challenge is to ensure that our successors can say the same at the end of our second century.

In terms of impact, 2019 represents a huge opportunity for us to enhance our impact (or perhaps awareness of our impact) within and outside our discipline. 2019 is the IUPAC centenary year, and perhaps more significantly, the International Year of the Periodic Table. This represents a huge chance to promote what we do and to bring people and their organisations into the IUPAC fold.

We welcome companies though our Company Associates program, volunteers through our project system, and individual members through our Affiliate Membership Program. We welcome opportunities to recruit keen scientists and new member countries from all over the world. Doing so will add financial and intellectual vitality to our organisation—new members always will!

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Stamps International

See also www.iupac.org/ publications/ci/indexes/stamps.html

Nitrogen Fixation before Haber

uch has been written about the German chemist Fritz Haber (1868-1934), who embodies at once the best and the worst that chemistry has offered to humankind. He received the Nobel Prize in Chemistry a century ago (1918) "for the synthesis of ammonia from its elements," an industrial process that led to the pervasive use of nitrogen-based fertilizers in agriculture and enabled the unprecedented population growth experienced in the world ever since. On the other hand, Haber is often considered the "father of chemical warfare" for his role in the development and deployment of chlorine and other poisonous gases during World War I. This note, however, is not about Haber's legacy but pays tribute instead to two resourceful Norwegians who preceded him in the quest for converting atmospheric nitrogen into more reactive, bioavailable forms of the element.

In 1903, Kristian Birkeland (1867-1917), a professor of physics at the University of Christiania (Oslo), and Samuel Eyde (1866-1940), an engineer and industrialist, jointly developed an electric arc process for the commercial production of nitrogen oxides and nitric acid starting from air. The pair of stamps shown here was issued in Norway on 29 October 1966, the exact date marking the latter's birth centennial, to commemorate their early contributions to what is now commonly referred to as nitrogen fixation.

The chemistry involved in the Birkeland-Eyde process wasn't entirely new: Henry Cavendish, William Crookes, Lord Rayleigh, and others had already investigated the effect of electric discharges on mixtures of nitrogen and oxygen. Although the Birkeland-Eyde





process was very inefficient in terms of energy consumption, it was commercially viable for a few years only because of the inexpensive (hydro)electricity available in Norway at the time. Within a couple of decades, the Haber-Bosch synthesis of ammonia, and the Ostwald process for its conversion to nitric acid, became the dominant industrial processes for the large-scale production of nitrogen-based fertilizers and explosives.

Interestingly, Birkeland was unsuccessfully nominated four times for the Nobel Prize in Chemistry (three of them together with Eyde), and thrice for the Nobel Prize in Physics. However, he is also recognized today for his important contributions to our current understanding of geomagnetism, solar wind, and the nature of polar auroras. As for Eyde, he had a successful career in business and politics: Norsk Hydro, the company he co-founded with Birkeland in 1905, is today one of the world's largest manufacturers of aluminum, and he was a member of the Norwegian Parliament (1918-1920) and served as Ambassador to Poland from 1920 to 1923.

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