Rediscovery of the Elements

The Periodic Table

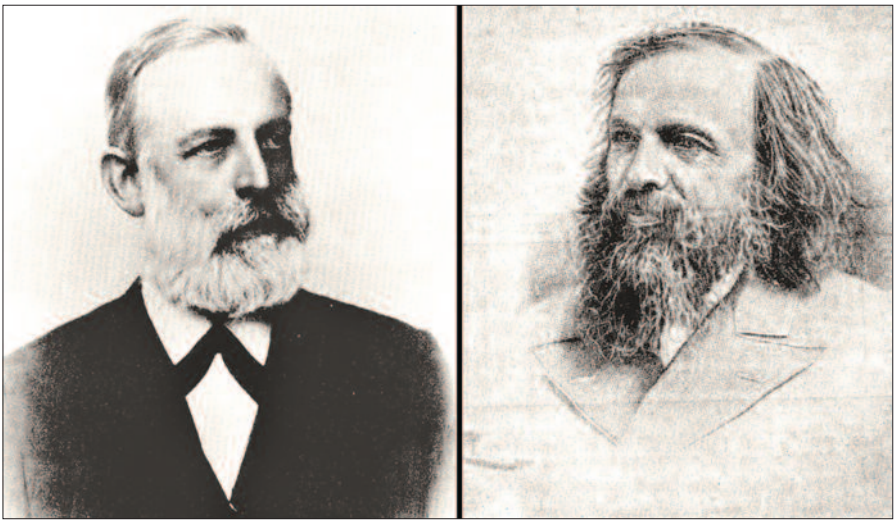


Figure 1. Although there have been several individuals who recognized patterns in the elements (see Note 1), Julius Lothar Meyer (1830–1895) (left) and Dimitri Ivanovich Mendeleev (1834–1907) are recognized as the discoverers of the Periodic Table.



James L. Marshall, *Beta Eta 1971*, and Virginia R. Marshall, *Beta Eta 2003*, Department of Chemistry, University of North Texas, Denton, TX 76203-5070, *jimm@unt.edu*

In a previous "Rediscovery of the Elements"[1] we witnessed the Karlsruhe Chemical Congress of 1860, where Stanislao Cannizzaro (1826–1910), by applying Avogadro's and Dulong-Petit's Laws to known data, developed an internally consistent set of atomic weights for the 60-odd elements then known. With these new atomic weight values, Dimitri Ivanovich Mendeleev (1834–1907) and Julius Lothar Meyer (1830–1895) (Figure 1) returned home and independently drafted new sortings of these elements that evolved into the modern Periodic Table. These two scientists were officially recognized as the discoverers of the Periodic Law and received the Davy Gold Medal at the Royal Society in 1882.[2] (Note 1)

The original motivation for the development of this new periodic system by Meyer and Mendeleev was a desire to develop a pedagogically useful arrangement of the elements for their new textbooks. It is difficult today, when each new edition from the university bookstore is commonly viewed as mere redactions of previous printings, for one to appreciate that in the 19th century textbooks were frequently the vanguard of new ideas in a rapidly evolving discipline. The respective arrangements of Meyer and Mendeleev showed that when arranged by atomic weight, the elements show a periodicity of properties including valence, chemical reactivity, and physical properties (Figure 2). With the observed trends came perceived implications—but the emerging philosophies of Meyer and Mendeleev were different. Both noticed gaps in the Periodic System; Meyer was reticent to make any comments about what might lie in them. Instead, he was more struck by the implications of

PERIODIC TABLE OF THE ELEMENTS
(Mendeleev, 1871)

Row	1 R_2O	2 RO	3 R_2O_3	4 RO_2 RH_4	5 R_2O_5 RH_3	6 RO_3 RH_2	7 R_2O_7 RH	8 RO_4		
1	H (1)									
2	Li (7)	Be (9.4)	B (11)	C (12)	N (14)	O (16)	F (19)			
3	Na (23)	Mg (24)	Al (27.3)	Si (28)	P (31)	S (32)	Cl (35.5)			
4	K (39)	Ca (40)	"eka-B" (44?)	Ti (48)	V (51)	Cr (52)	Mn (55)	Fe (56)	Co (59)	Ni (59)
5	Cu (63)	Zn (65)	"eka-Al" (68?)	"eka-Si" (72?)	As (75)	Se (78)	Br (80)			
6	Rb (85)	Sr (87)	Y (88)	Zr (90)	Nb (94)	Mo (96)	(100?)	Ru (104)	Rh (104)	Pd (106)
7	Ag (108)	Cd (112)	In (113)	Sn (118)	Sb (122)	Te (125)	I (127)			
8	Cs (133)	Ba (137)	*Di* (138)	*Ce* (140)						
9										
10			*Er* (178)	*La* (180)	Ta (182)	W (184)		Os (195)	Ir (197)	Pt (198)
11	Au (199)	Hg (200)	Tl (204)	Pb (207)	Bi (208)					
12				*Th* (231)		*U* (240)				

Figure 2. Mendeleev's Periodic Table, 1871, appearing two years after his initial systemization.[3] By now, valence was being used to help decide the fine points of the element placements: Mendeleev assumed that the oxide of beryllium was BeO, the oxide of indium was In_2O_3, and the oxide of uranium was UO_3. The atomic weight of tellurium was variable and uncertain; Mendeleev chose a value which showed iodine's greater than tellurium's value, although subsequent work established the opposite. The elements that are misplaced are italicized/underlined. "Di" was the symbol for didymium, which was later shown to be a mixture of Pr and Nd. Mendeleev boldly predicted at least three new elements with specific properties: eka-boron, eka aluminum, and eka-silicon. These elements were discovered less than 20 years later. Note that the entire column of inert gases is missing; these had not yet been discovered and recognized as elements. (Format of the table is modified by the authors for clarity).



Figure 3. Important sites associated with Meyer (in Germany) and Mendeleev (in Russia). At the time Breslau was a part of Silesia, Germany. Tobolsk, the birthplace of Mendeleev, is located across the Urals in Southern Siberia.



Figure 4. Birthplace of Meyer in Varel, now a bakery (Obernstrasse 10, Varel, Germany, N 53° 23.71 E 08° 08.40). Historical sites associated with Lothar Meyer (in contrast to Dimitri Mendeleev) are rare. Other than his birthplace, public recognition of Meyer is a geology building ("Lothar-Meyer-Bau," 56 Wilhelmstrasse Tübingen, Germany, N 48° 31.68 E 09° 03.82) at his final university [not illustrated].

the periodicity. He noticed, for example, that when plotted against atomic numbers, the atomic volumes (atomic weight divided by density) spiked with each alkali metal; he thought that this was due to some internal structure of the atom. Meyer's prophesies of atomic structure had to wait several decades until Niels Henrik David Bohr (1885–1962) interpreted the Periodic Table in terms of electronic structure. Mendeleev, presuming some primordial matter (he did not even believe in the existence of atoms), did not worry about such matters; he was not concerned with why the table worked but how these trends could predict future discoveries. He foretold new elements to fill these gaps, including chemical and physical properties. Most scientists considered these to be superstitious auguries, until three elements he specifically predicted[3] were in fact discovered (gallium, germanium, and scandium in 1875, 1879, and 1886, respectively). In his attempt to include all the elements, Mendeleev clustered his Periodic Table with the lanthanides and actinides (known at the time) which led to some errors in the place of some of the higher atomic weights (Figure 2). The more cautious Meyer excluded these "misfits" from his Table, and his original table was considered "more refined."[4] But because Mendeleev was more daring, his name became well-known rapidly, and students today more commonly associate the Periodic Table with him. (Note 2).

Rediscovering Meyer. (For a map of historic sites, see Figure 3). The birthplace of Lothar Meyer still exists in Varel, Germany,[5] and today is a delicatessen and bakery (Figure 4). After studying with Robert Bunsen at the University of Heidelberg (1854–1856), he graduated from and accepted a position (1859–1867) at University of Breslau (Breslau Universität, then Silesia, Germany; now Uniwersytet Wrocławski, Poland) (Figure 5). Here he drafted his first crude system by grouping 28 elements which he included in his textbook *Die modernen Theorien der Chemie* ("Modern Theories of Chemistry").[6] In 1866, he assumed an inorganic professorship at the Forstakademie (Forestry Academy; now the Institut für Forstwirtschaft,



Figure 5. Breslau University in the 19th century and today: (Breslau Universität, upper), where Meyer drew his first drafts of the Periodic System; today (lower) Uniwersytet Wrocławski, pl. Uniwersytecki 1, 50–137 Wrocław (N 51° 06.83 E 17° 01.99).



Figure 6. Eberswalde Forestry Academy. When Meyer was here, there was only one building (upper); today this building (lower) has been remodeled and serves as the main building (Alte Schickler'sche Gebäude, 3 Schlickerstrasse, Eberswalde, Germany, N 52° 49.95 E 13° 49.07) of a multi-campus university. At the entrance of this building are inscribed the words: "Den Wald zu pflegen/ Bringt Allen Segen"("Preserving the forests/Brings blessings to all"). Inside are several classrooms and a historic museum. There is no mention of Meyer in the museum except for a brief note that he was Professor of Mineralogy from 1866–1868. (Note 5) Outside town is a grand botanical garden with many species of trees collected from the world (1.7 km southwest).

Forestry Institute) in Eberswalde, Germany. The original building where he worked exists today (Figure 6). At Eberswalde, Meyer completed his first Periodic Table including 53 elements.[7] He did not publish this table at Eberswalde, but left it to his successor Adolf Remelé (1839–1915) when he left for the Karlsruhe Polytechnicum (Technische Hochschule) in 1868 (Figure 7). In Karlsruhe he published his classical paper "Die Natur der chemischen Elemente als Function ihrer Atomgewichte," ("The nature of chemical elements as a function of their atomic weights") where he organized 56 elements.[8] Even though he had originally formulated his Periodic System before Mendeleev (who had just published his system the previous year), he modestly stated that his system was "essentially identical" to that of Mendeleev with "no claim for originality."[7] In 1876, he became a professor of chemistry at the University of Tübingen, and quietly lived out his professional life until his sudden death in 1895.[5]

It is curious that Meyer is mentioned only briefly in the websites of Breslau University, Eberswalde Forestry Institute, and Karlsruhe University, and no plaques or monuments honoring him can be found at these institutions. For example, if one visits Karlsruhe, one can find plaques, a statue, and a Hörsaal (lecture hall) honoring Heinrich Rudolf Hertz (1857–1894), the first to produce radio waves artificially, and a monument and street honoring the memory of the Nobel Laureate Fritz Haber (1868–1934), the discoverer of ammonia synthesis—but there is no public recognition of Meyer.

Rediscovering Mendeleev (see Figure 3). In contrast to Meyer, Mendeleev is generously honored by memorials. In Tobolsk, his birthplace and school still exist (Figure 8). In the new section of Tobolsk, a huge monument has been erected in his honor (Figure 9). As the denizens of Tobolsk attest, other historical sites include the church Mendeleev's family attended, the location of the old Mendeleev home (now gone), the burial sites of Mendeleev's family, and an exhibit on Mendeleev in the Kremlin museum overlooking the old town of Tobolsk.

When the health of Mendeleev's father began to fail, his mother provided the family income by managing a glass factory at the neighboring village of Verkhniye Aremzyany (Figure 10). His father died in 1847, and the glass factory burned down in 1848. His mother, determined that Mendeleev would continue his education, took him over the Urals by horse-driven telega to Moscow, where he was rejected because he was "not from the Moscow district, but from Siberia." Stubbornly, his mother continued on to St. Petersburg where a friend provided a vital personal connection allowing her son Dmitri to matriculate at St. Petersburg University. After his education in St. Petersburg, he worked with H.V. Regnault (Paris) and Bunsen (Heidelberg) (1859–1861), then returned to St. Petersburg for a position in chemistry in 1861. Here he developed his Periodic Table and published it in *Osnovy Khimii* (*Principles of Chemistry*)[9] and Russian[10] and German[11] journals. Because of political disputes and his sympathy for students' protests which gained disfavor with the university administration, he left the university in 1890 and became Director of the National Bureau of Weights and Measures in St. Petersburg in 1893.

In St. Petersburg (Figure 11), it is fascinating not only to visit the classical tourist sites such as



Figure 7. Karlsruhe Universität. This is the original building (12 Kaisserstrasse, Karlsruhe, Germany, N 49° 00.56 E 08° 24.72), dating from 1825. Meyer worked in the left wing, built in 1836. This is 0.8 km west of the Ständehaus, the site of the 1860 Chemical Congress.[1] The university campus now sprawls northwards over an extensive area (on the other side of the original building).



Figure 8. Mendeleev's birthplace (upper) and school (lower) in the old section of Tobolsk, Siberia. His birthplace (Ulitza Rozhi Lyuksemburg 11, N 58° 11.74 E 68° 15.16) was once a hospital but is now in disrepair and is a nursing home. The "gymnasium" (Ulitza Rozhi Lyuksemburg 10, N 58° 11.81 E 68° 15.11) is now a pedagogical institute.



Figure 9. Monument to Mendeleev in the modern section of Tobolsk, Siberia (Komsomol Prospectus and Mendeleyev's Prospectus; N 58° 13.64 E 68° 16.58).

the Hermitage and Peter and Paul Fortress, but also to wander about the streets reading historic plaques and memorials devoted to Peter the Great, Lenin, Nabokov, Dostoevski, Borodin, etc. (Note 3) Two main sites in the city are devoted to Mendeleev. At the St. Petersburg University on Vasilyevsky Island, an elaborate museum devoted to Mendeleev is maintained, developed from his original office (Figure 12). In this museum can be found many paintings, photographs, original furniture, exhibits of his contributions to Russian technology (mining, ships, agriculture and farming, etc.), personal memorabilia (including his suitcases, which he constructed as a hobby), and other interesting items such as the tablecloth covered with autographs of visiting scientists. Portraits on the wall include not only Mendeleev and his family, but also the "famous scientists" who discovered Mendeleev's predicted elements: Lecoq de Boisbaudran (1838–1912), gallium; Lars Fredrik Nilson (1840–1890), scandium; and Clemens Alexander Winkler (1838–1904), germanium. Of particular historical interest is the lectern where Mendeleev played "chemical solitaire" with his "element" cards; he preferred to stand as he reshuffled and reordered the cards of the known 63 elements until he arrived at a pattern that appealed to him. He came upon his final arrangement on a day when he was frantically trying to meet a deadline for his publisher before he had to dash off for a tour of the cheese industry at Tver.[12]

When Mendeleev became Director of Chief of the Bureau of Weights and Measures in 1893, Russia was no further along in introducing the metric system than it had been early in the 19th century and he vigorously worked to modernize Russian technology.[13] Next to the Bureau today is a statue of Mendeleev (Figure 13) and a huge permanent Periodic Table on the wall of the adjacent building (Figure 14). Beside the Periodic Table is posted Mendeleev's dictum, "Nayuka nachinayetsya styechpor, kak nachinayut izmyeryats" ("Science begins then, when one starts to measure"). (Note 4)

Lomonosov, the "Father of Russian Chemistry." Walking down the beautiful tree-lined boulevard from the Mendeleev Museum (Mendeleevskaya Liniya), one passes the Russian Academy of Science building and the imposing statue of Mikhail Vasilyevich Lomonosov (1711–1765), the "Father of Russian Science" (Figure 15). Lomonosov joined the University of St. Petersburg in 1741 where he became professor of chemistry and eventually rector of the entire University. Lomonosov anticipated some of the work of Lavoisier and rejected the philosophy of phlogiston;[14] sometimes the law of conservation of mass is infor-



Figure 10. (Upper) Verkniye Aremzyany (25 km northeast of Tobolsk, N 58° 18.71 E 68° 35.45) was where Mendeleev lived as a youth after his father's death in 1847. (Lower) In the museum in the Kremlin of Tobolsk are displayed items manufactured in the glass factory which Mendeleev's mother managed and which burned down in 1848. Here Mendeleev learned his rudimentary chemistry by observing the preparation of various colored glass. (Courtesy, Tobolsk Tourist Bureau)

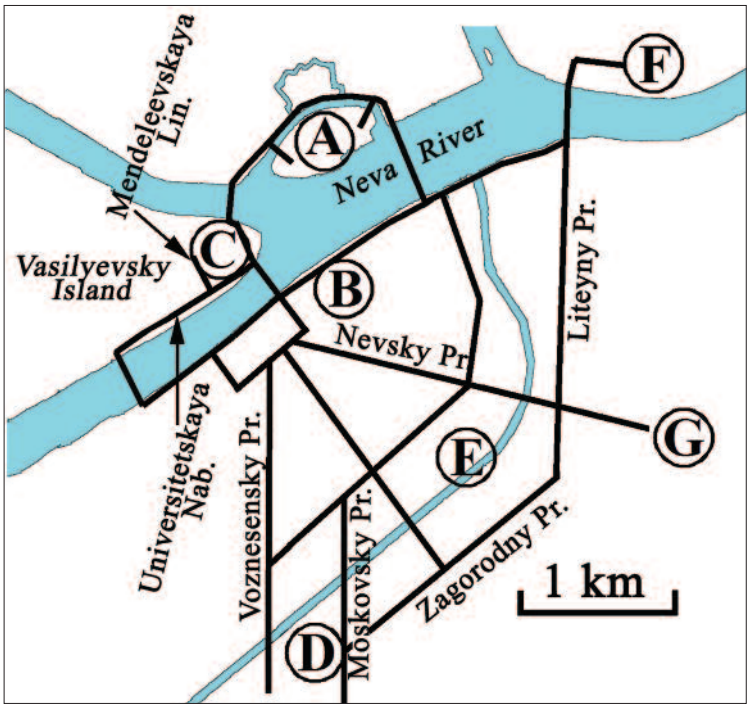


Figure 11. Sites in St. Petersburg, Russia, founded by Peter the Great in 1703 (known as Leningrad during the Communist years). As the Neva River flows westward toward the Baltic Sea (6 km away), it splits at Vasilyevsky Island. Foremost among tourist sites are included the Peter and Paul Fortress (A) and the Hermitage (B). St. Petersburg University on Vasilyevsky Island (C) is full of history and includes the Mendeleev Museum. At the Technological Institute (D) one can view Mendeleev's statue, the largest Periodic Table, and the Metrological Museum. Lomonosov is honored at the University (statue, C) and at the Lomonosov Square (bust, E). Train visitors arrive from Helsinki at the Finland Train Station (F) or from the south at the Moscow Train Station (G).

mally termed the "Lomonosov-Lavoisier law." For a scientist in the 18th century, he had a remarkably modern view of gases—he thought air was composed of hard molecules and that heat was simply "molecules in motion."[15] In 1749 he constructed the first chemistry laboratory for student training, long before Giessen.[16] Lomonosov had broad interests; he suggested Venus had an atmosphere, recorded the freezing point of mercury, developed vivid colors for stained glass, and performed pioneer work in anthropology, geology, mineralogy, literature, and education. Far removed from the scientific centers in Western Europe, however, this polymath remained relatively unknown despite his advanced concepts.

A Souvenir from St. Petersburg. Although Mendeleev made many technological contributions to Russian technology, one of the most important was to the vodka industry, which he standardized. In St. Petersburg, a local vodka is produced called "Mendeleev Vodka." The authors were able to bring back to the U.S. a bottle of this vodka (Figure 16), which now resides in the authors' element collection.

Acknowledgments:

The authors are indebted to Dr. Alex Bednekoff, retired Professor of Chemistry at Pittsburg State University, Pittsburg, Kansas, and active ACS member of the MO-KAN-OK section. Dr. Bednekoff, whose family is from Russia and who is fluent in the Russian language, has furnished a great deal of information, translation, and personal contacts. With his help, a tour was arranged at the Mendeleev Museum in St. Petersburg, planned by Igor Sergeevich Dmitriev, Dr. Sc., Professor and Director of the D. I. Mendeleev Museum and Archives, and guided by Maria Kiseleva, Museum Guide, D.I. Mendeleev Museum and Archives, Saint Petersburg State University, Mendeleevskaya liniya 2, Saint Petersburg 199034. Much of the information and photographs were obtained at this museum.

Euvgeny Ivnaovich Promotorov of the Information-tourist Bureau, Krasnaya Ploshad 4, Tobolsk, furnished much text and graphic information concerning the birthplace of Mendeleev.

Finally, the authors are grateful to the library staff of the Eberswalde-Forstakademie, Institut für Forstwirtschaft (Forestry Academy) for donating archival illustrations of the school.

Notes.

Note 1. Although Mendeleev and Meyer were the first officially recognized scientists to discover the Periodic Law, there were others who developed an organizational scheme of the elements shortly after the Karlsruhe Conference.[2] J. W. Sprosen has proposed six independent discoverers of the Periodic Law:[17] in addition to Mendeleev and Meyer he includes Alexandre-Emile Beguyer de Chancourtois (1820–1886), John Alexander Reina Newlands (1837–1898), William Odling (1829–1921), and Gustavus Detlef Hinrichs (1836–1923). These six scientists have been ranked by Sprosen on the basis of completion and depth of understanding:[2] First come Mendeleev and Meyer, who deeply understood the role of the trends in valence and physical properties in the Periodic organization. Next come de Chancourtois, a geologist at the École des mines in Paris, who discovered the "Telluric Screw" which helped explain correlations in mineral compositions; and Newlands, University College (London), who recognized





Figure 14. Above Mendeleev's statue is the expansive Periodic Table dedicated in 1936, the largest permanent Periodic Table in the world for almost a century. [19]

Figure 13. Statue of Mendeleev in St. Petersburg (19 Moskovsky Prospect, N 59° 55.08 E 30° 19.05), next to the Metrology Institute and across the street from the Technological Institute (at the corner of Moskovsky Pr. and Zagorodny Pr.) This is 2.8 km south of the Mendeleev Museum.



Figure 12. (Left) Mendeleev Museum in St. Petersburg, Russia (2, Mendeleevskaya Liniya, N 59° 56.50 E 30° 17.98). Inside, (upper right) are included his desk, but more important the lectern (lower right) where Mendeleev formulated his Periodic Table.

the Law of Octaves, where chemical properties cycled in groups of eight. Next come Odling, Oxford University, who proposed a cardinal sequence of the elements but left no room for undiscovered elements; and Hinrichs, University of Iowa, who was more interested in relationships among similar elements. Johann Wolfgang Döbereiner (1780–1849), the discoverer of the "Law of Triads" several decades earlier, was visited in a previous article (*HEXAGON*, Spring 2009).

Note 2. It is impossible to do justice in this brief article to the enormous and lasting contributions of Meyer and Mendeleev, whose insights and discoveries are embodied in the Periodic Table displayed in every chemistry classroom. The literature abounds with works devoted to detailed discussion of their work. For a beginning source, the reader is referred to the treatise produced by the International Conference of the Periodic Table in 2003.[2] Two excellent biographies of Mendeleev are *A Well-Ordered Thing. Dimitrii Mendeleev and the Shadow of the Periodic Table* by Michael D. Gordin[13] and *Mendeleyev. The Story of a Great Scientist* by Daniel Q. Posin.[18] The first biography is a cerebral and deep treatment of the philosophies of Mendeleev and the complex interplay of social, political, and scientific history. The second book is written in the genre of a historical novel that allows the reader to relive vicariously the joys and tribulations of Mendeleev—but in which "every factual event is accurate."[18]

Note 3. As one wanders about the historic sites in St. Petersburg identifying historical sites, one must cope with the written language and Russian alphabet in order to navigate and understand. For anyone wishing to travel to these Russian sites, Cyrillic equivalents and translations of streets and signs are available from the authors.

Note 4. Mendeleev owned a dacha at Boblovo, where he frequently retreated from

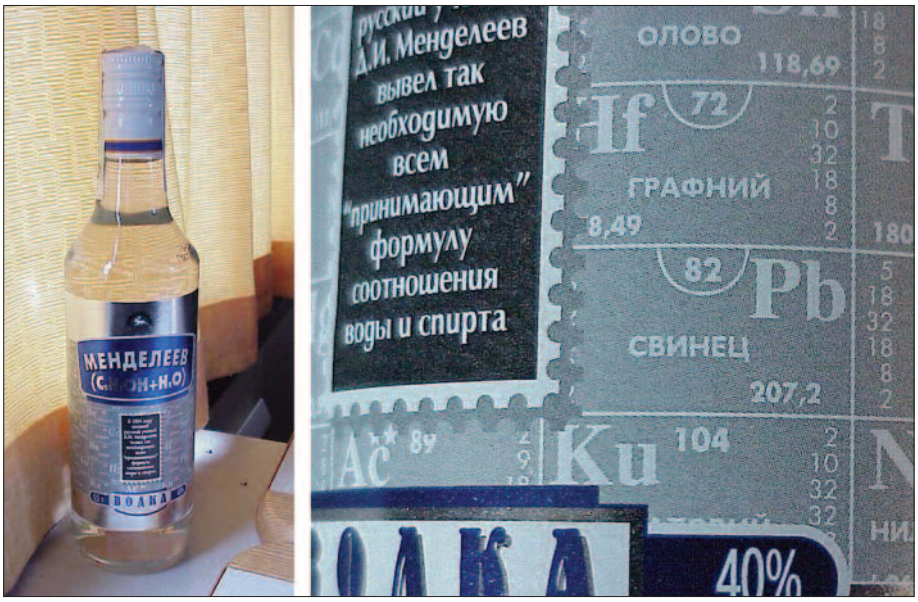


Figure 16. (Left) Bottle of Mendeleev Vodka, a local product of St. Petersburg. (Right) A portion of the Periodic Table is printed on the label. Originally proposed Russian names are used for some of the elements — for example, "kurchatovium" ("Ku") instead of "rutherfordium" ("Rf") for element 104, to honor the Russian instead of the British scientist. (Note 6)



Figure 15. Statue of M. V. Lomonosov, 150 meters southeast of the Mendeleev Museum at the corner of Mendeleevskaya Liniya and Universitetskaya Naberezhnaya (N 59° 56.43 E 30° 18.10), at the south edge of the University. There is also a bust of this famous scientist at Lomonosov Square (Ploshod Lomonosova, N 59° 55.85 E 30° 19.99, 2.0 km southeast), and a line of "Lomonosov buildings" extends eastward from the University toward the Vasilyevsky Island Split, (including the "Lomonosov [anthropology] Museum").

the university bustle and where he conducted agricultural experiments. Today the site is "Museum-Estate" Boblovo (19 km east of Klin, 81 km northwest of Moscow, N 56° 22.80 E 37° 00.88), where are collected papers and other personal possessions of Mendeleev. Mendeleev's daughter, Lyubov Dmitrievna Mendeleeva (1882–1939), married in 1903 the famous Russian poet Alexander Aleksandrovich Blok (1880–1921), whose home was located at Shakhmatovo nearby. Lyubov was an amateur drama actress and at one point worked with Vsevolod Meyerhold, a famous Russian theatre director. Her stage name was Basargina. In the late 1920s, she became interested in classical ballet and wrote an excellent treatise on the history of the classical dance technique, published until many years after her death (1987) in Russia.

Note 5. Inside the Eberswalde Exhibit a photograph exists of the faculty of six (dated 1870, two years after Meyer departed), and includes A[dolf] Remelé [1839–1915] who succeeded Meyer. It was to Remelé that Meyer handed over his unpublished Periodic Table in July 1868.[7]

Note 6. The authors have noticed that east of the Rhine River, sometimes wall Periodic Tables in classrooms still inscribe "Ku" instead of "Rf" for element 104.

References.

1. J. L. Marshall and V. R. Marshall, *The HEXAGON of Alpha Chi Sigma*, **2007**. *98(1)*, 4–7.
2. D. H. Rouvray and R. B. King, ed., *The Periodic Table: Into the 21st Century.* **2004**, Research Studies Press Ltd. Baldock, Hertfordshire, England, 91–114.
3. D. Mendeleev, *Ann. Chem. Pharm.*, **1871**, *Suppl. 8*, 133-229; Berichte, **1871**, *4*, 342–352.
4. M. Kaji, *Bull. Hist. Chem.*, **2002**, *27(1)*, 4–16.
5. R. Winderlich, *J. Chem. Soc.*, **1950**, *27(7)*, 365–368.
6. L. Meyer, *Die modernen Theorien der Chemie*, **1864**, Breslau.
7. J. R. Partington, *A History of Chemistry*, **1962**, Vol. IV, Macmillan, N.Y., 890.
8. L. Meyer, *Ann. Chem. Pharm.*, **1870**, *Suppl. 7*, 354–364.
9. D. Mendeleev, 1869–71 *Osnovy Khimii (Principles of Chemistry)*, St. Petersburg, Russia.
10. D. Mendeleev, *Zh. Russ. Khim. Obshch.*, **1869**, *1*, No 2/3, 60–65.
11. D. Mendeleev, *Zeitschrift für Chemie*, **1869**, *12*, 405–406.
12. R. F. Trimble, *J. Chem. Ed*, **1975**, *58(1)*, p 28.
13. M. D. Gordin, *A Well-Ordered Thing. Dimitrii Mendeleev and the Shadow of the Periodic Table.* **2004**, Basic Books. A Member of the Perseus Books Group. New York.
14. J. R. Partington, *op. cit.*, Vol III, 201–204.
15. B. Menschutkin. *J. Chem. Ed.*, **1927**, *4(9)*, 1079–1087.
16. G. B. Kauffman and F. A. Miller, *J. Chem. Ed.*, **1988**, *65(11)*, 953-963.
17. J. W. van Sprosen, *The Periodic System of Chemical Elements: A History of the First Hundred Years*, **1969**, Elsevier, Amsterdam.
18. D. Q. Posin, *Mendeleyev. The Story of a Great Scientist.* **1948**, Whittlesey House, McGraw-Hill Book Company, Inc. New York.
19. B. N. Menschutkin, *J. Chem. Ed.*, **1936**, *13(8)*, 373. For a recent larger structure at the University of Murcia in Spain, see *https://www.chemistryworld.com/the-worlds-biggest-periodic-table-probably/3007512.article.* The St. Petersburg table measures 68.2 square meters, the Murcia table measures 150 square meters. M. S. Reisch, *Chem. & Eng. News*, **2017**, *95(25)*, 40.