

## Innovative by Tradition: The Beginnings of Chemistry at Göttingen

As early as in 1735, shortly after the founding of Göttingen university, lectures in chemistry were held at several professors' private homes and in rented venues. There were plans to set up a chemical laboratory as part of the faculty of medicine, as well as a botanical garden and an anatomical institute. Initially, however, pharmaceutical and chemical work and research could only be conducted at the University Pharmacy, often involving quarrelling with the lessee. The university's chemical institute in the Hospitalstrasse was only established in 1783, but it was generously equipped with laboratories, side rooms and an auditorium. The first director's (Johann Friedrich Gmelin) official residence was located on the upper floor. He was a professor at the faculty of medicine as well as at the faculty of philosophy, which was in accordance with the variety of subjects he taught and conducted research in: chemistry, sampling, technology, pharmacy, botany, and mineralogy. His son, Leopold Gmelin, is the famous originator of the extraordinarily important Gmelin database which is continued and regularly updated up to the present day.

Gmelin's successor as director of the chemical institute was Friedrich Stromeyer who was the first official professor for pharmacy and chemistry. In 1805, Göttingen university was the first university in Germany to be equipped with a student laboratory where practical lessons in modern analytical chemistry were taught. Hence, Justus von Liebig was wrong when he wrote in his memoirs: "Laboratories where chemical analysis was taught did not exist at that time; the places called laboratories were rather kitchens, filled with all sorts of furnaces and utensils to trigger metallurgical or pharmaceutical processes. Nobody knew how to teach analysis." Stromeyer achieved a good reputation reaching far beyond Göttingen by publishing a large number of scientific papers. In 1817 he was honoured by a call to serve as a professor in succession to Martin H. Klaproth at Berlin university, but he declined and stayed in Göttingen. He had just discovered the new element cadmium, and thoroughly examined its chemical characteristics. Among his well-known developments are several analytical methods, for example the process of separation of strontium from calcium. The achievements of his students, among them Leopold Gmelin, Robert Wilhelm Bunsen and Eilhard Mitscherlich, bear witness to his qualities as a teacher.

When one year after Stromeyer's death Friedrich Wöhler became professor for pharmacy and chemistry in Göttingen in 1836, he had already achieved world fame. Here he continued his fundamental work on organic chemistry, partly in collaboration with Liebig, who was in Giessen at that time. By his research on uric acid and oil of bitter almonds he expertly demonstrated how the most complex problems of the time were tackled, how the question of constitution was mentally approached, and how organic chemical work was conducted. His universalism was one of Wöhler's outstanding qualities, as was the thoroughness and solidity of all of his work, which was not at all a matter of course during the pioneering times of this new subject. He conducted a systematic examination of all the chemical elements known in his times, a fact from which his students greatly benefitted. Under Wöhler the Göttingen chemistry student laboratory came to be considered as one of the best on the continent. Associate professors such as Rudolf Fittig and Friedrich Beilstein also contributed to this good reputation.

After Wöhler's death in 1882, Hans Hübner who had been a student of Wöhler and of Friedrich August Kekulé became the next director. As an academic researcher he was a pure organic chemist who above all specialised in the examination of the substitution reactions in the benzene nucleus, a highly topical matter at the time. Unfortunately, Hübner's multifarious, successful work came to an abrupt end by his untimely death two years later. Victor Meyer from Zurich became his successor.

Meyer, who worked in Göttingen only for five years (1884-1889), was active in all three core areas of chemistry: inorganic, organic, and physical chemistry. Researchers as well as

academic teachers were fascinated by him. When he left for Heidelberg, assistant professors Ludwig Gattermann and Paul Jannasch went with him. Hence, Meyer's successor Otto Wallach was faced with the task of establishing a new, attractive group of academic staff. The number of students had grown so much since Wöhler's time that the laboratory had to be modified, and new buildings had to be erected. The research conducted was varied; Otto Wallach himself from the mid-1880s onwards mainly occupied himself with the terpenes, a class of alicyclic compounds. It was he who examined this largely unexplored subject of natural substance chemistry from scratch, gradually bringing clarity to the character of the terpenes. When formulating the so-called isoprene rule, he actually anticipated regularities that were only discovered half a century later on the basis of biosynthesis. He was awarded the Nobel Prize in 1910 for his work on the terpenes. His findings strongly influenced the German fragrance industry.

After Wöhler and Wallach, Adolf Windaus followed in the line of famous Göttingen natural substance chemists. After he had come to Göttingen in 1915 he continued his earlier work on cholesterol until he finally succeeded in discovering its constitution. However, he had not anticipated the expansion of this area of steroid chemistry: it became clear that the basic structure occurred in several natural substances, such as the D vitamins, bile acid, amphibious poisons, and also – as Adolf Butenandt discovered – in human sexual hormones. Windaus was awarded the Nobel Prize in 1928. His way of working was unique and served as a paradigm: many professors of the following generation studied under him or came to work with him when they had already acquired their professorial lecturing qualification, such as Hans Brockmann and Hans Herloff Inhoffen. Other Göttingen chemists were awarded this prestigious prize for their research, among them Walther Nernst and Richard Zsigmondy. The latter is of particular importance for Göttingen since the membrane filter separation technology division of the Sartorius AG company goes back directly to Zsigmondy's findings and the "Membrane Filter Society" which was founded by him.

With the course of time the variety of chemical research at Göttingen grew so broad that separate institutes were set up for organic, inorganic and physical chemistry. During the post-war years the directors of these institutes, Hans Brockmann, Oskar Glemser and Wilhelm Jost, successfully re-established the good international reputation. As the existing buildings in the city centre became insufficient, the faculty of chemistry moved to its present premises in the northern area of the university in 1973/1974.

The Göttingen Museum of Chemistry located at the faculty of chemistry was founded in 1979. In its permanent exhibition and its magazine it houses a broad variety of documents regarding the history of chemistry at Göttingen university since its foundation in 1737. A major subject of the collection is the work of Friedrich Wöhler. The collection is continuously expanded, mainly through donations. The museum does not have its own budget, but it receives funding from the faculty and its institutes. The base funding is provided by a sponsoring society most of whose members are professors and alumni of the faculty of chemistry. The museum's periodical is the "Museumsbrief" which is annually mailed to the members of the Göttingen Chemical Society.

This periodical is available on-line and in several public libraries. So far, two reference books have been published which contain information on the people who have taught and studied at the Faculty of Chemistry. Special exhibitions and participations in other exhibitions are also employed as a means of public relations and specialist and general education. Examining and describing the history of the subject of chemistry involves looking at its interconnections with the other subjects in the natural sciences and the humanities as well as with economy and politics. The Göttingen Museum of Chemistry is an extraordinary educational establishment which offers the possibility to examine these multi-faceted interconnections in a generally understandable way.