

Part IV of the series, dealing with the third decade of the award, will appear in the next issue.

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## DIVERSIONS AND DIGRESSIONS

### A Note on the Discovery of Nuclear Fission

*Fathi Habashi, Laval University*

The year 1989 marks the 50th anniversary of the discovery of uranium fission. However, the first observation of uranium fission unknowingly occurred five years earlier. In 1934, Enrico Fermi (1) in Rome announced the discovery of at least five new radioactive elements as a result of bombarding uranyl nitrate with neutrons, one of which, with a half life of 13 minutes, he supposed to be a transuranium element corresponding to element number 93. Fermi put it in the periodic table under rhenium and called it eka-rhenium. This work was inspired by the so-called phenomenon of induced radioactivity discovered a year earlier by Irene Curie and Frederic Joliot in France as a result of bombarding atomic nuclei with alpha particles. Fermi used neutrons, recently discovered by James Chadwick in England, instead.

Fermi's paper attracted the attention of Ida Noddack (1896-1978) (2), best known as the discoverer of rhenium, largely because it dealt with yet another element in the manganese group and was thus presumably related to her work on rhenium. Noddack was at the time a chemist at the Physikalische Technische Reichsanstalt (Imperial Physico-Technical Research Office), a government laboratory in Berlin. Soon after reading Fermi's paper, she published a comment (September 1934) entitled "On Element 93" (3) in which she showed that Fermi's experimental evidence was incomplete and his conclusions were unjustified. She also suggested an alternative interpretation of his results, writing "When heavy nuclei are bombarded by neutrons, it would be reasonable to conceive that they break down into numerous large fragments which are isotopes of known elements but are not neighbors of the bombarded element (in the Periodic Table)" (4).

In this statement, Noddack conceived, before anybody else, the idea of nuclear fission. Her argument was as follows. When



Ida Noddack (1896-1978)

atoms are bombarded by protons or alpha particles, the nuclear reactions that take place involve the emission of an electron, a proton, or a helium nucleus and the mass of the bombarded atom suffers little change. When, however, neutrons are used, new types of nuclear reactions should take place that are completely different from those previously known.

Fermi's experiments were repeated by Otto Hahn (1879-1968) and his coworkers in Berlin. They confirmed his conclusions and published a series of papers on extensive radiochemical separations of the so-called trans-uranium elements. The results, however, became so contradictory that after five years of intensive research and extensive publication the concept of trans-uranium elements had to be abandoned. Hahn then announced in January 1939 the definite formation of barium during the bombardment of uranium and started speculating about the mechanism of its formation (5). Ida Noddack wrote a short article in *Die Naturwissenschaften* (6) in March 1939 in which she reminded Hahn of her suggestion five years earlier that the uranium atom might have undergone fission, and ended by chiding him for failing to cite her paper on this matter, although she had once explained her views to him personally. The editor of the journal apparently asked Hahn to comment, but he refused, and the editor had to add a note of his own instead (7):

Otto Hahn and Fritz Strassmann informed us that they have neither the time nor the interest to answer the preceding note. They think that they would rather renounce commenting, as the possibility of breaking down a heavy atom into smaller fragments - an idea already expressed by many others - cannot be concluded without experimental evidence. They leave the judgment on the correctness of the views of Frau Ida Noddack and the way she expressed them to their peers.

At the time Hahn was 55 years old and already Director of the Kaiser Wilhelm Institute for Chemistry (now the Max Planck Institute). A well established scientist, he had traveled abroad on numerous scientific missions, had discovered protactinium with his associate, Lise Meitner, (1878-1968) in 1918, and had written a textbook on radiochemistry. However, he apparently could not accept the new idea that the uranium atom was split into two fragments. It was Meitner who finally explained the results of the work as fission in 1939, a few months after she was forced to leave Germany. Hahn received the Nobel Prize in 1944. In his autobiography (8), published in 1966, his opinion of Noddack's contribution remained unchanged and he dismissed her with a single sentence: "Her suggestion was so out of line with the then-accepted ideas about the atomic nucleus that it was never seriously discussed".

#### References and Notes

1. E. Fermi, "Possible Production of Elements of Atomic Number Higher Than 92", *Nature*, 1934, 133, 898-899.
2. Born Ida Tacke, married Walter Noddack (1893-1962) director of the Physikalische Technische Reichsanstalt in Berlin in 1926.
3. I. Noddack, "Über das Element 93" *Angew. Chem.*, 1934, 47 (37), 653-656.
4. "Es wäre denkbar, dass bei der Beschussung schwerer Kerne mit Neutronen diese Kerne in mehrere grössere Bruchstücke zerfallen, die zwar Isotope bekannter Elemente, aber nicht Nachbarn der Bestrahlten Elemente sind".
5. O. Hahn and F. Strassmann, "Nachweis der Entstehung aktiver Bariumisotope aus Uran und Thorium durch Neutronenbestrahlung; Nachweis weiterer aktiver Bruchstücke bei der Uranspaltung", die bei der Bestrahlung von Uran mit Neutronen entstehen", *Naturwissenschaften*, 1939, 27 (67), 11.
6. I. Noddack, "Bemerkung zu den Untersuchungen von O. Hahn, L. Meitner und F. Strassman über die Produkte, die bei der Bestrahlung von Uran mit Neutronen entstehen", *Naturwissenschaften*, 1939, 27, 212-213.
7. Translation by the author.
8. O. Hahn, *A Scientific Autobiography*, Scribner's, New York, 1966, p.140.

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## THE 1893 WORLD'S CONGRESS OF CHEMISTS

### A Center of Crystallization in a Molecular Mélange

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For more than a decade after its founding, the American Chemical Society struggled to induce new members to join the 230 "charter subscribers" it had signed by the end of 1876. The membership roster slowly rose to the 300 mark, where it hovered for only a few years before plummeting to its nadir in 1889, when only 204 souls appeared on the official list. Yet, within seven years, the Society membership would break the 1000 mark and continued to increase for almost a century with only a few negative aberrations. This sudden and dramatic reversal in the numbers of those willing to invest time and money in a troubled organization signals the existence of events that plucked the Society from the precipice of extinction and secured its future as a leading professional organization for chemists.

The complexities of those crucial years centered around 1889 have not yet been completely unraveled by historians. However, there is no question that attention should be focused on the heated accusations that the original American Chemical Society was American in name only, and was really a New York based operation that had little to offer those outside of the city. The dissatisfaction culminated in 1889 with the attempted takeover by Washington chemists Harvey W. Wiley and Frank W. Clarke, who sought to form the Continental Chemical Society out of Section C of the American Association for the Advancement of Science and absorb the New Yorkers (1).

Their efforts were thwarted by Charles F. Chandler, the guiding hand behind the formation and operations of the ACS. Realizing that his organization was doomed if changes were not made, Chandler took less than a year to revise the constitution and hold the first general meeting outside of New York City. On short notice 43 chemists made their way to Newport, Rhode Island on 6 and 7 August 1890 to attend the first National Meeting of the ACS. At that meeting Clark acquiesced, agreeing to abandon the Continental Chemical Society and support the "new" ACS. To prove their intent of providing accessibility to more chemists and thus justify their claim to nationalistic territory, the Society held additional meetings in Philadelphia, Washington, New York, Rochester, and Pittsburgh in the next two years.

On 27 April 1893, Professor Albert C. Hale, head of the physical sciences department at the Boys High School in Brooklyn, New York, and General Secretary of the ACS, submitted a report to the ACS Council that detailed the current conditions of the Society, but also included some history and "prospects for the future". Hale, who served the Society on a