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## Mendeleev's Discovery of the Periodic Law

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The story behind the discovery of the periodic law is surprisingly well documented. However, the primary sources and many of the secondary ones are in Russian and so the story is not as well known in this country as it deserves to be. Through materials preserved in the Mendeleev Museum in Leningrad,[1] Academician (Philosophy) B. M. Kedrov has traced the development of the idea. Mendeleev's notes show that the periodic system was created during a single day, February 17 (Old Style, corresponding to March 1 in our calendar), 1869. In his book, "The Day of A Great Discovery" (*1*), Kedrov reconstructs the events of that day as follows.[2]

That morning Mendeleev received two letters from A. I. Khodnev concerning a trip M. had planned to visit several cheese dairies. One was a personal note sent by a messenger. It is probable that M. received it during breakfast because one can still see the circular stain left from a glass or cup having been set on it. On this note, bearing the date Feb. 17, M. jotted down his first attempts at arranging the elements systematically according to weight.

Once he began, M. abandoned plans to leave on this day to inspect cheese dairies and devoted himself to developing the idea further. On a second piece of paper, also dated Feb. 17, he made two incomplete attempts at a systematic arrangement of the elements. It was apparently at this time that he received a visit from his friend A. A. Inostrantsev, who later recalled that during this visit M. seemed depressed and out of sorts, complaining that everything had come together in his head but that he could not express it in a table. It was after this visit, Kedrov believes, that M. listed the exact atomic weights of the elements in the margin of a list of the elements in a copy of his "Foundations of Chemistry." Then from this list M. wrote out separate cards for each of the 63 known elements with their atomic weights and important chemical and physical properties. Using the cards to create various arrangements, M. engaged in what Kedrov calls "chemical solitaire" for several hours. Finally, he copied out on a sheet of paper (undated) the arrangement he had worked out with these cards.[3] This rough draft, bearing numerous corrections, has columns of elements arranged with atomic weights decreasing from top to bottom.

It is possible that at this time M. took a short nap. He may have dreamed of a somewhat different arrangement than the one he had just finished copying. Inostrantsev is the authority for the story that M. saw the periodic system in a dream after having worked on it without success. Kedrov thinks that a final, fair copy of the periodic system with directions for printing, dated Feb. 17, 1869, was made after this nap[4] and that the change to columns with low atomic weights at the top could be due to this dream. There is some support for this in the fact that Inostrantsev said M. had told him the dream table required only a single correction after he had written it down. The copy for printing has, in fact, one correction on it. However, the earlier notes make plain that M. developed the periodic system consciously; it did not come to him full-blown in a dream.

The story that M. saw the periodic system in a dream is given by Eduard Farber in his "Evolution of Modern Chemistry" (1952) but is not repeated in his essay "Dreams and Visions in a Century of Chemistry" (*5*) sixteen years later. Nor does it appear to have been known by Vanderbilt (*6*) who was interested in the role of dreams in discoveries and inventions. Of the short, general histories of chemistry, only Leicester's edition (7th ed., 1967) of Weeks's Discovery of the Elements mentions the fact that the creation of the periodic system was the work of just one day.

### Acknowledgment

The writer thanks Prof. John H. Wotiz for making available a tape of the lecture by Prof. R. B. Dobrotin (deceased Feb. 1980), Director of the Mendeleev Museum, to Prof. Wotiz's History of Chemistry class on July 9, 1979, during their visit to the Mendeleev Museum. The tape was made by Prof. Ethelreda Laughlin, Cuyahoga Community College, a member of the class.

### Literature Cited

(1) Kedrov, B. M., *Den' Odnogo Velikogo Otkrytiya, Izdatel'stvo Sotsial'no-Ekonomicheskoi Literatury*, Moscow, **1958**, 560 pp.
(2) Gillespie, C. C., *Editor*, "Dictionary of Scientific Biography," Vol. 9, Charles Scribner's Sons, New York, **1974**, p. 286.
(3) Personal communication from Prof. John H. Wotiz.
(4) Krotikov, V. A., J. CHEM. EDUC., **37**, 625 (1960).
(5) Farber, E., "Kekulé Centennial" (*Editor* Benfey, O. T.), Advances in Chemistry Series No. 61, American Chemistry Society, Washington, D. C., **1966**, p. 129.
(6) Vanderbilt, B., J. CHEM. EDUC., **52**, 709 (1975).

[1] The Museum is housed in Mendeleev's living quarters in the University of Leningrad (St. Petersburg) where he was Professor of Inorganic Chemistry from 1867 to 1890.

[2] This paper presents only the temporal sequence of events. The sequence of ideas is also shown by Kedrov and is outlined briefly in his article on Mendeleev in the Dictionary of Scientific Biography (*2*).

[3] All of the documents, original or photocopies, mentioned in this paper, except for the cards, are in the Mendeleev Museum. Reproductions of them are given in (*1*). According to Prof. John H. Wotiz, Southern Illinois University, he was shown some cards by Prof. A. A. Petrov of the Technical University of Leningrad during a visit to the Technical University in 1969. It was claimed that they were the cards M. used (*3*). M. became a professor at the Technical University in 1864 and taught there even after his appointment to the University.

[4] Photographs of this copy and the rough draft preceding it may be seen in (*4*).

This column is a series of short articles on the less known events that contributed to important and interesting developments in chemistry. Manuscripts, of about two double-spaced, typewritten pages and other inquiries should be addressed to the column editor, Dr. John Wotiz, Department of Chemistry and Biochemistry, Southern Illinois University, Carbondale, Illinois 62901.