The life and work of Fritz Haber revisited on the 150th anniversary of his birth, in Berlin, Jerusalem, and Karlsruhe

Three recent symposia marked the hundred and fiftieth anniversary of the birth of the German physical chemist and Nobel laureate Fritz Haber (1868-1934). Among his most significant – and practical – achievements was the fixation of atmospheric nitrogen. However, and not lost on the audiences at the three events, was the fact that the life and times of Haber straddled some of the most turbulent periods in modern times. Because he has become so closely associated with the introduction of gas warfare, highly selective portraits of his career and invariably glib judgements on his work abound in the public domain. To counter this trend, some of the presentations addressed the striking persistence of negative and stubborn attitudes, and presumptions, with respect to Haber, drawing attention to the problem of how moral judgements on men – and women – of great achievement of past times are uttered in more recent, and very different times. The three symposia commemorating the sesquicentenary of Haber's birth on 9 December 1868 provided an opportunity to rexamine aspects of his life and work.

The first symposium (organised by Bretislav Friedrich and Gerard Meijer), was held on 10 December 2018 by the Fritz Haber Institute of the Max Planck Society, at Harnack House in Berlin-Dahlem, close to the site of Haber's former residence. At Dahlem in 1911, Haber – just two years after his invention of the nitrogen fixation process – became the founding director of the Kaiser Wilhelm Institute for Physical Chemistry und Electrochemistry, which in 1952 was renamed in his honour. The first speaker, Bretislav Friedrich, in *Who was Fritz Haber?,* began with a description of Haber's early life, prior to his receiving a research post in 1894 at the Technische Hochschule Karlsruhe, where he would become full professor at age 37. At Karlsruhe, he brought about the highly challenging synthesis of ammonia from its elements under a pressure of 200 atmospheres (402 kPa) at an elevated temperature of over 500 ℃ in the presence of an osmium catalyst. Since the thermodynamically-limited yield was low, it was necessary to recirculate the unreacted gases in a continuous, closed loop.

Next, Deri Sheppard (University of South Wales) in *'An ideal partnership;' Haber, Le Rosssignol and the ammonia synthesis*, emphasized the critical role played by Haber's English assistant Robert Le Rossignol (1884-1976) in the design and construction of a complex steel laboratory apparatus for the ammonia synthesis. Le Rossignol had previously developed his skills in both engineering and chemistry at University College London.

Margit Szöllösi-Janze (Luwig-Maximilans-Universität), in *Science at war: Fritz Haber and the chemical industry, 1914-1918*, recounted Haber's role as a wartime administrator and mediator between science, chemical industry, and the military. It was through this work that he became associated with the first large-scale wartime gas attack, on 22 April 1915 at Ypres, against French, Algerian, and Moroccan troops. This has left a lasting legacy concerning the use of toxic gases in war, including, later on, against civilian populations. During World War I, the BASF Haber-Bosch synthetic ammonia process was increasingly applied in the manufacture of munitions.

Stefan L. Wolff (Forschungsinstitut, Deutsches Museum) in *Haber as a Jewish German patriot: from Baptism to Zionism*, examined Haber's conversion as a young man to the Christian faith. In 1933, Haber's situation in Germany changed soon after the National Socialist's assumed power. The Law for the Restoration of the Civil Service, of April 7, required that Haber dismiss coworkers of Jewish descent. Haber stepped down in protest and through his resignation letter rejected the racist Nazi policy. He received offers of support outside Germany, including from former institute assistant Setsuro Tamaru, in Tokyo. In the autumn of 1933, Haber joined William Pope at Cambridge. Chaim Weizmann, the chemist and Zionist leader, invited Haber to join the Daniel Sieff Research Institute, at Rehovot, in mandate Palestine. Haber's heart problems precluded his travel there. He died in Basel, Switzerland, on 29 January 1934.

Jan Willem Erisman (Vrije Universiteit Amsterdam), in *How 110 years of ammonia synthesis changed the world food production and environment*, pointed out that while Haber's method for nitrogen fixation enables the feeding of about half of the world population, this has contributed to widespread obesity and other health issues in the

developed world. Moreover, release of reactive nitrogen from fertilizer use contributes to environmental degradation.

At Harnack House the Belgian artist David Vandermeulen exhibited images from his pictorial biography of the life and times of Fritz Haber. So far, four volumes of the lavish six-volume *Fritz Haber*, have been published. Hanoch Gutfreund (The Hebrew University of Jerusalem) presented a display of correspondence between Haber and Albert Einstein, from The Hebrew University's Albert Einstein Archives. The letters demonstrate a strong and warm friendship, though the two men disagreed on key issues, ideological and otherwise.

The second Haber symposium (organized by Roi Baer and Igor Shapiro) was held at the Fritz Haber Center for Molecular Dynamics, the Institute of Chemistry, The Hebrew University of Jerusalem, Israel, on 17-18 December 2018. Tony Travis (Edelstein Center for the History and Philosophy of Science, Technology and Medicine, The Hebrew University) in *Fritz Haber and the pursuit of nitrogen* described the research in chemistry and engineering that brought about the Haber-Bosch process. By 1930, synthetic ammonia had become a global industry, its several novel high-pressure processes all based on Haber's 1909 method as devised at Karlsruhe.

The third Haber symposium was held at the The Karlsruhe Institute of Technology (KIT) on 15 January 2019 (organized by Marcus Popplow, Caroline Robertson-von Trotha, and Doris Wedlich). Alexander Wanner, KIT's vice president for Higher Education and Academic Affairs emphasized Haber's role as "one of the most outstanding scientists who ever worked in Karlsruhe" without, significantly, ignoring the fact that Haber has been labelled "the Father of Chemical Warfare." In the light of often clouded and unsettling ambiguities concerning Haber, Wanner highlighted the aim of the colloquium to provide "a solid basis of information as well as a discussion from different perspectives and perceptions." After a brief address by Caroline Robertson-von Trotha, the chair of KIT's Centre for Cultural and General Studies, Bretislav Friedrich, in *Fritz Haber at 150: The unfolding views of and on a German Jewish Patriot*, continued with these themes in his keynote talk. Bretislav emphasized the need to fully understand the context of Haber's life and times in order to arrive at

a balanced perspective on his activities. There followed a discussion among a panel, and subsequently involving the audience, that raised issues as diverse as the relationship between Haber and Einstein, forms of commemorating Haber on KIT's campus, and initiatives for an extended integration of ethical issues into curricula.

Bretislav Friedrich
Anthony S. Travis