

Thriving for Unity in Chemistry

The First International Gathering of Chemists*

by Michael W. Mönnich

Congresses are still a necessary and popular means of communication within a scientific discipline even in the age of the Internet and e-mail. Chemistry can look back at a 150-year old tradition: the first international congress of chemists took place on 3-5 September 1860 in Karlsruhe.

In the middle of the 19th century, the science of chemistry had come to a dead end. The work of Lavoisier had laid the foundations of modern chemistry; the following decades saw the introduction of many kinds of nomenclature, so that it became increasingly difficult to communicate about chemical compounds. That atoms were the smallest building blocks of chemical compounds, as proposed by Dalton, became widely accepted; however, little was known of how the atoms were arranged. Different scientific schools supported different views—even on fundamental theoretical questions such as the basis for a scale of atomic weights.

For example, the research of Jean Baptiste Dumas (1800-1884) and his students led to questions regarding the theory of Jöns Jakob Berzelius (1779-1848). Berzelius was the most renowned chemist of his time and his concept of electrochemical dualism in the construction of organic compounds was then widely accepted. The contemporary chemist Lothar Meyer (1830-1895) described the situation as follows: "We now easily recognize that the argument was mainly about three things: electrochemical dualism, Avogadro's Hypothesis, and the relative atomic weights of the elements. However, at the time, this was not so obvious; the most common arguments were about the formulas used to represent how chemical compounds were formed. . . . As a result, there was much confusion, every substance, even the simplest, had a series of formulas, e.g., water: H₂O or HO or

H₂O₂, mine gas (methane): CH₄, C₂H₄ Even a simple compound such as vinegar could have enough proposed formulas to fill an entire printed page."¹

C ₄ H ₄ O ₄	empirische Formel.
C ₄ H ₂ O ₃ + HO	dualistische Formel.
C ₄ H ₂ O ₄ . H	Wasserstoffsiure-Theorie.
C ₄ H ₄ + O ₄	Kerntheorie.
C ₄ H ₂ O ₂ + HO ₂	Longchamp's Ansicht.
C ₄ H + H ₂ O ₄	Graham's Ansicht.
C ₄ H ₂ O ₂ .O + HO	Radicaltheorie
C ₄ H ₂ .O ₃ + HO	Radicaltheorie.
C ₄ H ₂ O ₂ } _H O ₂	Gerhardt. Typentheorie.
C ₄ H ₂ } _H O ₄	Typentheorie(Schischkoff)etc.
C ₂ O ₃ + C ₂ H ₃ + H O	Berzelius' Paarlingstheorie.
H O.(C ₂ H ₃)C ₂ . O ₃	Kolbe's Ansicht.
H O.(C ₂ H ₃)C ₂ . O.O ₂	ditto
C ₂ (C ₂ H ₃)O ₂ } _H O ₂	Wurtz.
C ₂ H ₃ (C ₂ O ₂) _H O ₂	Mendius.
C ₂ H ₂ .HO}HO}C ₂ O ₂	Geuther.
C ₂ { _O ^{C₂H₃} }O + HO	Rochleder.
(C ₂ ^{H₃} / _{CO} + CO ₂) + HO	Persoz.
C ₂ { _H ^{C₂O₂} } _H O ₂	Buff.

Thus, by the middle of the 19th century it was generally felt that the scientific situation in chemistry was unsatisfactory. Three young professors of chemistry took the initiative to organize a congress at which the subjects in dispute could be resolved: Friedrich August Kekulé, Carl Weltzien, and Charles Adolphe Wurtz.

The Three Organizers

Friedrich August Kekulé von Stradonitz (1829-1896) originally studied architecture at the University of Giessen. Inspired by the lectures of Justus von Liebig (1803-1873) he changed to chemistry. After receiving his degree and after stays in Paris, Switzerland, and England, Kekulé became a professor of chemistry at the University of Ghent in Belgium. It was there that he clarified the structure of the aromatic carbon compounds. In 1867, he was named professor of chemistry at the University of Bonn. Today, his name is especially associated with the concept of the six-membered carbon ring of benzene as the prototypical aromatic compound which he proposed in 1865.²

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Carl Weltzien (1813–1870) was a student of Friedrich Wöhler (1800–1882) and Eilhard Mitscherlich (1794–1863) in Berlin. He came to the Polytechnic in Karlsruhe in 1841 and nine years later became head of the Chemistry Department.³

Charles Adolphe Wurtz (Karl Adolph Würtz, 1817–1884) was born in Wolfisheim, Alsace, France, received a medical degree in Strasbourg, Germany, and then studied chemistry in Giessen with Liebig. He was an assistant with Dumas in Paris starting in 1845 and succeeded him in 1853 as holder of the chair in chemistry at the Faculty of Medicine. Kekulé knew Wurtz from his time in London in 1852.⁴

The driving force for the organization of an international conference of chemists undoubtedly came from Kekulé who was at this time a professor of chemistry at Ghent.

In the summer of 1859 Kekulé visited Weltzien in Karlsruhe and proposed that an international congress of chemists be organized in the city of Baden to settle the confusion regarding the concepts “atom,” “molecule,” and “equivalence.” Karlsruhe was seen as a suitable venue for the proposed conference not only because Weltzien was head of the chemistry department at the Polytechnic but also because support could be hoped for from Grand Duke Frederick I (1826–1907) of Baden who was known as a patron of science.

The current Karlsruhe Institute of Technology was founded in 1825 as the Grand ducal Polytechnic School of Baden; modeled on the École Polytechnique in Paris, it was the first Technical University in Germany and had an excellent reputation. In 1851, Weltzien had built a chemistry laboratory modeled on Liebig’s in Giessen—the laboratory cost 25 000 Gulden, almost half the annual budget of the Polytechnic.⁵ This and the appointment of three prominent scientists to chairs of chemistry had moved Karlsruhe into the first rank among schools of chemistry at German universities. Karlsruhe’s convenient location led the organizers to expect that many French colleagues would participate in the proposed conference as well as the already well-known Heidelberg chemist Robert Bunsen (1811–1899).

Preparations

After the meeting with Kekulé in Karlsruhe, Weltzien, during the winter semester 1859–1860, sketched the plans for a conference in letters to Wurtz in Paris and August Wilhelm Hofmann (1818–1892) in London.

At the end of March 1860, Kekulé and Weltzien travelled to Paris to visit Wurtz and took the first steps to implement their plans. A circular letter was planned to obtain the support of the most important chemists of the time. In a letter dated 14 March 1860, Kekulé wrote that the most important goal of the conference was to come to an agreement on the basic questions in theoretical chemistry.

The appeal was quickly initiated, with the three settling on Karlsruhe as the location for the meeting in the first week of September. Wurtz sent invitations to their French colleagues while Kekulé invited the British and Weltzien the German. The invitation letter from

Weltzien on 10 July stated the necessity and goals of an international congress: “More precise definition of what is meant by the expressions: atom, molecule, equivalence, atomicity, basicity, and designated expressions; investigation as to the true equivalent of bodies and their formulas; introduction of a proportional description and a rational nomenclature.”⁶



Friedrich August Kekulé von Stradonitz (1829–1896)



Ständerhaus Karlsruhe.

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In addition to the three organizers, 42 renowned chemists signed the letter, among them Bunsen, Dumas, Liebig, Mitscherlich, and Wöhler. Others among the list of signatories were Stanislaw Cannizzaro (1826–1910), Otto Erdmann (1804–1869), Herman von Fehling (1811–1886), A.W. Hofmann, Herman Kopp (1817–1892), Louis Pasteur (1822–1895), Henry Roscoe (1833–1915), and Adolph Strecker (1822–1871). Weltzien received 129 letters⁷ and the responses were so positive that it was felt that the practical organization of the congress could begin.

Organization and Goals

From the beginning, it was intended that the congress would not only allow an exchange of views but that the participants would also come to decisions. Kekulé expressed it as follows: “To me it seems clear that the majority of the congress cannot make resolutions that are binding on the minority (and even less on those not present). Nevertheless, votes on many items would be useful because of the moral weight thus obtained. Discussion of certain key subjects could lead to the clarification of errors and thus to a consensus.”⁸ All university chemistry faculty would have the right to vote.

A further concern of the organizers was to arrange the congress so that there would be little opportunity for the display of personal sensitivity or vanity thereby enabling the participants to concentrate on the issues at hand. Kekulé therefore insisted that a permanent conference chair should not be elected. He feared that such an election would cause the defeated candidates to suffer from injured pride and he worried that a chair of the congress could lead it into a direction of his own preference. It was also decided not to have a large number of prepared lectures as these would contribute little to the goal of the congress: “The meeting will be without a result if everyone is given the opportunity to present himself and his personal views in a

well prepared lecture.⁹ Kekulé placed great reliance on the “agenda leaders” (secretaries): “The Secretariat must be chosen from among the most energetic and active young people from each country, or better said, each language. The actual leadership of the work of the congress will be in the hands of the Secretariat.”¹⁰ It was obvious that Kekulé sought to hold a meeting with the character of a modern workshop rather than a display congress where the famous members of the guild present their various opinions.

Participants

There were 127 chemists at the Congress in Karlsruhe; 57 from Germany, 21 from France, 18 from Great Britain, 7 each from Russia and Austria-Hungary, 6 from Switzerland, 3 each from Sweden and Belgium, 2 from Italy, and 3 from other countries.¹¹ Present were well-known chemists such as Bunsen, Adolf von Baeyer, Emil Erlenmeyer, von Fehling, Carl Fresenius, Kopp, Friedrich Beilstein, Jean-Baptiste Boussingault, Dumas, Arnould Paul Edmond Thénard, Cannizzaro, Dmitri Mendeleev, and Lothar Meyer. Most of the participants knew each other as the academic chemistry community at this time was still small. In addition, most of them had learned their chemistry in Paris, Giessen, or Heidelberg.

The participants were for the most part supporters of a conservative tendency to retain the system of Berzelius. Only a minority, to which the organizers themselves belonged, followed the molecular theory of the French chemists Auguste Laurent and Charles Gerhardt.

The Event

The congress started on Monday, 3 September at 9:00 AM. The meeting was held in the assembly hall of the Baden Parliament on Ritter St.¹² Weltzien, as general secretary of the meeting, greeted the delegates with an address that emphasized the international and discipline-specific nature of the meeting: “For the first time the representatives of a single scientific discipline have met, and it is the youngest science . . . We represent different countries and speak different languages, but we are related by our craft . . . We are gathered for the specific purpose of attempting, in good conscience, to prepare the way for unity on points of significance for our beautiful science.”¹³

An opening address by Kekulé followed, the text of which has not survived.¹⁴ Notes were made of all



Chemical Laboratory in Karlsruhe, built in 1851.

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the meetings and proceedings prepared by Wurtz for eventual publication in French, German, and English.¹⁵ Wurtz sent his French version to Kekulé in the fall, who noted the receipt of the text in a letter to Weltzien dated 19 November 1860 in which he asked for time to complete the editing and translation into German.¹⁶ The publication of the proceedings was delayed a number of times and in the end never took place. However, a German translation of Wurtz' proceedings is available as they were edited by the Karlsruhe chemist Karl Engler as part of a Festschrift published by the Technical University Karlsruhe on the occasion of the 40th anniversary of the rule of Grand Duke Frederick of Baden in 1892.¹⁷ Engler's edition of the proceedings is one of the most important sources of information about the meeting, supplemented by notes made by Meyer and Mendeleev as well as news items in the local Karlsruhe newspapers.¹⁸

The congress was organized as follows; Weltzien led the first meeting on 3 September at which Kekulé, Lev Nikolaevitch Schischkov, Strecker, Wurtz, Roscoe, and William Odling were named as secretaries of the congress. A nine-member committee, chaired by Kopp, then met in private to propose a detailed theme for the congress. They decided on the disputed meanings of the terms "atom," "molecule," and "equivalence." In the evening, a congress dinner for 120 people was held "in the large hall of the museum"—probably the current Karlsruhe art museum.

On the next day, the assembly discussed the question proposed by the committee, although no conclusions could be reached. The disputed subjects were therefore referred back to the committee, which met twice on the same day and decided to present the assembly with three specific nomenclature proposals.

On the third day the congress met, with Dumas as chair, to discuss the questions posed by the commission regarding nomenclature and the use of chemical symbols. During the discussion, Cannizzaro, at that time a little-known Genovese professor of chemistry, warned against trying to return the state of knowledge back to that of Berzelius' time, as chemistry had steadily developed since then.¹⁹ After a heated dis-

ussion, the congress resolved that the sum formulas introduced by Berzelius could still be used.

Results

The retention of the Berzelius style formulas as the only substantive result of the congress would seem at first glance to be very disappointing, a result very much different from the high expectations of the organizers. Still, the Karlsruhe Chemists Congress was undoubtedly the most significant event in the history of chemistry in the mid-19th century.

The concrete results originally planned by the organizers were not achieved; however, the gathering of so many chemists, from within Germany and from outside, had a catalytic effect on the development of theoretical chemistry. The development of the periodic system and the general acceptance of the Avogadro-Ampère theory in particular were undoubtedly promoted by the congress. Meyer, the codeveloper of the periodic system and a congress participant, testified to this later: "While formally it was without result, in fact it was very

useful, the many exchanges of views prepared for the later general agreement. At the end of the meeting friend Angelo Pavesi distributed on behalf of the publisher of an obscure journal a paper reprinted for the occasion, 'Sunto' by Cannizzaro, which had appeared a number of years earlier but had not received much attention. . . . I was astonished at its clarity, the little manuscript covered all the important points in dispute. It was as if scales fell from my eyes, doubts vanished, and a feeling of calm certainty came over me."²⁰ The congress undoubtedly helped to a large extent in the development of the periodic system of the elements.²¹


The Karlsruhe Congress was the first professional congress of a scientific discipline; it was followed in the following 20 years by 6 more: 1867 in Paris, 1872 in Moscow, 1873 in Vienna, 1876 in Philadelphia, 1878 in Paris, and 1880 in Düsseldorf.

The innovative nature of the Karlsruhe Chemists Congress should not be underestimated. Of course there had been natural science societies whose members met regularly for discussion and to hear lectures,



Carl Weltzien (1813-1870)

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as early as 1746 in Europe (Switzerland) and 1822 in Germany, but these were mostly regional in nature and covered all disciplines (e.g., the “Meeting of the Society of German Natural Scientists and Physicians”). In contrast, the Karlsruhe meeting was viewed from the outset as an international and a discipline-specific meeting with a definitive theme. 

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