

CHAPTER 1

Introduction

Autocracy and Mr. Mendeleev

Oh, what a marvelous affirmation of evolutionary theory! Oh, what a great chain extends from a dog to Mendeleev the chemist!

—MIKHAIL BULGAKOV¹

The best place to begin this very Russian story is in Germany. On three days during the first week of September 1860 in the southern town of Karlsruhe, chemists from across Europe assembled to discuss weighty issues—or, more accurately, the issue of weight, which was threatening to overload their science with inconsistency and contradiction. The German organic chemist August Kekulé conceived of the gathering as a chance to resolve crucial disagreements about the conventions of chemistry, such as the calculation of atomic weights and even what terms like “molecule” and “atom” meant. The appeal soliciting attendance was sent out in July over the signatures of some of the most prominent names in chemistry.² A young chemistry postdoctoral researcher from St. Petersburg—then conveniently living in nearby Heidelberg—could not pass up the opportunity to attend such an event and meet the luminaries of his field. His name was Dmitrii Ivanovich Mendeleev.

The Karlsruhe Congress was a significant event in the history of nineteenth-century chemistry for several reasons, none of which depends upon Mendeleev’s attendance. First, Karlsruhe represents the first time that chemists from across Europe gathered in one place to resolve central scientific issues and thus was an important stage in the professionalization of chemistry as an international science.³ Second, Amedeo Avogadro’s 1811 hypothesis concerning the standardization of atomic weights was revived at the Congress by Italian chemist Stanislao Cannizzaro, a move that bridged a chasm of widespread confusion and laid the groundwork for a consensus about the notion of atomic weights that remains the basis of chemistry to this day. Young Mendeleev, for example, who was twenty-six at the time, would for the rest of his life recall Cannizzaro’s innovations as central to the formation of his periodic system of chemical elements.⁴



Figure 1.1. Mendeleev in 1869, from Trirogova-Mendeleva, *Mendeleev i ego sem'ia*, facing p. 9.

The memory of the Karlsruhe Congress also had much more personal consequences for Mendeleev as he reflected on his imminent return to St. Petersburg, capital of an empire then on the brink of substantial reforms. The model of Karlsruhe offered an opportunity to think about organizing expertise to resolve conceptual disputes calmly; the experience proved so important that he felt he had to share it with the Russian public. Mendeleev wrote a letter on 7 September to his Russian mentor A. A. Voskresenskii, who (at Mendeleev's request) published it in St. Petersburg's chief daily newspaper. "The chemical congress which just finished in Karlsruhe is such a remarkable event in the history of our science that I consider it an obligation to describe to you—even in a few words—the sessions of the congress and the results it achieved," he exulted.⁵ Mendeleev was a young chemist passionate about his science, and he was also an ambitious man craving a place in the limelight of St. Petersburg culture. By enlightening the public about Karlsruhe, he sought to make a grand entrance as a public intellectual.

The Congress thus raises three issues that provide a convenient entry into our story. At the most basic level, the Congress changed Mendeleev's

understanding of several chemical concepts in a way that would resonate throughout the discipline. Beyond that, the Congress placed him in contact with other specialists, providing him with a rational model for the coordination of civil servants. In the Russia of the Great Reforms to which Mendeleev returned, such models were posited as deliberate and pointed contrasts with a culture of officialdom legendary for its arbitrariness and indeterminacy. Karlsruhe held the potential to redeem Petersburg. Finally, Karlsruhe changed the way Mendeleev thought of himself as a Petersburg intellectual. Although he was certainly not the only chemist in the city (and far from the most prominent), he boldly chronicled his own experiences, communicating to Petersburgers the meaning of chemistry and its consequences for everyday life. We will follow Mendeleev on his triple path—as chemist, bureaucratic expert, and public figure—from this opening gambit at Karlsruhe until his death amid revolution and turmoil.

This is the story of two systematic misfits: Dmitrii Mendeleev and the Russian Empire. The central figure of this tale is the former, but its central object of inquiry is the latter; through Mendeleev and his vocation of chemistry, the turbulent culture of late Imperial Russia is laid bare. The periodic law, Mendeleev's chief claim to fame, was at once a symptom of underlying pressures in the Russian environment and within chemistry. Both Russian history and the history of science converge around the notion of a "systematic misfit": the tension between the attempt to create comprehensive, orderly systems, constructed for stability and clarity, and the awkward application of those systems to the real world. To the extent that a system can predict future behavior or events, it provides stability; on the other hand, such regularity makes it vulnerable to misfits that refuse to comply with its rigor. This is not the fault of Russians, or chemistry, or Mendeleev, but is merely a consequence of the inevitable messiness of the natural and social worlds in which we live. When one encounters such a misfit—in the periodic system, in economics, in private life—one has three choices: ignore the misfit; attempt to rebuild the system around the misfit; or, like the mythical Procrustes, who lopped off the legs of travelers to fit them into his bed, jam the misfit into the confines of the original system. Each approach, with varying degrees of hope and violence, appears in Mendeleev's story, tracing a path through the cultural politics of the late nineteenth century that ranges from the machinations of empires to the vibration of atoms.

Liberalism in the Name of Autocracy

Mendeleev was excited by the Karlsruhe Congress not just because it resolved some thorny confusions within chemistry. That was hardly a reason

to compose a newspaper article for the chemically illiterate public. Imagine today a write-up of a scientific meeting becoming national news, and you will appreciate the peculiarity. Mendeleev wanted Russian readers to hear another message. After describing Cannizzaro's reform of atomic weights, Mendeleev offered special praise of the unanimity with which the chemists had validated the measure:

The result [of voting on Cannizzaro's suggestions] was unexpectedly unanimous and important. Having adopted the distinction between atom and molecule, chemists of all countries adopted the basis of the unitary system. . . . To this story let me add that in all the discussions there was not one malicious word between both parties. All this, it seems to me, is a complete guarantee of the quick success of these new foundations in the future. Not one among 150 chemists agreed to vote against these foundations.⁶

In Mendeleev's view, proper decision-making proceeded in a courteous, communal, reasoned, and consensual environment—all in all, a perfect model for fundamental reform.

This reaction to Karlsruhe was fundamentally *conservative*, in a very specific sense. It is difficult to characterize precisely Mendeleev's political position because it did not fall into the easy categories of "reactionary," "liberal," or "radical" that usually organize our understanding of past politics. Mendeleev was one of many Russians who borrowed very heavily from liberal rhetoric while pursuing ends such as autocracy or Russian chauvinism that mesh poorly with nineteenth-century conceptions of liberalism (the latter being a doctrine, distinct from today's credo of the same name, that emphasized free trade, property rights, and individual autonomy from the state). A liberal working in the name of autocracy, Mendeleev supported the rule of law only insofar as it was the best way, in his view, to preserve traditions essential to Russian stability—traditions embodied in the institution of autocracy. By contrast, his Russian contemporaries who identified themselves with liberalism were liberals in the name of Russia. For them, liberalism linked Russia to the legal and political traditions of European progress. For Mendeleev, these liberals were deluded or misinformed—or simply dangerous—and he had no patience for them.

Viewing Mendeleev as a conservative opens up our understanding of Russian culture in surprisingly novel ways. In light of the momentous events of 1917, historians have understandably emphasized radicals in late Imperial Russia to the exclusion of multiple competing movements. While we now work with an incredibly rich taxonomy of trends among radicals—populists, legal Marxists, Bolsheviks, Socialists-Revolutionaries, anarchists, nihilists,

Mensheviks, Empirio-Critics, and so on—every position on the Right has been lumped together under the general banner of reaction. In trying to understand tsarist autocracy through the eyes of those wanting to overthrow it, we have lost sight of vital distinctions among the guardians of the established order. To be sure, there were extreme reactionaries who wanted to halt all change in Russia, but there was also an equally important group of conservatives who actively lobbied for gradual reform in order to maintain, wherever possible, the aspects of tsarism they considered worthy of preservation. They recognized that the world was changing, and that Russia had to change with it or perish. These conservatives consistently attempted to exploit particular features of autocracy in order to tame its most dangerous opponents.

Liberalism in the name of autocracy was a specific Russian variant of European conservatism. Not exactly an ideology, it was more of an attitude toward history and the state. Following the nineteenth-century historian Nikolai Karamzin (and his precursor Edmund Burke), conservatives believed that tradition, the residue of historical epochs as revealed in national institutions, was a valuable force for stability.⁷ (Reactionaries, by contrast, held to tradition for its own sake.) When adherence to *all* traditions threatened the stability of society, conservatives embraced gradual reform as a way to adapt to change within the framework of historical traditions. The challenge of selecting among various traditions was tremendously invigorating to conservatives, who could reject even the most venerated of Russian social institutions, such as the nobility, in order to uphold autocracy. Autocracy itself was nonnegotiable: not only was it the most characteristic Russian national tradition, but it served as the instrument of gradualist reform. Thus, the functions, values, and structures the state had accumulated through historical accretion were the features that made those institutions worth preserving. This political position bears more than an accidental relation to the common understanding of the scientific method.

In theory (and often in practice), the tsar's authority was absolute and unconstrained.⁸ But this did not imply political stagnation. To the contrary, in the context of rapid economic modernization and social dislocation, the autocrat often proved willing and able to reform the state surprisingly comprehensively within the bounds of his own theoretically unbounded authority. In fact, the tsar was the *only* individual in Russia with the authority to change any aspect of the system, however minor. Repeatedly during his life, Mendeleev witnessed different tsars issue transformative, even progressive, decrees through fiat. It was a power he respected and coveted. Mendeleev and other conservatives valorized the tsar's reforming powers as free of the inefficiency of parliamentary compromise and senseless debate. Rationalism (suitably

conformed to tradition, of course) dictated Russia's path, and conservative experts were the arbiters of the rational. They did not want to eliminate the tsar's autocratic power; they wanted access to it. In attacking the person of the tsar, terrorist radicals pointed to the same feature of the topography of power: for change to happen, the top had to permit it—or be eliminated.⁹

The immediate mechanism for reform was the much-maligned Imperial bureaucracy, which in Mendeleev's lifetime experienced the rise of a new stratum of civil servants—the *raznochintsy* (literally, “people of various ranks”).¹⁰ *Raznochintsy* originated overwhelmingly from families affiliated with the increasingly professionalized civil service of the early nineteenth century and thus were neither landed nobility nor serfs. They tended to be educated and socialized within bureaucratic culture. Mendeleev was a *raznochinets* by virtue of his father's position as an educational administrator. But Mendeleev was something more than just his father's son (if anything, he was his mother's son): he was a highly trained chemist. He was not just a civil servant: he was a civil servant with specialized skills. Such professionals assumed a new importance in Petersburg after the defeat of Russian forces in the Crimean War (which ended in 1856 after the death of Nicholas I and the accession of his son, Alexander II). The state moved from being a world closed to advice to an administration starving for information and expertise. Besides a cohort of influential reforming bureaucrats, a sizable portion of the now-active cultural elite consisted of professionals—lawyers, physicians, engineers, economists, and even chemists.¹¹

The crucial point here is that each of these different professionals offered a different form of *expertise* to the reforming state. Mendeleev, for one, was quite aware of the distinctions between different types of expertise, such as legal and scientific, that the state might wish to consult. In late October 1870, after a disappointing experience serving as an expert witness in a court case on the determination of poisons, and at the very moment he was finalizing his periodic law, he wrote his first and only legal article:

Of course the expert is not the judge, defense attorney, or prosecutor, but nevertheless, if he is called then one must give him the right to express his opinion on those subjects he was called to judge; without this the expert's role and the utility expected from his specialized knowledge is significantly diminished to the detriment of the truth sought in court. It is necessary not to forget here that the expert is also subject to oath like witnesses, and true statements are demanded from him, but [the officers of the court] don't give him the opportunity to speak truly.¹²

Mendeleev, the *raznochintsy*, and the rest of the professionals each wanted the opportunity to speak truly. What they considered to be true and which

opportunities they were willing to exploit, however, varied widely depending on their political and intellectual commitments.

Yet both Russian liberals and Russian conservatives from among this professional stratum joined forces in support of the program of reforms enacted by Tsar Alexander II beginning in 1861, the so-called Great Reforms.¹³ These Reforms not only structured the political and social landscape of Imperial Russia long after most of them were scaled back or scuttled, but profoundly shaped how individuals like Mendeleev viewed the notion of reform in general. Mendeleev and like-minded conservatives continually attempted to replay the Great Reforms scenario—and at times, it became a farce. An understanding of the Great Reforms from the conservatives' point of view is thus necessary to understanding Mendeleev's bureaucratic work and, moreover, his chemistry.

The Great Reforms were a set of seven measures: emancipation (1861), the university statute (1863), rural councils (*zemstva*) (1864), the European-style judicial system (1864), censorship reform (1865), municipal autonomy (1870), and the universal draft (1874). Alexander II viewed the Reforms as necessary to provide for a more stable military and fiscal structure, thus reinforcing the bulwarks of autocracy while presenting them (particularly emancipation) as acts of unbounded love for his people.¹⁴ This view of the Great Reforms had a profound resonance among a wide group of intellectuals and elites. The bureaucrats (most of them *raznochintsy*) who developed the Reforms considered Russia's fundamental problem to be a surfeit of arbitrary power (*proizvol*), and they wished to transform Russia from a realm of subjects to a polity of citizens subject to the rule of law (*zakonnost'*). To be sure, the Reforms did not curtail the absolute power of the tsar but rather aimed to restrict the domains in which he deployed it arbitrarily. He remained an absolute autocrat, but, like Scotus's God, he ordained a rule-bound order. For Mendeleev, the Great Reforms were not a "revolution from above," but an *antirevolutionary* force rooted in tradition. At the base of these Reforms there persisted what we, adapting Isaiah Berlin, might call the "conservatives' dilemma": How does one reconcile a rational basis for modernization (the liberal project centered on law) with attention to national traditions that do not necessarily have anything rational at their base (the conservative project emphasizing stability)? How could conservatives eliminate the deleterious consequences of *proizvol* while relying on the mechanism of *proizvol* themselves?¹⁵

Although many of the reforming measures were watered down in practice, the sense of a tremendous rupture in the Russian state and in what it *meant* to be a subject of the tsar spread widely. Members of the Petersburg elite addressed such issues in a stunning variety of ways. Their common concern was often not so much whether a civil society existed, but about how to create an

ordered society.¹⁶ Diverse groups on both the left and the right faced an equally acute problem of order. Liberals sought solutions to problems of order in parliamentarianism and constitutionalism. Radicals sought them in socialism, populism, and revolution. Reactionaries looked to the Orthodox Church, a revived autocracy, and Great Russian nationalism.¹⁷ Conservatives, or liberals in the name of autocracy, more than anyone else remained wedded to state-sponsored reform: committed to the principles of the Great Reforms *and* those of autocracy, they compromised wherever they could. *How* they compromised was what mattered.

Making Sense of the Man

Chemists provided useful expertise for the state in the form of consultation on sewage, oil, coal, dyestuffs, pharmaceuticals, and other chemical products, and Mendeleev provided advice on all of these subjects. But his involvement with the state highlights other ways in which scientific expertise could contribute to the cultural redefinition of the Russian public. In the nineteenth century, many scientists considered chemistry to be a model of a “unified” culture because its subject matter was both accessible and dramatic. In Russia in particular, chemistry was seen as the exemplar of almost all the sciences, and beginning in the middle of the century, chemists acquired high public visibility, in large part due to Mendeleev’s good offices.¹⁸ For example, when lawyers wanted an expert witness on poisons to testify in a murder trial, Mendeleev volunteered. When public lectures on chemistry were authorized for general education, Mendeleev stepped forward. When cheese needed to be inspected, kerosene street lamps evaluated, alcohol measured and taxed—in short, when any public chemical venture in the Imperial capital required expert intervention—Mendeleev made it clear that he was more than useful: he was essential.

Past studies of this phenomenon have tended to emphasize the “public face” of chemistry, as if chemists always made a hard and fast distinction between the forms of their science they showed to the public and the “real” science performed in the laboratory. For Mendeleev, not only was chemistry performed before the public of a piece with his more “standard” chemical investigations, but it formed an inextricable part of his politics. Arguing against Spiritualism, advising on tariffs, and formulating the periodic law were related activities of creating order in a society sorely in need of it. Mendeleev’s world always remained rooted in chemistry, for it was there that he sought to produce a coherent solution to the crisis of modernization faced by the Russian elite.

All of this suggests why Mendeleev presents an ideal case for investigating the place of science, particularly chemistry, in Russian culture, and in turn

the place of Russian culture within chemistry. He spent roughly thirty years teaching at St. Petersburg University at a time when the role of the natural sciences in the University curriculum underwent dramatic changes. He served as a consultant for the Ministry of Finances and the Naval Ministry, as director of the Chief Bureau of Weights and Measures, and as close advisor to Tsar Alexander III, Sergei Witte, and other central figures in the late tsarist state. This was a period in Russian history when an extremely small coterie of individuals comprised the cultural elite of Petersburg, and Mendeleev's contacts extended from novelists to painters to engineers, leaving his imprint on almost all areas of the humanities and the sciences. His dominant role in the Russian Physico-Chemical Society meant that he had his finger on the pulse of those sciences in Russia; he was their ambassador to Western Europe, and he was the West's representative in the scientific periphery that was Petersburg.

Petersburg, the capital of Imperial Russia and Mendeleev's home throughout his entire adult life, served as both the scene of his extraordinarily rich scope of activity and the mechanism—through its copious bureaucracy—by which he carried out his designs. For many of the young professionals and bureaucrats who were implicated in the Great Reforms, service in the capital presented the surest path for advancement in the empire.¹⁹ Mendeleev was no exception. He would become a public celebrity, alternately fêted and criticized in the emerging organs of the popular press, themselves products of the Great Reforms. A public figure in at least three senses, Mendeleev was a subject of public discussion, a public servant, and a prominent interpreter of chemistry; taken together, he was the embodiment of public knowledge. The central warrant for his claims was his discovery of a law of nature—the periodic law—and the predictions he made from it. By virtue of prediction, Mendeleev could in turn argue for an economic system and a political structure that would make individual agents more predictable and pliant before a modernizing autocracy. Laws of society became metaphors for laws of nature.²⁰ Mendeleev and his periodic law have exerted a surprisingly persistent pull on Western intellectuals, as seen, for example, in two rather different works written by former chemists. The first is Oliver Sacks's memoir of his childhood experimentation in chemistry. Sacks used his memories of England before and during the Second World War as a framework for a narrative of the history of chemistry. In this account, chemistry progresses through history until it arrives at the synthesis of the periodic law—and its hero, a Russian savant named Dmitrii Mendeleev.²¹ The second, Primo Levi's breathtaking *The Periodic Table*, is a collection of autobiographical essays, vignettes, and short stories, all organized around the elements of the periodic system in a variety of ways. In some the element in question is the subject of chemical research; in others, the element stands as

a metaphor for personal qualities; in yet others, the elements are personified.²² This wonderful text makes sparse reference, though, to Mendeleev, the formulator of the system that serves Levi so well. And while it is a fact that Mendeleev the man is more often than not subsumed in historical reference by his great work, he deserves to be rescued, as it were, from the shadow of the periodic table. In the narrative that follows, Mendeleev and his law are sometimes the subjects of study, sometimes metaphors (consciously or unconsciously deployed), sometimes things to be built upon, and at other times notions to be defended—but always pliant images that reflect the varieties of historical experience in late Imperial Russia.²³

That material is shaped here into a narrative that differs from conventional biography. Rather than beginning with Mendeleev's birth in January 1834 and ending at his death in January 1907, I concentrate on Mendeleev and the Russian Empire from emancipation to the Revolution of 1905, the epoch of Mendeleev's greatest chemical achievements and of Russia's greatest hope for a reformed liberal state. I have selected seven major episodes from Mendeleev's life not because they were objectively the "most important" (whatever that would mean), but because each emphasizes a different feature of the cultural life of both Imperial Petersburg and nineteenth-century science.²⁴ This cultural biographical study thus aims to illuminate both the history of chemistry and the history of the Russian Empire. In the person of Mendeleev, both chemistry and empire staked their claims together.