A Place **That Radiates Great Science**

The **Kaiser Wilhelm Institute for Chemistry** opened its doors in Berlin-Dahlem 100 years ago. Just three years later, it produced its first Nobel laureate: Richard Willstätter had worked out the structure of chlorophyll. However, the research facility, later reborn as the **Max Planck Institute for Chemistry** in Mainz, became world-famous through the discovery of nuclear fission.

TEXT **ELKE MAIER**

The grand opening was set for October 23, 1912. By 10:00 a.m., VIPs from the worlds of economics, science and politics were assembled in the chemical institute's library. Those in attendance awaited an exalted guest: the Kaiser himself was to formally open the Institute of Chemistry, along with the neighboring Institute for Physical Chemistry and Electrochemistry. And so began the work of the first two research institutions of the Kaiser Wilhelm Society, which was founded the year before.

"Today, the building is decked out in all its finery, like a bride on her wedding day," said Emil Fischer, Chairman of the *Chemische Reichsanstalt*, the German Imperial Chemical Association, who had backed the founding of the research facility. "But we are here to celebrate the marriage of this institute to science, under the patronage of His Majesty. It is therefore easy to tell the future of this union. We confidently expect it to produce an uninterrupted throng of thriving, promising children, in the form of brilliant discoveries and useful inventions […]."

Like its neighboring sister institution, the Institute for Chemistry was designed by court architect Ernst von Ihne in the style of the Dahlem villas, and completed in the record time of a mere eleven months. The laboratories were both modern and functional: "White tiles […] and the generous use of glass on all sides ensure good illumination during the day. In the evening, lighting is provided by […] electric light bulbs […]. Clean, shiny flooring directly promotes cleanliness."

His Majesty assumes the honor: On October 23, 1912, Kaiser Wilhelm II (left) is seen formally opening the Institute of Chemistry that was named after him. Walking alongside him is Adolf von Harnack, the first President of the Kaiser Wilhelm Society.

To provide the eminent guest himself with an idea of the institute's work, the ceremony was to be followed by an official tour: the Kaiser marveled at a "chlorophyll solution of wonderful color and fluorescence," peered at crystals of the same substance under the microscope, and was given a demonstration of glowing radioactive compounds in a darkroom.

The Institute for Chemistry comprised three independent departments: the Department of Inorganic and Physical Chemistry was led by the Institute's Director, Ernst Otto Beckmann. The Head of the Department of Radioactivity was initially chemist Otto Hahn, later followed by physicist Lise Meitner. Richard Willstätter had been recruited to head up Organic Chemistry.

Willstätter was a student of the famous Adolf von Baeyer, wrote his doctorate in Munich on the structure of cocaine, and conducted research at the ETH Zurich. In Dahlem, he devoted himself to photosynthesis and to working out the structure of flower and fruit pigments. With this aim in mind, he created the most magnificent institute garden of all time, including plantings "of large-flowered asters, red sage, red-leaved beetroot, deep purple pansies […]."

That entire splendor disappeared into large stone tubs, where the plants' pigments were extracted. This required large amounts of alcohol, which soon broke the budget due to the high alcohol tax. Richard Willstätter had to make do with the cheaper solvent acetone. But all this investment paid off: in 1915, Willstätter received the Nobel Prize for Chemistry for his research on plant pigments, especially chlorophyll.

By that time though, the work for which he was so highly distinguished was left to lie fallow, as World War I dictated the type of research carried out at the institute. Willstätter was given the commission to develop filters for gas masks that were needed to protect the troops from chlorine, phosgene and "all other known and potential poisons and irritants" involved in gas warfare. Around 30 million of the new three-layer filters went into use within a year.

Institute Director Ernst Otto Beckmann had also dedicated himself to matters of national importance. Originally, this versatile chemist had worked mainly on the precise determination of molecular masses; now, he was looking into raw material procurement issues. The lupine was a promising candidate as a source of protein-rich feeds. However, in addition to valuable protein, this relative of the pea also contains many bitter compounds.

To separate them out and make the plant palatable, the scientist relied on hot water and regular taste tests of his mixtures. The key factor was "the more or less scratchy sensation at the back of the palate, perceived when swallowing a sample of the leaching water." This self-experimentation proved to be his undoing: in 1923, Beckmann died – the suspected cause of death being a form of poisoning known in veterinary science as lupinosis.

The Hahn/Meitner department was shut down at various times during the war. Otto Hahn served in the Poison Gas Unit, while Lise Meitner worked as an X-ray technician at a military hospital. Soon after, though, things began to look up again. In the 1920s, the Kaiser Wilhelm Institute for Chemistry was one of the foremost radioactivity research facilities. Eventually, in 1938, the institute was responsible for working out a process that ushered in a new age, namely nuclear fission.

As is so often the case in science, this fateful discovery was also an accidental one: Otto Hahn and Lise Meitner, together with chemist Fritz Straßmann, were actually on the trail of something completely different. Following the trend of their times, they were

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» The Max Planck Institute for Chemistry's new building is now officially open. This edifice, containing facilities such as a modern mechanical workshop, mass spectrography and radiochemistry departments, as well as a high-voltage plant used for generating artificial radioactivity, cost around four million Deutschmarks. The institute's role is to conduct basic research into nuclear physics and nuclear chemistry.«

trying to create transuranic elements: radioactive elements that are heavier than uranium and don't occur naturally. In their quest for these substances, scientists diligently fired slow neutrons at samples of uranium. The particles, it was thought, would stick in the uranium nucleus, making it grow into a transuranic one.

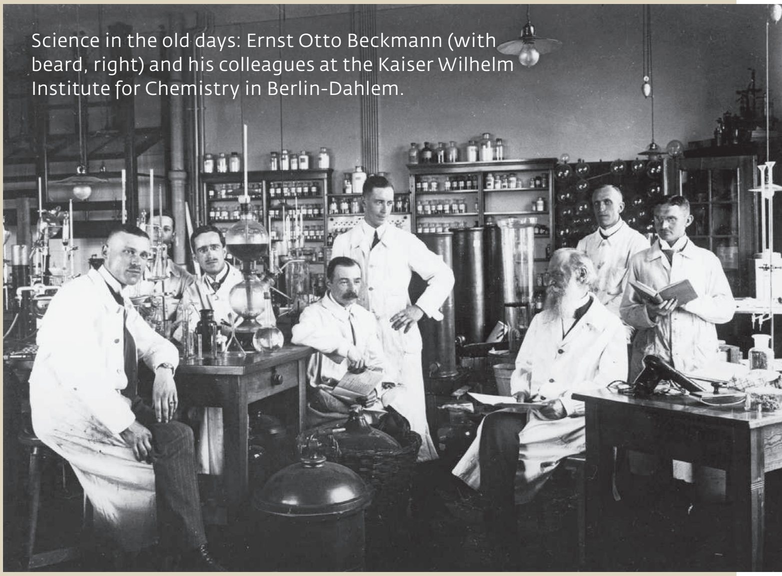
But the trials that took place in the north wing of Dahlem's Institute of Chemistry in December 1938 didn't go according to plan. Shortly before Christmas, Otto Hahn and Fritz Straßmann had repeatedly subjected uranium samples to this neutron bombardment. Lise Meitner could no longer take part in these experiments: because of her Jewish origins, she had been forced to flee from the National Socialists a few months previously, and had taken refuge in Sweden.

In Stockholm, shortly before Christmas, she received a letter from her friend and research colleague Otto Hahn, in which he asked her for a remote diagnosis: "There's something so peculiar about these radioisotopes that you are the only one we're telling about it for now. It could still be a very strange coincidence. But we're getting closer and closer to the terrible conclusion that our Ra[dium] isotopes are not behaving like Ra[dium], but like Ba[rium] […]. Perhaps you could suggest some kind of inconceivable explanation. We ourselves know that it can't really split up into Ba[rium]."

Their findings were confusing because, had the trials gone as planned, radium should have been detectable as a by-product. Instead, they had produced barium, an element with a much smaller nuclear mass than uranium. Together with her nephew, physicist Otto Robert Frisch, Lise Meitner sought an explanation. After a long walk in the woods, they reached the following conclusion: the uranium nucleus hadn't grown as a result of the neutron bombardment; quite the opposite: it had been blown up.

So the barium was indeed a fission product of uranium, releasing an enormous amount of energy upon its formation. Otto Hahn was awarded the 1944 Nobel Prize for Chemistry for discovering nuclear fission, while Lise Meitner and Fritz Straßmann went away empty handed – a decision that continues to fuel discussion even today.

After this ground-breaking discovery, the Kaiser Wilhelm Institute for Chemistry in Dahlem existed as such for only a few more years. Air raids during the night of February 16, 1944 devastated


Science in the old days: Ernst Otto Beckmann (with beard, right) and his colleagues at the Kaiser Wilhelm Institute for Chemistry in Berlin-Dahlem.

large sections of the building, including Otto Hahn's office. What remained was moved to disused textile works located in the town of Tailfingen in Germany's Württemberg region.

In April 1945, Otto Hahn was captured there by the Allies and interned in England along with nine other scientists. Even though Hahn later insisted that his institute merely conducted basic research, there is no doubt that his results were also fed into top-secret projects such as the "*Uranverein*" (Uranium Club) nuclear energy project, which was controlled for a time by the German Army's Weapons Agency, the *Heereswaffenamt*, and which involved research into the military uses of nuclear energy.

The institute never returned to its place of origin. Instead, after the war, it reopened as the Max Planck Institute for Chemistry in Mainz. Like Tailfingen, Mainz, too, was in the French Occupation Zone; France wanted to keep the research facility within its jurisdiction. When a new building was opened on July 9, 1956, it was given the additional name of "Otto Hahn Institute."

Today, the old institute building in Dahlem, at no. 63 Thielallee, now known as the "Hahn-Meitner Building," is home to the Biochemistry Institute of the Free University of Berlin. Three bronze plaques sited there commemorate nuclear fission and those who discovered it: "This act has opened up new paths in materials and space research, and has given mankind the gift of atomic energy."