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DOI: 10.1002/anie.201300056

History of Chemistry

125 Years of Chemistry in the Mirror of "Angewandte"**

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Keywords:
Angewandte Chemie · history of chemistry

In memory of Heinz A. Staab

This Review investigates the development of Angewandte Chemie since the founding of the journal in 1887 and analyzes how its content reflects the changes in chemical research over these 125 years. Although Angewandte Chemie was originally founded as a journal for applied ("angewandte")—technical and analytical—chemistry, numerous review articles and abstracts published even in its first 50 years enable the milestones in chemical research in a much broader sense to be traced nicely. With the introduction of the International Edition in 1962, the author base, which had until then been primarily limited to German-speaking countries, became increasingly international, and the journal experienced impressive growth. Today, with its attractive layout, successful mix of articles, and high impact factor, Angewandte Chemie covers chemical research around the world in its full breadth, with its many achievements and future challenges.

From the Contents

1. Introduction

This year, *Angewandte Chemie* is celebrating its 125th anniversary: a good occasion to look back on the history of the journal and at the same time to explore how it has reflected the development of chemistry over the years. This undertaking was only possible within a sensible timeframe owing to the accessibility of the complete scientific content of the journal from the first issue in 1887 in electronic form in the Wiley Online Library.[1] I "leafed through" each issue electronically and tried to identify and summarize the most important trends from my perspective. It emerged from my reading that the historical development of the journal can best be divided into four eras: 1) the boom period of the chemical industry (1887–1913), 2) the period encompassing the two world wars (1914–1945), 3) the period of rebuilding and consolidation (1947–1980), and 4) the period in which *Angewandte Chemie* experienced rapid growth and internationalization (1981–2012). This analysis can of course only be very incomplete; however, it became clear to me during the preparation of this Review, what a rich source of information the complete electronic availability of all issues offers, especially to science historians, who can use this treasure trove in conjunction with scientific methodology for the detailed and rigorous study of the trends in chemical research and in parallel the social role of chemistry. Across the four indicated time periods, this Review shows how *Angewandte Chemie* has changed over time and which trends in chemistry have shaped the journal in particular. The influence of the respective editors-in-chief is analyzed, as well as the innovations that they introduced during their term. Some of the most important scientific contributions in each of the four time periods are also presented. Those selected significantly influenced the development of journal.

The advent of the industrial revolution in the middle of the 18th century had had far-reaching effects on chemical research at institutions of tertiary education and from the middle of the 19th century on the development of the chemical industry. Although there were already older companies in Germany, such as Merck, whose beginnings can be traced back to the second half of the 17th century, and various soda factories, which enabled the upsurge of the glass industry, many more chemical factories became established from the middle of the 19th century onward, some of which still play a decisive role in industrial-chemical development today. Examples are the companies Bayer, established in 1863 in Elberfeld, and BASF (Badische Anilin- und Sodafabrik), established in 1865 in Ludwigshafen. Chemical research at tertiary institutions laid the foundation for this industrial boom; predictable constitutive organic structural chemistry, as primarily developed by August Kekulé,[2] proved particularly important. Whereas initially the production of natural and synthetic dyes was the main focus of these companies, medicinal research supervened at the end of the 19th century, followed by the plastics industry at the beginning of the 20th century.[3]

At the time of the foundation of *Angewandte Chemie* in 1887, there were already a number of excellent journals in Germany and elsewhere in Europe—in particular, in England and France—for the publication of chemical research. These journals endured in different forms into the 1990s. They were then for the most part merged into the European ("ChemPubSoc Europe") journals,[4] which were founded from the middle of the 1990s, and were in this way instrumental to the success of these new journals. Original chemical research was published in these early journals, in most cases with detailed experimental procedures. Examples of flourishing chemical journals in Germany at the time of the founding of

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[**] The content of all tables and of Figures 1, 9, 11, and 12 is based on information from the journal's homepage or the Editorial Office of *Angewandte Chemie*.

Table 1: *Angewandte Chemie* from 1887 until today (the journal did not appear in 1946).

Name of the journal	Publisher	Editor-in-Chief
Zeitschrift für die chemische Industrie Volumes 1 and 2 (1887)	J. Springer	F. Fischer (1887–1899)
Zeitschrift für angewandte Chemie		H. Caro, L. Wenghöffer (1900–1901)
1–16 (1888–1903)	J. Springer	L. Wenghöffer (1902–1903)
17–20 (1904–1907)	Verlag des VDCh-Kommissionsverlags J. Springer	B. Rassow (1904–1921)
21–33 (1908–1920)	Verlag des VDCh-Kommissionsverlags Spamer	
34–44 (1921–1931)	Verlag Chemie	A. Binz (1922–1932)
Angewandte Chemie 45–54 (1932–1941)	Verlag Chemie	W. Foerst (1933–1966)[a]
Die Chemie 55–58 (1942–1945)	Verlag Chemie	
Angewandte Chemie Ausgabe A: Wissenschaftlicher Teil 59–60 (1947–1948)	Verlag Chemie	
Angewandte Chemie 61–73 (1949–1961)	Verlag Chemie	
Angewandte Chemie and *Angewandte Chemie International Edition (in English)*		H. Grünewald (1967–1978) O. Smrekar (1979–1982)
74–108 (1962–1996) and *1–34* (1962–1996)	Verlag Chemie VCH Verlagsgesellschaft (from 1985)	P. Gölitz (1982–present)
109–125 (1997–present) and *35–52* (1997–present)	Wiley-VCH	

[a] In 1947 and 1948, the journal was published by R. Pummerer and edited by F. Boschke.

Angewandte Chemie are the *Journal für Praktische Chemie*, founded by Otto L. Erdmann in 1828, *Annalen der Chemie*, cofounded by Justus Liebig in 1832, the *Zeitschrift für analytische Chemie*, founded by Carl R. Fresenius in 1862, and the *Berichte der Deutschen Chemischen Gesellschaft*, published by the Deutsche Chemische Gesellschaft (DChG, German Chemical Society) and founded in 1868.[3d] In the year in which *Angewandte Chemie* first appeared, Wilhelm Ostwald founded the *Zeitschrift für physikalische Chemie*; the *Zeitschrift für anorganische und allgemeine Chemie*, published by Gerhard Krüss, appeared for the first time in 1892. Parallel to these journals specialized in original communications, the *Chemisches Zentralblatt*, with abstracts of articles published in the scientific literature on chemistry and chemical technology,[5] had appeared since 1830. Together with the *Chemical Abstracts* published since 1907 by the American Chemical Society (ACS), the *Chemisches Zentralblatt* significantly facilitated access to the primary literature.

In 1867, the DChG was founded by August Wilhelm von Hofmann, who also became its first president. This organization united chemists at tertiary institutions and also to some extent those involved in industrial research.[6] Twenty years later, in 1887, the German Society for Applied Chemistry was founded as a professional association of practical chemists to replace the Verein Analytischer Chemiker (Association of Analytical Chemists), which had been founded in 1877. In 1896, this society was then renamed the Verein Deutscher Chemiker (VDCh, Association of German Chemists).[7] The *Zeitschrift für die chemische Industrie* was established in 1887 as the membership journal of the VDCh and was renamed the following year as the *Zeitschrift für angewandte Chemie*. Its current name, *Angewandte Chemie*, was adopted in 1932 (Table 1).[8] Its first Editor was Ferdinand Fischer of the University of Hanover. After the Second World War, the two chemical societies, the DChG and the VDCh, were merged as the newly founded Gesellschaft Deutscher Chemiker (GDCh, German Chemical Society, 1949),[9] whose most important scientific periodical became *Angewandte Chemie*.

François Diederich, born in 1952 in Luxemburg, studied chemistry at Heidelberg University, where he completed his PhD (with Prof. Heinz A. Staab) in 1979. From 1979 until 1981 he carried out postdoctoral research with Prof. Orville L. Chapman at the University of California at Los Angeles (UCLA). He then returned to Heidelberg to qualify as a lecturer at the Max Planck Institute for Medical Research and moved back to UCLA in 1985 as Acting Associate Professor. He was made Full Professor in 1989 and transferred in 1992 to the ETH Zurich. His research interests include molecular recognition and structure-based drug design, carbon-rich molecular architectures, and optoelectronic materials.

2. The Boom Period of the Chemical Industry (1887–1913)

2.1. The First Years until around 1900

Under initially different names (Table 1), *Angewandte Chemie* was a professional membership journal of the VDCh. The content in the first years of its appearance also reflected the nature of this association. There was a clear focus on applied chemistry, and in particular on technical and analytical chemistry. This focus was also defined by the subtitle of the *Zeitschrift für die chemische Industrie* in its first year: "with particular consideration given to technical chemical methods". Accordingly, authors who made significant advances in chemistry toward the end of the 19th century, such as Adolf von Baeyer and Emil Fischer, are not found; these chemists published in other journals, such as the "*Berichte*" or the "*Annalen*". Instead, articles on developments in industrial processes and technical analysis took up the major part of the issues published in the first year. There were hardly any structural formulas, but instead attractive ink drawings of new apparatus. All in all, the quality of the journal was already high at that time. The effort made to ensure high quality is also reflected by the actively used section "Corrigenda", which has always appeared regularly. Table 2 shows the topic areas to which abstracts with a length of 1–2 pages were assigned in the first year of the journal. Such abstracts of articles published elsewhere were an important component of the journal for many decades. There were also longer articles, all of which contained technical analytical details. For example, the review "On Investigations of Wine", which spanned two issues, described the analysis of the composition of wine.[10] Most articles in the journal were 1–3 pages long. They were mostly review articles, congress reports, and lectures given at meetings; only in the technical and analytical field were there already articles that described original research. In the first and also the following years, a particularly large number of articles appeared by the Editor Ferdinand Fischer and his colleague Georg Lunge (Polytechnikum Zürich) on the board of directors of the VDCh. In 1887, the journal, which appeared every two weeks and was published in two volumes, contained a total of 712 scientific pages and 76 articles (Figure 1). Until 1897, there was little change in the size of the journal, which continued to appear every two weeks and reached a total of 801 pages in 1897 with 174 now shorter articles.

An exemplary table of contents of the *Zeitschrift für angewandte Chemie* for the period 1888–1898 (1894, volume 7, issue 2) is shown in Table 3 and illustrates the technical–analytical focus of the journal.

Table 2: Subject areas of the abstracts in the first year of the journal in 1887.[15]

acids and bases	metallurgy
apparatus	new books
bleaches and paints	organic compounds
combustion plants	organic dyes
explosives	other inorganic materials
fats industry	paper
fermentation industry	statistics, trade reports
foodstuffs	sugar and starches
fuels and lighting	technical methods
glass, clay, and cement	water and ice
manure, waste	

The demand for information was enormous in a time without radio, television, and of course the new media, and could only be satisfied by journals, books, seminars, and conventions. The information published in the journal was remarkably international, whereby industrialization in North America and the developing economic model there were given particular attention. Lunge had already reported on the occurrence and use of natural fuel gas in North America in issue 5 of the first year of the journal.[11] Numerous articles by other authors on industrial development in North America in the following years expressed great interest in and even admiration for the then successful American industrial model.

The huge importance of the great world fairs for the communication of knowledge and information within the developing industrialized society emanates from numerous articles. Thus, Lunge reported in depth on the Paris World Fair of 1889[12] and later on the Columbian Exposition in Chicago in 1893 (Table 3).[13] At the latter, virtually all German chemical companies presented their latest products, which were also mentioned by name in the report about the

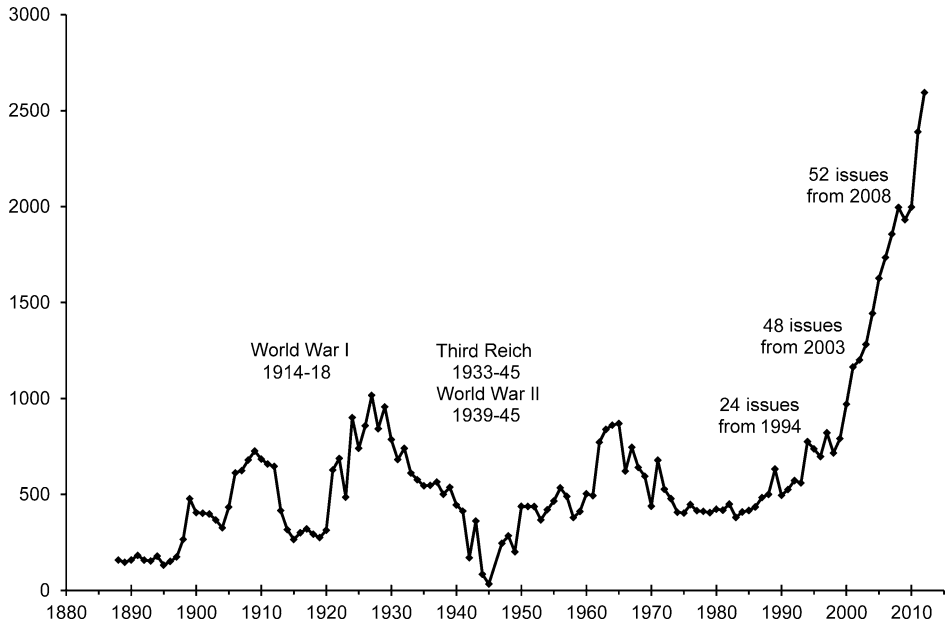


Figure 1. Number of articles published annually in *Angewandte Chemie* since 1887.

Table 3: Table of contents of issue 2 of volume 7 (1894).

Article type		Page
Articles	G. Lunge: The Columbian Exposition in Chicago	37–46
	E. Donath, R. Strasser: On the Determination of Indigotine in Indigo	47–50
	E. Jensch: Bonding Form of the Sulfur That Remains in Roasted Zincblende	50–52
	M. Gröger: Determination of Iodine in the Presence of Bromine and Chlorine	52–54
	A. Borntraeger: Again on the Use of Tartar for the Titer Determination of Standard Bases	54–55
Abstracts	Metallurgy	55–62
New Books		62–64
Proceedings	Proceedings of the Regional Branches of the VDCh	64–68

exposition.[14,15] There were 12 general sections in Chicago: A) agriculture; B) horticulture; C) living creatures: tame and wild animals; D) fish and fisheries; E) mines, mining, and metallurgy; F) machinery; G) transportation; H) manufacturing; I) electricity and its applications; K) fine arts: painting, sculpture, architecture; L) liberal arts: education, music, etc.; M) ethnology and archaeology. According to Long, sections A, E, H, I, and L were the main sections of interest to chemists.[14] The difference between the world fairs at that time and those today, which are predominantly focused on tourism, is evident.

A major section of the journal covered the annual general meetings of the German Society for Applied Chemistry and, after the name change, the VDCh. The lectures held at the annual general meetings were discussed in detail. Many of these lectures were printed, as well as lectures held at other national and international congresses, such as the International Congress for Applied Chemistry. Extremely detailed reports on meetings of regional branches of the VDCh were also published.

At the beginning of the 1890s, electrochemistry was added as a new category to the section "Abstracts". It developed over the following years into one of the dominant topics, and was examined from all angles.[16] This increasing presence in the journal mirrors the increasing industrial application of electrochemistry, for example, in the chloralkali process,[17] in corrosion protection, in the electrolytic refining of coinage metal, and in electrical welding techniques.

In view of the great demand for information, it is not surprising that a well-kept, comprehensive section on new books formed a part of the journal from the start; this section has remained an attractive component of *Angewandte Chemie*. A further feature, which was taken up again some years ago by *Angewandte Chemie*, were the very readable obituaries, the first of which was written by Georg Lunge for his once colleague Victor Meyer, who was at the Polytechnikum Zürich from 1872 until 1885 as the successor of Johannes Wislicenius before he moved to Göttingen and finally to Heidelberg.[18]

A heated discussion took place in the journal toward the end of the 19th century as to the way in which chemists should complete their education for a career in industry. Carl Duisberg, who became a member of the board of directors of the company "Farbenfabriken vorm. Friedr. Bayer & Co" in 1900 and was named chairman of the board in 1912, became particularly involved in this debate (Figure 2). He argued for the introduction of a uniformly regulated state examination that would be valid in the whole of Germany to raise the quality of education of technical chemists, and he underpinned his demand with a nationwide survey sent to all larger chemical companies and factories.[19,20] However, numerous university professors, including Wilhelm Ostwald, Adolf von Baeyer, and Victor Meyer, were opposed to the introduction of such an examination.[19b] This public discussion continued in the journal for several years, until a royal decree on October 11, 1899 established that technical institutes could also award diploma degrees (diploma in engineering, Dipl.-Ing.).[21] Over the following years, Carl Duisberg, more than any other industrial chemist, continued to comment on the level of education of chemistry students and to work for improvements. The intense discussions about education and teaching in the journal at that time stand in stark contrast to the content of leading chemical journals today, in which the topic of teaching hardly occurs, and the focus lies exclusively on research.

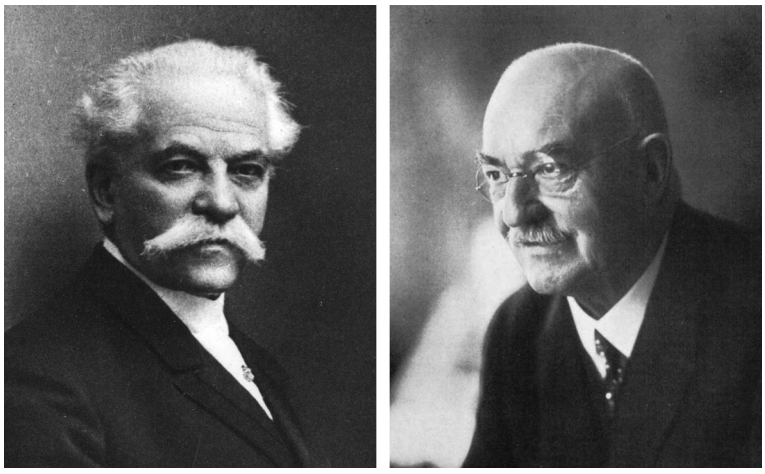


Figure 2. Carl Duisberg (right) and Heinrich Caro (left; from the company archive of BASF), the first director of the scientific laboratory of BASF, around 1900. Duisberg, from 1900 director on the board of the Farbenfabriken vorm. Friedr. Bayer & Co., from 1907 chairman of the VDCh and later chairman of the supervisory board of the I.G. Farbenindustrie AG, was one of the most important authors of the *Zeitschrift für angewandte Chemie*. He did not only comment on economic questions, but was also very committed to ensuring that chemists received a good education.[23]

2.2. The Prosperous Period from the Turn of the Century until the First World War

From 1898 onward, the amount published in the journal increased rapidly, as it now appeared weekly. Until 1903, around 1300 pages were published each year, thereafter over 2000; at the end of this period, the number of pages published each year even exceeded 2800. With very few exceptions, the authors were from Germany and other German-speaking countries. In 1900, there was a change in leadership in the editorial office. Ferdinand Fischer was succeeded by the chairman of the VDCh at the time, Heinrich Caro, who was on the board of directors and the supervisory board of BASF and head of the scientific laboratory there (Figure 2), and Ludwig Wenghöffer, who had until then been responsible for the economic/commercial section of the journal. In 1904, Berthold Rassow then began a 17-year term as Editor-in-Chief of the journal (Table 1).

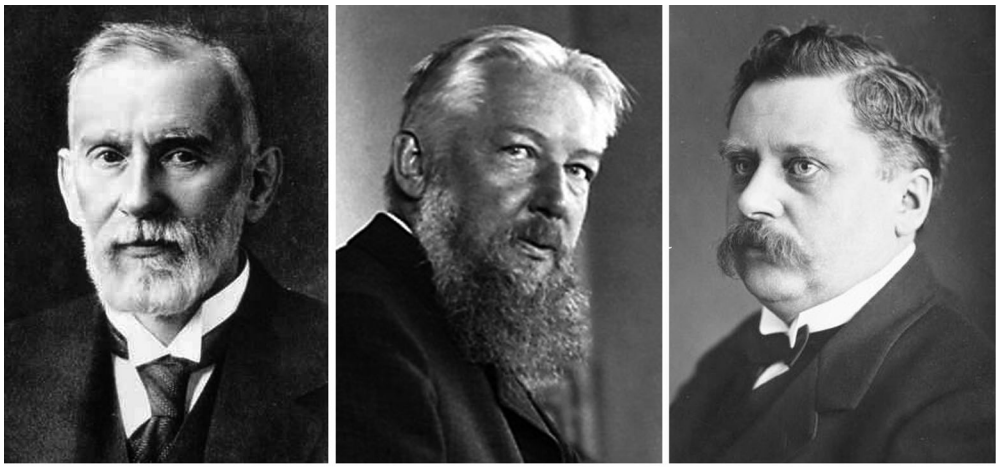
The number of members of the VDCh increased continuously and had reached 5000 by the time the 25th jubilee annual general meeting took place in 1912 in Freiburg im Breisgau; the circulation of the *Zeitschrift für angewandte Chemie* was 5500 in 1910. More and more regional branches were founded, even abroad. Thus, Duisberg gave a lecture about the influence of Liebig on the development of the chemical industry in the Chemist Club in New York on May 12, 1903 at an event organized by the New York regional branch (!) as a centennial celebration of the birth of Liebig.[22,23]

After the change of editorship to Rassow, the range of topics in the journal expanded further—in accord with the rapid and extensive developments taking place in the chemical industry. The table of contents of issue 21 from 1899 and that of issue 1 from 1910 are compiled in Table 4. From 1904 on, abstracts were limited to technical and analytical-chemical developments in Germany and abroad, so as to create complementarity to the *Chemisches Zentralblatt*. Meeting reports (e.g. of the Chemical Society, the Naturforschenden Gesellschaft Basel, the Academy of Sciences in Vienna, the Russian Physical-Chemistry Society at St. Petersburg, or the Chemical Society in Rome) and reports on international congresses continued to serve as important sources of information. Patents and developments in patent protection were discussed regularly along with foreign and trade news in the economic/commercial section of the journal, but also in a section devoted entirely to patents.

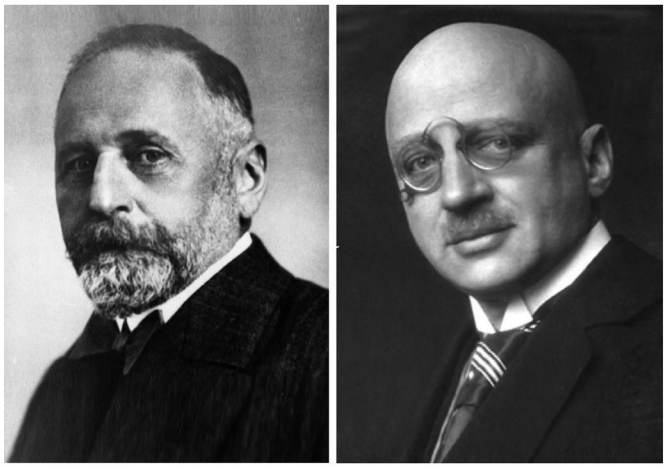
An increasing number of articles dealt with organic and inorganic compounds (Table 4), and more drawings of structural formulas appeared. In 1886, Henri Moisson (Nobel Prize 1906) prepared pure fluorine for the first time, and over the following years, organic fluorine chemistry was developed. Thus, a first review article on organic fluorine compounds appeared in 1899 and the author commented that

Table 4: Table of contents of issue 21, volume 12 and issue 1, volume 23.

Article type		Page
	issue 21 (*12*, **1899**)	
Articles	G. Barth: The Degradation of Cement through the Action of Bacteria	489
	A. Binz, F. Rung: On the Zinc Dust Vat	489–494
	A. Harpf: On Some Properties of Liquefied Sulfurous Acid	495–496
Apparatus	H. Göckel: Report on New Apparatus from the Company Alt, Eberhardt & Jäger in Ilmenau	494–495
	D. Claassen: On Calibrated Saccharimeters	496–497
	F. Friedrichs: Automatic Mercury Air Pump	498
	Apparatus	501–502
Abstracts	Progress in Scientific Electrochemistry in 1898	498–501
	Inorganic Materials	502–504
	Organic Compounds	504–506
	Dyes	506–508
Economic/Commercial Section		508–512
VDCh		512
	issue 1 (*23*, **1910**)	
Articles	C. Duisberg, B. Rassow: To the Members of the VDCh	1–2
	P. Ehrlich: Basic Principles of Experimental Chemotherapy	2–8
	H. Rabe: Studies on the Enhancement of the Performance of Sulfuric Acid Chambers	8–12
	H. Hermanns: The Conveyor Systems at BASF in Ludwigshafen	12–20
	H. Rabe: Taps with a Square Bore	20
	K. Matton: New Safety Syphons	20–21
	Report of the International Atomic Weight Commission for 1909	21–22
Economic/Commercial Section		22–27
News		27
Employment and Higher-Education News		27–29
New Books and Book Reviews		29
From Other Associations and Assemblies		29–32
Patent Lists		32–35
VDCh		36–42
Abstracts		42–48



P. Ehrlich W. Ostwald A. Werner



R. Willstätter F. Haber

Figure 3. Early Nobel Laureates who published in the *Zeitschrift für angewandte Chemie*, with the year in which they received the Nobel Prize and the source of the photograph: Paul Ehrlich (1908; Deutsches Historisches Museum Berlin), Wilhelm Ostwald (1909; www.nobelprize.org), Alfred Werner (1913; ETH-Bibliothek Portr. 09965.jpg), Richard Willstätter (1915; Chemische Sammlung, Departement Chemie und Angewandte Biowissenschaften (D-CHAB), ETH Zurich), Fritz Haber (1918; http://commons.wikimedia.org/wiki/File:-Fritz_Haber.png).

"from a medicinal point of view, fluorine compounds have already become a big field".[24]

Fritz Haber (Figure 3) was the first later Nobel Laureate (1918) to publish in the *Zeitschrift für angewandte Chemie*. In 1900, he presented an overview of his "Investigations on the Electrolytic Reduction of Nitro Bodies",[25] and in the following year he reported in detail on the progress made in electrochemistry on the basis of what he had seen at the Paris World Fair in 1900.[26]

Progress reports from fields outside technical analytical chemistry now appeared regularly and with ever-shorter intervals between them. Topics included inorganic experimental chemistry, ethereal oils and scents, bacterial research, food chemistry, natural products, organic chemistry, pharmaceutical chemistry and drugs, photochemistry, physiological chemistry, and radioactivity. In particular, the rapid development of organic and pharmaceutical chemistry at the time is strongly reflected in the content of the journal. For example, issue 1 of 1910 (see Table 4) contains a legendary article by Paul Ehrlich (Figure 3) on the "Basic Principles of Experimental Chemotherapy".[27] Like most of the long review articles at the time, that of Ehrlich was also based on a lecture, in this case held at the annual general meeting of the VDCh in Frankfurt am Main.

The interest in the American economy continued to occupy a large part of the journal. Thus, it was reported on the new big power stations at the Niagara Falls;[28] the article on the St. Louis World Fair in 1904 took up almost the whole of issue 51, including a report on a visit to the Anheuser-Busch Brewery in St. Louis.[29] A further article deals with the "American Entrepreneurial Spirit as a Consequence of Upbringing".[30]

The progress reports in organic chemistry were dominated by new reactions, such as the Grignard reaction,[31] and by heterocyclic chemistry. With an important lecture at the annual general meeting of the VDCh in Nuremberg on June 8, 1906 "On the Question of Valency", which was printed in full in the journal,[32] the later Nobel Laureate Alfred Werner from Zurich (Figure 3) provided the foundation for the rise of inorganic complexation chemistry several decades later. In his lecture, he postulated octahedral ligand coordination on the basis of experimental findings and discussed the various isomers yielded by the presence of different ligands in this coordination mode.

The term catalyst was defined in 1895 by Wilhelm Ostwald (Figure 3), who received the Nobel Prize in 1909 for his physical-chemical studies toward the understanding of catalysis. Catalysis rapidly became a central issue in industrial technical chemistry. It is therefore not surprising that articles on catalysis appeared increasingly in the journal. A long essay by Fritz Raschig entitled "Thoughts on Catalysis",[33] which was also based on a lecture at the Nuremberg general meeting, attracted enormous attention and was followed by a large number of related articles, some of which also put forward opposing views. Ostwald, an active author of the journal, had the chapter "On Catalysts" of his book "Principles of Chemistry" published in the journal in 1907.[34] A further topic of fierce scientific contention, in which Raschig but also Lunge and others were involved, was the mechanism of the lead chamber process for the production of sulfuric acid and the intermediates formed in the process.[35,36]

The discussion about safety and the effects of industrial chemistry on the environment also began at this time. Not only were big accidents described in detail, such as the explosion in the Chemischen Fabrik Griesheim-Elektron, in which 17 people died and 20 were seriously injured,[37] but an increasing number of articles appeared that dealt with the effects of harmful industrial gas emissions, the problem of the sulfur in coal and coke, or water pollution.

In 1908, the section "News" was added, in which the latest developments in industry at home and abroad were reported, as well as details of conferences and company anniversaries (Table 4).

A wealth of new topics established themselves around 1910. The demand for fuel for emerging motor vehicles as well as the energy issue in general (coal, hydroelectric power) now found their way more and more into the journal. Furthermore, the topic of colloid chemistry became increasingly popular. Haber, an active author of the journal, reported in 1910 on the production of nitric acid from air and thus for the first time on the challenge of the "Technical Transformation of Free Nitrogen into Fixed Nitrogen".[38,39]

In 1911, the VDCh awarded the first Adolf von Baeyer Medal to Paul Friedländer, the discoverer of thioindigo, for his research on dyes; in 1912, Fritz Hofmann, the inventor of artificial rubber ("Buna"), received the first Emil Fischer Medal, which was sponsored by Carl Duisberg. In 1911, issue 23 was entirely devoted to the memory of Heinrich Caro, and began with a "Memorial Page" by Duisberg.[40] Caro (Figure 2), whose name is not only connected with peroxymonosulfuric acid (the Caro acid), but also directly with the development of numerous groundbreaking BASF products, such as alizarin and methylene blue,[41] died on September 11, 1910. There were also obituaries for important foreign scientists, such as Alfred Nobel, Jacobus Henricus van't Hoff, Dimitri Medelejev, and Marcellin Berthelot.

In 1912, synthetic rubber became an important topic,[42] and the age of macromolecular chemistry began. The articles cited in Ref. [42], including a contribution by Fritz Hofmann, are based on lectures that were held at the 25th jubilee annual general meeting of the VDCh in Freiburg. Hermann Staudinger took up a position at the ETH Zurich in 1912 as the successor of Richard Willstätter, who moved first to the newly established Kaiser Wilhelm Institute of Chemistry in Berlin and in 1916 as the successor of Adolf von Baeyer to Munich. At the ETH, Staudinger took up his research on high-molecular-weight materials and made significant progress in their development before his move to Freiburg in 1926.

A further increase in the size of the journal occurred in 1913: it now appeared with 102–104 issues a year, that is, twice a week. Of the approximately 2500 pages, a third were taken up by original scientific reports (which are considered herein), a further third by abstracts, and the last third by news on economic and VDCh issues. For a time, two types of issue were published alternately: one with only scientific articles and one with news on economic and association issues; this publication pattern explains the large number of issues published each year.

At the 8th International Congress of Applied Chemistry in September 1912 in New York (which, like its predecessors, was reported on in depth), Duisberg, who had given up his position as chairman of the VDCh at the beginning of the year, gave a long lecture on "The Latest Achievements and Problems of the Chemical Industry", in which he emphatically highlighted the by now remarkable breadth of industrial chemical research and technology.[43] Also at this event, August Bernthsen, who as the successor of Heinrich Caro led the main laboratory of BASF, gave a lecture on the synthesis of ammonia. He said that Haber (Figure 3) was convinced that a technical synthesis of ammonia from the constituent elements was possible and was in contact with BASF with respect to the promotion of these studies.[44] The journal also printed the lecture of Leo H. Baekeland, in which he spoke about the chemical composition of resinous phenol condensation products (bakelites), on the occasion of the conferment of the Willard Gibbs Medal of the American Chemical Society.[45] As the first article by Richard Willstätter (Figure 3) in the journal, the transcription of his lecture "On Chlorophyll" at the annual general meeting in Breslau appeared in 1913;[46] two years later he obtained the Nobel Prize in Chemistry for his research on plant pigments, in particular on chlorophyll.

3. The Period Encompassing the Two World Wars (1914–1945)

The journal experienced a significant downturn twice in this era as a result of the two world wars and the National Socialist dictatorship, and a high point in the second half of the 1920s, which lasted until Hitler seized power (Figure 1). These three periods are discussed separately herein. During the time between 1914 and 1945, the journal remained predominantly a national periodical, with few contributions from foreign authors.

3.1. The First World War

The downturn of the journal in the First World War was initially mainly a consequence of censorship, as many technical and industrial companies, as well as the institutes

of the Kaiser Wilhelm Society (founded in 1911), such as the Kaiser Wilhelm Institute of Physical Chemistry directed by Haber (now the Fritz Haber Institute of the Max Planck Society),[47] were engaged in research and development relevant to the war. As the war continued, more researchers were also drafted, and thus research institutes lost more and more staff.

The First World War began on August 1, 1914. Its influence was not apparent until the end of the year in the journal, which was at first structured as before. It was reported in detail in two issues on the annual general meeting that took place in Bonn from June 3 to June 6, 1914.[48] At this event, Haber was presented with the Liebig Medal, which had been founded in 1903 by the VDCh on the occasion of the 100th anniversary of Liebig's birth, for the synthesis of ammonia[49] (BASF had applied in 1910 for a patent for the Haber–Bosch Process, which was successfully carried out in 1913), and Willstätter was presented with the Adolf von Baeyer Medal for his research on chlorophyll and plant pigments (Figure 3).

Toward the end of 1914, the war became a central theme in the journal, with topics such as how the VDCh was supporting the war effort, patent law and war, and war-related export bans and legislation. In the following years, articles in the scientific section of the journal covered the feeding of the population during wartime, the chemical industry and war, the situation of the chemist during wartime, and similar topics in a patriotic, although in comparison with the later propaganda under the Nazi dictatorship, not intolerable style. The inhuman use of gas in the First World War—a violation of international human rights—was promoted to a large extent by Fritz Haber, and was not mentioned in the journal until later on, although still before the end of the war.[50]

From 1916 on, there was a continuous decrease in the size of the journal and the number of articles published. However, it was still reported on the development of chemistry in countries with which Germany was at war, such as England and France.[51] Research and development in pharmaceutical companies appeared to have been affected very little at this time. Thus, Carl Mannich wrote in his half-yearly report "Pharmaceutical Specialties and Nostrums" on behalf of the Section for Medicinal–Pharmaceutical Chemistry: "The great war has not been able to significantly stem the flood of constantly emerging specialties and nostrums."[52] In accord with this assessment, quarter-yearly reports on new drugs appeared from 1917 on.

As early as 1911, the VDCh set up an anniversary trust,[53] one of the aims of which was "to send young chemists on study trips". Later, in 1917, the "Liebig Scholarship Society for the Promotion of Young Scientists" was founded,[54] the purpose of which was to grant scholarships to German chemists who had completed their tertiary education, primarily those with a PhD degree, to enable them to broaden their knowledge as assistants of professors. The Liebig Scholarship Society, whose first chairman was Duisberg, was effectively the predecessor of the present-day Chemical Industry Fund of the German Chemical Industry Association, a fund set up in 1950 by Otto Bayer.[55] The motivation to set up such a society was to make Germany economically competitive again for the time after the war, the imminent end of which was alluded to in more and more articles.

At the annual general meeting of the VDCh in Leipzig, Ostwald held a lecture on October 21, 1916 on the "Analysis and Synthesis of Colors", which was received with "sustained applause" and in 1917 was published as the first of numerous articles on "Ostwaldian color theory".[56] Additionally, from 1916 on, review articles were published annually on the research carried out on valency in the previous year, as valence theory to describe chemical bonding had become increasingly accepted by practical chemists.[57,58]

Shortly before the end of the war, in November 1918, Alfred Stock published a major article on chemistry instruction at high schools in Germany.[59] Like many other articles, for example, on the economic and employment situation of chemists,[60] this assessment was intended to identify prospects for overcoming the huge challenges that were expected for the time after the war. With respect to education, Stock called for better coverage of the subject of chemistry, for which, however, the required well-trained teachers were lacking.

3.2. The Period between the World Wars

The downturn of the chemical industry lasted into the 1920s as result of the recession, war damage, and reparation payments, as well as the temporary boycott of German products by some countries. However, the primary reason for the decline was the lack of available chemists and the limited workforce in general.

In 1919, the abstracts became a component of the *Chemisches Zentralblatt*. The *Zeitschrift für angewandte Chemie* still published 104 issues a year, and from this point on, issues containing research accounts and summarizing review articles and those containing economic and association news were published alternately. Reprints were introduced.[61] In several articles, attempts were made to come to terms with the world war and the problems that had arisen as a result of it, and to develop new perspectives for the future.[62] The journal reestablished international ties by offering space to foreign authors. In this way, the presidential address of Sir William J. Pope at the annual general meeting of the Chemical Society on March 27, 1919 on "Chemistry in the National Service" was printed in translation.[63] H. Grossmann wrote about "The Importance of the Study of Foreign Languages for the Education of Chemists".[64] All in all, around 1920, the journal was very insubstantial in terms of the scientific part: only 352 scientific pages were published in 1920 in the 104 issues. Afterwards the amount published increased again rapidly to a new high in 1927 with 1596 pages. In the following years, the great global economic crisis and the subsequent depression again led to fewer pages. In 1922, Arthur Binz became Editor. The journal was published weekly (52 issues) from 1924 on by the newly founded publisher Verlag Chemie. Its name was changed in 1932 to the current *Angewandte Chemie*. The membership of the VDCh increased steadily: in June 1926 there were already 8000 members, and the number climbed further to 9500 in 1935.

Issues on a particular topic and other special issues appeared, mostly in honor of a researcher or industrial chemist who had contributed significantly to the development of a field. Examples are issue 62 of 1922 for the 70th birthday of Heinrich Precht[65] with ten articles on the potash industry and its research, issue 11 of 1923 for the 70th birthday of Gustav Aufschläger with eight articles on the explosives industry,[66] and issue 53 of 1923 for the 70th birthday of Ernst Beckmann (Beckmann rearrangement).[67] A special issue appeared later (1931)[23] on the occasion of the 70th birthday of Duisberg, who over several decades had certainly done more than any other for the organization of research in the natural sciences in Germany, and in particular for the VDCh.

Table 5 gives an example of how the journal was structured at the time around 1930. Although the spectrum of scientific topics was expanding, technical analytical chemistry remained dominant. Indeed, accounts of original research were almost exclusively on this general topic. Friedrich Bergius (Nobel Prize in Chemistry 1931 together with Carl Bosch) contributed a major review article in technical chemistry on "New Methods for the Processing of Mineral Oil and Coal";[68] in an essay, the famous architect Walter Gropius posed the question: "What Does the Modern Architect Expect from Building-Materials Chemistry?"[69]

Developments in the various branches of chemistry were examined in detail in regular progress reports. Thus, just after the war, overviews appeared on the developments in aliphatic chemistry (by Willstätter)[70] and on new pharmaceutical products introduced during the previous few years.[71] A particularly important series was "Progress in Organic Chemistry" (see the example in Table 5), the forerunner of the later successful series "New Methods in Preparative Organic Chemistry" (see Table 6). High-quality overviews, mostly based on lectures (especially at annual general meetings of the VDCh but also at colloquia held at universities and the Kaiser Wilhelm Institutes), showed the broad expansion of the spectrum of scientific research during the 1920s. The following examples illustrate this trend.

The age of atomic theory and quantum theory, in which physics and physical chemistry in Germany played a leading role, had begun. Walter Peters provided a first overview in 1920 on the research of Rutherford, Bohr, Planck, and other key researchers,[72] which was followed in the coming years by many others. Lise Meitner (Figure 4) wrote about "Radio-

Figure 4. Lise Meitner (source: http://www.helmholtz-berlin.de/aktuell/pr/pm/pm-archiv/2003/lise-meitner_de.html) and Otto Hahn (source: http://www.biography.com/people/otto-hahn-9325003).

activity and Cosmic Processes" in 1923,[73] Otto Hahn (Nobel Prize in Chemistry 1944) about "Atomic Disintegration and Element Research" (Figures 4 and 5) in 1924,[74] Alfred Stock about "The Atom",[75] Herrmann Mark about "Atomic Structure and Quantum Theory",[76] Arnold Sommerfeld about "The Theory of the Periodic Table and the Development of Wave Mechanics",[77] Hans Reichenbach about "Einstein's New Unified Theory on Gravity and Electricity",[78] and Max Born (Nobel Prize in Physics 1954) about the "Theory of Homopolar Valence in Multiatomic Molecules".[79] In the 1920s, figures were still very rare, and most of these overview articles are purely text documents.

Although X-ray crystal-structure analysis had already been developed in the previous decade (Max von Laue received the Nobel Prize in Physics as early as 1914, the

Table 5: Table of contents of issue 1 of volume 43 (1930), which had a total of 1152 pages.

Article type		Page
Articles	E. Brüche: Some New Results in Atom Physics and Nuclear Chemistry	1–6
	E. Lehmann: Progress in Organic Chemistry 1924–1928. II	6–12
	D. Vorländer: Current Knowledge on Amorphous and Crystalline Resins and Varnishes	13–16
	A. Lottermoser and F. Schwarz: Studies on Viscose III. On the Influence of Oxygen on the Ripening of Viscose	16–19
	F. Help: Dr. phil. Dr.-Ing. e. h. Wilhelm Heraeus. Senior Proprietor of the Company W. C. Heraeus in Hanau, on the Occasion of his 70th Birthday on January 9, 1930	19–21
Analytical Technical Investigations	H. Ginsberg: On Quantitative Sulfate Determination in the Presence of Aluminum Fluorides	21–24
Conference Reports	Annual Meeting of the German Section of the International Society of Leather Industry Chemists	24–25
	German Association for Technical Roentgenography jointly with the Association of German Foundry Experts and the International Office of the Technical University Berlin	25–28
News		28–29
Employment and Higher-Education News		29
New Books		29–32
VDCh		32

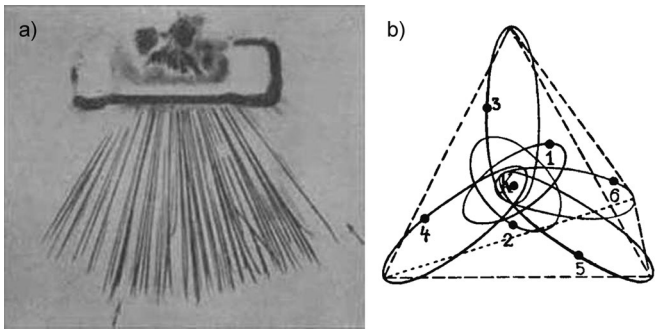


Figure 5. Figures from "Atomic Disintegration and Element Research" by O. Hahn:[74a] a) particle tracks of α rays; b) Bohr model of carbon.

Debye–Scherrer method for X-ray diffraction dates from 1915, and the Nobel Prize in Physics went to William Henry and William Lawrence Bragg in 1915),[80] it was not used in research for structure elucidation until the 1920s, and initially only by specialists, as shown by two overview articles in 1925 by A. Reis[81] and Mark,[82] who carried out research with Karl Weissenberg. For example, these new methods were used to elucidate the structure of carbon modifications.[83] However, crystal-structure analysis was not implemented widely for structure elucidation in organic and inorganic chemistry until the 1950s and 1960s.

In organic chemistry, the first articles by Karl Freudenberg[84] appeared in the journal, as well as more regular accounts of original research by Paul Karrer (Nobel Prize 1937), for example, "Investigations of Polymer Carbohydrates" and "On Reserve Cellulose and Cellulose",[85] and the journal developed increasingly into a forum for the intensely studied field of sugar chemistry,[86,87] which also attracted communications from non-German-speaking countries.[88] Numerous detailed overviews on new methods in organic chemistry appeared,[89] for example, on catalytic hydrogenation and its application.[89b] Taddeus Reichstein (Nobel Prize in Medicine 1950) summarized heterocyclic chemistry for the period 1929–1931 together with R. Oppenauer in the series "Progress in Organic Chemistry".[90] Paul Walden became an important author, who demonstrated in 1925 how stereochemistry affected technical developments—from dyes and tanning agents to medicines.[91] One of the rare articles by an author from a non-German-speaking country was contributed by William A. Noyes from the University of Illinois in Urbana, who spent time in Germany on a lecture tour and lectured on "Oxidation and Reduction as Electronic Processes".[92] Early studies of important future authors of the journal were published, such as that of Karl Ziegler (Nobel Prize 1963) on the investigation of free radicals[93] and that of Richard Kuhn (Nobel Prize 1938) on the analysis of organic compounds by oxidation with chromic acid.[94]

With natural products chemistry and physiological chemistry, further branches of chemistry developed at a wild pace in the 1920s. Thus, Max Bergmann reported in 1925 "On the Macromolecular State of Carbohydrates and Proteins and Its Synthesis",[95] Hans Fischer (Nobel Prize 1930) "On Hemoglobin and Some Porphyrins",[96] Heinrich Wieland (Nobel Prize 1927) in his Nobel Lecture on "The Chemistry of Bile Acids",[97] Adolf Butenandt (Nobel Prize 1939) "On the Chemical Investigation of Sex Hormones",[98] and Otto Warburg (Nobel Prize in Medicine 1931) in his Nobel Lecture on "The Oxygen-Transferring Respiratory Ferment".[99] With the Nobel Lecture of Heinrich Wieland began the tradition, which continues to this day, of printing the lectures of the Nobel Laureates for chemistry as well as for physics and physiology or medicine—when the topic has high relevance to chemistry—in *Angewandte Chemie*. This tradition was only interrupted during the National Socialist regime.

A further scientific milestone in the 1920s was the development of macromolecular chemistry by Staudinger (Figure 6), who was awarded the Nobel Prize in 1953. Already

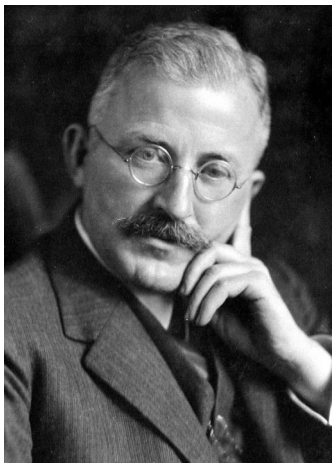


Figure 6. Herrmann Staudinger (1935; source: ETH-Bibliothek Zurich, Bildarchiv).

in 1920, at the ETH Zurich at the time, he postulated that many materials described previously as organic colloids were actually highly polymerized or highly condensed products, in which the core building blocks were bonded to one another through normal valence bonds.[100] The challenging identification and analysis of such different polymers as rubber,[101] polyoxymethylene, cellulose, and polystyrene was described by Staudinger in several accounts with detailed experimental data, and the two-part article on "The Chemistry of High-Molecular-Weight Organic Materials in Terms of Kekulean Structure Theory", which he—now in Freiburg—published in 1929, is a highlight of this period.[102]

3.3. The National Socialist Dictatorship and the Second World War

The disastrous influence of the criminal National Socialist government on chemistry and the chemists in Germany was covered authoritatively at the beginning of the year 2000 by Ute Deichmann in her habilitation treatise. I whole-heartedly recommend her book *Flüchten, Mitmachen, Vergessen: Chemiker und Biochemiker in der NS-Zeit*[103] as well as her review in *Angewandte Chemie* on this topic in 2002.[104] My brief account herein demonstrates which areas of chemistry continued to develop fruitfully, at least until the beginning of

the Second World War, and which changes in content during this time shaped *Angewandte Chemie* even beyond the end of the war.

Soon after the seizure of power by Hitler and the Nazi party, on April 7, 1933, the law for the restoration of the professional civil service was passed,[105] which led to the removal of Jewish and politically unpopular civil servants from public service. Over the following years, a great many important scientists and their employees at tertiary institutions were forced into exile or emigrated, in particular in the fields of biochemical (physiological) research and quantum physics. Organic chemistry was less affected[103] and gained influence at the expense of other areas of research. This situation necessarily led to a reorientation of *Angewandte Chemie*, which was initiated and carried out systematically at the end of the 1930s by Wilhelm Foerst, who succeeded Binz as Editor-in-Chief of the journal from 1933 until 1966, with a break during the years 1946–1948 (Table 1). Unfortunately, Foerst, whose contribution to the development of the journal is undisputed and can not be ignored, "…did not prevent *Angewandte Chemie* from providing space for the criminal National Socialist (Nazi) ideology", as Peter Gölitz wrote in his editorial to mark the 125th anniversary of the journal in issue 1 of this year.[106]

In 1933, in the first half of which National Socialist propaganda in the scientific part of the journal was still hardly noticeable, 52 thin issues with a total of just 814 pages appeared. These issues were structured similarly to that highlighted in Table 5. The style of the journal changed in the following years: even entirely technical contributions were presented, for example, under the series title "Tasks of Chemistry in the New Germany". The VDCh annual general meeting, which was always reported on in detail with ever more intolerable Nazi propaganda, became the "Reichstreffen der Deutschen Chemiker" ("Assembly of German Chemists in the German Reich").

Annual page volumes of 800–900 pages were maintained until 1940, when only 26 double issues with 596 pages were published. From 1943, the journal appeared irregularly; in 1944, seven issues were published with a total of 164 pages, and in 1945 just three issues with 80 pages. In 1946, *Angewandte Chemie* did not appear at all. For a time, from 1942 to 1945, the journal was renamed *Die Chemie*. Since 1934, there has been a distinction made between essay/review articles and communications of original research in the structuring of the journal. Furthermore, for reviews, keywords relating to the content were introduced.

The printing of Nobel Lectures was continued at first; thus, in the year after they received their Nobel Prize, Irving Langmuir (Nobel Prize 1932) reported on "Surface Chemistry",[107] Harold Urey (1934) on "Some Thermodynamic Properties of Hydrogen and Deuterium",[108] Irène Joliot-Curie and Frédéric Joliot (1935) "On the Synthesis of Radioactive Elements",[109] and Peter Debey (1936) on "Methods to Determine the Electrical and Geometrical Structure of Molecules";[110] this last lecture appeared in a special issue for the 50th anniversary of *Angewandte Chemie*, for which Walden wrote the editorial.[111] After 1937, no more Nobel Lectures were printed, and the tradition was not taken up again until 1954, with the lecture of the Nobel Laureate in Physiology or Medicine of the previous year, Hans A. Krebs, on the citric acid cycle.[112]

In terms of its content, the journal was still dominated by technical analytical chemistry; however, organic chemistry was catching up fast. In the field of natural products, Helmut Bredereck summarized in 1934 the progress that had been made in the still young research area of nucleic acids.[113] Vitamin research was of particular importance in Germany;[114] therefore, progress in this field was reported on in detail in issue 30 of 1934 and also later on.[115] In 1938, Richard Kuhn received the Nobel Prize in Chemistry for his research on carotenoids and vitamins.[116] He remained one of the most active authors of the journal until the end of the war and beyond. His dubious conduct under the Nazi regime and during the Second World War, when he was involved in the development of nerve gases, which were fortunately never used, has been investigated and documented in detail.[103,104,117]

In 1939, the Nobel Prize in Chemistry was awarded to Adolf Butenandt for his studies on steroid hormones[98] and Leopold Ruzicka for his research on polymethylenes and higher terpenes.[118] In the previous year, Feodor Lynen published his first article in the journal on "The Virus Problem".[119]

There were important developments in organic synthetic and structural chemistry, with new authors, who would have a significant influence on chemistry after the Second World War. Thus, Rudolf Criegee reported on the oxidative cleavage of the C–C bond,[120] Georg Wittig described the occurrence of free radicals in organic reactions,[121] and Freudenberg proposed a structure for lignin.[122] As early as 1934, Kurt Alder and G. Stein described the thermal polymerization of cyclopentadiene,[123] and Hans Herloff Inhoffen reported from the main laboratory at the company Schering on the synthesis of aromatic steroids.[124] These developments, along with many others published for the most part in the "*Berichte*" and the "*Annalen*", prompted the Editor-in-Chief Foerst to introduce a series in 1940 on "New Methods in Preparative Organic Chemistry", to which many prominent authors contributed. This series, which appeared from 1940 to 1943 (Table 6) and was then continued from 1955 until 1969, was also published in the form of a book. It stands, in my eyes, for the turning point of the journal with regard to its content. From this point on, the journal increasingly moved away from applied, technical analytical chemistry. The editorial statement to introduce the series was followed directly by the overview "Syntheses with Lithium Organic Compounds" by Wittig as the first contribution.

Initial signs of the boom in inorganic chemistry that began in the 1950s (see Section 4) also appeared before the Second World War. Thus, Walter Hieber, who according to Ernst Otto Fischer was the father of metal carbonyl chemistry,[125] reported on metal-carbonyl–hydrogen compounds,[126] Erich Einecke described the state of fluorine chemistry 50 years after the synthesis of elemental fluorine by Moisson,[127] and Erich Zintl reported on intermetallic compounds and phases, which are connected with his name.[128]

Table 6: Contributions to the series "New Methods in Preparative Organic Chemistry" until 1943.

Author	Title	*Angew. Chem.*
	New Methods in Preparative Organic Chemistry: Editorial Statement	**1940**, *53*, 241
G. Wittig	Syntheses with Lithium Organic Compounds	**1940**, *53*, 241–247
T. Bersin	Meerwein–Ponndorf Reduction and Oppenauer Oxidation	**1940**, *53*, 266–271
R. Criegee	Oxidation Reactions with Lead Tetraacetate and Periodic Acid	**1940**, *53*, 321–326
H. Brockmann	Chromatographic Adsorption	**1940**, *53*, 384–390
W. Bockemüller	Introduction of Fluorine into Organic Compounds	**1940**, *53*, 419–424
F. G. Fischer	Use of Biochemical Oxidation and Reduction Reactions for Preparative Purposes	**1940**, *53*, 461–471
F. Wittka	Molecular Distillation	**1940**, *53*, 557–567
G. Schramm	New Methods for the Purification of Proteins	**1941**, *54*, 7–14
J. Nelles	Substitutions on Aliphatic Compounds	**1941**, *54*, 77–85
B. Eistert	Syntheses with Diazomethane	**1941**, *54*, 99–105, 124–131 and **1942**, *55*, 118–121
G. Stein	Oxidation Reactions with Selenium Dioxide	**1941**, *54*, 146–152
H. P. Kaufmann	Methods for the Rhodanation of Organic Compounds	**1941**, *54*, 195–199
R. Schröter	Hydrogenation Reactions with *Raney* Catalysts	**1941**, *54*, 229–234 and 252–260
D. Kästner	Boron Trifluoride as a Catalyst for Chemical Reactions	**1941**, *54*, 273–281 and 296–304
C. Grundmann	Hydrogenation Reactions with Copper–Chromium Oxide Catalysts	**1941**, *54*, 469–474
K. Alder	Methods of Diene Synthesis	**1942**, *55*, 53–58
P. L. A. Plattner	Dehydrogenation Reactions with Sulfur, Selenium, and Platinum Metals	**1942**, *55*, 131–137 and 154–158
T. Wieland	Chromatographic Methods for the Separation of Amino Acids	**1943**, *56*, 213–215
K. Wiechert	Use of Hydrogen Fluoride in Organic Chemical Reactions	**1943**, *56*, 333–342

Technical processes were of course also still a prevailing topic. Thus, M. Pier reported on synthetic fuels and the influence of the raw material and the catalyst on their production and on performance indicators, such as the octane rating.[129] Plastics[130] and macromolecular chemistry were dealt with by Staudinger[131] and Mark in particular. In an article coauthored by H. Dostal, Mark examined the kinetics of polymerization in detail.[132] In the area of physical chemistry, Werner Kuhn reported on the catalytic generation of optically active materials and analyzed the kinetics and thermodynamics of chiral resolution processes and direct asymmetric syntheses.[133] Finally, one of the most useful analytical technical innovations was described in a communication by Karl Fischer in 1935, namely, a "New Method for the Volumetric Determination of the Water Content of Liquids and Solids", which is now known as the Karl Fischer titration.[134]

4. The Period of Rebuilding and Consolidation (1947–1980)

This period begins with the reappearance of *Angewandte Chemie* in 1947 and ends with the transition to the current Editor-in-Chief, Peter Gölitz, in 1982. Many important steps taken to develop the journal in this era helped to lay the foundation for the upswing described in Section 5. In 1947 and 1948, Rudolf Pummerer, supported by Ferdinand Boschke, led the editorial office; Foerst then took on the responsibility again until 1966. Helmut Grünewald was Editor-in-Chief from 1967 until 1978; he was followed by Otto Smrekar (1979–1982; Table 1). Each editor-in-chief had a decisive influence on the development of the journal during his time in charge, as shown in the following discussion.

4.1. The Development of the Journal and Its Innovations

The introduction to the first issue of 1947 provided important information on the structure and direction of the journal. The journal was divided into two parts: a scientific part A, the forerunner of *Angewandte Chemie* as we know it today, and a technical–economic part B, which from 1949 was published as *Chemie-Ingenieur-Technik* by Verlag Chemie and later by Wiley-VCH. Part A addressed the research chemists in academia and contained "summarizing progress reports and original articles, news, book reviews, topical information, and employment and higher-education news". Part B was directed at chemists in industry as well as chemical and process engineers.[135] Only the further development of part A is discussed herein. In the first few years, *Angewandte Chemie* appeared irregularly; thus, in 1948, 8 issues were published with a total of 224 pages; from 1950, 24 issues appeared each year, and the number of pages increased to about 800 and after 1961 to up to 1200 only to fall again below 1000 in the middle of the 1970s. In 1977, the "Blue Sheets" ("Blauen Blätter") split away (see below), and there was a change to monthly publication and 12 issues, whereby the total number of pages in 1981 was around 1100.

Certainly the most important step in this period was the introduction of the *Angewandte Chemie International Edition in English*, which appeared alongside the German-language edition from 1962. This visionary move was motivated by the desire on one hand to be able to better communicate the research conducted in Germany-speaking countries beyond this region and on the other hand to attract authors from other countries to a greater extent. The latter was only moderately successful; there was certainly an increase in the number of foreign authors, particularly those who provided reviews and progress reports, but the actual leap to internationality did not occur with respect to communications until the period beginning in 1981.

From 1953, four years after the foundation of the GDCh, the information bulletin of the society, the *Nachrichten aus Chemie und Technik* (known as the "Blue Sheets" ("Blauen Blätter")), was printed on blue pages and included with *Angewandte Chemie*. This bulletin was conducive to the development of the journal, as the editors could now concentrate more closely on the scientific articles. Thus, in 1975 the section "Conference Reports" and in 1979 the section "News" were discontinued; the employment and higher-education news appeared by this time in the "Blue Sheets". Obituaries, which appeared so frequently before the Second World War, almost completely disappeared from the journal in the 1950s and were not reintroduced until the new millennium, in my view, as an interesting component of the journal. The "Blue Sheets" were a part of *Angewandte Chemie* until they appeared in 1977 as a self-contained monthly scientific magazine; they celebrated their 60th anniversary in 2012 as *Nachrichten aus der Chemie*.[136]

Figure 7. Development of the changing cover pictures of *Angewandte Chemie*. Top left: the first (1977), for the review "Experimental Electron Densities and Chemical Bonding";[137] top center: for the communication "Benzoid *versus* Annulenoid Aromaticity: Synthesis and Properties of Kekulene" (1978);[138] top right: the first in color (1986), for the communication "Periodic Potential Surfaces in Crystal Structures";[139] bottom left: for the review "Starburst Dendrimers" (1990);[140] bottom center: for a communication on nanoporous polyoxomolybdate clusters (2002);[141] bottom right: for the communication "Aldehyde Umpolung by N-Heterocyclic Carbenes" (2010).[142]

The idea of using *Angewandte Chemie* as a "carrier" for the launching of new journals was successfully adopted again in the late 1980s and the 1990s, when *Advanced Materials* as well as *Chemistry—A European Journal* and other journals of the ChemPubSoc Europe[4] were distributed with *Angewandte Chemie* (sometimes physically bound to the established journal) for their first year or two.

In 1977, the cover picture, which changes from issue to issue, was introduced as a hallmark of *Angewandte Chemie*, first still in black and white, and then in color from issue 1 of 1986 on. In the early years, aesthetically pleasing structures of new molecules were most often used as cover pictures, but later the pictures became increasingly artistic (Figure 7). Since the introduction of the cover picture, authors have aspired to "make it to the cover" with their research.

The graphical table of contents was also introduced in 1977, at first in black and white and from 2001 on in color. The graphical tables of contents became particularly attractive when they appeared on the website of the journal. From the beginning, the value of the graphical table of contents in *Angewandte Chemie* lay in the presentation not only of a picture of a synthesized or investigated molecule or system, but also of a short and informative text to provoke curiosity about the research. Without a graphical table of contents, it would be almost impossible for the practicing scientist to keep on top of the many articles published in *Angewandte Chemie* and other chemistry journals.

Color in the journal found its first major use in the exceptional review by Robert B. Woodward and Roald Hoffmann on "The Conservation of Orbital Symmetry",[143] which is still today one of the most frequently electronically downloaded articles of that time in *Angewandte Chemie* (Table 7). In this review, the orbital lobes were colored blue and green to indicate the sign (positive or negative); it was not until 1988 that Wolfgang A. Herrmann made greater use of color in his review on "High Oxidation State Organometallic Chemistry, A Challenge—the Example of Rhenium".[144] It only became really colorful in later years, and in this context, the impressive review in 1990 on starburst dendrimers by Donald A. Tomalia and William A. Goddard III must be mentioned (Figure 7).[140]

Although during the whole period and beyond, shorter and longer reviews appeared, whereby that by Woodward and Hoffmann[143] certainly lies at the upper end of the scale for

Table 7: Top full-text downloads of articles that appeared in *Angewandte Chemie* from 1887 to 1981 (as of August 2012). The number of downloads corresponds to the German edition. The number of downloads is given for the corresponding article in the International Edition (after 1961) in brackets.

Author	Title	*Angew. Chem.*	Downloads
R. Huisgen	1,3-Dipolar Cycloadditions: Past and Future	**1963**, *75*, 604-637	395 (1614)
B. Neises, W. Steglich	Simple Method for the Esterification of Carboxylic Acids	**1978**, *90*, 556-557	376 (4224)
R. B. Woodward, R. Hoffmann	The Conservation of Orbital Symmetry	**1969**, *81*, 797-869	320 (1532)
D. Seebach	Methods of Reactivity Umpolung	**1979**, *91*, 259-278	237 (887)
K. Fischer	New Method for the Volumetric Determination of the Water Content of Liquids and Solids	**1935**, *48*, 394-396	233
H. Schaefer, B. Eisenmann, W. Müller	Zintl Phases: Transitions between Metallic and Ionic Bonding	**1973**, *85*, 742-760	214 (164)
K. Ziegler, E. Holzkamp, H. Breil, H. Martin	The Mülheim Normal-Pressure Polyethylene Process	**1955**, *67*, 541-547	208
H.-W. Wanzlick, E. Schikora	A New Approach to Carbene Chemistry	**1960**, *72*, 494	206

the total number of pages (and took up a whole issue), there was a real development in the length of communications. From the 1950s until the end of the 1970s, communications really were brief, and most took up between half a page and a whole page; sometimes they were not even more than half a column long. A good example was the communication by Hans-Werner Wanzlick (with E. Schikora) on the carbenes named after him (Figure 8),[145] which were renamed after the year 2000 as N-heterocyclic carbenes (NHCs) and used successfully as ligands in organic homogeneous catalysis, for example, in olefin metathesis.[146] Subsequently, the length of communications increased to between one and two pages.

Increasingly, communications were published in *Angewandte Chemie* on research in all areas of chemistry, and detailed accounts of the studies followed in "full-paper journals", such as the "*Berichte*" and the "*Annalen*". After an appropriate period of time, an overview article by the same authors appeared in *Angewandte Chemie*. The ratio of communications to reviews increased; the turning point had already been reached in 1955. In 1954 there were 70 review articles and 57 brief communications; in 1955 there were 65 review articles and 131 brief communications. The number of communications at first increased slowly and continuously, but from 1990 on increased rapidly, whereas the number of reviews in their different formats has remained almost constant (Figure 9).

Ein neuer Zugang zur Carben-Chemie

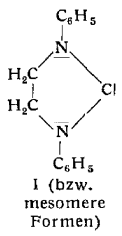
Von Priv.-Doz. Dr.-Ing. H.-W. WANZLICK und Dipl.-Ing. E. SCHIKORA

Organisch-Chemisches Institut der Technischen Universität Berlin

Dianilino-äthan, das glatt mit Aldehyden reagiert[1]), läßt sich unter geeigneten Bedingungen auch mit Chloral umsetzen. Aus dem erhaltenen 1.3-Diphenyl-2-trichlormethyl-imidazolidin läßt sich, z. B. durch Erhitzen in einem indifferenten Lösungsmittel, Chloroform abspalten. Hierbei entsteht eine farblose, kristalline Verbindung, die sich chemisch wie I verhält. Lösungen nehmen schnell Luftsauerstoff auf und liefern 1.3-Diphenyl-imidazolidon-(2), Wasseranlagerung führt zur Monoformyl-Verbindung des Dianilinoäthans u.s.w. Bisher vorliegende Molekulargewichtsbetimmungen (in Campher) brachten bei 300 liegende Werte (I: theor.: 222), die für ein Gleichgewicht:

$$2\ \mathrm{I} \rightleftharpoons (\mathrm{I})_2$$

sprechen.



I (bzw. mesomere Formen)

Die Untersuchungen werden fortgesetzt, wobei die weitere Erforschung der I-Chemie, die Synthese anderer Verbindungen vom I-Typ und die Suche nach neuen Zugängen zu dieser neuartigen Verbindungsklasse im Vordergrund stehen.

Eingegangen am 4. Juli 1960 [Z 930]

[1]) *H.-W. Wanzlick* u. *W. Löchel*, Chem. Ber. *86*, 1463 [1953].

Figure 8. Example of a very short, but significant communication from 1960.[145]

4.2. The Major Trends in Chemical Research

Table 8 contains the names of the 150 *Angewandte Chemie* authors who have had more than 35 articles published in the journal. Many of these authors began their scientific career during the period discussed in this section. It is beyond the scope of this Review to recognize their achievements individually; only a few fundamental developments are discussed exemplarily herein.

The first volumes of the journal after the Second World War covered a very broad range of topics, which extended from radiochemistry and the theory of atomic structure and bonding, through synthetic methods, natural products, and drugs, to biological chemistry. The inorganic chemistry of main-group elements, which was developing at a rapid pace, and in particular inorganic sulfur chemistry, was also a central theme. In this way, the editors signalized clearly the new broad orientation of *Angewandte Chemie*, which helped to attract new authors from the various fields. In 1949, encouraged by Adolf Windaus, Derek H. R. Barton was the first foreign author after World War II of a communication ("Optical Rotation and Molecular Structure of Steroids").[147] Issue 4 of 1949 was a special issue dedicated to the memory of Max Planck, who had died in 1948.[148] Max von Laue and Werner Heisenberg described his scientific life work, and a great array of outstanding reviews on the development of the radiation laws and photochemistry as well as quantum and wave mechanics followed. Particularly striking is the introduction "In Memory of Max Planck" written by Albert Einstein on behalf of the National Academy of Sciences of the United States of America.[149] Many other special issues appeared subsequently, for example, in 1950 to mark the 75th birthday of Paul Pfeiffer, who had discovered the salen

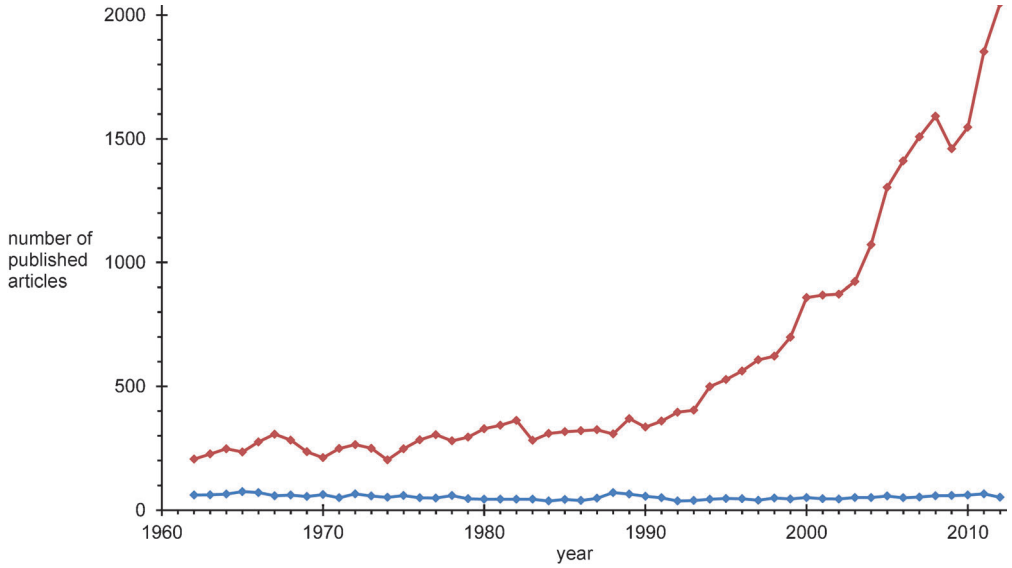


Figure 9. Growth in the number of communications (in red) during the period 1962–2012, in which the number of reviews (in blue) remained almost constant.

ligands. In this case, the special issue highlighted progress in the fields of inorganic and organometallic coordination complexes and the application of these compounds in other fields, such as analytical chemistry.[150] Issue 13/14 in 1954 was a large special issue on the occasion of the 100th birthday of Paul Ehrlich and summarized developments in the pharmaceutical–biological field.[151] Furthermore, as early as 1952, a special issue on polymer chemistry appeared with contributions from Mark and Staudinger, among others.[152]

In 1951, Feodor Lynen published a communication in *Angewandte Chemie* titled "On the Chemical Structure of Activated Acetic Acid", which was followed in subsequent years by further communications as well as major review articles on the fatty-acid cycle.[153] One can rightly say that Lynen was the first scientist to publish in *Angewandte Chemie* all of his important original research, which earned him the Nobel Prize in Physiology or Medicine in 1964.

The application of spectroscopic methods (IR,[154] UV/Vis,[155] Raman,[156] ESR,[157] and NMR spectroscopy[157–160]), mass spectrometry,[161] X-ray crystal-structure analysis,[162] and later cyclic voltammetry,[163] which became hugely important for the characterization of the properties of molecular materials, came to the fore. These methods and the development of spectrometers, which would soon be available for use in most research institutes, dramatically influenced the way in which organic and inorganic chemists identified and characterized their new compounds. Characterization became easier in most cases and above all considerably faster; however, the description of the most important spectroscopic data in communications also led more and more to an increase in their length, especially as there was not yet anywhere that these data could be deposited. As a parallel development, modern separation methods (gas chromatography, gel electrophoresis, high-performance liquid chromatography) were used increasingly for the purification of the synthesized compounds. Accordingly, numerous overviews and communications on analytical separation methods were published.[164]

In organic chemistry, which together with inorganic chemistry dominated the journal during this period, new synthetic methods were being developed continuously and described in detail in the series "New Methods in Preparative Organic Chemistry", which appeared until 1969. The list of contributors to this series contains many prominent names.[165] In 1955, Wittig, one of the most important authors of this period, published "Intermediate Formation of Dehydrobenzene (Cyclohexadienyne);[166] this article was followed by numerous others on approaches to and the reactivity of benzynes. However, the olefination reaction that is named after him, for which he received the Nobel Prize in 1979, was first published in 1954 in *Chemische Berichte* as a comprehensive full paper.[167]

Heterocyclic chemistry had a high status in the period from the 1950s to the 1970s in *Angewandte Chemie*. The development of 1,3-dipolar cycloaddition reactions as led by Rolf Huisgen stands out in particular.[168] These transformations are still among the most-used reactions in organic chemistry, especially for the synthesis of heterocyclic pharmaceuticals. The copper-catalyzed variant of the Huisgen 1,3-dipolar cycloaddition of azides to acetylene became the prime example used to illustrate the concept of click chemistry, introduced later by Barry Sharpless and co-workers;[169] this reaction is today the most-used ligation method for the construction of bioconjugates and new materials.

Further examples of the development of synthetic methods during this period are the studies of Dieter Seebach on Umpolung, one of the rare German terms to be used in English scientific language,[170] and on the structure and reactivity of lithium enolates,[171] as well as the introduction by Ivar Ugi of the four-component reaction,[172] later much used in combinatorial chemistry for the generation of lead compounds,[172] asymmetric synthesis with hydrazones as de-

Table 8: 152 authors have had more than 35 manuscripts published in *Angewandte Chemie* (between 1946 and October 2012).

Name	Number	Name	Number	Name	Number
Nicolaou, K. C.	177	Scherer, Otto J.	62	Regitz, Manfred	48
Roesky, Herbert W.	167	Schmidt, Max	62	Schumann, Herbert	48
Vogel, Emanuel	143	Carreira, Erick M.	61	Vollhardt, K. Peter C.	47
Müllen, Klaus	122	Erker, Gerhard	61	Fürstner, Alois	46
Krüger, Carl	119	Bögge, Hartmut	60	Harms, Klaus	46
Schmidbaur, Hubert	112	Clegg, William	60	Jung, Günther	46
Seebach, Dieter	106	Hopf, Henning	60	Rheingold, Arnold L.	46
Herrmann, Wolfgang A.	103	Huisgen, Rolf	60	Wong, Chi-Huey	46
Müller, Achim	103	Noltemeyer, Mathias	60	Buchwald, Stephen L.	45
Stoddart, J. Fraser	103	Müller, Gerhard	59	Que, Jr., Lawrence	45
Bock, Hans	98	Sheldrick, George M.	59	Rebek, Jr., Julius	45
Vögtle, Fritz	98	Appel, Rolf	58	Grützmacher, Hansjörg	44
Prinzbach, Horst	95	Niecke, Edgar	58	Kaupp, Gerd	44
Waldmann, Herbert	92	Nieger, Martin	58	Shibasaki, Masakatsu	44
Schleyer, Paul von Ragué	88	Glemser, Oskar	57	Jørgensen, Karl Anker	43
Knochel, Paul	86	Osuka, Atsuhiro	57	Mulzer, Johann	43
Schwarz, Helmut	86	Schmidpeter, Alfred	57	Schultz, Peter G.	43
Diederich, François	85	Wieghardt, Karl	57	Xia, Younan	43
Reetz, Manfred T.	85	Boche, Gernot	56	Eschenmoser, Albert	42
Boese, Roland	84	Brunner, Henri	56	Frenking, Gernot	42
Kauffmann, Thomas	82	Staab, Heinz A.	56	Hoffmann, Reinhard W.	42
Danishefsky, Samuel J.	81	Effenberger, Franz	55	Vahrenkamp, Heinrich	42
Werner, Helmut	80	Hoppe, Dieter	55	Wiberg, Nils	42
Fenske, Dieter	79	Steglich, Wolfgang	55	Carell, Thomas	41
Pritzkow, Hans	78	Lehn, Jean-Marie	54	Peters, Karl	41
De Meijere, Armin	77	Märkl, Gottfried	54	Power, Philip P.	41
Krebs, Bernt	77	Mayr, Herbert	54	Schlögl, Robert	41
Gompper, Rudolf	76	Schmidt, Richard R.	54	Spek, Anthony L.	41
Huttner, Gottfried	75	Slawin, Alexandra M. Z.	54	Bredereck, H.	40
von Schnering, Hans Georg	75	Wilke, Günther	54	Feringa, Ben L.	40
Beller, Matthias	74	Barluenga, José	53	Kitagawa, Susumu	40
Seppelt, Konrad	72	Dimroth, Karl	53	Kniep, Rüdiger	40
Williams, David J.	72	Schmidt, Ulrich	53	Radacki, Krzysztof	40
Fröhlich, Roland	70	Schnöckel, Hansgeorg	53	Binger, Paul	39
Kunz, Horst	70	Enders, Dieter	52	Mulvey, Robert E.	39
Berndt, Armin	69	Kaim, Wolfgang	52	Reinhoudt, David N.	39
Stalke, Dietmar	69	Trost, Barry M.	52	Whitesides, George M.	39
Jansen, Martin	68	Bestmann, Hans Jürgen	51	Köster, R.	38
Massa, Werner	68	Drieß, Matthias	51	Kuhn, Richard	38
Gleiter, Rolf	67	Herdtweck, Eberhardt	51	Raithby, Paul R.	38
Hafner, Klaus	67	Hünig, Siegfried	51	Schröder, Detlef	38
Ziegler, Manfred L.	67	Ugi, Ivar	51	Steudel, Ralf	38
Jones, Peter G.	66	Adam, Waldemar	50	Beck, Wolfgang	37
Fischer, Ernst Otto	65	Fujita, Makoto	49	Herberhold, Max	37
Kessler, Horst	65	Giese, Bernd	49	Meier, Herbert	37
Maier, Günther	65	Mirkin, Chad A.	49	Niemeyer, Christof M.	37
Tietze, Lutz F.	65	Siebert, Walter	49	Schmid, Günter	37
Bertrand, Guy	64	Simon, Arndt	49	Baran, Phil S.	36
Lex, Johann	64	Thomas, John Meurig	49	Fischer, Roland A.	36
Nöth, Heinrich	64	Willner, Itamar	49	Ried, Walter	36
Braunschweig, Holger	62	Henkel, Gerald	48		

scribed by Dieter Enders,[173] the enantioselective homoaldol reaction developed by Dieter Hoppe,[174] and the synthesis of enantiomerically pure α-amino acids by Ulrich Schöllkopf.[175] Partially as a consequence of the thalidomide scandal,[176] the development of methods for the synthesis of enantiomerically pure compounds had become a matter of great importance in organic synthesis, as chiral potential drugs now had to be prepared in optically pure form.

In 1956, Woodward published a review on "New Developments in the Chemistry of Natural Products",[177a] in which he presented his total syntheses of natural products, such as strychnine and chlorophyll.[177b] He was awarded the Nobel Prize in 1965 for these achievements. His studies had an enormous influence on research at American Universities, but did not prompt a similarly large expansion of natural products synthesis in German-speaking countries for two main reasons: 1) The National Institutes of Health financed this research particularly generously, as it promised the intensified development of new preparative methods for use in drug development, and at the same time, the natural

products were viewed as potential lead structures for new pharmaceuticals. There was no such strong support of this chemistry in Europe after the Second World War. 2) The complexity of the long total syntheses required the participation of fully trained chemists, in other words, numerous postdoctoral researchers, and in Germany there was no established system for the support of postdoctoral fellows.

Angewandte Chemie dedicated issue 1/2 of 1957 entirely to natural products and their synthesis.[178] Later, biogenetically oriented total syntheses took center stage, such as those of camptothecin by Ekkehard Winterfeldt,[179] hemoglobin by Burchard Franck,[180] and the corrins and vitamin B12 by Albert Eschenmoser.[181]

Peptide chemistry developed strongly from the beginning of this period on, whereby in view of the current marked revival of interest in macrocyclic peptide drugs, the studies of Theodor Wieland on the constituent ingredients of the green death cap mushroom[182] and the later studies by Horst Kessler on *cyclo*-Leu5-enkephalin[183] should be mentioned specifically. There was an even greater surge in the development of sugar chemistry, through the research of Kurt Heyns[184] and Hans Paulsen[185] as well as Frieder W. Lichtenthaler[186] and Richard R. Schmidt, whereby the synthesis of glycosides via imidates, such as trichloroimidates, by Schmidt was a seminal advance.[187] Investigations into the chemistry and function of nucleic acids were led by Friedrich Cramer in particular.[188]

Stereochemical research occupied a central position since the introduction at the beginning of the 1950s of conformational analysis, for which Derek Barton was awarded the Nobel Prize in 1969.[189] Among numerous important articles, a few can be singled out for their particular significance: the review by Kurt Mislow in 1958 on "The Absolute Configuration of Atropisomeric Diaryl Compounds",[190] the description by Gerhard M. J. Schmidt in 1969 of absolute asymmetric synthesis in crystals,[191] and a review on the determination of the stereochemistry of reaction paths on the basis of crystal-structure data, for example, by consideration of the Bürgi–Dunitz trajectory for nucleophilic attack on carbonyl compounds.[192] The most important contribution was undoubtedly the legendary review by Robert S. Cahn, Christopher Ingold, and Vladimir Prelog in 1966 on the "Specification of Molecular Chirality", in which the CIP system was introduced.[193]

At the end of the 1950s, physical organic chemistry turned increasingly toward the synthesis and investigation of theoretically interesting molecules. Figure 10 shows representative examples of this research, for which *Angewandte Chemie* became an essential forum.[194] Thus, following the studies of Franz Sondheimer on annulenes,[195] the question of the aromaticity of benzenoid and nonbenzenoid structures became a central theme. In 1964, Emanuel Vogel published the synthesis of the aromatic 1,6-methano-bridged derivative of [10]annulene (Figure 10)[196] and developed this new field of annulene chemistry over the following years in an impressive manner as one of the main authors of the journal (Table 8).[197]

Many investigations were concerned with valence isomerization in unsaturated systems,[206] other studies with the construction of highly strained rings, in particular, strained

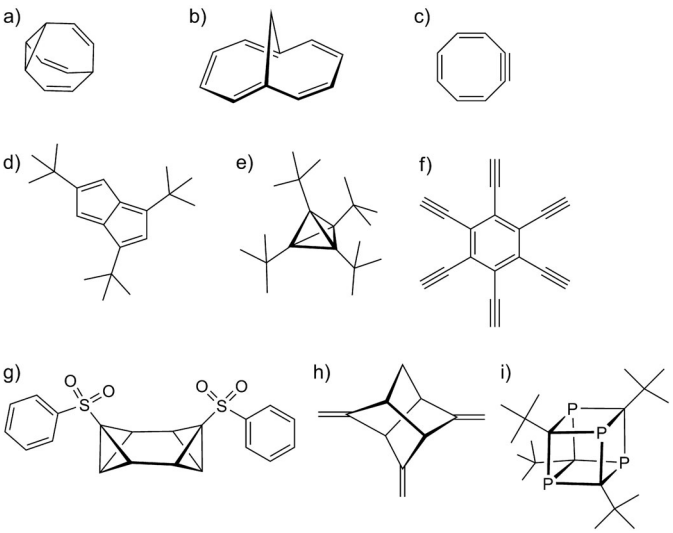


Figure 10. Examples of theoretically interesting molecules in *Angewandte Chemie* from the 1960s to the 1980s: a) bullvalene,[198] b) 1,6-methano[10]annulene,[196] c) the smallest dehydroannulene detected as an intermediate,[199] d) a stable low-substituted pentalene,[200] e) a stable tetrahedrane, which was characterized by X-ray crystal-structure analysis,[201] f) hexaethynylbenzene,[202] g) an octabisvalene,[203] h) stellatriene,[204] i) a tetraphosphacubane.[205]

alkynes.[207] In 1978, Günther Maier surprised the experts in the field with the isolation of tetra-*tert*-butyltetrahedrane (Figure 10) as a stable molecule that could be characterized both in solution and in the solid state.[201]

The upsurge of organic photochemistry in the journal also began at the end of the 1960s.[208] Reactive intermediates of thermal and photochemical transformations were investigated increasingly. The use of superacids enabled the synthesis of carbocations and their characterization by NMR spectroscopy in the early 1970s, for which George Olah was awarded the Nobel Prize in 1994.[209,210] Carbenes were also increasingly a focus of research at that time,[211] and at the end of the 1970s preparative radical chemistry became popular worldwide, on which topic Bernd Giese, among others, published important articles in *Angewandte Chemie*.[212] Also at the end of the 1970s, Helmut Schwarz began developing the mass spectrometer into a chemical laboratory and subsequently managed to synthesize and characterize highly reactive molecules, many of which had only been detected previously in space.[213]

At the beginning of the 1970s began the era of photoelectron spectroscopy, with the aid of which orbital energies and interactions, such as through-bond interactions, were studied experimentally for different classes of molecules, above all by Edgar Heilbronner, Rolf Gleiter, and Hans Bock.[214] The boom in organic functional materials, especially "push–pull" π systems with useful optoelectronic properties, also began in the early 1970s.[215] For these studies, the electron-gas model of Hans Kuhn, which had already been described in 1959, provided a useful description of electron delocalization in conjugated π systems.[216] Toward the end of this period, a review by Jerome H. Perlstein on "Organic Metals—The Intermolecular Migration of Aromaticity" indi-

cated the way forward towards advanced organic materials.[217]

Inorganic chemistry also experienced a true renaissance after the Second World War. This revival was not only observed in complex and organometallic chemistry,[218] as is also shown shortly, but also in the chemistry of the main-group elements, in particular, of boron, fluorine, silicon, sulfur, and phosphorus. Again and again in the chemistry of the main-group elements one comes across the name of Herbert Roesky,[219] who had come from the great school of inorganic chemists led by Oskar Glemser in Göttingen (Table 8). A further important school of the main-group elements was that of Egon Wiberg at the Ludwig Maximilian University in Munich. When it came to inorganic molecules, Konrad Seppelt was inimitable in the filling of gaps, in the sense that he synthesized many compounds that had until then been viewed as inaccessible.[220] Interestingly, the only female researchers who published as the main authors in the journal in this period—Margot Becke-Göhring[221] and Marianne Baudler[222]—were both active in phosphorus chemistry.

Above all, however, inorganic chemistry received huge impetus in the middle of the 1950s from the discovery of metallocenes, such as ferrocene;[223] the pioneering studies by Geoffrey Wilkinson and Ernst O. Fischer were recognized in 1973 with the Nobel Prize.[224] In 1955, Karl Ziegler reported on "The Mülheim Normal-Pressure Polyethylene Process",[225] and his groundbreaking developments together with Giulio Natta[226] ("Ziegler–Natta catalysts") earned them the Nobel Prize as early as 1963. In issue 16 of 1955, Ziegler and co-workers published a series of seven back-to-back communications, including one on the synthesis of aluminum alkyl compounds[227a] and one on olefin polymerization.[227b] During this whole period it was not unusual for three, four, and in individual cases up to seven communications from a single research group to appear in direct succession. However, the communications were very short, so that the seven Ziegler communications only took up three pages. As the communications became longer, and also as a consequence of the systematic introduction of the peer-review system, these sequential publications disappeared almost entirely.

With the groundbreaking studies of Fischer and Ziegler, organometallic chemistry became a main topic in *Angewandte Chemie* for many years. It was dominated by the "Munich School" founded by Fischer and the "Mülheim School" continued by Günther Wilke.[228] A further highlight in organometallic chemistry was the introduction of Fischer carbene and Fischer carbyne complexes, named after their discoverer, who also made them the topic of his Nobel Lecture "On the Road to Carbene and Carbyne Complexes" in 1973.[224] In the middle of the 1970s, reactions with naked metal atoms, generated in atom vaporizers, came to the fore.[229] After this time, hardly any studies were published without the X-ray crystal-structure characterization of the synthesized complexes. New authors, such as Wolfgang A. Herrmann, Heinrich Vahrenkamp, Helmut Werner, and Walter Siebert, played a major role in the further development of the chemistry of transition-metal complexes. Triple-decker sandwich complexes and even larger stacks were constructed,[230] and metal–metal multiple bonds and metal clusters became a prominent theme.[231] The metal clusters grew in later years to structures of breath-taking complexity and size, with multinanometer diameters.[141,232] Overall, however, the interest in transition-metal complexes shifted over the following years from pure structural chemistry to catalysis. At the end of the 1970s, a further area of research became the focus of much attention: inorganic solid-state chemistry, for which *Angewandte Chemie* became perhaps the most important platform.[233]

Although this overview is focused mainly on organic and inorganic chemistry, in accord with the content of the communications, the whole breadth of chemistry was represented in the reviews published at that time. Examples are the reviews of Dieter Oesterhelt on "Bacteriorhodopsin as an Example of a Light-Driven Proton Pump"[234] and Gerhard Ertl, who received the Nobel Prize in 2007, on "Elementary Processes at Gas/Metal Interfaces".[235]

5. The Period of Rapid Growth and Internationalization (1981–2012)

In the last period, both the number of authors and the number of articles increased so drastically, that it is hardly possible to mention individual articles. The reasons for this impressive development are analyzed in this section. The beginnings of supramolecular chemistry are examined more closely, however, as this field has played a major part in the upswing of the journal and become a key discipline in modern chemical research, which increasingly takes place at the interfaces with biology and physics. Otherwise, only the research topics that have found their way into the journal over the years are outlined. It is fair to say that *Angewandte Chemie* today presents the whole spectrum of international chemical research at a very high level.

5.1. The Development of the Journal from 1981

On November 1, 1982 Peter Gölitz became Editor-in-Chief of *Angewandte Chemie*. By this time, the length of communications had increased further, and at the beginning of 1982, an *Angewandte Chemie Supplement* had been introduced. A communication in the main issue now rather had the form of an extended abstract, and the complete manuscript appeared in the supplement. However, as the *Angewandte Chemie Supplement* was extremely unpopular, as I am ready to admit on the basis of my own experience, the original format was readopted in 1984.

The size of the journal increased continually from around 1000 pages in 1984 to over 1800 pages in 1993 (Figure 1), published in 12 issues per year. From 1994, 24 issues appeared each year, with at first 2600 pages (1994) and later over 5100 pages (2002; Figure 11). From 2003, 48 issues were published a year, and since 2008, the journal has appeared weekly (52 issues). During this time, the amount published has increased from over 6000 pages (2003) to more than

13500 pages (2012). The number of published articles has also increased rapidly, especially since the year 2000 (Figure 1), whereby this growth can for the main part be attributed to the increasing number of communications. Figure 11 shows the

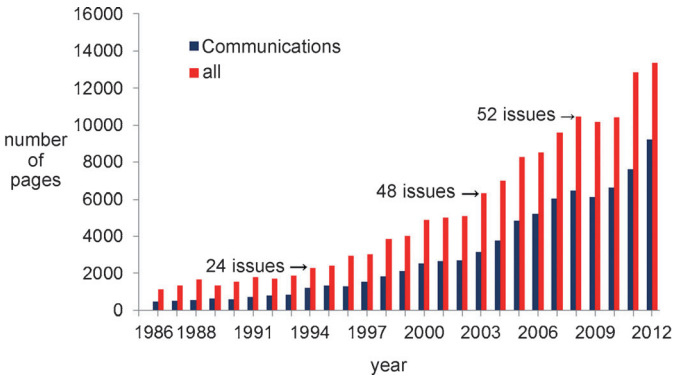


Figure 11. Number of pages for the communications and for all articles in *Angewandte Chemie* since 1986.[236]

number of published pages for the communications alone and for all articles in the journal. This graph was taken from one of Gölitz's informative editorials,[236] which have appeared regularly since the middle of the 1990s, and updated.

The author base rapidly became more international, above all, of course, as a result of the English-language edition of the journal. Whereas the communications received from abroad were still in the minority (26%) in 1986, when a total of 426 communications were submitted, they already accounted for two thirds (65%) of the 1090 communications received in 1995.[236,237] In 2012, 89% of the 7300 communications received by the editorial office were from abroad, most of them from China, the USA, Japan, and South Korea. However, the number of communications from Germany has also increased steadily, if more slowly, and after China, the USA, and Japan, Germany occupies fourth place in the country statistics.[236] As the number of submitted communications increased, so did the rejection rate, despite the continuous significant growth in the amount published. In 1986, the rejection rate was still around 30%, but by 2010 it had reached 78%.[236] At the same time, the annual impact factor published by the Institute for Scientific Information (ISI) in Philadelphia increased continuously: from about 4 in 1986 to about 5 by 1992, to between 6 and 7 by 1996, and to about 8 by 2002. The impact factor was above 10 for the first time in 2006 (10.232), and by 2011 it had increased to 13.455.[238] A further indicator of how publications are received is the number of full-text downloads, which has also increased continuously, and particularly dramatically for the International Edition. Examples are the review "Click Chemistry: Diverse Chemical Function from a Few Good Reactions"[169a] by Sharpless and co-workers from 2001 and the communication "A Stepwise Huisgen Cycloaddition Process: Copper(I)-Catalyzed Regioselective Ligation of Azides and Terminal Alkynes"[169b] from 2002 by the same research group, both of which have a particularly high number of full-text downloads, which continues to increase strongly.

The journey of *Angewandte Chemie* to become a first-rate product with an exemplary layout and an interesting mix of articles, a journal in which today many chemists from around the world first publish their best research, was accompanied by numerous innovations and changes. A first important step of the new editor-in-chief was the introduction of a fair and rigorous peer-review system for all contributions to the journal. Above all, this refereeing process created confidence in the journal and its editors, also abroad. Further fundamental changes and innovations are listed in Table 9.[236] Owing to the popularity of the colorful, artistic, and often inspiring cover pictures (Figure 7), which enable chemical discoveries to be presented in a way that is attractive even to non-specialists, additional "cover pictures" were introduced: in 1995 frontispieces to reviews and the first communication of

Table 9: Fundamental changes and innovations during the period of the upswing of *Angewandte Chemie*.[236]

Year	
1986	first submissions of manuscripts on floppy disks
1990	the authors of reviews are introduced with a brief biography and a photograph
1991	new section: Highlights
1995	appointment of the International Advisory Board
2000	new section: Essays
2001	table of contents in color
2002	online submission of manuscripts
2003	new sections: News, Obituaries, Meeting Reviews
2004	online publication of volumes 1–36 of the International Edition ("backfiles")
2005	all articles and the accompanying Supporting Information are first published online in Early View
2006	online publication of volumes 1–109 of *Angewandte Chemie*
2007	new section: Spotlights on our Sister Journals
2009	new sections: Author Profile and History in the Making Twitter and Facebook are used
2010	referees receive certificates new section: Flashback
2011	Editorials not only from the editorial office, the Editorial Board, and the International Advisory Board, but also by other people with something important to say about teaching and research in chemistry

an issue, in 2007 and 2012 inside-cover pictures front and back, respectively, and in 2011 a back-cover picture. All of these pictures appear online on the Early View page. All cover pictures are selected according to strict quality criteria, above all on the basis of the referee reports. Today, many of these beautiful graphical interpretations of chemical research decorate corridors, offices, and laboratories of researchers around the world. Since 1995, the editorial office has been supported in its work not only by the Editorial Board, whose members are selected by the Board of Directors of the German Chemical Society (GDCh), but also by an International Advisory Board with top-class scientists in countries from which a particularly large number of communications are received.

In this way, the current format of the journal evolved. In both its electronic and its printed form, the journal is presented in three parts: The first part contains the Editorial

(in certain issues), the graphical table of contents, information on publications in the ChemPubSoc Europe sister journals, an Author Profile, News, Obituaries, and Book Reviews; the second part contains the various types of overview articles: Highlights (2–3 pages), Essays, Minireviews (max. 10 pages), and longer Reviews. The second part is followed by up to 40 communications, most of which are 3–5 pages long. In the online version of the journal, the often voluminous Supporting Information, which now accompanies all communications, is readily retrievable. These days, communications are effectively full papers, if the Supporting Information is taken into account. The practice maintained until the end of last century of publishing first a communication and later a detailed article with all experimental details has almost completely disappeared. If required, the sections "Corrigenda" and "Correspondence" can be added. The latter provides the opportunity for an exchange between the authors of an article and a reader who favors another interpretation of the results on the basis of a weighty scientific argument.

Special issues that deviate from this format are rare, but therefore have an even higher profile. Thus, on the 100th anniversary of *Angewandte Chemie* in 1988, issue 1 appeared without communications, but instead with eight reviews on 211 pages. A further special issue without communications was published in 1990 on the occasion of the 125th anniversary of BASF (issue 11). Of the seven reviews published, all of which are based on plenary lectures at a celebratory symposium in Ludwigshafen, two stand out that were revolutionary at the time and still make meaningful and stimulating reading today. One was penned by George M. Whitesides, who explored the question: "What Will Chemistry Do in the Next Twenty Years?",[239] and the other by Dieter Seebach posed a similar question: "Organic Synthesis—Where Now?"[240] In my eyes, these high-caliber special issues contributed strongly to the rise of the journal. Other successful special issues include issue 1 of 2011 for the 50th anniversary of the International Edition, issue 43 of the same year on the occasion of the 100th anniversary of the Fritz Haber Institute, and issue 1 of this year for the 125th anniversary of *Angewandte Chemie*. The proportion of female "starred authors" (corresponding authors) of articles in the journal has increased slowly but surely since 2000.

5.2. Change in the Content of Angewandte Chemie during This Period

In view of the unmanageably large number of communications published, the best way to gain an overview of the rapid developments in chemistry as they have appeared in *Angewandte Chemie* during this period is to read through the reliably topical reviews. I chose this approach to write an editorial entitled "25 Years Full of Chemical Discovery" on the occasion of the 50th anniversary of the International Edition.[241a] Another view of how the focal points of the research presented in *Angewandte Chemie* have changed is offered by a comparison of "tag clouds" from 1995 until today (Figure 12). In these two-dimensional representations, the keywords associated with the publications are ordered alphabetically and weighted.

As expected, the tag clouds reflect the major trends very accurately, for example, from asymmetric synthesis to asymmetric catalysis, nanomaterials, and supramolecular chemistry,[241b] as well as to the construction of systems through self-assembly. I would like to refine this analysis somewhat and add some less frequently examined topics that have been the focus of high-caliber publications.

Thus, from the beginning of the 1980s, important articles on membrane-mimetic chemistry appeared, organotitanium reagents were developed, and more and more stereoselective syntheses were described. Nevertheless, a certain stagnation of organic chemistry at this time—albeit at a high level—can not be denied, as indeed pointed out by Seebach in his above-mentioned Review.[240] From the middle of the 1980s, organic chemistry received fresh inspiration from many angles, in particular through supramolecular chemistry, as shown below. From about 1990, top American researchers in the field of total synthesis published their original research increasingly in *Angewandte Chemie* (in this context, K. C. Nicolaou and Samuel J. Danishefsky, Barry M. Trost and David Evans must be named in particular; see Table 8), which certainly contributed strongly to the further internationalization of the author base and readership of the journal. In terms of natural products, complex sugars and their bioconjugates maintained their high status in the journal. Toward the end of the 1980s, *Angewandte Chemie* became an important forum for modified and expanded porphyrins and their analogues, as initiated by the legendary communication of Vogel on porphycene,[242] as well as for porphyrin wires and porphyrin antenna systems. The journal filled a similar role for the various other new organic materials and in particular for dendrimer chemistry[140] in the 1990s. Fullerene chemistry became increasingly important from 1992 on, and was joined later by the chemistry of carbon nanotubes and graphenes, both of which generated strong interdisciplinary interest.

From the 1990s on, both organic and inorganic chemistry turned increasingly toward homogeneous and in particular asymmetric catalysis with transition-metal complexes. In this field, the ligand class of N-heterocyclic carbenes experienced a great boost in popularity. From 2003 on, organocatalysis expanded into an important area of research, as did organogold catalysis from 2004. Furthermore, in 2000 a renaissance in preparative fluorine chemistry began, with new methods for catalytic enantioselective fluorination.

An important branch of inorganic chemistry that developed from the early 1980s is bioinorganic chemistry, which offers much inspiration for the design of catalysts. Unfortunately, young scientists are lacking in this field worldwide, certainly owing to its complexity. The chemistry of main-group elements and that of inorganic solid-state materials have always been important components of the journal, and these topics have not lost their appeal. Since 2000, the focus has been on metal–organic frameworks. Around this time, the combinatorial synthesis of catalysts and materials also pushed its way to the foreground, as well as, in bioorganic chemistry, the evolution-controlled optimization of enzymes for enantioselective syntheses.

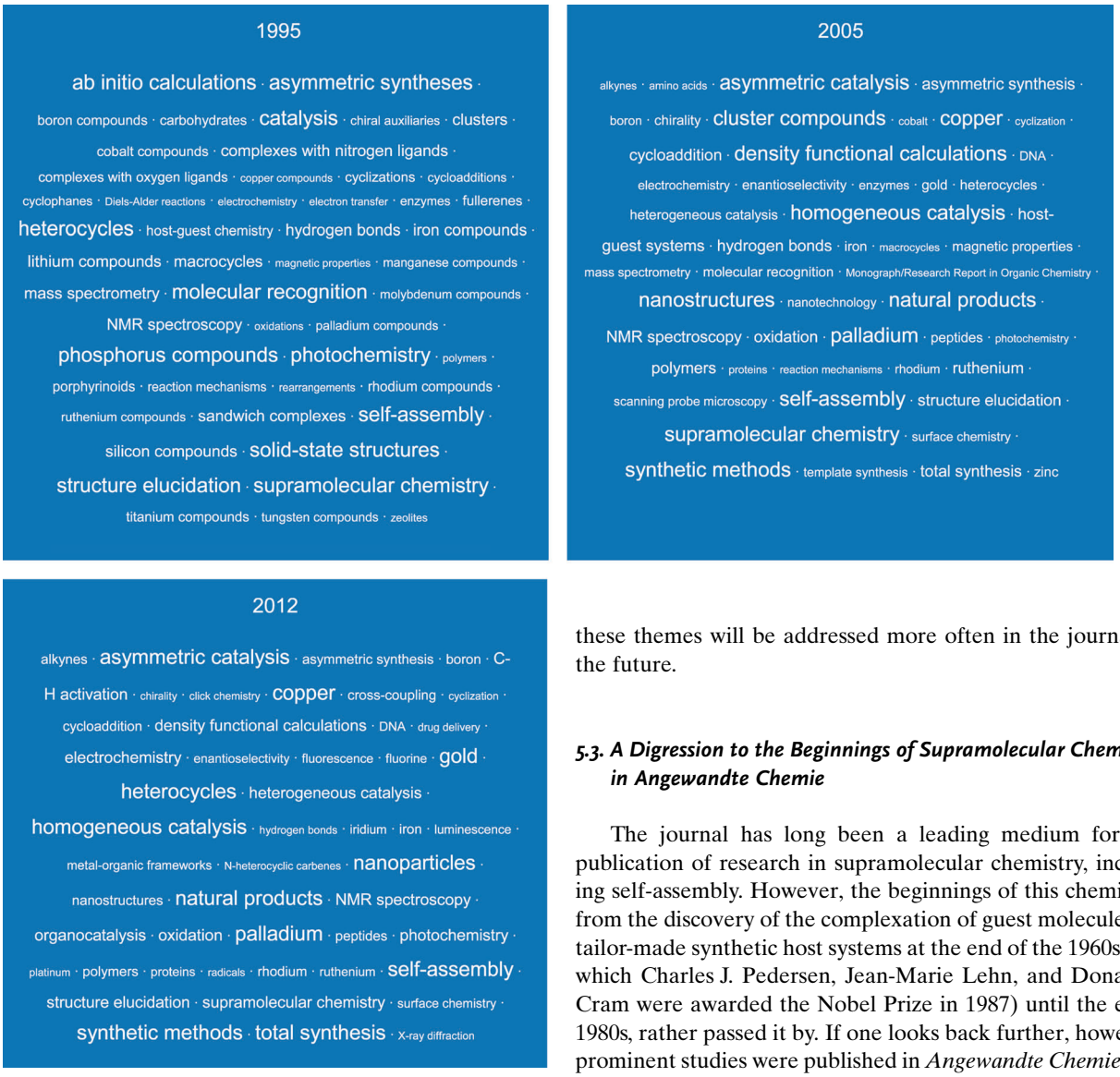


Figure 12. Three typical tag clouds for the period 1995–2012.

From 1995 on, nanochemistry became a dominant theme (Figure 12), with the emphasis on template synthesis, nanoparticles, nanowires, nanotubes, and nanolithography. Its upswing was favored above all by the development and accessibility of scanning tunneling microscopy and related methods as well as high-resolution transmission electron microscopy. During the first decade of this century, microfluidics then found its way into the journal. Furthermore, since the middle of the 1990s, an increasing number of articles on bioanalysis and bioelectronics have been published in *Angewandte Chemie*.

Physical-chemical research, in particular, theoretical calculations, for example, on the basis of density functional theory, is also increasingly finding its place in the journal. More and more frequently, such calculations also accompany experimental studies. Articles on energy issues and sources of renewable energy have appeared sporadically since the beginning of the century, and it is not hard to predict that these themes will be addressed more often in the journal in the future.

5.3. A Digression to the Beginnings of Supramolecular Chemistry in Angewandte Chemie

The journal has long been a leading medium for the publication of research in supramolecular chemistry, including self-assembly. However, the beginnings of this chemistry, from the discovery of the complexation of guest molecules by tailor-made synthetic host systems at the end of the 1960s (for which Charles J. Pedersen, Jean-Marie Lehn, and Donald J. Cram were awarded the Nobel Prize in 1987) until the early 1980s, rather passed it by. If one looks back further, however, prominent studies were published in *Angewandte Chemie*, but these contributions never really became "mainstream".

Freudenberg was one of the first to examine the dextrins formed by the degradation of starch, the cyclodextrins, which had been discovered by Schardinger around 1900, and to recognize their potential for inclusion complexation.[243] In 1949, K. L. Wolf and R. Wolff[244] wrote about "Supermolecules", which they described as "kinetic units of higher organization that are formed by the association of two or more valence-saturated molecules". Lehn later adopted this name in his Nobel Lecture: "Supramolecular Chemistry—Scope and Perspectives: Molecules, Supermolecules, and Molecular Devices".[245] Thereafter, the term "supramolecular chemistry" rapidly became established worldwide. Whereas inclusion compounds in the solid state, such as those in the urea lattice, were already known,[246] inclusion compounds in the cavity of cyclodextrins were first introduced in 1952 by Cramer in *Angewandte Chemie*, whereby the author highlighted the "striking parallels to the lock-and-key relationships of biochemical processes".[247] As soon as 1953, he reported that the redox potentials of dyes, such as methylene blue, change upon inclusion complexation with

cyclodextrins.[248] In a review in 1956, he described the catalysis of reactions of substrates included within the cavities as well as the resolution of enantiomers with the aid of the optically active cyclodextrins.[249] With this article, Cramer laid down the basic methodological principles for many investigations carried out later in preparative host–guest chemistry.[250] In his contribution together with J. Marx on the "Synthesis of Macrocyclic Diamides" in 1957, Herrmann Stetter described important methods that later found broad application in host–guest chemistry and also postulated the formation of host–guest complexes with these synthetic systems.[251]

In 1970, in the section "Conference Reports", the first report on synthetic host–guest complexes appeared: "Cryptates, a New Class of Cation Complexes" was based on a lecture given by Lehn at a meeting of the regional branch of the GDCh in Karlsruhe.[252] In 1972, Pedersen and H. Karl Frensdorff contributed a review on "Macrocyclic Polyethers and Their Complexes".[253] In 1974, the first report on preparative host–guest chemistry from a laboratory in Germany appeared—"Novel Ligand Systems for Complexing Alkali Metal Ions"[254] by Fritz Vögtle and Edwin Weber—which was followed by many other contributions by these authors. The Lehn research group described "Chiral Macrobicyclic and Macrotricyclic Ligands" in the same year,[255] and this article, too, was followed by numerous others, in particular on cation transport through membranes. The potential of crown ethers as phase-transfer catalysts was recognized at this time.[256] In the second half of the 1970s, the first studies reported in the journal on anion complexation appeared. Thus, in 1977, Franz P. Schmidtchen described anion recognition by macrotricyclic quaternary ammonium salts.[257] In 1983, I reported with K. Dick on the inclusion complexation of neutral aromatic hydrocarbons by macrocyclic cyclophane host molecules in aqueous solution.[258]

It is, however, certainly not the case that only the inclusion complexation of guests by hosts was investigated before the middle of the 1980s; other studies were concerned with further systems that are today classified as supramolecular. Physical-chemical investigations on the change in absorption spectra as a result of the formation of electron-donor/acceptor complexes were carried out above all by the research group of Günther Briegleb.[259] The first multistep syntheses of catenanes and rotaxanes were described by Gottfried Schill and Arthur Lüttringhaus in 1964.[260] These syntheses were later simplified drastically by the use of template effects by Fraser Stoddart and Jean-Pierre Sauvage. Other research groups reported investigations at monolayers,[261] liquid-crystalline bilayers,[262] and model systems for biomembranes.[263]

Around the middle of the 1980s, *Angewandte Chemie* grew rapidly into its leading role in supramolecular chemistry. In the December issue of 1986, a review by Cram on the central importance of preorganization for the strength and selectivity of host–guest complexation appeared.[264] In 1987, the Nobel Prize was awarded to the founders of this field; the three Nobel Lectures were published in *Angewandte Chemie* in the following year.[245,265,266] Within a short period of time, many important original articles now appeared, for example, by Lehn on the energy-transfer luminescence of europium(III) and terbium(III) cryptates,[267] by Sauvage on the templated synthesis of the first molecular knot,[268] by Stoddart on template-controlled catenane synthesis,[269] by Cram on the generation and characterization of a stable cyclobutadiene in a hemicarcerand,[270] and by Julius Rebek and Javier de Mendoza on the first supramolecular capsule compound, the "tennisball".[271] All of these communications were featured on a cover picture (Figure 13).

It was only natural that this abundance of original contributions and inspiring reviews increasingly led researchers in supramolecular chemistry to submit their research to

Figure 13. Selected cover pictures for articles on supramolecular chemistry from 1987 to 1993.[267–271]

Angewandte Chemie, particularly as the journal provided enough space for these communications that the mostly large supermolecule structures could be reproduced in an attractive way, above all with an adequate size, and of course more and more often in color. The appeal of the attractive cover pictures was a further enticement for new authors. As supramolecular chemistry later extended into all domains, from polymer chemistry and self-assembling systems to nanomaterials and bioanalysis,[272] *Angewandte Chemie* was well-positioned to become a leading publication medium also in these new areas.

6. Summary

The content of *Angewandte Chemie* very nicely reflects the major topics in chemical research in industry and at tertiary institutions over the past 125 years. Until the middle of the 1930s, an overview of the prevailing trends was provided primarily by high-quality reviews and essays, whereas the majority of the communications concerned the field of applied (technical and analytical) chemistry. The journal had already opened up with respect to its content before the Second World War, whereby organic chemistry in particular took on a leading role. From the middle of the 1950s, the great renaissance of inorganic chemistry began. Organic and inorganic chemistry clearly dominated the content of the journal until the end of the 1990s; today, the journal is shaped additionally by highly interdisciplinary research. The frequent articles in the 1960s–1980s on theoretically interesting molecules in organic and inorganic chemistry were to a large extent displaced by research in the field of supramolecular chemistry, which in turn played a significant role in directing chemical research to the interfaces with biology and materials research. Today, besides organic synthesis, supramolecular and nanostructured self-assembled systems, homogeneous and increasingly also heterogeneous and biological catalysis, and recently also bioanalysis dominate the content of the journal. New developments in other areas, such as physical, theoretical, technical, and pharmaceutical chemistry, as well as chemical biology, also have their place in the journal. The whole spectrum of chemistry is represented.

Highs and lows in the history of the journal reflect the political and economic environment at the time, with a large upswing in the period of chemical industrialization until the First World War, the downturn during the First World War and subsequent years, and a new upswing in the 1920s. The major advances in research in Germany during this time in the fields of atomic theory, quantum mechanics, and also biochemistry were dealt with regularly in reviews. The period of National Socialism, which regrettably also found its way into the journal, led to a shallowness of the journal and with the Second World War to its demise; in 1946, it did not appear at all. Subsequently, there was an upward trend until the end of the 1960s, followed by a certain stagnation until the middle of the 1990s. Since then, *Angewandte Chemie* has experienced steep and continuous growth, which continues today. The reasons for the upswing are manifold; they lie, however, above all in the internationalization of the author base and thus ultimately in the introduction of the International Edition. Also of importance were the establishment of a rigorous peer-review system at the beginning of the 1980s, an attractive article portfolio with different types of reviews, news, and communications, and an effective layout, whereby the graphical table of contents and the constantly changing cover pictures must be mentioned in particular. The introduction of the online edition of both the German and the English version of the journal was a complete success and has led to an ever-broader global readership and author base.

The role of the editor-in-chief has been significant throughout these 125 years. With each change in leadership came new innovations, and the nature and style of the journal changed mostly in a productive way as a result. The credit for the growth of the journal since the 1990s is due to a very large extent to the current Editor-in-Chief Peter Gölitz. He has been able to assemble a great editorial team, which has grown to a considerable size,[106] and in Neville Compton and Haymo Ross he has the support of two top-class deputy editors.

Gölitz was fully committed to quality and internationality, and to attract the desired authors made "his" product as attractive and well-known as possible. He showed great flexibility and from early on allowed longer communications—up to four or five pages—to provide room for the latest natural product syntheses or the description of complex supramolecular systems. His personal commitment is outstanding. Most of us have experienced him as a "hands-on" person: for 30 years he has arrived at many national and international congresses and events with a pile of copies of *Angewandte Chemie* and proceeded to distribute them to the participants. The way he actively addresses possible new authors, in particular young academics, and maintains contact with established authors of the journal deserves the greatest recognition, as does his commitment to German as a scientific language and thus to the continuation of *Angewandte Chemie*.

The writing of this Review was supported by the ETH Zurich. It would not have come about without the help of the editorial office of Angewandte Chemie. In particular, I thank Peter Gölitz for his advice, Haymo Ross for his role as a patient sparring partner as the idea for the composition of this Review developed during the ACS Meeting in San Diego in spring 2012, and Mario Müller for his help with data collection, without which the informative graphical material, such as the tag clouds and the various figures and tables pertaining to the development of the journal, would not exist.

Received: January 4, 2013
Published online: February 18, 2013

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[3] The brief historical analysis in this Review would not have been possible without web-based information, which was checked; I used the following Wikipedia pages as published in October

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