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# Flüchten, Mitmachen, Vergessen

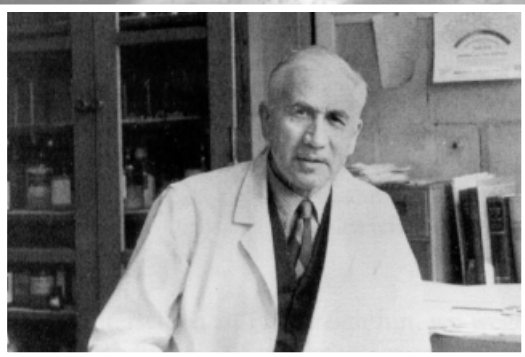
## Chemiker und Biochemiker in der NS-Zeit*

Fritz Haber

...My decision to request my resignation comes from the contrasts between the tradition with regard to research, in which I have lived so far, and to the altered views which you, Herr Minister, and your ministry, represent as champions of the huge current national movement. My tradition in my scientific position requires that in the selection of workers I consider only their technical abilities and their character without asking about their racial origins.
Fritz Haber, April 30, 1933

...We also recognize the overwhelming contribution to the fundamentals of modern chemistry that can be attributed to the Western civilizations that have given the world a Scheele and a Berzelius, a Lavoisier and a Pasteur, an Avogadro and a Cannizarro, a Liebig and a Wöhler. To ensure the survival of their blood, and the further development of this culture the peoples of Europe are under arms, just as those of the old east Asian cultural area are for theirs. We think of the men in whose hands our combined fates lie, the Duce, Tenno, and our Führer, three times Sieg Heil.
Richard Kuhn, December 5, 1942

Richard Kuhn



Otto Meyerhof

Forgiveness is not my responsibility, but that of a higher power. Our duty is to keep the memory of this horror alive and thus to prevent future generations from living through it again. That is, I think the most important responsibility of German researchers and educators today.
Otto Meyerhof, April 28, 1947

* The book *Flüchten, Mitmachen, Vergessen: Chemiker und Biochemiker in der NS-Zeit*, is published by Wiley-VCH, its title can be translated as Flee, Collaborate, Forget: Chemists and Biochemists in the National Socialist Era.

# Chemists and Biochemists during the National Socialist Era

**Ute Deichmann***

Chemistry and biochemistry in Germany was notably affected by the dismissal and emigration of Jewish scientists. The expulsion of Jewish scientists aided to significantly reduce the international regard for German science, particularly in biochemistry, physical chemistry, and quantum chemistry, after 1945. In most cases remaining scientists adjusted quickly after 1933 to the new political circumstances, with a few exceptions. A number of them even actively supported the politics of National Socialism. This fact as well as the common stance to forget the 12 years of National Socialist rule complicated the exchange of international scientific knowledge after 1945 and delayed affiliation of the weakened fields of research to the level of international research.

**Keywords:** antisemitism · emigration · history of chemistry · science policy

## Introduction

In 1938 Arthur Schleede, Professor of Inorganic Chemistry at the Technische Hochschule in Berlin, a member of the NSDAP since 1933, complained in a letter to the president of the Deutsche Chemische Gesellschaft (the German Chemical Society), Richard Kuhn, that five years after the National Socialists had come to power it was still possible for a number of Jewish chemists to appear as co-editors of German scientific journals:

> "*Irrespective of the true admiration for the actual achievements of other nations we must assume a German attitude in the presentation of our German journals. Not without reason does foreign journalism regard German science as a stronghold of reactionarism, for five years after the awakening of the German nation, it was still possible for Jews to appear as co-editors on the title pages of German journals, with their names in full and at times even with their current addresses. No matter whether Jew with recognized achievements, such as Willstätter, or Jew with none, such as Paneth (…). From the perspective of foreign countries this attitude of 'objective science' gives rise to the impression of criticism of the fundamentals of National Socialism by the German intelligentsia, yet it is of particular importance that it is German chemists who have made a considerable contribution to the worldwide renown of the German nation.*"[1]

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It is worth noting that at this time, Friedrich (Fritz) Paneth had already received international recognition through his work in the areas of radiochemistry (in cooperation with Georg von Hevesy) and the proof of the existence of free alkyl radicals by using radiomarkers (in cooperation with Hofeditz). There is no record of a response by Kuhn to Schleede's letter. Shortly afterwards, however, Paneth, who was living in exile in London, received a letter from the publishers of the *Zeitschrift für Anorganische und Allgemeine Chemie*, Wilhelm Biltz and Gustav Tamann, that informed him that in future the list of collaborators on the title page of the journal would be omitted since "*this list no longer corresponds to the current status of our journal*."[2]

Schleede's letter demonstrates two characteristic attitudes of German chemists and biochemists in Germany after 1933: on the one hand almost all accepted a new definition of that which was to be regarded as the "German viewpoint". In agreement with the Nuremberg Rassengesetzen (Race Laws) of 1935 not only were Jews no longer regarded as Germans, but they were to be excluded from all scientific activities in Germany. On the other hand, chemists and biochemists—like other scientists too—distinguished themselves through precipitate obedience. In many cases the organizations acted with conformity and Jews were excluded or expunged as authors or co-editors of scientific journals without there being any corresponding legal requirement to do so.

Schleede was without doubt correct in his assumption of the international importance of German chemists. Up until the 1930s German chemists and biochemists, both in academic science and in the German chemical industry, were internationally preeminent, despite the considerable success of American and British scientists, especially in physical chemistry. After 1933, there was silence, however, about the fact

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that Jewish chemists and biochemists had contributed extensively to this international renown since the 19th century. Thus, four of the six German Noble prize winners in chemistry up to 1918 were Jews or of Jewish descent (von Baeyer, Haber, Wallach, Willstätter), and a creative Jewish chemist, Heinrich Caro, had founded the first central research laboratory in the dyestuffs industry (BASF). Shortly after the seizure of power by the National Socialists in 1933 the participation of Jewish scientists in academic life in Germany came to an enforced end, which was followed by their exclusion from private companies and a general loss of rights. Their contribution to science was mentioned less and less.[3]

The following contribution investigates with the keywords "flee", "collaborate", and "forget" the effects of National Socialism on chemistry and biochemistry in the German (and Austrian) universities and Kaiser Wilhelm Institutes (KWIs). At the center are the dismissal and forced emigration of all Jewish chemists and biochemists (from here forward (bio)-chemists) and the few non-Jewish colleagues who let themselves be known as critics of the regime or as "friends of Jews"; the various forms of collaboration of scientists who did not emigrate as well as the few cases of nonconformism; and the general silence on this subject after 1945 or the attempt to allow the 12 years of National Socialist rule and their joint responsibility to slide into oblivion. The contribution is based essentially on an in-depth study of chemists and biochemists during the National Socialist era by the author.[4] These three aspects will be discussed essentially in regard to chemists and biochemists with habilitations in Germany and Austria at that time—those who were driven from their positions and those who remained—including their research, as well as developments during the postwar years.

## 1. "Flee"—Dismissal and Emigration of (Bio)chemists

### 1.1. Dismissals and Emigrations

The comparatively large number of Jewish chemists and biochemists in German universities and KWIs, which amongst other things was associated with the professional perspectives of academic chemists in the dyestuffs industry, resulted in these specialties being greatly affected by the dismissal of all Jewish scientists and a few non-Jewish scientists who were critics of the regime in the years between 1933 and 1938: 26% of the chemists and biochemists (physiological chemists; most with habilitation) at the German and Austrian universities and relevant KWIs were driven from their positions; at least 20% of all (bio)chemists emigrated.[5] According to the then current rhetoric, about 90% of the dismissed/emigrated (bio)chemists were forced to relinquish their positions for reasons of race, that is, they were either Jewish or non-Jews who had Jewish ancestry or were married to a Jew. The Professor of Inorganic Chemistry Hans von Wartenberg was even dismissed because his wife was "half Jewish".

The relatively new interdisciplinary areas of physical chemistry and biochemistry, where about a third of the scientists lost their positions, were particularly affected by the dismissals (in organic and inorganic chemistry the number was about 23%). Physical chemistry was at that time comparatively less-well regarded; the physical chemistry departments of universities were less well equipped than those of organic chemistry, and because of their relative marginalization they offered a talented minority such as the Jews the chance of advancement. Medical biochemistry was (as physiological chemistry) also one of the disciplines within the medical faculties most strongly relegated to the margins, even in the 1920s. At the beginning of the 1930s there were only a few professorships, and only in 1932 was the subject recognized as an examination subject. Biochemists were also employed at various KWIs, or as part of other university institutes of medicine, for example, pathology.

A few of the Jewish or "non-Aryan" scientists were also regarded as politically unacceptable and were in part dismissed for this reason, before they were dismissed—at the latest by 1935—as Jews. These included Professors Walter Fuchs (Technische Hochschule (TH) Aachen) and David Holde (TH Berlin), members of the Social Democratic Party, and Professor Isidor Traube (TH Berlin), who at the end of the 1920s openly supported the left-wing Heidelberg professor Emil Julius Gumbel. Wilhelm Prandtl, professor at the University in Munich, was known as a Christian (catholic) man who never returned the "German greeting". When an invitation to visit a Party function was handed to him, he stated that he had nothing to do with the Party.[6] In 1937 he was dismissed, not for his political leanings, however, but because his wife was Jewish.

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In total, six people were dismissed for solely political reasons. Three of them are detailed—the others were Alfons Klemec (professor of the University of Vienna, reinstated in 1942), Ernst Terres (honorary professor at TH Berlin), and Robert Wizinger-Aust (extraordinary professor at the University of Bonn).

1) Otto Krayer (Figure 1,[*], extraordinary professor of pharmacology at Berlin, was the only scientist who refused to accept the position of a dismissed Jewish colleague (Prof. Phillipp Ellinger of Düsseldorf) he was offered on moral grounds. In a letter to the Erziehungsminister (Minister for Education) he pointed out the reasons for his decision and denounced the dismissals as unjust.[7] He lost his former position in Berlin and he emigrated to London at the end of 1933. Krayer's conduct in England left a deep impression: the pharmacologist Sir Henry Dale called him "*the only German gentleman*."[8] In 1937 Krayer accepted the position of professor and director of the Pharmacology Institute at the Harvard Medical School, where he remained active until his death in 1982.

Figure 1. Otto Krayer.

[*] All the photos of people shown in this article were obtained from the book *Flüchten, Mitmachen, Vergessen. Chemiker und Biochemiker in der ZS-Zeit*.[4]

2) The organic chemist Karl Fries, professor and from 1913 head of the Chemical Institute of the TH Braunschweig, was compulsorily retired in 1938 at the age of 63 because he opposed the habilitation of a chemist whom he considered professionally unsuitable but who was a "*passionate and locally important National Socialist*."[9] Fries then joined the institute of Professor Meerwein at Marburg where he continued with experimental research in a small space.[10] His successor in Braunschweig was the SS member Hermann Friese.
3) Wolf-Johannes Müller, Professor for Physical Chemistry at the TH Wien was dismissed in 1938 because he was considered a "friend of Jews". However, he was successful in returning to his old position after about a year.

### 1.2. Successful Emigrants: The Effects of Emigration on (Bio)chemistry in Germany

It is not possible to name all the important (bio)chemists who were dismissed and who emigrated within this review. Instead the 25 scientifically most influential are listed in Table 1. The Nobel Prize and the number of citations in the Science Citation Index of 1945–1954 were chosen as the criteria.[11] With the exception of Werner Kuhn, a Swiss citizen, all the people listed are Jews or of Jewish descent.

Physical chemistry in Germany was greatly affected by the expulsion, even though a few leading scientists, such as Max Bodenstein, Karl-Friedrich Bonhoeffer, Arnold Eucken, Max Volmer, and Carl Wagner, were not Jews and kept their positions. One of the physical chemistry centers was lost with the emigration of Haber and the total restructuring of the personnel in his institute—the colloquia in Haber's KWI had

Table 1. The 25 emigrated German and Austrian (bio-)chemists who received the most citations in the Science Citation Index 1945–54 (apart from recognizable own citations) and/or a Nobel Prize.

| Name | Specialty | No. of citations | Nobel prize |
|---|---|---|---|
| Max Bergmann | organic chemistry/biochemistry | 1880 | |
| Hermann K. Blaschko | biochemistry | 654 | |
| Konrad Bloch | organic chemistry/biochemistry | 1169 | 1964 |
| Ernst Boris Chain | organic chemistry/biochemistry | 588 | 1945 |
| Erwin Chargaff | organic chemistry/biochemistry | 1424 | |
| Felix Haurowitz | biochemistry | 671 | |
| Hans Krebs | biochemistry | 2529 | 1953 |
| Fritz Lipmann | biochemistry/chemistry | 1783 | 1953 |
| Otto Loewi | pharmacology/biochemistry | 513 | 1936 |
| Otto Meyerhof | biochemistry | 1467 | 1923 |
| Leonor Michaelis | biochemistry | 1703 | |
| David Nachmansohn | biochemistry | 1492 | |
| Carl Neuberg | organic chemistry/biochemistry | 1221 | |
| Max Perutz | organic chemistry/biochemistry | 352 | 1962 |
| Rudolf Schönheimer | biochemistry | 1508 | |
| Richard Willstätter | organic chemistry/biochemistry | 1556 | 1915 |
| Fritz Arndt | organic chemistry | 629 | |
| Ernst D. Bergmann | organic chemistry | 688 | |
| Rudolf Lemberg | organic chemistry | 645 | |
| Fritz Haber | physical chemistry | 419 | 1919 |
| Georg von Hevesy | physical chemistry | 1383 | 1943 |
| Werner Kuhn | physical chemistry | 1449 | |
| Hermann F. Mark | physical chemistry | 661 | |
| Otto Stern | physical chemistry | 98 | 1943 |
| Joseph J. Weiss | physical chemistry | 742 | |


Figure 2. Georg von Hevesy.

formed a site of interdisciplinary interaction of international repute. Georg von Hevesy (Figure 2), then one of the most important physical chemists in Germany, had begun to use radioactive tracers as markers in biology and medicine in Freiburg. He was awarded the Nobel Prize in 1943 for the development of this area of research. With von Hevesy, who in 1935 emigrated first to Denmark and then to Sweden, Germany lost an innovative, multifaceted physical chemist and a personality who had cultivated a series of contacts with leading international scientists.

The expulsion of Hermann Mark and many of his coworkers was a great loss to polymer chemistry. Unlike the founder of this research area, Hermann Staudinger (who regarded polymer chemistry solely as a branch of organic chemistry), Hermann Mark developed physical chemical methods for the investigation of polymers and devised a teaching and research program in polymer chemistry (at the University of Vienna). After his dismissal and emigration in 1938, he was later successful in establishing modern polymer science as a multidisciplinary academic research area at the Brooklyn Polytechnic Institute in the USA.

The losses to biochemistry, especially in the biochemistry of intermediate metabolism, were the most far-reaching.[12] With the death of Gustav Embden in 1933 and the emigration of Max Bergmann, Otto Meyerhof, Carl Neuberg, Carl Oppenheimer, and, as early as 1920, Leonor Michaelis, Germany lost most of its leading biochemists. The losses in biochemistry through the emigration of Ernst Chain, Erwin Chargaff, Konrad Bloch, Hans Krebs, Fritz Lipmann, and Rudolf Schönheimer (with the exception of Chargaff all Nobel Prize winners) become even more demonstrable in the next generation of scientists. Max Perutz (Figure 3), who left Austria as early as 1936 and who was awarded the Noble Prize in 1962 for the determination of the structure of hemoglobin by X-ray structure analysis, was one of the leading molecular biologists in England. Franz Knoop, Otto Warburg, who was the only "half Jew" to retain his position as director of a KWI, and, as important biochemists of the next generation, Feodor Lynen and Carl Martius remained in Germany.

Physicists who emigrated, including the non-Jewish Dutch physicist Peter Debye, who after his emigration in 1936 received the Nobel Prize for Chemistry for his contributions to the knowledge of molecular structure, are not mentioned in Table 1. The dismissal and emigration of physicists resulted in some pioneers of quantum chemistry, in particular Walter Heitler, Fritz London, and Hans Hellmann, also being driven from Germany.[13]

A few outstanding organic chemists also emigrated. However, the losses in classical organic and inorganic chemistry remained comparatively low overall because of the small percentage of Jewish scientists working in theses areas. Most leading organic chemists and natural product chemists at that time were not Jews. Thus, the most important of them,

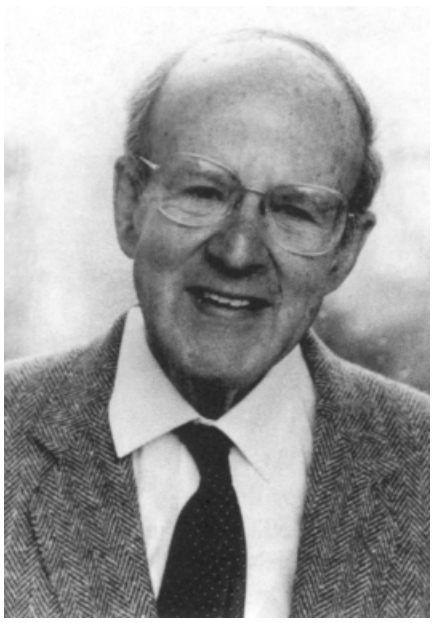
Figure 3. Max Ferdinand Perutz.

including Kurt Alder, Adolf Butenandt, Otto Diels, Hans Fischer, Richard Kuhn, Hermann Staudinger, Heinrich Wieland, Adolf Windaus, Georg Wittig, and Karl Ziegler (all of whom received Nobel Prizes in their lives), remained in Germany. Richard Willstätter had already retired when he emigrated to Switzerland. He had relinquished his position as Professor of Organic Chemistry at the University of Munich in 1924 as a protest against the several incidences of anti-Semitism in appointments at that university.[14]

The visible deterioration in biochemistry, a few areas of physical chemistry, and quantum chemistry in Germany after 1945 is attributable to a large extent to the emigration of outstanding Jewish scientists and to the strong dominance of classical organic chemistry as well as to the rigid structures in German universities. International centers of (bio)chemistry, especially the institutes of Max Bergmann, Fritz Haber, Otto Meyerhof, and Hermann Mark, disappeared from Germany or Austria. New ones did not arise. International relations were also subject to racial stipulations: the nonscientific criteria of ancestry and political conviction were also critical for the invitation of guests.

### 1.3. Countries of Emigration

More than 60% of emigrants went to the countries of Western Europe, especially to Great Britain, which accepted about a third of them. In Britain, the relief organization the Academic Assistance Council, later renamed as the Society for the Protection of Science and Learning, founded by British scientists, negotiated the getting of work permits, and assisted with further emigration to the USA. At the end of the 1930s, with the start of the Second World War and the subsequent German occupation of part of Europe, many emigrants had to flee once more, and in the 1940s the large majority of the emigrants lived in the USA, followed by Great Britain, and a few non-European countries such as Turkey, Palestine, and

the countries of South America. About half of them obtained positions at universities, a fifth in industry. Older emigrants, in particular, often suffered material difficulties.

The acceptance of Jewish emigrants depended upon their reputation and specialty. In the USA, biochemistry created a niche for the outstanding scientists from Germany and Austria. With the exception of Max Bergmann, however, emigrants specializing in organic chemistry found no place at American universities; the specialty was already too far advanced to be generally interested in emigrants from Germany or Austria. To the best of my knowledge, the impact of antisemitism on American Chemistry has not yet been studied. In Palestine/Israel young chemists, especially Ernst David Bergmann (formerly of Berlin) and Ladislaus Farkas (formerly at KWI for Physical Chemistry), became exceptionally influential. This situation arose because the Zionist leader and chemist Chaim Weizmann had been successful in obtaining the necessary financing to found a new research institute, the later Weizmann Institute of Science, and because he could not entice the then best-known German–Jewish scientists, for example, Albert Einstein, James Franck, Fritz Haber, Otto Stern, and Richard Willstätter, to emigrate to Palestine. Other countries on the periphery of science also established scientific disciplines and institutions with the help of German–Jewish emigrants. Thus Fritz Arndt (formerly of Breslau) founded organic chemistry and Felix Haurowitz (formerly of Prague) biochemistry at Istanbul University.[15] Alexander Schönberg (Figure 4) contributed decisively to the development of modern chemical research, particularly in preparative organic photochemistry and chemistry teaching in Egypt. German emigrants also became highly influential in Brazil, where, for example, Hans Stammreich (formerly at Berlin) at the University of Sao Paulo became a pioneer in the Raman spectroscopic analysis of colored substances.[16] In Portugal, Kurt Jacobsohn, a former student of Carl Neuberg at the KWI for Biochemistry), founded a school of biochemical research at the Instituto Bento da Rocha Cabral in Lisbon and contributed greatly to the development of biochemistry as an independent discipline in Portugal.[17]

Figure 4. Alexander Schönberg.

Schönberg's experience in Egypt demonstrates that, in other parts of the world too, emigrants occasionally encountered problems from Germany through claims of the "Aryan master race". In 1937 Schönberg, professor at the TH Berlin until his dismissal in 1934, became Professor of Organic Chemistry at Cairo University and Director of the Chemical Institute. Mark von Stackelberg, Professor of Physical Chemistry at Bonn University, member of the NSDAP and SA, applied for a professorship at Cairo University in 1938. When he received the prospectus from Cairo University and discovered from it that the head of the Chemical Institute (Schönberg) came from Berlin, he became suspicious. He asked the Reichserziehungsministerium (State Ministry for Education) whether Schönberg was a Jewish emigrant and asked the German legation in Cairo for information whether the dean, "in view of the fact that Arabs and Jews are at loggerheads in Palestine, would be appreciative if I were to request not to be subordinate to a Jew but at least coordinate?"[18] In response, the Reichserziehungsministerium made it clear in a letter to the Auswärtige Amt (Foreign Office) that Schönberg had two, possibly three, Jewish grandparents and decided: "a subordination of Prof. Dr. von Stackelberg to Prof. Dr. Schönberg is totally out of the question. Prof. von Stackelberg must at least be assured the same rank as Schönberg."[19] Those responsible in Egypt were clearly not convinced by the suggestions from Germany. von Stackelberg remained as professor in Bonn. In a judgment of the Denazification Board for Appeal of 1949 it was said of him:

> "*During a personal hearing, the person in question was able to convince that he had joined National Socialism originally out of enthusiasm and conviction. He had, however, not approved of everything without criticism. … The Board has of the person in question the impression of a sincere character who has always tried to make his convictions and his conscience the guiding principle of his affairs. He cannot be blamed for the political mistake. The person in question can be regarded as fully cleared.*"[20]

Schönberg returned to Berlin in 1957 on reaching the retirement age limit in Cairo. He was forced to lay claim to the status of professor emeritus at his old academy, now the Technical University of Berlin, through a legal restitution process.[21] As his student and co-worker Erich Singer observed, he spoke extremely rarely of his past. Only when during his last months of life "*the force of his self-discipline subsided through illness*" did it emerge "*how much he had really been affected by the flight from his mother country made necessary by the pressure of circumstance*".[22]

### 1.4. The Fate of Some of the Persecuted

Successful scientists who made a career in the USA or England or obtained positions in other countries constituted only a part of the dismissed and emigrated (bio)chemists. At the other end of the spectrum are those who remained in Germany or Austria without position and who suffered under increasing anti-Semitism, and above all those who either in Germany or after their flight overseas, were murdered by the National Socialists or committed suicide. Theses include Hans Liebermann (TH Berlin), Wilhelm Traube (Berlin University), Carl Oppenheimer (Landwirtschaftliche Hochschule

Berlin), Peter Rona (Berlin University), and Reginald Herzog (KWI for Fiber Chemistry). Also mentioned is Arnold Berliner, the founder and former editor-in-chief of the most important German and, into the 1930s, one of the leading international scientific journals *Die Naturwissenschaften*. He committed suicide when he was ordered to leave his apartment during the deportations in Berlin in June 1942.

As already mentioned, many Jewish chemists were active in the chemical industry since the 19th century. As a rule, dismissals in industry were carried out a few years later than in the universities (about 1937). As a result, many of those affected were no longer able to flee Germany in time. It is known that a few were deported and murdered in the concentration camps. These included Arthur von Weinberg (Cassella Farben; I.G. Farben supervisory board), Max Weiler (I.G. Farben, Elberfeld), Edgar Zwergel (I.G. Farben Agency, Amsterdam), Benno Strauss (Friedrich Krupp, Essen).[23] A comprehensive investigation of the fate of Jewish industrial chemists after 1933 is currently not available.

## 2. "Collaboration"—Behavior of Non-Jewish (Bio)chemists 1933–1945

Every state or every political system demands of its citizens compliance with the respective laws. The height of the price of compliance with the laws of the National Socialist State can be recognized in the known abhorrent developments. With the exception of two members of the communist resistance (Robert Havemann and Georg Groscurth), none of the non-Jewish (bio)chemists in Germany were arrested for oppositional behavior. This fact cannot be explained without large compromises being made and raises the question of co-responsibility. Many conformed for opportunistic reasons without becoming convinced National Socialists. Only a few stood out through nonconformism and aid for their Jewish colleagues. A number of (bio)chemists actively supported National Socialist race ideology and policies. Collaboration was usually rewarded with generous research sponsorship by the Deutsche Forschungsgemeinschaft (DFG; German Council for the Advancement of Scientific Research) and the Reichsforschungsrat (State Research Council); political activity was often beneficial for the career.

Collaboration was carried out at many different levels, often not as a result of political pressure but precipitate obedience. It could comprise of compliance with the law on the dismissal of Jewish coworkers, silence in the face of injustice that began with the dismissals and crimes, in denunciations, in the severance of contacts with Jewish colleagues, students, and teachers, in the admission to National Socialist organizations (whether from opportunism or conviction), in political activity, in war-related research, in taking over functions in the Reichsforschungsrat, and cultural–political propaganda for foreign countries. Collaboration led finally to the enslavement and murder of internees of the Auschwitz concentration camp in the I.G. Farben facility Auschwitz–Monowitz. In the following section a few examples of nonconformity and different forms of collaboration are presented.

### 2.1. Nonconformity

Nonconformity and aid for Jewish colleagues and co-workers were found from a few (bio)chemists who themselves were affected by the anti-Jewish measures. The most well known example is that of Fritz Haber, who as a German state employee told his Jewish co-workers of the impending dismissal and informed the general management board of the Kaiser Wilhelm Gesellschaft (KWG) of their names, but then immediately resigned his position as Director of the KWI for Physical Chemistry in protest.[24] Amongst the few unaffected (bio)chemists who disapproved of the National Socialists and in part helped imperiled people, often with considerable personal involvement, were the Nobel Prize winners Adolf Windaus and Heinrich Wieland as well as Max Volmer and Fritz Strassmann.[25] Professors Max Bodenstein, Hans Fischer, and Hans Meerwein also offered assistence to some Jewish or "half-Jewish" students. "Half-Jewish" co-workers were employed during the war by Karl-Friedrich Bonhoeffer, Karl Freudenberg, Hermann Staudinger, and by the NSDAP members Rudolf Hüttel, Egon Wiberg, and Otto Westphal; this was legal until 1942.[26]

The attitude of the head of the Institute for Organic Chemistry in Göttingen, Adolf Windaus, is described here in more detail as an example of nonconformity. He was a professor of the old school, but also a democrat and guided by a profound moralistic conscience. Unlike many of his colleagues, he had refused to become involved in research on poison gas during the First World War. Windaus did not cave in when in 1933 a group of National Socialist undergraduate and post-graduate students wanted to drive out the only Jewish postgraduate student of the Institute, Klauss Neisser, and denounced other students and co-workers at the Institute to the SA as friends of Jews. In November 1935 he wrote to the Reichserziehungsministerium that under other political conditions he would have acted energetically against the agitation in the Institute:[27] "*I doubt, however, that I would act within the view of the Ministry, and it is not my intention to oppose my superior authorities.*" He saw in resignation the only way out, for: "*I am too old to be able to change the ethical perspectives with which I have grown up.*"

In contrast with Haber, who in 1933 requested his retirement for a similar reason, the Ministry was conciliatory towards Windaus when it met his conditions: the leading activists had to change university. Windaus (Figure 5), who never greeted with the Hitler salute or signed with "Heil Hitler" and openly professed that he disliked the then political developments, was persuaded to remain in office. In this case, the continuance of the world-renowned research of the Nobel Prize winner Windaus was more important to the science politicians than the fulfillment of the political–ideological demands of the stu-

Figure 5. Adolf Windaus.

dents. After obtaining his doctorate in 1935 Klaus Neisser emigrated to Brazil.

Windaus found—and was here, too, an exception—the anti-Jewish movement at the beginning of 1933 an almost intolerable injustice that had devastating effects on chemistry in Germany. Thus, on the 10th April, 1933 he wrote to his former student Adolf Butenandt:[28]

> "*Unfortunately I am lacking that feeling of inner peace to enjoy my every day. To have to look at injustice and not to be able to help is difficult to bear. I have just come from Kaiserstrasse. A man was standing there shouting: 'the Jews are being destroyed'. Even if he did not mean bodily destruction it annoyed me that the police left him alone to agitate. It is distressing to see how pernicious instincts are so easily awakened, brutality, hatred, jealousy, and how quickly all feeling for justice and humanity is lost.*"
> "*That Schönheimer's going is a great loss. What do these men know that Haber ensured nitrogen supply during the war and that he had organized the whole gas campaign! What do they know how highly Willstätter is regarded in other countries and what he has achieved for German science and through it for the economy. At this moment people are carrying past placards on which stands the most unbelievable and hellish slander against the Jews.*"

Windaus was the only university teacher of chemistry who sought a dispensation for participation in the Haber commemoration in January 1935 (he was refused). University teachers would have been able to take part legally with such a dispensation from the prohibition on participation issued by the Reichserziehungsminister Rust. The board of the Deutsche Chemische Gesellschaft refused participation from the start, and the Verein deutscher Chemiker (Association of German Chemists) forbade participation in the commemoration in a written communication to its members (see below).

As the above citation shows, Windaus was a German state employee who essentially discharged his duty of obedience to the State. In 1935 he turned down an offer from the University of Chicago. The reasons for this are unclear, but it is possible that his age played a role—he was 59 years old in 1935. Windaus, however, stood out through his unusual moralistic integrity, an integrity which was also revealed in his research in which he repudiated speculation and admitted to errors.

The (bio)chemists Robert Havemann and Georg Groscurth belonged to the communist resistance.[29] The resistance group "European Union", founded by them in 1942, was denounced in 1943, and many of its members, including Havemann and Groscurth, were sentenced to death. Whereas Groscurth was executed on the 8th May, 1944, Havemann received a deferment of execution and he survived thanks to a number of professors of chemistry and pharmacology who succeeded in convincing the authorities that his research was vital for the war effort.[30]

In 1935 a number of chemists in industry did not behave with conformity. They protested, however, not against the National Socialist regime but against the board of the Verein deutscher Chemiker. Its ban issued against participation in the Fritz Haber commemoration resulted in a large number of letters of protest and even resignations.[31] Members of the association, including also those who made no secret of their anti-Semitism, protested not only because they felt unjustly censured, but because they did not agree that a commemoration for this outstanding German scholar and patriot should be forbidden. There are no indications that the protest resulted in professional disadvantages. Chemists at universities and KWIs did not protest.

### 2.2. Acceptance of the Anti-Jewish Measures

It is one of the most notable phenomena in academia in 1933 that the severest measures of National Socialist policies against science were carried out under a high degree of silence and with the frequent consensus of scientists: the persecution of Jews and people with Jewish ancestry, who often identified themselves with the German nation and culture, took place without public reaction on the part of the non-Jewish colleagues and, in most cases, even without private protest or signs of compassion.[32]

The reaction of the noted Heidelberg organic chemist Karl Freudenberg to the criticism of the dismissals by his colleague George Barger at Edinburgh University highlighted an attitude that was widespread in Germany. In his letter to Barger, Freudenberg (Figure 6), who maintained personal relationships with Jewish colleagues (including Max Bergmann and Hermann Mark) and who did not become a member of the NSADP, welcomed the dismissal of his Jewish colleagues as a necessary remedy for German ills: "*It is a matter of orders with which one has simply to conform. I am fully convinced that a cure at the heart of the German nation was necessary, and is disputed by but just a few. As to the method by which it was carried out, no lengthy reflections can be engaged upon in this country since it is a matter of command and it is entirely immaterial where the individual stands on this.*"[33] The fact that Hitler was a putschist and used terror as well as political violence to ensure power also represented no

Figure 6. Karl Johann Freudenberg.

hindrance within academic circles to their unconditional support. Thus according to Freudenberg, "*amongst most educated Germans the recognition for that achieved is prevalent (…). We have a unified central government of considerable power, and at the head of it an absolutely fine man who simplifies the administration with considerable energy.*"[34]

Freudenberg's letter enables anti-Semitism and the tradition of obedience of German civil servants, which include university teachers, to be recognized as two motives for the silence and the agreement to the dismissals. The historian Saul Friedlander differentiates between the "cultured Judeophobia", which characterizes the attitude of the majority of "Aryan" professors, and the radical form of Judeophobia which developed amongst students.[35] A further motive—taking advantage—played a role mainly with younger academics and students who obtained the positions of those dismissed. These various motives had the result that non-Jewish scientists who otherwise differed clearly in their attitude and behavior towards the National Socialist regime almost without exception accepted the dismissals without comment and to a certain extent with approval. Examples are the openly National Socialist and anti-Semite Wolfgang Ostwald, the compliant but nonmembers of the NSDAP Karl Freudenberg and Paul Harteck (physical chemist, former assistant of Haber), Karl-Friedrich Bonhoeffer, who otherwise rejected National Socialism, and the communist resistance member Robert Havemann.[36] Unlike in physics, the anti-Semitism amongst chemists was not associated with the rejection of certain research fields as "Jewish", but was directed mainly at the exclusion of Jewish colleagues amongst scientists and students.

As civil servants, German professors had a duty of obedience towards the State. However, unlike their younger colleagues without tenure, they would have been able to voice a certain amount of criticism without endangering their position. The large majority of professors and directors, however, followed the regulations on the dismissal of Jewish co-workers to the letter, and many, such as Arthur Schleede cited at the beginning, took the initiative themselves when it came to the exclusion of Jews from scientific life in Germany.

Precipitate obedience also defined the behavior of Richard Kuhn, the head of the Institute for Chemistry at the KWI for Medical Research (Figure 7). In 1933 he dismissed his Jewish co-workers without the least effort to keep them longer, and in 1936 he denounced his colleague Otto Meyerhof to the General Council of the Kaiser Wilhelm Gesellschaft because he continued to employ Jewish co-workers. Kuhn, one of the most important natural product chemists in Germany, did not want to run the risk of the slightest disadvantage or bad reputation for the Institute; there is no indication that he was an anti-Semite. In 1939 Kuhn was awarded the Nobel Price for Chemistry for 1938, but refused the honor, as did Gerhard Domagk and Adolf Butenandt, because after January 1937 the National Socialist government in Germany no longer allowed the acceptance of the Nobel Prize. Under political pressure, Kuhn (as did Butenandt and Domagk) wrote a sharply worded letter to the Royal Swedish Academy of Science in which he not only refused to accept the prize but labeled the award of the prize to a German as an attempt to provoke the prize winner into contravention of a decree of the Führer.[37] Kuhn wrote by hand at the bottom of the letter: "*The Führer's will is our belief.*"[38]


Figure 7. Richard Kuhn.

The inorganic chemist Wilhelm Klemm also resorted to denunciation to prevent contributions from Jewish or "non-Aryan" authors appearing in future German chemical journals. In June 1942 he sent the editorial staff of "Berichte" an official letter on the "non-Aryan" descent of Georg-Maria Schwab, and on the strength of it the managing editor, A. Ellmer, abandoned the publication of a new contribution from Schwab.[39] I am not aware of Klemm's motive; he had been professor in Danzig since 1933, in 1938 he became a member of the NSDAP, and in 1951 professor in Münster. During the National Socialist era the editors of purely scientific journals were not forced to undertake research into the Jewish descent of authors. Thus, at least up to the denunciation by Klemm, contributions from Schwab appeared in a number of German journals (apart from "Berichte", the *Zeitschrift für Physikalische Chemie*, the *Kolloid-Zeitschrift*, and the *Viennese Chemiker Zeitung*). Schwab, himself a catholic, had a Jewish father and was therefore dismissed and he emigrated to Greece.

The difference between the essentially voiceless adherence to the dismissal of Jewish colleagues and co-workers and the criticism of other political science measures, for example, the increasing centralization of education and the deprivation of the power of faculties in matters of appointment, is remarkable. Other regulations were also sometimes avoided, thus, for example, after 1940 a number of chemists continued with their fundamental research under the label "research important for the war effort".

Anti-Semitism also occurred in the chemical industry. One example is the long-standing board member of I.G. Farben, Heinrich Hörlein, who joined the NSDAP in 1933. On his instigation, the Deutsche Chemische Gesellschaft had already urged its Jewish president (Alfred Wohl) and vice president (Artur Rosenheim) to resign in May 1933. In April 1933 Dr. Hermann Kretschmar, leader of the chemistry group in the Kampfbund für deutsche Kultur (Front for German Culture) and member of the Deutsche Chemische Gesellschaft wrote that he knew that Hörlein "*as only member of the board [of the Deutsche Chemische Gesellschaft] had put a stop to Jewish infiltration*".[40] Hörlein became director of Bayer-Werke after the war.

### 2.3. Political Good Behavior and NSDAP Membership

Political adaptation, whether it be from conviction, opportunism, or both, also manifested itself amongst (bio)chemists (as in other academic disciplines) in the joining of National

Socialist organizations. About 53% of the (nondismissed) academic (bio)chemists became members of the NSDAP (in the case of biologists 57.6%) and 7.2% members of the SS (in the case of biologists 5.3%).[41] A larger percentage of younger scientists joined the NSDAP: of those under 40 years of age, it was about 63%. Of a total of 93 (bio)chemists appointed professors between 1933 and 1945, 59 (63%) were members of the NSDAP. 28 (bio)chemists, 11 of them physical chemists, had already joined the Party prior to 1933. It may be assumed that this group, at least, consisted of committed National Socialists. Eleven of them became professors at the latest by 1945, including four who were also members of the SS.

Membership of National Socialist organizations was not mandatory for habilitation and professorship, but it often facilitated it. Principally, younger scientists at smaller universities were to some extent under considerable pressure to join one of these organizations. Party membership therefore did not necessarily mean National Socialist conviction (a number of nonparty members also supported national socialist politics in other ways). It must also be mentioned that a few of the younger scientists did not yield to pressure and were therefore ready to suffer the consequences. Amongst those who were, in spite of this, appointed professors were the organic chemist and later Nobel Prize winners Kurt Alder (1940 in Cologne) and Karl Ziegler (1938 in Halle), the biochemists Hans Hermann Weber (1939 in Königsberg) and Karl Lohmann (1937 in Berlin), and the physical chemists Klaus Clusius (1936 in Munich), Wilhelm Jost (1943 in Leipzig), and Carl Wagner (1939 in Darmstadt). In the case of Jost, at least, the fact that he was not a member of a National Socialist organization delayed his appointment for a number of years.

The colloid chemist Wolfgang Ostwald, an NSDAP member from 1933, is an example of how a mere average scientist attempted—with partial success—to improve his academic position through party political engagement and collaboration. His engagement took the form of National Socialist propaganda in the USA and England as well as in Eastern European countries where he made special efforts to awake understanding for the anti-Jewish measures in Germany. He used the remarkable metaphor "recrystallization" for this, as he wrote in his report on his journey: "*as chemists they understood me best if I spoke of our revival as of a 'recrystallization', that is purification, stabilization, reforming, etc.*".[42]

A few scientifically notable (bio)chemists also joined National Socialist organizations, as the examples of Adolf Butenandt and Hermann Druckrey demonstrate. Butenandt (Figure 8), successor to the dismissed Carl Neuberger as Director of the KWI for Biochemistry, became a NSDAP member in 1936. In 1939 he was awarded the Nobel Prize for his pioneering research on steroidal hormones, which, as mentioned in Section 2.2, he had to refuse. His co-worker Günther Hillmann advised the head of the neighboring KWI for Anthropology, Otmar von Verschuer, how blood from artificially infected concentration camp inmates sent by Mengele from Auschwitz was to be investigated biochemically. The conclusion may be drawn from this fact that

Figure 8. Adolf Butenandt.

Butenandt was aware of the collaboration of his colleague von Verschuer with Mengele in Auschwitz.[43] He disputed this after the war and moreover contributed to the defense of von Verschuer with a testimonial authored in cooperation with Max Hartmann, Wolfgang Heubner, and Boris Rajewsky. Butenandt remained Director of the KWI (now the Max Planck Institute) for Biochemistry and became President of the Max Planck Gesellschaft in 1960.

The long-standing National Socialist Hermann Druckrey (member of the NSDAP from 1931 and the SA, where in 1943 he rose to Oberführer) was an internationally renowned cancer researcher. Presumably, because of his political activity, Druckrey never did receive a professorship after the war, but in 1948 he became head of a laboratory at the Surgical University Hospital in Freiburg, which became the Research Unit for Preventative Medicine of the Deutsche Forschungsgemeinschaft (DFG) after 1952. In 1956 the DFG elected him to chairman of the Dyestuffs Commission. In 1954 Druckrey became chairman of the Cancer Prevention Commission in New York, in 1956 member of the WHO Advisory Panel in Geneva on Food Additives, and member of the Italian Society for Cancer Research in Milan and the Royal Society, Medicine Section, in London.

The rapid political adaptation in chemistry is clearly demonstrated by the example of the Verein deutscher Chemiker, the "*only recognized professionally representative body of German chemists*" to which both university teachers and students as well as industrial chemists belonged. Under its chairman Paul Duden, member of the board of directors at Hoechst, the Association implemented conformity (Gleichschaltung) at a members' meeting as early as June 1933 by excluding Jewish members and introducing the Führer principle; Duden was appointed "Führer" of the Association by the Association's Board.[44] In 1934 the Association joined the Reichsgemeinschaft der technisch-wissenschaftlichen Arbeit (State Society for Technical and Scientific Endeavor), an association of a number of National Socialist led societies under Dr. Ing. Fritz Todt.[45] Todt was then head of the Hauptamt für Technik (Central Office for Technology) of the NSDAP and he became Reichsminister für Bewaffnung und Munition (State Minister for Armaments and Ammunition)

in 1940. In the new articles of the Association the promotion of chemistry "*by scientific and technical encouragement and support and the inculcation of its members into the National Socialist community*" was given as the objective of the Society.[46]

The Deutsche Chemische Gesellschaft did not officially implement conformity in 1933, but in precipitate obedience it replaced Alfred Wohl, a Jew elected president in 1932, by the inorganic chemist Karl Andreas Hofmann after just one year in office. In 1938 Richard Kuhn became president of the Society, an office he held until 1945. He submitted to political pressure from the Hauptamt für Technik of the NSDAP and agreed to the linking of the Society to the National Socialist Bund Deutscher Technik (Union of German Technology) and thus to its implementation of conformity.

### 2.4. Research and Politics

(Bio)chemists who had proved their non-Jewish descent and did not openly criticize the regime enjoyed wide-ranging freedom in the choice of research topics and, apart from war-related constraints, material support. Thus, when questioned by representatives of the Rockefeller Foundation after the end of the war, Adolf Butenandt emphasized the freedom which he had enjoyed as a scientist from the First World War up until the end of the National Socialist era, and had only been seriously hindered by the occupation policies of the Allies.[47] The research support of (bio)chemists by the Deutsche Forschungsgemeinschaft and the Reichsforschungsrat increased by a factor of 13 from 1933 to 1944—the increase was considerably greater than that of the support of academic research by industry—and a further source of finance was the Wirtschaftministerium (Ministry for Economic Affairs) with the newly founded Reichsamt für Wirtschaftsausbau (State Office for Economic Development) which financed mainly applied research.[48] Both important scientists, such as the then or future Nobel Prize winners Adolf Butenandt, Hans Fischer, Richard Kuhn, Hermann Staudinger, and Karl Ziegler, and totally insignificant researchers, including those whose careers were mainly politically motivated, were supported by large sums of money.

Examples of successful research are the natural product work of Butenandt and Kuhn, Druckrey's investigation of chemical carcinogens, the further extension of their diene synthesis by Kurt Alder and Otto Diels in 1928, and the discovery of nuclear fission by Otto Hahn, Lise Meitner, and Fritz Strassmann.

On the other hand, under the conditions of National Socialism, where the power of persons in leading positions was strengthened, criticism of power was more suspect than previously, and with increasing international isolation, criticism from abroad was no longer taken seriously (especially when it came from Jewish scientists) and poor science and fake results were able to exert greater influence than before (naturally, not all cases of fraud at this time are attributable to National Socialism). The research of the Halle professor and president of the Akademie der Naturforscher Leopoldina, Emil Abderhalden, on defense enzymes, which were later proven to be nonexistent, is an example. This research, the results of which could not be reproduced by Leonor Michaelis in Germany or by American researchers as early as 1914–1916, was extended and propagated by Abderhalden (Figure 9) as a basis for many medical uses, such as cancer diagnosis or the diagnosis of psychiatric diseases, during the National Socialist era. Abderhalden never retracted his results.[49] Only after his death in 1950 did the concept of defense enzymes slowly disappear from textbooks.

Figure 9. Emil Aberhalden.

Cancer research, especially research into the causes of cancer, was financially one of the most greatly supported areas of medicine.[50] It included research aimed at the identification of X-rays and chemicals as carcinogens, including carcinogens at the workplace. Hermann Druckrey (see Section 2.3) successfully investigated the carcinogenic action of azo dyes and their precursors, including aniline. Butenandt's extensive project on the experimental investigation of the formation of tumors by steroids, especially steroidal hormones, and their metabolic products was also supported within this context.

Cancer research was also an area in which cases of fraud mounted. Thus, the main part of biochemical research into the early recognition and serodiagnosis of cancer was based upon the use of the method of the Abderhalden defense enzymes, and, irrespective of whether this method is regarded as self-deception or fraud, was therefore totally valueless. A number of other biochemists based their research on the sensational discovery of the German organic chemist Fritz Kögl in Utrecht, who in 1939 allegedly demonstrated that proteins in tumor tissue differed from those in normal tissue in that they showed a higher content of D-amino acids, particularly D-glutaminic acid, a discovery which was later shown to be a falsification by a co-worker. Ernst Waldschmidt–Leitz, Professor of Organic Chemistry at the German University in Prague from 1937 combined Kögl's assertion with the concept of Abderhalden defense enzymes and proposed the thesis that the D-peptidases apparently existent in tumor tissue could be regarded as a defense reaction against the tumor and could be used as therapy. He even spoke openly of the possibility of a tumor vaccine. At the initiative of the DFG

and the foreign section of the Reichsärztekammer (State Medical Association) his promises were published in a Viennese journal as a propagandistic demonstration of German research success. This is an example of the fusion of fraudulent research with propaganda in a society ideologically influenced by National Socialist propaganda.[51]

After 1933 there was a small group of researchers who pursued the development of a "German chemistry" under racial viewpoints. The organic chemist Conrad Weygand, the physical chemist Karl-Lothar Wolf and his students Rembert Ramsauer and Helmut Harms were amongst their number. The efforts of these outsiders to a "German chemistry" encountered no appreciable interest, either from professional colleagues or political circles, and had little influence upon chemical research or teaching.[52]

There was no appreciable ideological pressure on chemistry, as was exercised for a time in physics on the representatives of quantum mechanics by propagandists of the anti-theoretical "Aryan physics". This can be explained on the one hand by the fact that the importance of chemistry, including academic chemistry, was clear from the start for the economic and military objectives of National Socialism, and on the other by the fact that the area of theoretical chemistry, particularly quantum chemistry, was for the reasons explained in Section 1.2 only weakly represented prior to 1933 and thereafter further weakened by emigration.

The four-year plan and the demands made of scientists after 1939 to undertake research important for the war effort led to a significant increase in work which served the aims of economic self-sufficiency or were war-related. After 1939 a large number of (bio)chemists carried out (at least officially) research important for the war effort or for the State, although labeling research a "state" or "war" priority did not in every case mean that it was not of significance for fundamental research. The most greatly supported projects of importance to the war effort included research on synthetic fuels, questions of friction and lubrication in high-performance engines, improvements to plastics, and research into materials for chemical weapons.

Chemical war gases were produced and in use against international law during the First World War. The initiative for this came from scientists themselves, notably from Fritz Haber, who cooperated with industry and the military and was supported by prominent German academics.[52] Carl Duisberg, director general of the Farbenfabriken Bayer and later chairman of the supervisory board of I.G. Farben, played a prominent role in the industrial development of chemical war gases. During the National Socialist era too, scientists—of different ideological persuasions—cooperated with industry and the military in research on war gases. Research was carried out both on war gases such as mustard gas and phosgene, which had already been used during the First World War, as well as on the nerve gases tabun and sarin, newly discovered by the I.G. Farben chemist Gerhard Schrader as part of his research into phosphorus-containing insecticides. These materials were developed further into usable war gases by I.G. Farben.[53]

Many chemists at KWIs and universities undertook research into war gases; two directors of KWIs, Peter Adolf Thiessen and Richard Kuhn, undertook it with particular intensity. Thiessen (Figure 10), already an activist for the SA and NSDAP in the 1920s, identified himself explicitly with the economic–military and ideological aims of the new state.

Figure 10. Peter Adolf Thiessen (3rd from the left) with Erich Hückel, Peter Debey, Klaus Clusius, and H. H. Franck.

Thus, in 1936 he supported the propaganda exhibition "Germany" initiated by Joseph Goebbels, and Goebbels thanked him personally.[54] On the May 1st, 1940 Hitler accepted the KWI into the ranks of the "Model National Socialist Operations" with the award of the Golden Flag.[55]

The KWI with Thiessen as director was especially well funded.[56] Besides the high support grants from the DFG/RFR, Thiessen received financial support from I.G. Farben, the Wirtschaftsministerium, and the army. Research was undertaken mainly into the area of application-oriented colloid chemistry and less closely defined toxic gases. A considerable part of the research effort was considered secret and was not published. The existence of a pharmaceutical–chemical section funded by the Heereswaffenamt (army ordnance office) suggested that research into the development of chemical weapons was being carried out at the Institute itself. Thiessen also installed a war-gas research section at the war-gas production facility in Falkenhagen.[57]

In spite of the change in research to topics important for the war effort, the intensity and effectiveness of the war-gas research at this institute was significantly lower than during the First World War when the whole institute was involved in war-gas research after appropriate extension. The history of the KWI for Physical Chemistry illustrates the continuity in the cooperation of the elite from the state, military, and science under National Socialism. It illustrates the change of the old nationalism, which included Jews and allowed a scientist such as Haber to develop and use toxic gases for the nation, and the new nationalism, in which there was no place for Jews, regardless of their political persuasion. It shows, just as in the following example of Richard Kuhn, that chemists in leading positions also worked on new war gases and their antidotes during the Second World War—research which was a requirement for their possible use. War-gas research also took place in other European countries and in the USA. Here a view of the political context is important: German scientists knew that they supported the imperialistic and (in the east) genocidal war aims of Hitler with their research on these mass destruction agents.

From 1945 to 1956 Thiessen was involved in research into the separation of uranium isotopes as part of the atom bomb project in the USSR. After this period he lived in the German Democratic Republic (GDR). In 1956 he became a professor at the Humboldt University, Director of the Institut für Physikalische Chemie der Akademie der Wissenschaft in Berlin, and in 1957 chairman of the Forschungsrat (Research Advisory Board) of the GDR, in whose founding he was involved.[57b]

Reports from allied intelligence teams and statements from previous co-workers confirm that during the war Richard Kuhn investigated nerve gases of the tabun – sarin series in the KWI for Medical Research in Heidelberg headed by him, and carried out experiments on the development of antidotes.[58] The poison gas section of the Heereswaffenamt regularly sent Kuhn compounds of the tabun – sarin series from other laboratories so that he could test these and compounds synthesized by himself for their activity in a procedure developed at Heidelberg. Thus, Kuhn experimented with nerve gases of the tabun – serin series in his institute. In spring 1944 he was successful in developing a new nerve gas called soman which was more toxic than sarin. Kuhn was in contact with Hitler's former personal physician, Karl Brandt, who had been appointed by Hitler as commissioner for gas protection, and in the summer of 1944 discussed with him possible methods of treatment for tabun and sarin poisoning.[59]

According to information from Kuhn, the Heereswaffenamt terminated his research into poison gas in September 1944. All relevant documents were removed and the destruction of laboratory notebooks was ordered. During his interrogation by the allies, Kuhn stated that he had not carried out any further research in the area of soman. All the documents were allegedly buried in a mine shaft about 15 km east of Berlin, and their complete contents taken to the Karpov Institute in Moscow by Professor Colonel Kargin. The background to the order by the Heereswaffenamt to cease research into poison gases was not given. Kuhn remained director of the KWI/MPI for Medical Research in 1945, and in 1950 he was appointed a full professor at Heidelberg University and in 1955 vice-president of the Max – Planck Gesellschaft.

Kuhn was an outstanding scientist who after 1933, and especially during the Second World War, placed his scientific activities and his organizational talent at the service of National Socialist Germany. His achievements as chemist, his nationalism (which also prompted him to fundamental affirmation of the national socialist regime), his ability to maneuver between politics and science, and his opportunism explain at least in part his power during the National Socialism period. Erwin Chargaff characterized Kuhn as "*a Karajan of chemistry. Essentially he was very good, but he degenerated politicly, like Heisenberg*."[60] Otto Meyerhof accused Kuhn "*of having freely placed his remarkable scientific ability and mastery of chemistry at the service of the regime whose unspeakable heinousness and infamy*" was "*well known*" to him.[61] Like Heisenberg, Kuhn belonged to those scientists who, regardless of whether they were convinced of the National Socialist ideology, supported the regime with their reputation and were ready (in the case of Kuhn partially successfully) to develop for Hitler agents of mass destruction. In this way they were not only co-responsible for the injustices of National Socialism but damaged science in Germany far beyond the era of National Socialism.

### 2.5. Crime

The greatest crime of chemistry was the production and use of cyklon B, a product of the Deutsche Gesellschaft für Schädlingsbekämpfung (German Society for Pest Control), controlled by the I.G. Farben, for the industrial destruction of humans and the exploitation of Jewish and other slave workers in the I.G. Farben-Werk in Auschwitz. (Only brief mention can be made here to the considerable number of publications on this topic.[62]) The Nuremberg I.G. Farben Trials of 1947 – 1948 made this crime known to the public at large. Twenty four leading employees of I.G. Farben, including the chairman of the supervisory board (and honorary Professor for Chemistry at Berlin University) Carl Krauch, Director General Hermann Schmitz, the I.G. Farben expert for butadiene polymerization and poison gas and head of the facility for synthetic rubber at I.G. Farben-Werk in Auschwitz Otto Ambros, and all other members of the board of directors were accused by the Nuremberg Military Tribunal. The main point of the accusations concerned slavery and mass murder. The chemists and industrialists were accused of having enslaved and killed the civilian population, prisoners of war, and concentration camp inmates. The judgment, which was pronounced on the July 29th, 1948, marked the beginning of the cold war in which West Germany became an alliance partner of the Western Allies. Thirteen of the accused received prison terms which stretched from one and a half to eight years, including the above-mentioned Otto Ambros, who like Walter Dürrfeld was sentenced to eight years imprisonment, Fritz ter Meer to seven years, and Heinrich Bütefisch and Carl Krauch to six years each.

## 3. "Forget"

### 3.1. General

There was no open discussion in Germany in the sciences after the war of the anti-Jewish measures after 1933 and of the past of their coprofessionals, their support of National Socialist ideology and policies, and involvement in crime. Biologists did not involve themselves critically with, for example, the political past of the behavioral scientist Konrad Lorenz, who had openly welcomed and scientifically legitimized national socialist race policies (and was awarded the Nobel Prize in 1973).[63] Human geneticists (anthropologists, eugenicists, and psychiatrists) refused to grapple with the ideological and practical contribution of their discipline to the National Socialist policies of selection and annihilation.[64] Max Weinreich's book *Hitler's Professors, The Part of Scholarship in Germany's Crimes against the Jewish People*, published by YIVO in New York, 1946, in which the author drew attention to the central role of human geneticists and jurists in the

crimes of the national socialists against Jews, was never translated into German.

German physicists were unsuccessful in the construction of a nuclear reactor and an atomic bomb. Their representatives, especially Werner Heisenberg and Carl-Friedrich von Weizsäcker, spread the rumor after the war that German physicists had not produced the atom bomb for moral reasons. Robert Jungk, who from a lack of background knowledge had contributed considerably to the spread of this rumor in 1956 with his book *Heller als Tausend Sonnen*, recognized later that he had been misled. Thus in the preface to *Die Uranmaschine* by Mark Walker he wrote: "*That with the translation into many languages of my 1956 book 'Heller als Tausend Sonnen' I had contributed to the myth of passive resistance of the important physicists is attributable to my high esteem for these personalities which I have had since to recognize as inappropriate.*"[65] This legend was finally destroyed in Germany in 1992 when the British government released tape recordings which documented discussions with German nuclear physicists interned in the British Farm Hall after the war.[66a] In 1947 the physicist Samuel Goudsmit had already shown in the USA that this legend had been invented by a number of German physicists themselves, in particular C.-F. von Weizsäcker, in Farm Hall when they received news of the dropping of the American atomic bomb on Hiroshima. Goudsmit attributed the failure of the German uranium project under Werner Heisenberg to deficiencies in scientific organization, the errors and inability of individual scientists and their complacency. (His book was never translated into German.)

### 3.2. Absent Discussion of Auschwitz

How did the situation appear in chemistry? The central role of the chemical industry in the genocide at Auschwitz has certainly been mentioned in a number of individual publications, but it has never been the subject matter of open discussion to the same extent as that of the (American) atom bomb, neither immediately after the war nor at any time since.[67] Chemists have themselves remained silent or denied the known participation of I.G. Farben representatives in the crime. The political past of many scientists or their research on poison gas was not the subject matter of open criticism.

In the years 1946 to 1950 neither Auschwitz nor the Nuremburg Trials were subject of comment in *Angewandte Chemie*, the mouthpiece of the chemical societies in the different zones of Germany after 1945 (although it was mentioned in the *Physikalische Blätter*, see the 1948 letter from the GDCh board below). The only allusion to the injustice towards Jewish colleagues during National Socialism is found in a discussion of the autobiography of Richard Willstätter[14a] by Rudolf Pummerer.[68] As the inventor of E 605 (1944) and other insecticides, Gerhard Schrader (see Section 2.4) was honored with the silver Ehrenplakette for services to agriculture and the Otto Appel Denkmünze in 1955. In 1956 the Gesellschaft Deutscher Chemiker (GDCh) awarded him the Adolf von Bayer Denkmünze "*in recognition of his outstanding services in the discovery of novel and highly effective pesticides based upon phosphate esters …*" The portrait of Schrader published on this occasion by Burckhardt Helferich, the President of the GDCh, in *Nachrichten für Chemie und Technik* (**1956**, *4*, 286) made no mention of his work on tabun and sarin. In a celebration held by the GDCh to mark the 80th birthday of Alwin Mittasch in 1950 it is stated without further comment: "*men such as Carl Krauch, Christian Schneider, Christoph Beck, Matthias Pier are amongst the best of their profession.*"[69]

On the other hand chemists criticized the indictment of prominent members of the I.G. Farben board of directors in Nuremburg. Karl Freudenberg wrote to his colleague Paul Karrer in Switzerland: "*our friend Hörlein and his companions in suffering are a cause of concern to us. Not that they have done anything wrong, but because the intention to not to allow the submission of any justification is becoming clear. This situation must be given the greatest attention. …*"[70] Freudenberg made a significant contribution to the defense of the chairman of I.G. Farben (Carl Krauch) and Adolf Butenandt as well as to the acquittal of the director of the Elberfeld facility of I.G. Farben (Heinrich Hörlein), who had been accused of being responsible for pharmacological experiments with methylene blue on prisoners in concentration camps.[71]

After the announcement of the judgment in the Nuremberg I.G. Farben trial, the GDCh, that is, the academic chemists, tried to lodge an appeal with the military governor and justice of the American zone, General Clay, by referring to the coercions of total war.[72] Their letter shows that chemists did not then recognize the atrocious occurrences in the I.G. Werk Auschwitz and the responsibility of individual leading members of I.G. Farben:[73]

> "*Following expressed approval of this submission by the members at attendance at the general assembly in Hanover the Council of the 4500 membered Gesellschaft Deutscher Chemiker requests you, General, to refuse the necessary confirmation of the sentence passed by the American Military Court in Nuremberg against 13 directors of the previous I.G. Farben Industry.*
> *We know the convicted to be honorable men from work over many decades. We are of the opinion that the methods used by the prosecuting authorities are not in keeping with the methods previously stipulated in Germany prior to the Hitler regime and in the United States of America. We are further of the view that the judges did not take into account the circumstances of total war in a dictatorial state ruled by terror. We do not understand the severity of the prison sentences imposed on men who in our opinion are in this way unjustly made comparable to common criminals. We cannot believe from our knowledge of the convicted that dishonorable thought or deeds have really been proven against them. The strive for understanding between nations filling us all, is made difficult by this judgment. We would be very thankful, General, if you interceded so that the judgment is set aside by the American Federal Court, whose judges are respected throughout the world.*"

It is remarkable that the peoples of nations who themselves or their relatives were enslaved or murdered in Auschwitz continue to be ignored in the strive towards international understanding. A precondition for understanding would have

been to allow them to experience justice in retrospect by punishment of those guilty. The Italian chemist Primo Levi, a Jewish slave worker in Auschwitz, has discussed this topic in many publications.[74]

Industry joined the criticism of the Nuremberg judgment. A meeting of the "Arbeitsgemeinschaft Chemische Industrie des Vereinigten Wirtschaftsgebietes" (Chemical Industry Federation of the Unified Economic Area) in Cologne on the October 14, 1948, at which numerous senior officials of government, justice, and administration were present, was openly critical in front of the press.[75] The main preoccupation of the chemical industry was to prevent further damage to its image. An altercation with the Nuremberg Trials was at least avoided in the chemical journals. It was not the involvement of its own kind in the crime which caused disquiet, but the publication of Willstätter's autobiography in 1949, in which Willstätter implied anti-Semitism on the part of the founder and long-term director of I.G. Farben, Carl Duisberg.[76]

Only in 1988 in a commemorative publication of Bayer Werke, one of the successor companies of I.G. Farben, was the murder of slave workers in the construction of a new major facility of I.G. Farben for the production of artificial rubber and synthetic fuel in Auschwitz acknowledged. There it is stated: "*according to the 'Jewish Conference on Material Claims against Germany' a total of about 38,000 prisoners, mostly of Jewish descent, had to work at the site [major facility for I.G. Farbenindustrie in Auschwitz] from 1941 to 27th January, 1945. It is assumed that more than 30,000 of these people perished.*"[77]

### 3.3 The Amnesia of the Kaiser Wilhelm Gesellschaft (Max Planck Gesellschaft) and Universities

The exclusion or denial of the historical truth, which is particularly striking with the example of chemists and the crimes in Auschwitz, characterizes the whole of the German post-war history at universities and in the Kaiser Wilhelm Gesellschaft. Thus, the Tübingen university lecturer Walter Jens found during an inspection of documents of Tübingen University that "*the protocols from the era after 1945 [were] most eerie: as if nothing had happened! No Stalingrad, no Auschwitz, no eugenic sterilization, and no scientific ennobling of anti-Semitism! … no act of contrition, no recognition of guilt, no stocktaking, no inner reflection shaped by a spirit of soul-searching…*"[78]

Scientists in Germany wanted to quickly move towards normality and forget the past. In view of the fact that, because of the destruction of many institutes and poor material conditions, they continued research and teaching often under difficult conditions, a certain amount of denial and concentration on survival and construction was understandable. However, the fact that the crimes committed by the Germans themselves went more or less unrecognized remains incomprehensible and frightening. Many made Hitler and a few Nazis responsible for these crimes, sometimes they were attributed to human failings in general. A large number of German scientists showed neither feelings of guilt nor of sorrow, but merely self-pity. One of the reasons was denazification.

After the end of the war a large number of university lecturers were dismissed by the allies' denazification authorities. Membership of the NSDAP was often sufficient. Many of them were reinstated or retired during the course of the next five years. Even a few political activists were able to become full professors once more. In (bio)chemistry at universities in Germany the remarkable picture was thus formed that amongst the full and associate professors at many German universities at the beginning of the 1950s the proportion of former NSDAP members (for whatever reason they had joined) was often considerably higher than NSDAP members during National Socialism: in West Germany (in (bio)chemistry) in total 53 % of full professors, 70 % associate professors, and 71 % supernumerary professors who held positions at universities at the latest by 1952 were previously members of the NSDAP. At universities in the German Democratic Republic, where denazification was carried out more thoroughly, the proportion of former NSDAP members amongst professors (full professors, professors with teaching duties, or professors with lectureships) was considerably lower at 36 %. The reason that the proportion of previous NSDAP members amongst professors after the war was so high is because during National Socialism a larger percentage of young scientists had organized themselves within the NSDAP. If it is assumed that the situation in other subjects was similar, then German students were taught mainly by former National Socialists after the war.

In contrast to this it must be considered that former Jewish refugees were recalled in only very few cases.[79] Many of them would not have returned—the large percentage of former National Socialists at universities played a role in this—others, especially the refugees in Turkey, awaited a recall to Germany and under certain conditions would even have returned immediately at the end of the war.[80] However, they were offered no positions. The fact that neither the Berufsbeamtengesetz (permanent civil servant law) was recognized as an injustice after 1945 nor that deprivation of citizenship was automatically reversed resulted in the effects of the widespread attitude of "forgetting" of the history of the 12 years and the co-responsibility of scientists in the injustice not being brought about during that period.

The post-war correspondence of emigrated chemists and biochemists with their German colleagues makes it clear that to a large extent they looked at the problems of the time solely from a German perspective.[81] They emphasized the injustice suffered by themselves and presented themselves as victims at the hands of Hitler and the allies as well as their denazification. This attitude interestingly also predominated with the scientists who were not politically incriminated. One example is Otto Hahn (Figure 11). As the discoverer of atomic nuclear fission but

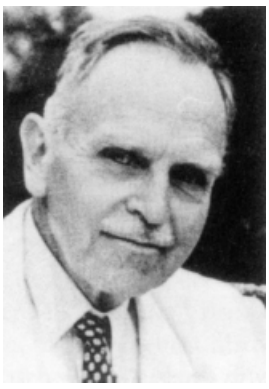

Figure 11. Otto Hahn.

who had not participated in the construction of the atomic bomb and as someone who was known as an anti-Nazi, Hahn embodied the "good" German scientist after 1945. In April 1946 he became president of the Kaiser Wilhelm Gesellschaft (KWG; shortly after the Max Planck Gesellschaft). In his letters to former colleagues in exile the widespread feelings of Germans, who regarded themselves in the first instance as victims, find expression. Furthermore they clearly show his loyalty to the KWG and lack of sensitivity. The absence of self-critical comments and words of sympathy is conspicuous. As Ruth Sime showed in her biography, Lise Meitner suffered under the new nationalism of Hahn, who tried not to mention the past when abroad and to emphasize the injustice that had befallen Germany.[82]

When Otto Meyerhof, one of the few emigrants who after the war corresponded extensively with former German colleagues on the situation of science in Germany, wrote to Hahn, "*nobody who has found safety here from Nazi persecution can think of returning to a country that has become the graveyard of his nearest and dearest*,"[83] Hahn replied in an insensitive manner:[84]

> "*I can understand that after all that has happened here in Germany to your relatives and close friends that you have no desire (sic) to return here. However, I consider it unjust for those abroad to make the majority of Germans responsible for all the happenings during the last 12 years. If it had been known abroad how great the pressure had been, how it intensified from year to year then one would have a certain understanding that many not very strong characters have simply given up the struggle because they said: we cannot change anything*."

Hahn's attempt to justify compromise or obedience to the National Socialist regulations does suggest a certain feeling of guilt, and emphasizes the new solidarity between former Nazis and non-Nazis towards criticism from abroad. Hahn spoke only of political pressure, and thus avoided the active role of the universities and KWG in supporting the anti-Semitic policies.

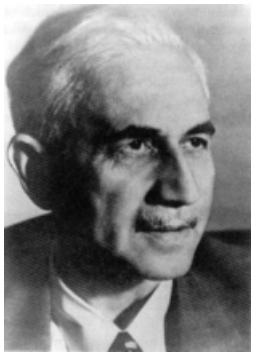

Figure 12. Otto Meyerhof.

Meyerhof (Figure 12) was one of the emigrants who spoke out in favor of scientific relationships with overseas researchers being taken up again as soon as possible with the German "anti- and non-Nazis". He believed there was a right for objective criticism. However, he found as he wrote to Hahn in November 1946 that:

> "*even the best and most tested of my German friends such as yourself have still not been able to free themselves sufficiently from the narrow field of vision imposed by the Nazis to be able to attribute the new situation prevailing in Germany and Europe to its true roots. Whereas I can fully agree with your complaints on the present situation I depart fully in my interpretation. The interpretation I hold is that everything which Germany is now experiencing it 'thanks solely to its Führer' and that it has itself to thank for its Führer. Germany is not only conquered, that is the least, it has gone through a moral catastrophe, which is without example in history. It has catastrophically devastated the surrounding countries and infected them with its moral disease that now we are in a quandary of how the curse of an evil deed that continually brings forth evil can be prevented. Collective judgments are meaningless. With 'Germany' I mean the majority of leading responsible persons.*"[85]

Meyerhof pointed out the difference to France, where in the 1890s a state crisis arose because of a single Jew, Captain Dreyfus. "*When tens of thousands became without rights in Germany in 1933 no one cared, particularly in the universities.*" He recalled the excuses which he heard as he reproached colleagues in Göttingen about the silence of the faculty following James Franck's resignation, and of that which he experienced in Heidelberg at the time. Meyerhof regarded it as "*unavoidable for the recovery of the spiritual life of Germany*" that not only the 150% Nazis should be removed from the universities, but also the 75 to 99%. "*So to say as compensation*" for him and other emigrants standing up for a sensible policy in respect of German science he demanded of Hahn and other non-Nazis that the circumstances in universities be changed and all those who had failed morally be dismissed.

In a short reply, Hahn ensured Meyerhof and "*many other **American** colleagues*" of his and von Laue's friendship, but did not go any further into the questions raised.[86] Instead, Max von Laue, with whom Hahn had discussed Meyerhof's letter, replied. He agreed with Meyerhof's judgment that the moralistic collapse in Germany arose because initial resistance ("*Principiis obsta*") had indeed been possible up to the middle of 1933, but little of it would have been traceable, but he criticized the denazification of the universities, with the exception of political activists, as worse than "*Hitler methods*".[87]

Max von Laue was one of the German scientists who during the Nazi era intervened most strongly for Jews, and whom the anti-Jewish measures had affected emotionally. Even he was not ready to understand what a former Jewish refugee must have felt in 1946 when it was explained to him that the methods of the allies (independent of whether they were regarded as legal or appropriate) were worse than the Hitler methods for those involved. Hahn too annoyed former colleagues who now lived as emigrants abroad when during his visit to Sweden to collect his Nobel Prize in 1946 he expressed the opinion that what the Allies were doing in Germany within the framework of denazification was nothing other than what the Germans had done in Poland and Russia.[88] A few years later, however, von Laue changed his attitude drastically and he became one of the critics not only of the failure of German scientists in 1933, but also of their insincerity after 1945.[89]

The behavior of Hahn, von Laue, and many other German scientists during the initial post-war years is a reminder of "the sentimentalism, selfishness, self-pity, and the lack of objectivity", which according to Michael Balfour and John

Mair "tend to characterize a nation in defeat".[90]. The considerable economic problems in Germany, a narrow nationalistic viewpoint, low sensitivity, and, with Hahn, his new role as President of the KWG (MPG) reinforced this attitude. Such a "forgetfulness" made the cooperation of German National Socialists with those emigrants who would have been willing to aid in the reconstruction of science in Germany impossible, and made normalization of scientific and personal relationships of German scientists with emigrants and colleagues abroad difficult. In particular, former National Socialists had difficulty at first. One example is Adolf Butenandt, who declined a position at Harvard Univerity in 1935; the fact that he had taken over the position of the dismissed Jewish colleague Carl Neuberg as KWI director together with his former membership of the NSDAP made international contacts difficult. For a number of years he was neither invited to international conferences nor did he receive invitations from colleagues in the USA with whom he previously had active exchanges. When during a stay in USA in 1951, the International Union of Chemistry had just decided to accept Germany again as a member Butenandt offered to take part as Germany's representative at a meeting he received no invitation.[91]

Many emigrants and scientists from other countries who had suffered under German occupation expected a word of regret to be expressed after the war. One of them was Sir Francis Simon, formerly Professor Franz Simon from Breslau. In 1951 he refused an invitation from Karl-Friedrich Bonhoeffer to take part in a meeting of the Bunsen Gesellschaft with the following reason:[92]

> "*There are plenty of scientists in the world and what they have to say can be read. When one goes to a conference one will have the feeling that one is with people of the same mind and not in the society of opportunists. In my opinion German scientists in their totality lost their honor in 1933 and have done nothing to win it back. I admit one can say that it is not to everyone's liking to risk his position or life, but after the war it was by no means necessary. The least one could have expected after all the misfortune that had been caused was that German scientists in their entirety or through their scientific societies would have said openly and clearly that they regret what had happened. I have not noted any of this—if I am mistaken please correct me.*"

Fifty years later, in June 2001, the President of the MPG, Hubert Markl, apologized to the surviving victims for the involvement of the directors and staff of the KWG in the crimes of the Nazi regime.

After 1945, new directions of research which had been founded abroad were taken up with considerable delay in Germany, even when material and technical essentials were available. A decisive reason for this lay in the international isolation and self-imposed isolation of German scientists as a result of the National Socialist past. The expulsion, disenfranchisement, and later murder of European Jews as well as the attempt to bring Europe under the domination of National Socialist Germany by aggression had occurred with the knowledge, the involvement, and the active support of scientists. This past, and the fact that the majority of German scientists kept silent after 1945, had a negative effect upon international exchange. It thus delayed for years, in part for decades, the reconstruction of specialties which had been greatly weakened as a consequence of the dismissals in 1933 (above all in biochemistry) as well as the development of new interdisciplinary fields, including molecular biology and physical organic chemistry.

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[1] A. Schleede to R. Kuhn, March 18, 1938, Material of the GDCh, Frankfurt.

[2] W. Biltz and G. Tamannto F. Paneth, November 17, 1938, Archives of the MPG, Sect. III/45/121.

[3] Thus, patents of Jewish chemists in Germany had to appear without names or under other names after 1933. Fritz Haber, who died in 1933, had no obituary in the *Zeitschrift für Angewandte Chemie*, a few other chemical journals, for example, *Berichte der Deutschen Chemischen Gesellschaft* and the *Zeitschrift für Elektrochemie*, did publish obituaries for Haber, but not for other Jewish chemists. The Deutsche Chemische Gesellschaft even exercised restraint in the mention of von Baeyer and Wallach "*on order sooner or later not to be open to undesirable reproach*" as the managing editor of "Berichte" wrote to the president Richard Kuhn on July 14, 1942 (Material of the GDCh, Frankfurt).

[4] U. Deichmann, *Flüchten, Mitmachen, Vergessen. Chemiker und Biochemiker in der NS-Zeit*, Wiley-VCH, Weinheim, **2001**.

[5] Chapter 3 in ref. [4].

[6] Berlin Document Center (now Bundesarchiv (Federal Archive)), REM File W. Prandtl, Gesamturteil der NSDAP-Gauleitung München (Collective Judgment of the NSDAP District Leadership, Munich) of October 19, 1938.

[7] "Otto Krayer. October 22, 1899—March 18, 1982": Avram Goldstein, *Biogr. Mem. Nat. Acad. Sci. USA* **1987**, *57*, 151–225; "Otto Krayer, 22.10.1899 to 18.3.1982 und das 'Gesetz zur Wiederherstellung des Berufsbeamtentums' (April 1933)": U. Trendelenburg, *DGPT Mitteilungen* No. 16, February 1995, 33–34.

[8] E. Chargaff in conversation with U.D., New York, January 27, 1997.

[9] Personal communication from Prof. Henning Hopf, August 13, 1999. Fries, after whom the Fries rearrangement is named, insisted that the swastika flag be removed from a laboratory. To remind present day students of Fries and his stance Prof. Hopf named one of the Braunschweig practical laboratories the Fries Hall.

[10] According to Prof. Hopf after 1933 the TH Braunschweig was particularly thoroughly cleansed because it had refused to appoint Hitler Professor for Political Science (after 1930 the State of Braunschweig had a coalition government of National Socialists and commoners).

[11] On the discrepancies between performance and too high or too low a number of citations see ref. [4], p. 138. Details on the number of citations of non-emigrated (bio)chemists (p. 230) may also be found there. Names and biographical information of 148 dismissed and/or emigrated (bio)chemists are listed there on pages 118–125 and 134.

[12] See also D. Nachmansohn, *German-Jewish Pioneers in Science 1900–1933*, Springer, New York **1979**; "Wieviel Zufälliges doch in der Entwicklung steckt. Als die Physiologische Chemie zur Molekularbiologie wurde. Kritisches zur Geschichte der biochemischen Forschung": L. Jaenicke, in *Wie die Zukunft Wurzeln schlug* (Ed.: R. Gerwin), Springer, Berlin, **1989**; "Paradigmenwechsel und Exodus, Zellbiologie, Zellchemie und Biochemie in Berlin": Michael Engel in *Exodus von Wissenschaftlern aus Berlin* (Eds.: W. Fischer, K.

Hierholzer, M. Hubenstorf, P. T. Walther, R. Winau), de Gruyter, Berlin, 1994, pp. 296-341 (Forschungsbericht 7).
[13] For H. Hellmann, see "Hans G. A. Hellmann (1903 – 1938). I. Ein deutscher Pionier der Quantenchemie in Moskau": W. H. E. Schwarz, D. Andrae, S. R. Arnold, J. Heidberg, H. Hellmann, Jr., J. Hinze, A. Karachalios, M. A. Kovner, P. C. Schmidt, L. Zülicke, *Bunsenmagazin* **1999**, 10 – 21; "Hans G. A. Hellmann (1903 – 1938). II. Ein deutscher Pionier der Quantenchemie in Moskau": W. H. E. Schwarz, A. Karachalios, S. R. Arnold, L. Zülicke, P. C. Schmidt, M. A. Kovner, J. Hinze, H. Hellmann, Jr., J. Heidberg, D. Andrae, *Bunsenmagazin* **1999**, 60 – 70. For information on the effects of the banishment of physicists for chemistry see ref. [4], pp. 154 – 159.
[14] a) See the autobiography of Willstätter: R. Willstätters, *Aus meinem Leben. Von Arbeit, Muße und Freunden*, Verlag Chemie, Weinheim, **1949**. b) On the motives for resignation see also F. Litten, *Der Rücktritt Richard Willstätters 1924/25 und seine Hintergründe*, Algorismus: Studien zur Geschichte der Mathematik und Naturwissenschaften, Heft 32, München, **1999**.
[15] For the scientific influence of emigrants in Turkey see "Die Emigration deutschsprachiger Naturwissenschaftler von 1933 – 1945 in ihrem sozial- and wissenschaftshistorischen Wirkungszusammenhang": Regine Erichsen in *Die Emigration der Wissenschaften nach 1933* (Eds.: H. A. Strauss, K. Fischer, C. Hoffmann, A. Söllner), Saur, Munich, **1991**.
[16] "Hans Stammreich": B. Schrader, A. Otto, *Bunsenmagazin* **2000**, 120 – 122. On the emigration to Brazil see R. G. Saidel, G. A. Plonski, *Shaping Modern Science and Technology in Brazil. The Contribution of Refugees from National Socialism after 1933*, Leo Baeck Institute, New York, **1994**, 257 – 270 (Year Book 39).
[17] "The Emergence of Biochemistry in Portugal during the Twentieth-Century" I. Amaral, A. M. Nunes dos Santos, R. E. Pinto, Lecture at the XXth International Congress of History of Science, **1997**.
[18] M. von Stackelberg to the German Legation in Cairo, September 12, 1938 (personal file of von Stackelberg, University Archive, Bonn).
[19] Letter of the Reichserziehungsministeriums of September, 28, 1938 (personal file of von Stackelberg, University Archive, Bonn).
[20] Judgment of September 15, 1949 (personal file of von Stackelberg, University Archive, Bonn).
[21] "Alexander Schönberg 1892 – 1985": E. Singer, *Chem. Ber.* **1987**, *120*, III.
[22] "Alexander Schönberg 1892 – 1985": E. Singer, *Chem. Ber.* **1987**, *120*, I.
[23] Further literature and source information are found in ref. [4], pp. 128 – 129.
[24] On Fritz Haber, see a) D. Stoltzenberg, *Fritz Haber. Chemiker, Nobelpreisträger, Deutscher, Jude*, VCH, Weinheim, **1994**, and b) M. Szöllösi-Janze, *Fritz Haber 1868 – 1934. Eine Biographie*, Beck, München, **1998**.
[25] Chapter 2 in ref. [4]. For Wieland's political stance, see "Chemiker im Gespräch: Erinnerungen an Heinrich Wieland": H. Hamm-Brücher and G. Freise, *Chem. unserer Zeit* **1977**, *11*, 143 – 149; "Erinnerungen an Heinrich Wieland (1877 – 1957)": B. Witkop, *Liebigs Ann. Chem.* **1992**, I-XXXII; "Heinrich Wieland hundert Jahre: Sein Werk und Vermächtnis heute/Heinrich Wieland Centennial: His Lifework and His Legacy Today": B. Witkop, *Angew. Chem.* **1977**, *89*, 575 – 589, *Angew. Chem. Int. Ed.* **1977**, *16*, 559 – 572. For Straßmann's political stance during the NS era, see F. Krafft, *Im Schatten der Sensation. Leben und Wirken von Fritz Straßmann*, Verlag Chemie, Weinheim, **1981**, pp. 40 – 46. Straßmann is the only German chemist honored with a tree in the Avenue of the Righteous, in Yad Vashem, Jerusalem.
[26] I am not aware whether anyone employed these co-workers beyond the officially allowed deadline.
[27] Berlin Document Center, now Bundesarchiv, REM File Windaus, Windaus to the REM, November 2, 1935.
[28] Cited according to: B. Müller-Hill, *Erinnerung und Ausblendung. Ein kritischer Blick in den Briefwechsel Adolf Butenandts, MPG Präsident 1960 – 1972*, **2001**. There is no reply of Butenandt in his papers.
[29] a) See R. Havemann, *Fragen, Antworten, Fragen. Aus der Biographie eines deutschen Marxisten*, Piper, Munich **1990** especially pp. 81 – 92 (new edition); b) "Robert Havemann—eine deutsche Biographie": D. Hofmann, Epilogue to ref. [29a].
[30] Ref. [29a], p. 83.
[31] "Dem Vaterlande—solange es dies wünscht. Fritz Habers Rücktritt 1933, Tod 1934 und die Fritz-Haber-Gedächtnisfeier 1935": U. Deichmann, *Chem. unserer Zeit* **1996**, *30*, 141 – 149.
[32] See chapter 2.3.2 in ref. [4]. Helmut Behrens, who during National Socialism was active as a student and lecturer in chemistry at the TH Munich, remembers that the anti-Jewish measures including deportation were visible to all, but only a few of his colleagues were affected by them. ("Wissenschaft in turbulenter Zeit: Erinnerungen eines Chemikers an die Technische Hochschule München 1933 – 1953": *Algorismus—Studien zur Geschichte der Mathematik und Naturwissenschaften, vol. 25*, Münchener Universitätsschriften, Munich, **1998**, p. 64.)
[33] Karl Freudenberg to George Barger, July 17, 1933, K. Freudenberg-Nachlass, Universitätsarchiv Heidelberg, Rep. 14/111.
[34] Ref. [33].
[35] S. Friedlander in *Nazi Germany and the Jews, Vol.1*, HarperCollins, New York, **1997**, p. 56.
[36] For Ostwald see Section 2.3, for Freudenberg, Harteck and Bonhoeffer see chapter 2.3.1 in ref. [4]. Harteck refused to intercede for his dismissed colleagues, the Jewish assistants of the KWI for Physical Chemistry; he himself profited from the dismissals in that he took over the position of Otto Stern as Professor for Physical Chemistry in Hamburg. Bonhoeffer did not criticize the dismissals as such, merely the way in which they were carried out. For Havemann, see ref. [24b], pp. 669 – 673. For unknown reasons Havemann denounced the already dismissed or resigned scientists of the KWI for Physical Chemistry—Haber, Freundlich, Kallmann, Polanyi, and Söllner—in the summer of 1933 because of allegedly intended incorrect business practices at the Prussian Ministry for Education.
[37] "German Scientists and Hitler's Vendetta against the Nobel Prizes": E. Crawford, *Hist. Stud. Phys. Sci.* **2000**, *31*, 37 – 53.
[38] "Über manchmal bestehende Schwierigkeiten, einen Chemie-Nobelpreis entgegenzunehmen": A. Neubauer, Lecture at the Annual Congress of the GDCh in Würzburg, September 24, 2001.
[39] A. Ellmer to R. Kuhn on May 28, 1943, Material of the GDCh, Frankfurt, regarding the. publication of articles by Jews.
[40] H. Kretschmar to H. Hörlein on April 23, 1933, Archive of the GDCh, Frankfurt.
[41] For biology, see U. Deichmann, *Biologists under Hitler*, Harvard University Press, Cambridge, **1996**, chap. 2, for chemistry and biochemistry, see chapter 5 of ref. [4].
[42] W. Ostwald to the DFG on May 2, 1937, Bundesarchiv Koblenz (BAK), R73/13500.
[43] a) See B. Müller-Hill, *Murderous Science. Elimination by Selection of Jews, Gypsies, and Others, Germany 1933 – 1945*, Oxford University Press, Oxford, **1988**. Details on the current state of knowledge may be found in the article "Das Blut von Auschwitz und das Schweigen der Gelehrten": B. Müller-Hill in *Geschichte der Kaiser – Wilhelm-Gesellschaft,* vol. 1 (Ed.: Doris Kaufmann), Wallstein, Göttingen, **2000**, pp. 189 – 227.
[44] *Angew. Chem.* **1933**, *46*, 789.
[45] Obtained from records and material on the Verein deutscher Chemiker written and collected by Dr. H. Ramstetter. They are located at the offices of the GDCh. See also W. Ruske, *100 Jahre Deutsche Chemische Gesellschaft*, Verlag Chemie, Weinheim, **1967**, p. 152.
[46] Ref. [44].
[47] R. Havighurst, Rockefeller Foundation, October 6, 1947, Rockefeller Archive Center, Collection RF, RG 1.1/717 box 3, folder 19.
[48] For research support in (bio)chemistry see chapter 5 in ref. [4].
[49] Chapter 7 in ref. [4]; The Fraud of Abderhalden's Enzymes" U. Deichmann, B. Müller-Hall, *Nature* **1998**, *393*, 109 – 111, see also "Sensation, Irrtum, Betrug?—Emil Abderhalden und die Geschichte der Abwehrfermente": M. Kaasch, *Acta Historica Leopoldina*, **2000**, *36*, 145 – 200.
[50] In the budget of the medical branch of the des Reichsforschungsrats, for example, for the year 1938/39 cancer research was supported with considerably higher sums than general medicine and general genetic and race research (BAK, R73/12388, Etat der Fachsparte Medizin 1938/39; Kostenvoranschlag für das Rechnungsjahr 1937/38 für das Arbeitsprogramm auf dem Gebiet der Tumorforschung).
[51] Berlin Document Center (today Bundesarchive) REM File E. Walschmidt-Leitz.

[52] A comprehensive presentation on "German chemistry" is found in "*'Deutsche Chemie'. Der Versuch einer deutschartigen, ganzheitlich-gestalthaft schauenden Naturwissenschaft während der Zeit des Nationalsozialismus*" M. Vonderau, Dissertation, Marburg, **1994**.

[53] a) G. Gellermann, *Der Krieg, der nicht stattfand*, Bernard & Graefe, Koblenz, **1986**; b) "Die deutschen Gaskriegsvorbereitung 1919–1945": R. D. Müller, *Militärgeschichtliche Mitteilungen* **1980**, *1*, 25–54. I.G. Farben also worked—unsuccessfully—on the development of an effective protective filter against nerve gases. The absence of such a protection played an important role in the decision of Hitler and the army in the end not to use chemical weapons. According to Gellermann (ref. [53a], p. 208) other aspects were: the chemical groups of the army, the support troops, were still in their infancy in 1939. Later it was hardly possible to withdraw regiments from the front and to convert them into chemical warfare and defense units which would have been necessary for gas warfare. With the defeat of the Luftwaffe, the most important possible means of deployment of gas warfare agents was finally lost.

[54] Goebbels to Thiessen on September 3, 1936, Archive of MPG, I/1A, 1174.

[55] Thiessen to Telschow on May 4, 1940, Archive of MPG, I/1A, 1175.

[56] See chapter 5 in ref. [4].

[57] a) Georg Graue to Schröder KWG, July 20, 1951. According to Graue, a former co-worker of Thiesse, co-workers and materials were sent there but the work could no longer be started because it was too late; b) see also "Der Physikochemiker Peter Adolf Thiessen als Wissenschaftsorganisator (1899–1990)": C. Eibel, Dissertation, Historisches Institut der Universität Stuttgart, **1999**.

[58] Interrogation of R. Kuhn, April 1–2, 1946 at KWI for Medical Research, BIOS Final Report 542, Item No. 8, Imperial War Museum London, Dept. of Documents; R. Kuhn to Dr. Baumann, September 5, 1945, Archive of MPG, I/29/143; Professor Dr. L. Birkofer, Düsseldorf, April 11, 1994, and Prof. Dr. O. Dann, Eberbach, April 13, 1994, in conversation with UD.

[59] Interrogation of K. Brandt, BIOS Final Report 542, Item No. 8, Imperial War Museum London, Dept. of Documents. According to the information of Kuhn's co-worker Otto Dann, Kuhn expressed in these conversations his worry about the helplessness in protecting his own people in the event of an allied gas attack. (O. Dann in conversation with UD, April 13, 1994).

[60] E. Chargaff in conversation with UD, New York, January 28, 1997.

[61] O. Meyerhof to Richard Kuhn, November 1, 1945, Meyerhof papers, Archives University of Pennsylvania.

[62] See, for example, Peter Hayes, *Industry and Ideology. I.G. Farben in the Nazi Era*, Cambridge University Press **1987** and Joseph Borkin, *Die unheilige Allianz der I.G. Farben. Eine Interessengemeinschaft im Dritten Reich*, Campus, Frankfurt/M **1981**.

[63] See ref. [41], chapter 3.3.

[64] The first critical analysis of the past of human genetics by an anthropologis came from (Karl Saller, *Die Rassenlehre des Nationalsozialismus*, Progress Verlag, Darmstadt, **1961**), by a geneticist from Benno Müller-Hill (ref. [43a]).

[65] M. Walker, *Die Uranmaschine. Mythos und Wirklichkeit der deutschen Atombombe*, Siedler, Berlin **1990**.

[66] a) The protocols are published in: *Operation Epsilon. Die Farm-Hall-Protokolle oder die Angst der Alliierten vor der deutschen Atombombe* (Ed.: D. Hoffmann), Rowohlt, Berlin **1993**; the protocols clearly show that the refusal to construct the atom bomb for moral or political reasons is not discussed; b) the book appeared with a supplement to the introduction by D. Cassidy as *History of Modern Physics and Astronomy, Vol. 1*, Springer, Heidelberg, **1996**.

[67] An early example is *Otto Köhler, ..und heute die ganze Welt. Die Geschichte der I.G. Farben und ihrer Väter*, Rasch und Röhrig, Hamburg, **1980**.

[68] R. Pummerer, *Angew. Chem.* **1949**, *61*, 395. Although Willstätter's resignation in 1925 as a protest against anti-Semitism and his emigration in 1939 "*because of the Hitler persecution of Jews*" was mentioned, there are no passages in which Willstätter took issue with the behavior of his colleagues during the Nazi era. The journal printed a few pages of Willstätter's book in the same edition as a memoriam to Richard Willstätter. The innocuous chapter "*Extraordinarius in München 1902–1905*" was chosen.

[69] *Angew. Chem.* **1950**, *62*, 131–132.

[70] K. Freudenberg to P. Karrer, December 8, 1947, Freudenberg-Nachlaß, University acrchive, Heidelberg, Rep. 14/212.

[71] C. Krauch from the Nuremburg prison to K. Freudenberg June 25, 1948. P. Karlson, *Adolf Butenandt. Biochemiker, Hormonforscher, Wissenschaftspolitiker*, Wissenschaftliche Verlagsanstalt, Stuttgart, **1990**, pp. 149–151.

[72] "Das Nürnberger Urteil im Chemieprozeß": O. Gerhardt, *Phys. Bl.* **1948**, *4*, 429.

[73] Cited according to ref. [72].

[74] For example, in P. Levi, *Ist das ein Mensch? Erinnerungen an Auschwitz*, Fischer, Frankfurt, **1961**; P. Levi, *Die Untergegangenen und die Geretteten*, Hanser, Munich, **1990**.

[75] Cited according to ref. [72].

[76] The leading I.G representatives, particularly the director of the Bayer-Werke Heinrich Hörlein, were incensed by this passage. Hörlein spent many months in discussion with his colleagues at Bayer on possible actions, and he put pressure—without success—on the publisher of the book (Arthur Stoll) and *Angewandte Chemie*, to persuade them to publish a counter-response. See "The Richard Willstätter Controversy: The Legacy of Anti-Semitism in the West German Chemical Industry": J. Wiesen in *The German Chemical Industry in the Twentieth Century* (Ed.: J. E. Lesch), Kluwer Academic Publishers, Dordrecht, **2000**, pp. 347–366.

[77] E. Verg, G. Plumpe, H. Schultheis (Ed.: Bayer AG), *Meilensteine*, informedia-verlags-gmbh, Leverkusen, **1988**, p. 298.

[78] W. Jens, *Eine deutsche Universität. 500 Jahre Tübinger Gelehrtenrepublik*, Kindler, Munich, **1977**, pp. 342–343.

[79] Jewish refugees amongst the chemists who were called back to university teaching positions prior to their retirement were Stefan Goldschmidt (1946, Professor for Organic Chemistry at the TH Munich), Hans Kröpelin (1946, TH Braunschweig), Walter Fuchs (1949, Professor for Technical Chemistry at the TH Aachen), and Georg-Maria Schwab (1950, Professor for Physical Chemistry at Munich University). The following chemists returned to Germany after their age-related retirement: Friedrich Paneth (1953), Fritz Arndt (end of the 1950s), and Alexander Schönberg (1957).

[80] A list with the names of 24 university teachers in Turkey who in 1946 were willing to return to Germany is found in a letter from F. Breusch to O. Meyerhof, January 14, 1946, Meyerhof papers, University of Pennsylvania.

[81] I refer in the main to correspondence in the papers of emigrated Jewish scientists and non-emigrated German scientists as well as to personal interviews with chemists and biochemists.

[82] a) R. L. Sime, *Lise Meitner, A life in Physics*, University of California Press, Berkeley, USA, **1996**, p. 345; b) see also R. L. Sime, *Angew. Chem.* **1991**, *103*, 956–967; *Angew. Chem. Int. Ed. Engl.* **1991**, *30*, 942–953.

[83] O. Meyerhof to O. Hahn, June 25, 1946, Otto Hahn papers, Archive of the MPG, Rep. III/14A.

[84] O. Hahn to O. Meyerhof, June 5, 1946, Otto Meyerhof papers, University of Pennsylvania, Philadelphia, Archives.

[85] O. Meyerhof to O. Hahn, November 8, 1946, Otto Hahn papers, Archive of the MPG, Rep. III/14A.

[86] In letters to colleagues in Germany, Hahn expressed concern on the large number of active Nazis in universities, a concern which he did not communicate with his colleagues in exile. Thus, he questioned Klaus Clusius, Dean of the natural Science Faculty of the University of Munich, in a letter of May 4, 1946 as to how far it was true that a large percentage of active National Socialists were again working at this university (Otto Hahn papers, Archive of the MPG, III/14A.

[87] M. von Laue to O. Meyerhof, December 24, 1946, Otto Meyerhof papers, University of Pennsylvania.

[88] Ref. [82a], p. 345.

[89] Ref. [82a], p. 364.

[90] M. Balfour, J. Mair, *Four-Power Control in Germany and Austria*, Oxford University Press, London, **1956**

[91] A. Butenandt to K. Freudenberg, November 28, 1951, Freudenberg Estate, University Archive Heidelberg.

[92] F. Simon to K.-F. Bonhoeffer, March 22, 1951, Archives of the MPG, K.-F. Bonhoeffer papers.