chem.* **1992**, XVII.
[145] H. Wieland to H. Reissenegger, Munich, 15 October 1946, UAM Inst-I-98. The original text of the passage is as follows: "*Die einzige Befriedigung, die wir haben, besteht darin, dass wir Hitler und seine Verbrechergesellschaft nun endgültig losgeworden sind.*"
[146] H. Wieland to Dr. Knauer, Starnberg, 15 October 1946, UAM Inst-I-98; H. Wieland to Cl. Schöpf, Starnberg, 30 January 1946, UAM Inst-I-98.
[147] H. Wieland to L. Fieser, Starnberg, 30 January 1946, UAM Inst-I-98.
[148] H. Wieland to G. Hesse, Starnberg, 16 January 1946, UAM Inst-I-98.
[149] H. Wieland to Prof. Noack, 5 June 1946, UAM Inst-I-98.
[150] H. Wieland to Dr. Rosenfeld, Munich, 24 April 1947, UAM Inst-I-98.
[151] This applies, for example to Wieland's oldest son Wolfgang, see: BayStA, Spruchkammerakte 4658 (Wolfgang Wieland); to Wieland's brother Eberhard in Pforzheim; and to the second generation of owners of Boehringer Ingelheim. See: trial court dossiers in the Koblenz Central State Archives (Landeshauptarchiv Koblenz) 54013 and 134771 (Dr. Ernst Boehringer), 54012 and 134772 (Albert Boehringer), 54038 and 134736 (Julius Liebrecht).
[152] H. Wieland to the General Petitioner (Generalkläger) at the Office of Annulment (Kassationshof), Munich, 6 September 1948, BayStA, trial court dossier 2015 (Walther Wüst). The original text of the passage is as follows: "*Über die politische Haltung des früheren Rektors der Universität München, Prof. Dr. Walther Wüst, kann ich … folgende Aussagen machen: Prof. Wüst wurde ausschließlich aus politischen Gründen vom Ministerium zum Rektor ernannt. Unter normalen Verhältnissen wäre seine Wahl zum Rektor überhaupt nicht diskutiert worden. Aus eigener Erfahrung kann ich sagen, dass Prof. Wüst gegenüber politisch Andersdenkenden keine aggressive oder intolerante Haltung eingenommen hat. Ich selbst habe Dr. Wüst nie in SS-Uniform gesehen, da ich die Beteiligung an offiziellen Veranstaltungen während der Nazizeit grundsätzlich vermieden habe. Es ist mir auch nicht bekannt, ob er für die Partei oder ihre Gliederungen aktiv geworben hat. Gegen die Anordnungen der oberen Parteidienststellen hat sich Prof. Wüst zu Gunsten der wissenschaftlichen Interessen der Universität meines Wissens niemals ernstlich aufgelehnt. Ich möchte aber nicht unterlassen, hier anzuführen, dass er im Falle von Prof. K[arl] v. Frisch, der durch ministerielle Verfügung auf Grund der Nürnberger Gesetze seines Amtes enthoben werden sollte, für den Betroffenen eingetreten ist.*"
[153] A. Sommerfeld to H. Wieland, Munich, 27 June 1945, ADMM NL 57.
[154] R. Willstätter to privy counsellor Wende in the Prussian Ministry for Science, Art, and Adult Education in Berlin, Munich, 28 November 1920, Federal Archives (Bundesarchiv) Berlin DS (formerly BDC), Film A 0062, 1380f., folio 296. The communication is in the personal papers of Wilhelm Schlenk.
[155] C. Neuberg to H. Wieland, New York, 25 September 1947, UAM Inst-I-98. A carbon copy of the communication is in the Neuberg Papers of the American Philosophical Society Library, Philadelphia. The original text of the passage is as follows: "*Sollte ich je nach Deutschland kommen – und nur als Besucher – so wäre mein erster Weg zu Ihnen. So komisch es klingt, ich habe direkt eine gewisse Sehnsucht nach Ihnen. Das muss ich Ihnen erklären: Die grosse Sympathie, die ich für Sie habe, resortiert keineswegs allein aus der Bewunderung für Ihre Leistungen. Sie waren der erste unserer grossen Fachgenossen, der nicht wie etwa Emil Fischer, Wallach und bis zu einem gewissen Grade auch Willstätter, die Allüren eines Papstes hatte. Es wäre unnatürlich, wenn Sie nicht selbstbewusst gewesen wären, aber Sie hatten stets eine unendlich sympathische menschliche Bescheidenheit und unter einer manchmal etwas rauen Schale verborgene Warmherzigkeit.*"

