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REVIEW ARTICLE

The origins and impact of the International Congresses of Applied Chemistry, 1894–1912

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Abstract The First International Congress of Applied Chemistry was organised by the Association of Belgian Chemists in 1894, the eighth and last was held in Washington and New York in 1912. These congresses, unlike the early congresses on pure chemistry, were very successful and held with the highest patronage in the host countries. The ninth planned for St. Petersburg in 1915 was not held due to the intervention of the First World War. The initiative passed to IUPAC but due to political and financial restraints the International Congresses of Pure and Applied Chemistry did not commence till 1934.

Keywords Analytical chemistry · History · Congresses

The precursors

The international congresses of chemistry are considered to start with that held in Karlsruhe, 3–5th. September 1860, they are reviewed herein with particular reference to those in applied chemistry. The applied chemistry congresses will be shown to be distinct from those in the period 1860–1893, designated by George Sarton (1884–1956) in his listing of "International Congresses" [1], as "International Chemical Congresses" and distinguished from "International Congresses of Pure and Applied Chemistry" (1894–1950) which he stated succeeded them. This latter set of congresses were in fact purely applied, not pure and applied as listed by Sarton , a confusion since perpetuated [2, 3].

The Karlsruhe conference was the idea of August Kekulé (1829–1896) and came to reality with the assistance of Adolphe Wurtz (1817–1884) and Carl Weltzien (1813–1870) and was called to discuss chemical nomenclature, notation and atomic weights. All the documents at Karlsruhe relating to the Congress were collected, indexed and used by Carl Engler (1842–1925) in his account in 1892 [4] and later by Alfred Stock (1876–1946) [5]. Wurtz said 140 chemists attended but listed only 127 [6]. The Congress has since been discussed numerous times [7–14].

After the Karlsruhe meeting the international conventions of chemists were associated with the discussions of exhibits at the various International Expositions at Paris (1867, 1878 and 1889), Moscow (1872), Vienna (1873), Philadelphia (1876), Düsseldorf (1880), Milan (1881) and Chicago (1893), they had no formal organisation relating one to the other or sequencing [15]. The Paris Congress of 1889 was opened by Marcelin Berthelot (1827–1907) whose comment "Theories are not to be considered, but only practical questions, such as those related to analytical methods and nomenclature. ..." [15(a)], this concept carried over into the 1893 Congress held in conjunction with the World's Columbian Exposition in Chicago. At this meeting the chairman, Harvey Washington Wiley (1844–1930) suggested the establishment of a triennial international congress of chemistry. The American Chemical Society which had met conjointly with the Congress set up a committee to consider, "the expediency of holding similar congresses at regular recurrent intervals of time", and subsequently issued a letter of invitation in 1894 to foreign chemical societies to appoint similar committees [16]. The

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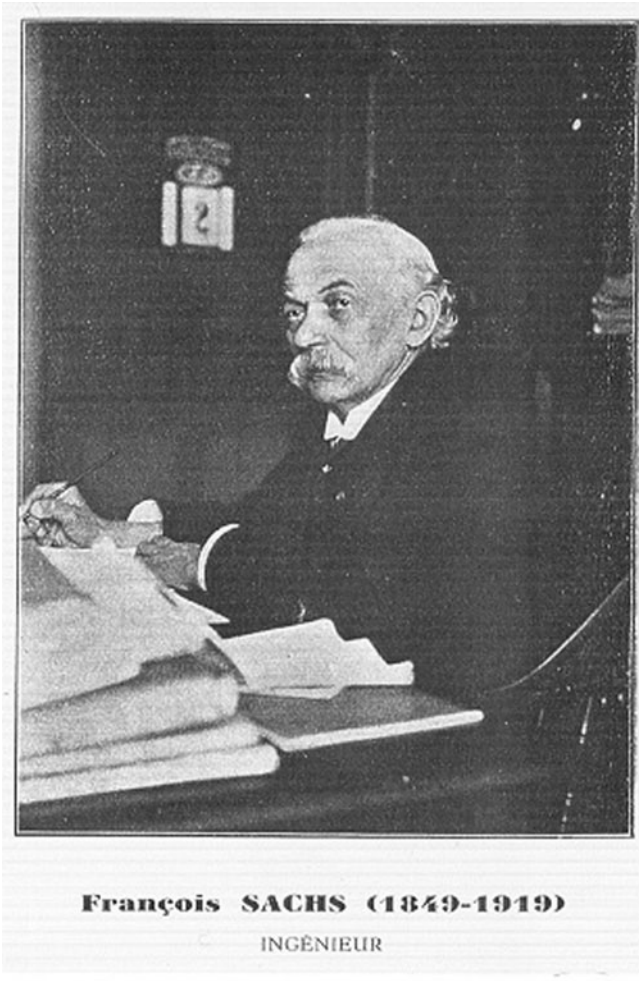
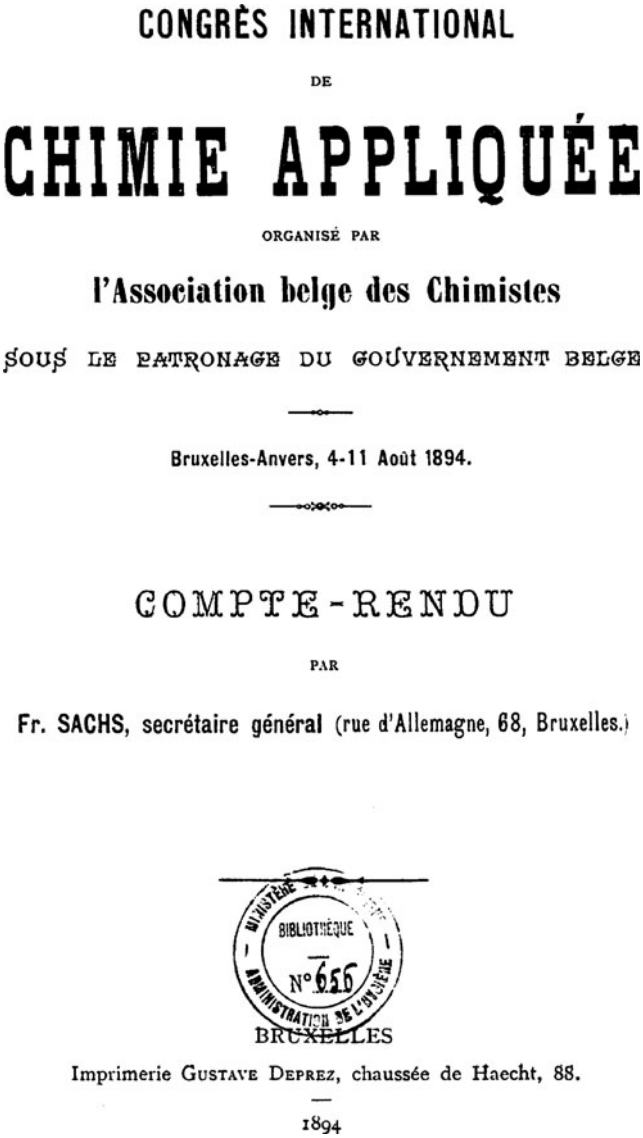


Fig. 1 Portrait of François Sachs, the prime mover in the establishment of the International Congresses of Applied Chemistry

concept was conceived independently and acted upon, prior to the general letter from the American Chemical Society, by the Association of Belgian Chemists who had already proposed in 1891 an international congress for 1893, but postponed it to 1894 [17]. Thus it is clear that the International Congresses of Applied Chemistry did not, as suggested by Sarton [1] succeed the International Chemical Congresses but developed from the community need, focused upon in the Chicago Congress. The Applied Chemistry Congresses had a considerable influence on the rates and degrees of professionalisation of chemists in the various host countries [18–19]. The two types of Congress continued their independent and separate ways, as exemplified by Paris acting as host for the two types of Congress in 1900, as noted by U. Fell [18(a)]. The Congrès International de Chimie Pure organised in conjunction with the Universal Exhibition was not well supported, whilst the Deuxième Congrès international de chimie appliquée was most successful with 1500 delegates and generated much published material.


CONGRÈS INTERNATIONAL

DE

CHIMIE APPLIQUÉE

ORGANISÉ PAR

l'Association belge des Chimistes

SOUS LE PATRONAGE DU GOUVERNEMENT BELGE

Bruxelles-Anvers, 4-11 Août 1894.

COMPTE-RENDU

PAR

Fr. SACHS, secrétaire général (rue d'Allemagne, 68, Bruxelles.)

Imprimerie Gustave Deprez, chaussée de Haecht, 88.

1894

Fig. 2 Title page of the Proceedings of the First International Congress of Applied Chemistry

The First International Congress on Applied Chemistry

The first International Congress on Applied Chemistry was held August 4–11, 1894, in Brussels and Antwerp, organised by the Association of Belgian Chemists [17]. This most important initiative was taken by the very young Association, founded in 1887. The Association was founded by a small group of chemists from the beet sugar industry. In 1889 they were joined by chemists (mainly trained as pharmacists) concerned with food adulteration and falsification [20, 21] then by agricultural chemists. Finally in 1890 chemists from the fermentation industry became members [22, 23].

Edouard Hanuise (1842–1913), the first President of the Association, at the General Assembly on 29 April 1891

informed the members that the board of management had discussed the possibility to organise an International Congress in Brussels [24]. The idea came from François Sachs (1849–1919), the Association secretary, and Hanuise, both were members of the sugar section and had long term good relations with sugar chemists in most of the European sugar-producing countries (see Fig. 1).

Sachs picked up the idea at the annual conference of the Austrian-Hungarian sugar chemists on September 1, 1890 when their chairman, Friedrich Strohmer (Director of the Experimental Station for the Beet-Sugar Industry, Vienna) expressed the wish that it would be useful to organise an international meeting for all sugar chemists in order to unify the methods of analysis used in the industry [25–28]. At first, Hanuise and Sachs thought to restrict the subject areas of the proposed conference in Brussels to sugar- and agricultural chemistry. However, D. Van Bastelaer (1823–1907), chairman of the food section opposed this proposal. Van Bastelaer had considerable experience of organising large conferences; he had earlier been President of a very successful sixth International Conference on Pharmacy in Brussels in 1885. He convinced the members of the Association that the conference should be organised by the Association itself, and that it should contain four sections, namely sugar, agricultural chemistry, food and biological chemistry [29, 30].

Sachs was the main driving force in the organisation of this first Congress, as he had multiple contacts with all the foreign Sugar Associations [31]. He came to an agreement with the French Sugar Association that the first Congress should be in Brussels in 1892 and that the second should be in Paris. He then stimulated all members of the Associations four sections to prepare for the event. Because the organisers realised that time was too short the Congress was postponed to 1893. All four sections had regular meetings, the main point on the agendas' being the discussion of the questions of international importance to be included within the programme. On August 29, 1892, the first circular of the "Congrès International des Chimistes" to be held in April 1893 was sent out, together with an attachment of 29 questions from the four sections [32].

Finally the conference was agreed to be held in 1894 in Brussels and Antwerp, because in that year an International Exhibition was to be held in Antwerp. Due to the International Exhibition it was much easier to attract subsidies and convince chemists from abroad to assist as well as to attend. The title became "Congrès International de Chimie Appliquée" and was confined to chemical aspects of sugar refining, agricultural chemistry, foodstuffs and biological chemistry. For most of the topics to be discussed position papers were prepared. A total of 31 reports, 18 from Belgium some from France, Germany and Austria and 1 each from the United States of America and from Bulgaria. The conference was very successful and attracted 397 participants from 27 countries (see Fig. 2).

At the closing ceremony in Antwerp, the conclusions of the discussions on all the questions posed in the four sections were discussed by all members of the conference in open session [26]. Most of the resolutions were accepted, some partially accepted and adjourned to the next conference (e.g. control of food falsification, the effects of discharge of treated and untreated water into rivers). For some questions international committees were set up to prepare reports for the next congress (e.g. calibration of chemical instruments, assimilation of phosphates by plants in different types of soil). Finally, it was decided that the second conference on applied chemistry be held in 1896 in Paris.

The Second International Congress on Applied Chemistry

The second international congress on applied chemistry was organised by the Association of chemists of the Sugar and Distillery Industries of France and the Colonies [33] and held in Paris, 27 July to 8 August 1896. Léon Lindet (1857–1927) was chairman and François Dupont (1841–1911) secretary general of the organising committee. Both were members of the French Sugar Association. The conference was placed under the patronage of the French Government and chaired by Pierre Eugène Marcelin Berthelot (1823–1907), the permanent secretary of the French Academy of Sciences and honorary chairman of the Sorbonne.

The main aims of the congress were to unify analytical methods, produce an agreement for the repression of the falsification of foods and agree procedures for dealing with waste waters from cities and industries.

The areas of applied chemistry were at the first extended to nine sections, in addition to the four sections of the first conference new sections were added, calibration of precision instruments, chemical industries, photography, mining and metallurgical industries. Electrochemistry was added as a tenth section and just before the start of the congress, an eleventh mixed section was added on waste-water treatment. The most successful congress attracted 1500 participants. The 500 or so questions introduced were discussed in the 60 sessions [34].

The opening address by M. Berthelot was quite remarkable; first he made it clear that the conference was focussed on applied chemistry. He said, "You, [messieurs] gentlemen, you are the specialists in the applied chemistry", he stressed however that, "pure chemistry is an essential base for applied chemistry" and went on to say, "in chemistry, theory and practice are bound to each other by indissoluble ties" [35].

The proceedings of the congress make up five volumes, each of about 500 pages [33]. In the resolutions agreed are clear links to the first conference, the creation of several international committees to prepare reports on clearly specified topics in order to continue or to finalise the debates in the next conference. In the analytical section, specific committees were established to order to make propositions on the calibration of different instruments, for example "the saccharimetric scale".

The Third to the Eighth International Congresses on Applied Chemistry

The **third congress** was held in Vienna, 28 July to 2 August 1898. The secretary general of the organising committee was F. Strohmer, director of the Austrian-Hungarian Sugar Association. The congress was divided into ten sections. A new section was that on the teaching of applied chemistry and professional affairs. The aims of the congress were as before: discussions on important problems in applied chemistry, unification of methods of analysis and the teaching of applied chemistry [36]. All the chemical laboratories in Vienna were made open to delegates; descriptions were given in Munroe's detailed report to the American Chemical Society [37].

The **fourth congress** was held, once again, in Paris from 23 to 31 July, 1900, during the period of the International Exhibition in Paris. The congress was attended by more than 1800 delegates. The programme was very similar to the ten sections conference of 1896. During the congress two important permanent commissions were established. The first was tasked with the realisation of the resolutions agreed at each congress and was made up of the Presidents of each congress. The second was to deal with analytical matters. This commission, under the presidency of Dr. G. F. Lunge (1839–1923) of Zurich, contained at least two experts from each country. Their task was to prepare documents about the conclusions from each congress and present the consensus views to the next congress [38, 39]. The main content and the social programme were documented by Wiley [40].

The **fifth congress** was held in Berlin, 2 to 8 June, 1903. In the invitation to attend it was made clear that the Berlin Congress would be organised as for the previous congresses. 2533 chemists from 38 different countries attended, about 500 papers were presented spread over eleven sections [41–43]. Innovations were the introduction of plenary lectures, including those given by E. Solvay (1838–1922), F. Moissan (1852–1927), W. Crooks (1832–1919), J Van't Hoff (1852–1911), and a broadening of the organisational base from one society only. The Berlin congress was co-organised by the "Verein Deutscher Zucker Chemiker", "Deutsche Bunsengesellschaft für Angewandte Chemie" and the "Verein Deutscher Chemiker". During the congress on June 4, C. T. Liebermann (1842–1914), the chairman of the "Deutsche Chemische Gesellschaft", invited the participants to honour W. Ramsey (1852–1916) and F. Moissan for their researches by the award of the first "Hofmann Medal" [43].

The **sixth congress** was in Rome, 26 April to 3 May, 1906. The invitation to attend noted that the first conference in this series was in Brussels in 1894 but incorrectly gave that it was at the initiative of the Belgian Association of Sugar Chemists. The conference was divided into 11 sections, 658 papers were presented and the total attending was 2375 [44, 45]. The excellent working of the International Committee on Analyses, established at the Paris congress of 1900 is demonstrated by the lengthy report presented to the congress by G. Lunge [46, 47]. The organisation of this congress was very complex due to the structure of chemistry in Italy at the time; its success was a major step in the professionalisation of chemistry in Italy [18(b)].

The **seventh congress** was in London 27 May to 2 June 1909. The proceedings ran to 19 volumes [48]. The attendance was 4100, 958 papers were presented in 11 sections and 6 subsections, as follows:

I. Analytical chemistry, II. Inorganic chemistry and allied industries, IIIa. Mining and metallurgy, IIIb. Explosives, IVa1. Organic chemistry and related industries, IVa2. Physiological chemistry and pharmacology, IVb. Colouring matters and their application, V. Industry and chemistry of sugar, VIa. Starch Industry, VIb. Fermentation, VII Agricultural chemistry, VIIIa Hygiene and medicinal chemistry, VIIIb. Pharmaceutical chemistry, VIIIc Bromatology, IX. Photo-chemistry. Photography, X. Electrochemistry. Physical chemistry, XI. Law, political economy, and legislation affecting the chemical industry.

As in 1906, the International Committee on Analyses produced its report for the congress [49]. The report by the Explosives Section "The rise and progress of the British explosives industry" [50] presaged the times to come and the demise of the series. Detailed reports of the proceedings and the social events are available [51, 52].

Each congress became larger than the one before. The **eighth congress**, 1912, in Washington and New York, 4–13 September, attracted nearly 4500 participants with subjects for discussion divided in 23 sections, as follows:

I. Analytical Chemistry, II. Inorganic Chemistry, IIIa. Metallurgy and mining, IIIb Explosives, IIIc Silicate Industries, IV. Organic chemistry, IVa Coal tar colors and dyestuffs, Va. Industry and chemistry of sugar, Vb. India rubber and other plastics, Vc. Fuels and asphalt, Vd.Fats, fatty oils and soaps, Ve. Paints, drying oils and varnishes, VIa. Starch, cellulose and paper, VIb. Fermentation, VII.

Agricultural chemistry, VIIIa. Hygiene, VIIIb. Pharmaceutical chemistry, VIIIc. Bromatology, VIIId. Biochemistry, including pharmacology, IX. Photochemistry, Xa. Electrochemistry, Xb. Physical chemistry, XIa. Law and legislation affecting the chemical industry, XIb. Political economy and the conservation of natural resources.

The proceedings increased to 29 volumes [53]. The next congress was planned for 1915 in St. Petersburg (Russia), but World War I intervened. The extensive report by the International Committee on Analysis was given for the second time by Lindet [54]. In addition to the lectures and social programme an extensive tour of various industries was provided [55, 56]. The Eighth Congress was regarded at the time as a great success with "the most brilliant assemblage of men eminent in pure and applied chemistry ever brought together on this continent and a worthy successor of the preceding Congresses" [57]. The article falsely claimed that the first Congress of Applied Chemistry, held in Brussels in 1894, was the outcome of the suggestion by Harvey W. Wiley. As explained earlier the time lines show that the Association of Belgian Chemists acted independently and indeed prior to the suggestion made by Wiley.

Despite the praise, after due reflection and discussions with friends, Bernard Conrad Hesse (1869–1934) gave a critique of the eighth and aspects of the seventh, aimed to assist the organisers of the ninth Congress planned for 1915 in St. Petersburg, but this was never held due to the intervention of World War 1 [58]. Interestingly the Belgian Association of Chemists had expressed similar criticism after the fourth congress in Paris, 1900. The other conferences mentioned by Sarton [1] of 1934 and 1938,were not in the sequence of Congresses of Applied Chemistry but of Congresses of Pure and Applied Chemistry organised by the International Union of Pure and Applied Chemistry, created in 1919 [59] in association with the General Assemblies. That listed as New York & Washington 1950 presumably refers to that held in New York in 1951.

Belgian criticism about the organisation of International Congresses On Applied Chemistry

After the IVth Congress in Paris, the Belgian Association of Chemists came to the opinion that this conference had been in several aspects chaotic and had deviated from the original ideas for such congresses. Their main criticisms were, too many questions were treated by each section (as many as 200), no preliminary reports had been made available and that insufficient time was available for discussion at a fundamental level. They also noted that the questions designed for the various International Committees were not dealt with because they had never met and that there was no feedback from the publishing of papers and reports in the journals of the national chemical societies. The most intense criticism concerned that various resolutions put forward and adopted related exclusively to France.

These criticisms were first expressed at a General Meeting of the Belgian Association of Chemists held on 7 June, 1900 [60]. Following discussion three motions were adopted:

1. Only important topics of international importance should be selected by the Organising Committee, after approval of concerned national societies or other appropriate institutions. Reports on the questions to be discussed should be sent to participants prior to the congress.
2. Questions relating only to one country should not be accepted. All other such communications should be avoided, if treated they should not be subject to a vote.
3. Key lectures should be organised on research topics and important new discoveries.

These motions were confirmed at the General Assembly of the Association 25 January, 1903 [61], however a little too late for the organisation of the fifth Congress in Berlin.

After the very successful Congress in Berlin there was still some dissatisfaction about the organisation of International Congresses. In order to prepare very seriously for the next Congress due to held in 1906 in Rome, the Belgian chemists decided to organise a national conference in 1905, in Liège [62].They hoped by preparing by preliminary discussions at national level, on for example the list of questions prepared by the International Committee on Analysis, to obtain more conclusive results in Rome. The conference took place 27 to 30 July, although a Belgian meeting many other national societies sent delegates including E. Paternò di Sessa (1847–1911), the President for the 6th Congress in Rome [63].

The aftermath

As noted the ninth Congress, that planned for 1915 for St. Petersburg did not take place. After its foundation the initiative passed to IUPAC, however due to political and financial constraints the International Congresses of Pure and Applied Chemistry did not commence till 1934. The loss of the International Congresses of Applied Chemistry was noted in 1927 and the Union criticised for its 15 year delay and lack of action "in bringing the chemists of the world together in a congress organised along democratic lines and devoted to science" [64].

Conclusions

Despite what has been stated there was no formal link between the 10 chemical congresses held 1860 to 1893 and

the 8 International Congresses on Applied Chemistry, 1894–1912. This latter series was, without doubt, initiated by the Belgian Association of Chemists. As the initiators the Belgian Association worked after the fourth Congress to try to optimise the organisation of the Congresses, because of the enormous work involved was not in proportion to the results obtained. They were all held with the highest level of patronage available in the host countries and had profound impacts on the internationalisation and professionalization of chemistry.

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