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Patriotism, Nationalism and Internationalism in Czech Science: Chemists in the Czech National Revival

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Introduction

In the multiethnic and multicultural space of the Habsburg Monarchy, the interrelations between patriotism, nationalism and internationalism in science expressed themselves in a very complex way and were sources of profound tensions. Tensions included inconsistencies between the inherent international character of science, on the one hand, and science operating as 'national science' in its social and political embodiment within scientific institutions defined by usage of the national language and using 'national' communication systems, on the other. The same applies to the fact that science has always been an international enterprise, but individual scientists have identified themselves with an ethnic group or a nation, which meant that they were anchored in nationally defined institutions where they used the language of their ethnic group for teaching as well as writing articles and books.

Carol Harrison and Ann Johnson have pointed out that 'research on nationalism has largely ignored the nexus between science and national identity', and that although 'scholars have lavished attention on the historical project of nation-building, calling attention to its complexity', they have been 'remarkably reticent about the place of science and technology in the construction of national identities'.¹ In accordance with this statement, historians have habitually interpreted the Czech National Revival in the nineteenth century as a matter of cultivating the Czech language and elevating it to the language of intellectuals, thus identifying the movement primarily with progress in education, literature and the fine arts. It is also necessary to point out that even in cases where historians have dealt with the role of science and scholarship in the creation

of national identity during the Czech National Revival, they have usually had in mind the humanities – especially history, linguistics, philology and related fields – while the natural sciences have been neglected. Jan Janko and I have tried to fill this gap in our book about the role of science in the Czech National Revival up to the 1870s.² There we demonstrated how the cultural, social and political emancipation of the modern Czech nation was closely linked to scientific and technological development in all its representations, including research, communication, education and institutionalization. This emancipation meant above all drawing a demarcation line between the Czechs and the Germans, who originally formed a socially, politically and economically stronger layer of society in the Czech Lands.³

Language did indeed become the leading symbol of national movements all over Europe in the nineteenth century, including the Czech National Revival, and this symbol also asserted itself in science; one of the most important items on the agenda of the Czech National Revival was the creation of a modern Czech scientific language.⁴ This effort had political as well as practical goals. The Revivalists aimed to show that the Czech language was able to express even the most complex scientific ideas and at the same time serve as a tool of teaching and communication. In reality this meant pursuing linguistically Czech science and establishing Czech scholarly institutions in which the language of teaching and publishing would be Czech.⁵ Another goal of the Revival was the education of broad strata of the Czech population and the popularization of scientific achievements. Also at the practical level, we should keep in mind that the nineteenth century, especially its second half, was the century of the advancement of industry and trade, with its demand for specialists at all levels of education. The common people, however, did not speak German; therefore Czech terminology was needed to open to them the road to schooling, and Czech-language terminology in the educated professions became an indispensable tool for this purpose.

In the nineteenth-century Czech Lands not only language but also political symbols and ideas, especially the ideas of nation and patriotism, found their reflection in science. Patriotism took on multiple forms, including 'provincial', 'state', 'national' and 'Slavic', with differing accentuation in different periods. In the second half of the nineteenth century, patriotism became allied with nationalism in both the Czech- and German-speaking environments. The narrow-minded national antagonism that developed in the 1880s infiltrated all layers of society in the Czech Lands, including the Czech and German communities. In this article, I will focus on the attitude of the Czech scientific community towards this ever-increasing Czech–German antagonism and militant nationalism in Czech society in the last third of the nineteenth century, examining especially the position of chemists.

Ethnic division in the chemical community in the Czech Lands in the second half of the nineteenth century

In the second half of the nineteenth century chemistry was more developed in the Czech Lands than in other parts of the Habsburg Empire, whether we consider the level of university education or research,⁶ and the Empire's chemical industry was sited mainly in the Czech Lands (Bohemia and Moravia).⁷ According to some sources, 75 per cent of the Austro-Hungarian chemical industry was located in the territory of the future Czechoslovakia,⁸ mostly in Bohemia. In 1880, the Czech Lands' share of Austria-Hungary's total production of food was 65.5 per cent, of sugar 95 per cent and of chemicals 37.7 per cent.⁹ In Bohemia the share of total production in the textile industry, which was closely related to the chemical industry, was 42 per cent,¹⁰ while, as Jan Havránek writes, the 'second strongest branch was... the food industry, which in 1880 represented 33 per cent of the total value of all industrial production in Bohemia and was important in Moravia, as well.'¹¹ While industries connected with agriculture (food, fermentation and sugar industries) had mostly Czech proprietors, the production of inorganic and organic chemicals and of textiles was predominantly in German hands. According to Havránek, 'The sugar industry became as important a source for the accumulation of Czech capital as textile manufacturing was for the accumulation of German capital in Bohemia.'¹²

Likewise, the Czech chemical community gradually established an institutional base separate from the German one. In the 1860s and 1870s, when the fall of the Bach absolutist government enabled a revitalization of political, social and public life, Czech chemists founded their first chemical societies. The earliest one, the Isis Association for Natural Sciences,¹³ started in 1866 as the predecessor of the Society of the Czech Chemists,¹⁴ formed in 1872, which still exists today.¹⁵ It had an almost exclusively Czech membership¹⁶ and was mostly sponsored by wealthy owners or directors of the sugar factories (so-called founding members);¹⁷ hence the journal of the Society, *Listy chemické*, served until 1883 not only scientific objectives but also the needs of the sugar-refining community as its publication and information base.¹⁸ At the same time, German chemists did not have a specialized professional chemical association¹⁹ in the Czech Lands, although the scientific association Lotos,²⁰ founded in 1848,²¹ also included chemists. University education in chemistry in the Czech language took place at the separated Czech Polytechnics²² from 1869 and at the Czech University, Prague, which came into existence in 1882 when the Karl-Ferdinands-University divided into independent Czech and German counterparts.²³ In Brno (Brünn)²⁴ Czech chemical education began in 1899, when the Czech Technical University was founded.²⁵ All these actions brought forth a differentiation and gradually a complete separation of the Czech and German chemical communities. The establishment of the Czech Academy of Sciences, Letters

and Arts²⁶ in 1890²⁷ is considered the culmination of the efforts of the Czech National Revival to create a network of Czech educational and scientific institutions consisting of Czech secondary schools, scientific societies and journals, and universities.²⁸ Although the Academy had rich financial resources for supporting research and publishing, its possibilities were limited as most research took place at universities and industrial laboratories. Another serious constraint was the conservatism of the Academy, which was reflected in its programme, structure and composition. The division of the Academy into four classes reflected a preference for the humanities and arts: only the Second Class (to which the chemists belonged) was dedicated to mathematical, natural and medical sciences, a perplexing disproportion at a time of vigorous development of the sciences in Europe.²⁹

The consolidation of the institutional base of linguistically Czech science in the 1860s–1880s, including chemistry, also led to growing tensions in the Czech scientific community. On the one hand, it came under the increasing pressure due to nationalistic attitudes in all strata of Czech society, but on the other it endeavoured to become an integral part of the international scientific community. Most Czech scientists were loyal to the Monarchy³⁰ but feared the increasing influence of Germany on Austria and therefore nurtured the Slavic idea as a counterweight.³¹ In the 1890s patriotism in science evolved in some circles into open nationalism, chauvinism and extreme isolation from German science, as mentioned above. Official contacts between Czech and German universities and other institutions in the Czech Lands practically ceased to exist, and personal links between Czech and German academics became rare. Determined nationalism was typical especially for the Czech Academy, which was intentionally founded as an exclusively Czech learned society,³² accepting only Czechs as regular members, using only the Czech language for communication and aimed especially at cultivating Czech literature and art. In this way the Czech Academy demarcated itself from the traditionally bilingual Royal Czech Society of Sciences (founded in 1784) and other nationally undefined or liberal scientific societies. Bilingualism was considered inadmissible not only by Josef Hlávka,³³ but also some scientists, like the pharmacologist Karel Chodounský.³⁴ Anti-German sentiments manifested themselves, for instance, in the election of the foreign, so-called non-resident members of the Second Class of the Academy, as can be seen in Table 7.1.

As the table shows, in the years 1891–1908 the Second Class elected 14 so-called non-resident or foreign members. The selection 'process', mostly arbitrary, favoured candidates related or known to the members of the Academy; with a few exceptions they were not prominent scholars. In accordance with the Academy's nationalistic attitudes, we can see among the foreign members only two Germans – citizens of the German Empire: Karl Josef Küpper, former professor of descriptive geometry at the Prague German Technical University,³⁵ and the mineralogist Paul Groth. The case

Table 7.1 Non-resident (foreign) members of the second class of the Czech Academy of Arts and Sciences before 1914

1891	Dmitri Ivanovich Mendeleev, chemist (St Petersburg)
1891	Karol Olszewski, chemist (Cracow)
1892	Charles Hermite, mathematician (Paris)
1894	Adalbert Carl von Waltenhofen, physicist (Vienna)
1895	Charles A. Oliver, ophthalmologist (Philadelphia, USA)
1896	William Ramsay, chemist (London)
1897	Karl J. Küpper (Bonn), former Prof. of descriptive geometry (Technical University, Prague)
1901	André Victor Cornil, physician (Paris)
1901	Tadeusz Browicz, pathologist (Cracow)
1903	Emil Christian Ch. Hansen, chemist (Carlsberg-Copenhagen)
1908	Eduard Suess, geologist (Vienna)
1908	Nikolay Nikolayevich Beketov, chemist (St. Petersburg)
1908	Paul Groth, mineralogist (Munich)
1908	Marie Curie (Paris)

of the prominent German chemist Friedrich August Kekulé demonstrates the firmness of the opposition to German scientists in the Czech Academy. His desire to become a member was so strong that in 1893 he even asked his Czech pupil Bohuslav Raýman to intervene on his behalf, but in spite of this he was never elected.³⁶ A certain lack of interest in the election of foreign members is also indicated by the fact that their total number was only fourteen, although the statutes of the Academy enabled each class to elect twenty members.³⁷

To be a good son of one's nation or to get involved in a supranational scientific network?

Czech scholars involved in the natural and exact sciences had been asking themselves this crucial question since the middle of the nineteenth century, when so-called 'provincial' patriotism started to be replaced by Czech nationalism, but the question became poignant especially from the 1880s, when pronounced nationalism and Czech-German antagonism dominated not only the Czech Academy but also Czech society as a whole. Czech chemists faced the controversial issues associated with this question quite early, for the first time in connection with the creation of Czech chemical terminology. In the 1820s practically no chemical expression existed in the Czech language, so Czech chemical terminology had to be invented from scratch.³⁸ This process soon acquired political overtones, because some influential revivalists considered it to be non-patriotic to introduce terms of German or even other non-Slavic origin. This circumstance led to the evolution of two streams in the formation of chemical nomenclature.

The so-called 'purists' followed the unrealizable 'patriotic' requirement of eliminating all terms of 'foreign' origin, and eventually arrived in the 1850s at a totally incomprehensible, useless and even absurd chemical language ridiculed by most chemists and mocked by other writers. The more reasonable, yet still 'patriotic', path was to devise modern Czech chemical terminology as a compromise between 'purist' requirements and the international chemical terminology that was evolving at the same time. However, in order to avoid the strong influence of German and Latin, new terms of Slavic (especially Polish) origin were created.³⁹

By the 1850s, despite various twists and turns, the fundamentals of modern Czech scientific (and chemical) terminology had been established as one of the essential achievements of the National Revival. Its inauguration was a semi-official act, for in 1853 the authorized *German-Czech Dictionary of Scientific Nomenclature* was published at the instigation of the ministry of culture and education.⁴⁰ The dictionary assembled all known Czech terms used in the sciences; the chemist Vojtěch Šafařík,⁴¹ then only 24 years old, used his philological talent to compile and modify the chemical entries, eliminate 'purist' oddities and adapt the whole system of chemical nomenclature to make it usable for teaching and writing scientific literature. The existence of a modern Czech chemical nomenclature conditioned the creation of a viable network of chemical institutions, which in turn stimulated after the 1860s the independent development of chemistry in Czech, representatives of which attempted to catch up with international developments in their field.⁴² In the main, Czech chemists were well aware of the danger of contemporary chauvinism, which threatened to abuse science for political goals. They understood that erecting nationalistic barriers would decrease the quality of domestic research and education, obstruct participation in international networks and inevitably lead to international isolation.

On the domestic scene, Czech chemists and their associations were expected to maintain the demarcation line between themselves and their German colleagues. Nonetheless, a detailed investigation reveals some leaks even in this seemingly impervious barrier, especially in the domain of industry and applied chemistry, where the economic advantages of cooperation between the Czechs and Germans overpowered patriotic appeals. The two strongest professional groups, the brewers and sugar industrialists, established bilingual (although Czech dominated) associations closely cooperating with the Society of Czech Chemists: the Spolek pro průmysl pivovarský v království Českém (Association for the Brewing Industry in the Czech Kingdom) in 1873 and the Spolek pro průmysl cukrovarnický v Čechách (Association for the Sugar Industry in Bohemia) in 1876. Both societies published their journals in Czech and German versions. We should not omit the powerful all-Austrian Österreichische Gesellschaft zur Förderung der chemischen Industrie (Austrian Society for Support of the Chemical

Industry), founded in Prague in 1878,⁴³ the headquarters of which remained in Prague and offered a base where Austrian, Czech and German industrial chemists could join forces. Its first president was Wilhelm Friedrich Gintl,⁴⁴ professor at the German Technical Academy (Deutsche Technische Hochschule) in Prague; among its Czech initiators was the chemist František Šebor,⁴⁵ a leading sugar specialist.

A prerequisite of the international partnerships in which Czech chemists engaged from the 1870s was publication in internationally comprehensible languages. Therefore, most of them did not obey the appeal of 'patriots' for exclusive publication in Czech and submitted their important papers either to German, French or English periodicals only or to these and concurrently to Czech journals, especially the *Listy chemické* (*Chemical Letters*). Many papers by Czech chemists appeared in *Liebig's Annalen*, the *Bulletin de la Société de chimie*, the *Journal of the Chemical Society*, the *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften* in Vienna and other leading journals. Czech chemists did not hesitate to contribute to specialized handbooks issued by German chemists; the foremost inorganic chemist, Bohuslav Brauner,⁴⁶ for instance, was the author of critical chapters on the atomic weights of 60 elements in *Abegg's Handbuch der anorganischen Chemie*.⁴⁷

Personal contacts, especially correspondence, between Czech chemists and German, British, French and other European scholars, were also common. Young Czech chemists frequently studied or conducted research at German, French or British universities, and the bonds with their foreign tutors and colleagues often persisted for the rest of their lives. Brauner's correspondence, for example, contains letters from Ernst Mach, Adolf Lieben, Richard Abegg, Henry Roscoe, William Ramsay, Zdenko Skraup and many other German and British scientific personalities.⁴⁸ In Bohuslav Raýman's papers⁴⁹ are letters from his teachers F.A. Kekulé, Charles Friedel and Charles Adolphe Wurtz⁵⁰ and other leading chemists. However, it is necessary to remark that contacts with British or French chemists were socially more acceptable than relations with German ones.

The Society of Czech Chemists, which had a richly structured membership⁵¹ including some members from abroad,⁵² also attempted to cultivate international contacts. The reasons were obvious. In the 1880s and 1890s the rapid development of chemistry and chemical industries in Germany, England, France and other European countries called for international cooperation that was vital for the quality of scientific research and economic development. Science and industry were both becoming international enterprises, and those who did not participate were falling hopelessly behind. International cooperation meant sharing or at least communicating new findings, laboratory methods and industrial processes, attending international meetings, exchanging students, teachers and literature, reading international journals, participating in circulation of knowledge. These were understood to be prerequisites for the scientific progress and economic

prosperity of one's nation; therefore, being patriotic also meant being international. Although the programme of the Society had all this in mind, its possibilities were somewhat limited by the increasing nationalism in Czech society. Among the Society's international activities was the exchange of journals, including periodicals in German, French, English, Danish, Polish, Russian, Croatian and other languages.⁵³ Nonetheless, the general public mood reflected itself here as well, specifically in the elections of foreign honorary members, acts that should have been the expressions of the highest esteem for outstanding contemporary chemists (see Table 7.2).

If we look at the list of elected foreign personalities, we see a trend quite similar to that in the Czech Academy (see Table 7.1): prevalent among the honorary members were internationally little-known Slav chemists (including one physician), and one searches in vain for the names of prominent German, French and British scientists, who dominated contemporary chemistry. Such elections of foreign members by the Society stopped in 1896, earlier than in the Czech Academy.

Table 7.2 Foreign honorary members of the Society of Czech Chemists and the Society for Chemical Industry in the Czech Kingdom*

Honorary Member	Elected to Society of Czech Chemists	Elected to Society for Chemical Industry
Aleksandr Mikhailovich Butleroff (St Petersburg, Russia)	1880	
Dmitri Ivanovich Mendeleev (St Petersburg, Russia)	1880	1894
Nikolai Aleksandrovich Menshutkin (St Petersburg, Russia)	1880	
Bronisław Radziszewski (Lviv, now Ukraine)	1880	1894
Louis Pasteur (Paris, France)		1893
Emil Christian Hansen (Carlsberg, Denmark)		1893
Karl Lintner (Weihenstephan, Germany)		1894
Maximilian Maercker (Halle/Saale, Germany)		1894
Vilém Dušan Lambl** (Warsaw, Poland)		1895
Emilio Nölting (Mühlhausen, Germany)		1896

Notes: *These societies existed for some time simultaneously due to a temporary split in 1893.

**The foreign honorary membership of V.D. Lambl (1824–95) is quite curious as Lambl was not a chemist but a Czech physician, from 1871 professor of therapy at the Medical School of the Imperial University of Warsaw. Lambl is best known for his discovery of the protozoan parasite *Lamblia intestinalis*.

The re-orientation of Czech chemists toward their Slavic colleagues culminated in the years 1880–1914, when five Congresses of Czech Scientists and Physicians (1880, 1882, 1901, 1908 and 1914) took place and became explicit platforms of Slavic scientific cooperation. Chemists and physicians were eager to establish permanent bonds between Czech scholars and their associations on the one side and Poles and Russians on the other. The idea behind this initiative was to use these Slavic linkages as a political tool to reinforce the positions of Slavic scholars and their national institutions within Austria-Hungary.⁵⁴ This new focus on Slavic science and Slavic patriotism in science was intended to replace the former reliance on German science and even included attempts to devise a pan-Slavic scientific nomenclature.⁵⁵ The leading role in this effort was played by Czech scholars who believed that a common Slavic scientific language could bring together the Slavic scientific community and maintain political equilibrium against the strong international German-speaking community.

This inclination toward Slavic science also found its reflection in the activities of Bohuslav Brauner, who became an enthusiastic propagator of Dmitri Mendeleev's Periodic Table of Elements and helped to ensure its acceptance by chemists all over the world.⁵⁶ Brauner obviously considered his cooperation with Mendeleev not only a scientific but also a patriotic task, associated with the deflection from German science to Slavic science. This is made explicit in Brauner's obituary for Mendeleev:

We Czechs are often censured because as cultivators of science we only feed off the leftovers from the table of great German science.... Although I truly respect German science, and especially the achievements of Germans in chemistry, I will always be proud that I never had to eat at the table of German science, and that the guiding star of my life was Slavic science established by Dimitrii Ivanovich Mendeleev.⁵⁷

At the same time, though, Brauner well understood the necessity for balance between international and national science:

It has been often discussed in scientific circles in smaller nations whether science is national or international.... Those who consider science a purely international matter are wrong, but mistaken are also those who dream about pursuing purely national science...and consider such pursuit of a purely patriotic science to be a God knows what 'patriotic' act. World science is a huge current that continuously rushes forward. The true scientist must swim in this current with the others... Those who want to take a higher place on the ladder of world science... must master the main world languages... Those who can must aim at maintaining contact, personal or literary, with the main representatives of world science; otherwise their activities will become mere patriotic provincialism... This is true

especially of scientists who are university teachers. Those who do not act this way will easily become biased and fall behind.⁵⁸

These two quotations from the same essay reflect the schizophrenic trap into which Czech chemists and natural scientists in general were pushed by the social and political situation in the Czech Lands. It sounds alarming that even Brauner, cosmopolitan by background, upbringing⁵⁹ and behaviour, was led to give way to some kind of nationalism. In his case, however, this was an inoffensive and unrealistically romantic Slavic nationalism, in which some Czech scholars found support at the turn of the twentieth century.

Attempts to soften nationalism within the Czech Academy of Sciences and Arts

The organic chemist and biochemist Bohuslav Raýman, a friend and contemporary of Brauner and a representative of the younger generation of Czech scholars, chose a different path (for biographical information see Table 7.3). In 1890 Raýman became Secretary of the Second Class of the newly founded

Table 7.3 Biographical data of Bohuslav Raýman

1852	Born in Sobotka, Northern Bohemia
1872–74	Chemistry studies, Czech Technical University, Prague with V. Šafařík
1874–76	Chemistry studies, doctorate at Bonn University with F.A. Kekulé
1876/77	Winter Term – Faculté de médecine, Paris, with C.A. Wurtz
1877	Summer Term – École nationale des mines, Paris, with C. Friedel
1877	Study trips to Belgium, Netherlands, England and Scotland, visiting also Roscoe's and Schorlemmer's laboratories
1877–82	Assistant at the Czech Technical University, Prague
1878	Habilitation based on thesis on aromatic compounds at the Czech Technical University, Prague
1879–80	President, Society of Czech Chemists
1882–1907	Dozent for organic chemistry, Czech Technical University
1885–91	Co-editor of the journal <i>Listy chemické (Chemical Letters)</i>
1886	Doctorate in philosophy, Czech University, Prague
1890	Associate professor (<i>Dozent</i>) of organic chemistry, Czech University, Prague
1890	Associate member of the Czech Royal Society of Sciences
1890	Full Member, Czech Academy of Sciences and Arts, Secretary of its 2nd Class
1893	Founder of the journal <i>Bulletin international</i>
1896	Professor of organic chemistry, Czech University, Prague
1899	Secretary General of the Czech Academy of Sciences and Arts
1903	Honorary Member of the Society of Czech Chemists
1910	Death in Prague from stroke, aged 58

Czech Academy, and his voice was from the very beginning one of the few within the Academy that argued for the elimination of the stimulating influence of the Academy on nationalism in scientific circles.

Raýman's activities in the years prior to his entrance to the Academy prepared him well for the role he would play in the future. He had many years' experience at universities and laboratories in Germany, France and Britain, where he worked under the eminent chemists Friedrich August Kekulé, Charles Friedel, Charles Adolphe Wurtz and Henry Roscoe. His correspondence shows ample international contacts with German, British, Polish, Russian and even Indian chemists. As a teacher at both Czech universities in Prague, Raýman trained several generations of Czech chemists, among whom he disseminated the ideas developed by the Justus Liebig school, with which he aligned himself. Before he joined the Czech Academy of Sciences, he was also member of the bilingual Royal Czech Society of Sciences⁶⁰ and the Société chimique de France, and he was a key functionary of the Society of Czech Chemists. Raýman's contacts went far beyond chemistry. We find in his papers⁶¹ letters from the Swedish Slavist Alfred Jensen, who had a high position in the Nobel Institute, and the English Slavist William Richard Morfill. Czech artists, poets and writers also belonged to his circle of friends.⁶² His endeavour to raise Czech science to top European levels was anchored in his authentic patriotism, which was neither declarative nor chauvinistic.

Raýman's main concerns in his position as Secretary of the Second Class of the Czech Academy stemmed from the Academy's statutes,⁶³ which in several paragraphs strongly accentuated the Czech character of the Academy. The Czech historian of science Jiří Beran accurately summarizes this peculiarity of the statutes:

Detailed study of the Statutes shows that the Academy understood the 'Czechness' and national character of science in the philological and geographical sense[s]. Science pursued exclusively in the Czech language, research into the local historical monuments and natural environment, these were the main aspects accentuated by Hlávka.⁶⁴ Only foreign members had the right to publish in foreign languages, while Czech scholars were only allowed to append summaries in a foreign language to their publications. In this way he retarded the active participation of Czech science and art in world culture, and at the same time enforced passive sharing of foreign results, so that he evoked disagreement especially among scientists.⁶⁵ Hlávka's concept of national science created to a certain extent barriers to its further development.⁶⁶

How bizarre such useless demonstrations of patriotism could be is shown by the example of the Russian physical chemist Nikolay Beketov. A foreign member of the Czech Academy, he was praised in the Academy's official

biography in 1910 for publishing only in Russian (with minor French exceptions).⁶⁷ Although the policy of publishing only in Czech pertained only to books and journals issued by the Academy itself, such principles affected to a certain extent the whole Czech intellectual community and prompted discussions about the essence of patriotism in science.

As stated above, nationalism mingled with conservatism manifested itself from the very beginning in the Czech Academy. While nationalism intervened in the sphere of language and communication, conservatism also interfered with the activities and routines of the Academy. Conservatives always joined forces, especially in the election of new members and Academy officers. In 1890, in consequence, some outstanding Czech scholars, such as the geologist, zoologist and palaeontologist Antonín Frič, the chemist František Štolba and the zoologist František Vejvodský, were not elected to the Academy.⁶⁸ The foremost poet Jan Neruda also never became a member of the Academy, which is attributed by some historians to his political engagement in the radical wing of the Young Czech Party.⁶⁹

Eventually, Raýman was the man who succeeded in finding at least a partial solution. Scientific works of the members of the Academy were published in the *Rozpravy ČAVU (Debates of the Czech Academy)*, issued by each class separately. In accordance with the statutes, most works published by Second Class students had a foreign-language summary, usually in French. In 1892 Raýman proposed⁷⁰ a relocation of these summaries into a separate periodical. For this purpose, the Second Class of the Czech Academy launched a new journal, the *Bulletin international. Classe des Sciences mathématiques, naturelles et de la médecine – Académie des Sciences de l'Empereur François Joseph I.* Gradually, the summaries became longer and tables and illustrations were added, until the abstracts became full papers and the *Bulletin* evolved into a fully fledged periodical. This was the first foreign-language journal published by a Czech scientific institution, in an attempt to compensate for the handicap of publishing scientific papers in a language that almost nobody except Czechs understood. Several years later, in 1901, in his article 'Patriotism and Science' published in the popular journal *Živa*, Raýman supported the necessity for the *Bulletin international* in the following words:

The main task of our universities is to cultivate science, *science in every sense of the word*... Our scientific worker must share the results of his research into natural phenomena with foreign workers. I suppose that there may exist a great historian who would write his works only in Czech, but I deny that there could exist a physicist, chemist, mathematician, biologist who would not take into account the world research to which he would contribute with his own truth for the progress of science. It is nonsense to expect that the great nations will come by themselves to search out our results; it is in our patriotic interest, and private, too, to make them acquainted with our work.⁷¹

Final remarks

In the course of the Czech National Revival in the nineteenth-century Czech Lands, patriotism played an important role in promoting the creation of a Czech scientific terminology, which in turn was a prerequisite for the formation of Czech research and educational institutions and the communication base of Czech science and scholarship after the 1860s. 'Slavic patriotism' as an offshoot of this Czech patriotism also gained ground in the Czech Lands after the 1880s as the starting point of cooperation with Slavic scientists, especially Poles and Russians. This cooperation reinforced the central European version of the Slavic idea conceived by Czech, Russian and Bulgarian Slavic philologists in the 1830s and 1840s.⁷² Despite the romantic features and idealized image linked with Pan-Slavism, this trend also strengthened communication channels of science across Europe in the second half of the century.⁷³

In the 1860s patriotism in science in the Czech Lands started to shift into nationalism and chauvinism, marked by strong demarcation from German science. These tendencies were especially evident in the 1890s within the Czech Academy of Sciences and Arts, which pleaded for the almost exclusive use of the Czech language in communication and showed a tendency to exploit science for political goals. Some scholars, especially chemists, understood that such trend set the tone for the whole domestic scientific scene, and would inevitably lead to international isolation and decrease the quality of domestic research and education. Although these chemists were a minority in the Second Class⁷⁴ of the Academy, they played a decisive role in the struggle against nationalistic excesses and in finding new solutions for international cooperation in the years before the First World War.

The reasons why chemists had such a central position in the Czech scientific community are quite complex, and only some of them can be mentioned here. First, they were backed by the powerful chemical industry, especially the sugar and fermentation industries, where progress and profitability were unthinkable without international cooperation. Second, at the turn of the 19th century industrial chemists became a massive social force in Europe, as well as the Czech Lands.⁷⁵ Third, Czech chemists were well prepared for international cooperation, since many of them had studied or carried out research abroad, mostly at German universities, or attended German universities in the Czech Lands. Last, but not least, chemists were well aware of the potentially disastrous consequences of nationalistically motivated isolation for the development of Czech science and technology, so they nurtured their international ties despite strong political pressure, and their senior representatives were powerful enough to influence scholars from other sciences. We must add, however, that although chemists attempted to overcome the divisiveness of nationalism, on the surface the mutual isolation of Czech and German science in the Czech Lands appeared to be irreversible.

However, strategies for coping with nationalism in the sciences in the Czech Lands in the second half of the nineteenth century appear to have differed considerably from those employed in the humanities.⁷⁶

Notes

Research for this chapter was supported by the Grant Agency of the Academy of Sciences of the Czech Republic (Grant No. IAA00630801). The author is indebted to Dr. Vlasta Mádlová for suggestions that helped to improve the chapter.

1. Carol E. Harrison and Ann Johnson (2009) 'Introduction: Science and National Identity' in C.E. Harrison and A. Johnson (eds.) *National Identity: The Role of Science and Technology (Osiris, Second Series, 24)* (Chicago: University of Chicago Press), 1–14, here 4.
2. Jan Janko, Soňa Štrbářová (1988) *Věda Purkyňovy doby [Science in Purkinje's Time]* (Prague: Academia).
3. For a detailed study on ethnicity in the Czech Lands see Jiří Kořalka (1996) *Češi v habsburské říši a v Evropě 1815–1914 [Czechs in the Habsburg Empire and Europe 1815–1914]* (Prague: Argo).
4. On the creation of Czech professional and scientific terminology see Janko and Štrbářová, *Věda Purkyňovy doby*, especially 107–14, 215–26; Soňa Štrbářová and Jan Janko (2003) 'Uplatnění nového českého přírodovědného názvosloví na českých vysokých školách v průběhu 19. století' [Assertion of the new Czech scientific nomenclature at the Czech universities in the nineteenth century], in Harald Binder, Barbora Křivohlavá and Luboš Velek (eds.) *Position of National Languages in the Education, Educational System and Science of the Habsburg Monarchy 1867–1918* (Prague: Výzkumné centrum pro dějiny vědy), 297–311, abstract in English 732–33; Ludmila Hlaváčková (2003) 'Čestina v medicíně a na pražské lékařské fakultě (1784–1918)' [Tschechisch in der Medizin und an der Prager Medizinischen Fakultät (1784–1918)], in Binder, Křivohlavá and Velek (eds.) *Position of National Languages*, 327–44, abstract in German 733–34.
5. We should keep in mind a terminological problem: in texts written in English, the terms 'nation' and 'national' have different meanings from their Czech translations 'národ' and 'národní'. While the term 'nation' and words derived from it refer to membership of a nation or citizenship in a state, their Czech equivalents indicate ethnicity. For this reason, we prefer to use the expression 'linguistically Czech science' rather than 'Czech national science'.
6. There is abundant literature on the development of chemistry in the Czech Lands, but the particulars are mostly scattered in various books and articles. Important references can be found, for instance, in Soňa Štrbářová (2008) 'Czech Lands: Chemical Societies as Multifunctional Social Elements in the Czech Lands, 1866–1919', in Anita Kildebaek Nielsen and Soňa Štrbářová (eds.) *Creating Networks in Chemistry; The Founding and Early History of Chemical Societies in Europe* (Cambridge: RSC Publishing), 43–74. See also Robert Rosner (2004) *Chemie in Österreich 1740–1914* (Vienna, Cologne, Weimar: Böhlau Verlag), 181–213, 289–329.
7. Jan Havránek (1967) 'The Development of Czech Nationalism', in *The Nationality Problem in the Habsburg Monarchy in the Nineteenth Century: A Critical Appraisal, Part II, The National Minorities, Austrian History Yearbook 3, Part 2* (Houston: Rice University Press), 223–60, here 228; Rosner, *Chemie in Österreich*, 298.
8. Redakce (1928) '1918–1928', *Chemický obzor*, 3, 325–28.

9. Bohumil Hájek, Ladislav Niklíček and Irena Manová (1981) 'Profesor Vojtěch Šafařík – jeden ze zakladatelů české chemie, 2. Část [Prof. V. Šafařík – one of the founders of the Czech chemistry, part 2], *Sborník Vysoké školy chemicko-technologické v Praze*, A, 23, 50–108, here 59.
10. Havránek, 'Development of Czech Nationalism', 228.
11. Havránek, 'Development of Czech Nationalism', 229. As Havránek emphasizes, the decreasing importance of industries dominated by German capital (glass, porcelain, textiles) resulted also in the decline of political influence of Bohemian Germans at the beginning of the twentieth century
12. Havránek, 'Development of Czech Nationalism', 230.
13. Přírodovědecký spolek Isis.
14. Spolek chemiků českých.
15. Today it is called Česká společnost chemická (Czech Chemical Society). A detailed account of the Society's early history is given in Štrbáňová, 'Czech Lands: Chemical Societies', where the numerous changes in the title and structure of the Society are also described.
16. Probably the only German member of the Society, for a few years at the turn of the nineteenth century, was Carl Zulkowski (1833–1907), professor of chemical technology of the Deutsche Technische Hochschule in Prague (1887–1904).
17. Štrbáňová, 'Czech Lands: Chemical Societies', 51.
18. Štrbáňová, 'Czech Lands: Chemical Societies', 55.
19. The all-Austrian Österreichische Gesellschaft zur Förderung der chemischen Industrie (1878) was not a typical chemical society and will be mentioned further on.
20. Naturhistorisches Verein Lotos.
21. Emilie Těšínská (2003) 'Vznik a působnost přírodovědného spolku "Lotos" v českých zemích' [Die Entstehung und das Wirken des naturwissenschaftlichen Vereins 'Lotos' in den böhmischen Ländern] in Binder, Křivohlavá and Velek (eds.) *Position of National Languages*, 327–44, abstract in German 735–36.
22. Ständisches Polytechnisches Institut, founded in 1806, from 1876 independent Czech and German Technical Universities.
23. Česká universita Karlo-Ferdinandova and Deutsche Karl-Ferdinands Universität.
24. K.k. Technische Hochschule in Brünn.
25. From the extensive literature on the history of chemical education at Czech universities see, for example, Otakar Quadrat (1966) *Nástin historického vývoje Vysoké školy chemicko-technologické v Praze (do roku 1945)* [Outline of the historical development of the Chemical Technological University in Prague until 1945] (Praha: SPN); Otakar Franěk (1969) *Dějiny České vysoké školy technické v Brně, vol. 1* [History of the Czech Technical University in Brünn, vol. 1] (Brno: VUT); relevant chapters in Václav Lomič and Pavla Horská (1979) *Dějiny Českého vysokého učení technického v Praze* [History of the Czech Technical University in Prague], part 1, vol. 2. (Prague: SNTL); Jan Havránek (ed.) (1997) *Dějiny Univerzity Karlovy III, 1802–1918* [History of the Charles University, vol. III, 1802–1918] (Praha: Karolinum); and Miroslav Schätz (2002) *Historie výuky chemie* [History of Chemistry Instruction] (Prague: Vysoká škola chemicko-technologická).
26. Česká akademie císaře Františka Josefa I. pro vědy, slovesnost a umění (ČAVU). In this article the expression 'Czech Academy' or the abbreviation ČAVU will be used.
27. Sources sometimes indicate different years for its constitution, from 1888 to 1891, e.g. Jiří Beran (1971) 'II. třída ČAVU v letech 1891–1914' [The Second Class

- of the Czech Academy in the years 1891–1914], *Dějiny věd a techniky*, 4, 193–208, here 193. 1888 is the year when the founder of the Academy and its patron, the architect Josef Hlávka, donated the money for its financing.
28. *Ibid.*, 193.
29. Jiří Beran, for instance, draws attention to these characteristics of the Czech Academy in (1973) 'Vznik a hlavní tendence ve vývoji České akademie věd a umění' [The origins and main tendencies in the development of the Czech Academy of Sciences and Arts] *Práce z dějin přírodních věd*, 4, 91–100. Beran notices that at the end of 1891, the Czech Academy had only one chemist and one physicist, but five jurists and even more philologists among its acting members (p. 194). The Czech Academy was divided into the following classes: I. philosophy, political sciences, jurisprudence, social sciences, history and archaeology, II. mathematical, natural and medical sciences, III. philology, IV. literature, fine arts and music.
30. Their loyalty is well documented by the several volumes of a memorial issued by the Czech Academy of Sciences, Letters and Arts on the occasion of the 50th anniversary of the accession of Emperor Franz Joseph I: (1898) *Památník na oslavu padesátiletého panovnického jubilea Jeho veličenstva císaře a krále Františka Josefa I: vědecký a umělecký rozvoj v národě českém: 1848–1898* (Prague: Nákladem České akademie císaře Františka Josefa pro vědy, slovesnost a umění).
31. Havránek, 'The Development of Czech Nationalism', 237.
32. Documents related to the establishment and statutes of the Czech Academy are published in Jiří Beran (1989) *Vznik České akademie věd a umění v dokumentech* [The Creation of the Czech Academy of Sciences and Arts in Documents], *Práce z dějin ČSAV*, B, vol. 2. (Prague: Ústřední archiv ČSAV). A survey of all members with ample additional biographical and other information is published in Alena Šlechtová and Jiří Levora (1898) *Členové České akademie věd a umění 1890–1952* [The members of the Czech Academy of Sciences and Arts 1890–1952] *Práce z dějin ČSAV*, B, vol. 3. (Prague: Ústřední archiv ČSAV).
33. Beran, *Vznik České akademie*, 27.
34. Karel Chodounský (1888) 'Česká akademie věd' [Czech Academy of Sciences], *Časopis lékařů českých*, 27, 385–87.
35. Karl Josef Küpper (1828–1900) was professor of geometry in Prague until 1898 and left for Bonn only after his retirement. His assistant was the Czech mathematician Eduard Weyr (1852–1903), a member of the Czech Academy, and Küpper was known for his friendliness to the Czechs. These facts can explain his election. See Franz Stark, Wilhelm Gintl and Anton Grünwald (eds.) (1906) *Die k. k. Deutsche Technische Hochschule in Prag 1806–1906* (Prague: Selbstverlag), 358–59; Jindřich Bečvář (1995) 'Eduard Weyr', in Jindřich Bečvář (ed.) *Eduard Weyr, 1852–1903* (Prague: Prometheus), 35–66.
36. For details see Soňa Štrbáňová and Jan Janko (1993) 'Kekulé s character in the light of his ennoblement', in John Wotiz (ed.) *The Kekulé Riddle. A Challenge for Chemists and Psychologists* (Clearwater, FL; Vienna, IL: Cache River Press), 195–210.
37. (1890) 'Stanovy České Akademie císaře Františka Josefa pro vědy slovesnost a umění' [Statutes of the Czech Academy], *Almanach ČAVU*, 1, 72–141, § 11, 79.
38. For more details see Štrbáňová and Janko, works cited in Note 5.
39. Due to this compromise and discrepancies between Czech and international chemical terminologies, contemporary Czech chemists still sometimes have trouble correlating Czech and international terminology.

40. (1853) *Německo český slovník vědeckého názvosloví pro gymnasia a reálné školy. Od komise k ustanovení vědeckého názvosloví pro gymnasia a reálné školy. Deutsch-böhmische wissenschaftliche Terminologie* [German–Czech Dictionary of Scientific Terminology for Gymnasien and Realschulen. By the Commission for the Establishment of Scientific Terminology for Gymnasien and Realschulen] (Prague: Kalvéské knihkupectví Bedřich Tempský).
41. This official scientific dictionary may be considered evidence of efforts by some of the revivalists to disentangle themselves from the pressure of narrow-minded ‘patrioteering’. The foreword was written by the foremost Slavist P.J. Šafařík (1795–1861), father of the chemist Vojtěch Šafařík (1829–1902), who, in turn, in 1860 wrote the first Czech university textbook on chemistry and in 1869 became professor of chemistry at the Czech Polytechnic.
42. For more details see, for instance, Soňa Štrbáňová (1986) ‘Vztah české a světové chemie’ [The relationship between Czech and world chemistry], *Sborník Vysoké školy chemicko-technologické v Praze*, A, 31, 9–24.
43. Its establishment is described in (1879) ‘Geschichte der Bildung der Gesellschaft’, *Berichte der Österreichischen Gesellschaft zur Förderung der chemischen Industrie*, nos. 1 and 2, 1–2; see also Rosner, *Chemie in Österreich*, 298.
44. Wilhelm Friedrich Gintl (1843–1908) was professor at the German Technical University (1870) and president of the Verein für chemische und metallurgische Produktion in Aussig (1890), the largest Austro-Hungarian chemical cartel. Rosner, *Chemie in Österreich*, 269–70; Stark, Gintl and Grünwald, *Die k. k. Deutsche Technische Hochschule*, 379.
45. František Šebor (1838–1904) was a leading Czech chemical production engineer, president of the Society of Czech Chemists (1892–97) and an honorary member (1893); see Oldřich Hanč (ed.) (1996) *100 let Československé společnosti chemické její dějiny a vývoj 1866–1966* [100 Years of the Czechoslovak Chemical Society, its History and Development 1866–1966] (Prague: Academia), 62.
46. Bohuslav Brauner (1855–1935), professor of the Czech University (1897), is probably the most widely known Czech chemist. He specialized in research into certain groups of elements in the Periodic System. His biographic references include: Gerald Druce (1944) *Two Czech Chemists* (London: The New Europe Publishing Co.), 5–44; Jaroslav Heyrovský (1935) ‘Professor Bohuslav Brauner died February 15th 1935’, *Collection of Czechoslovak Chemical Communications*, 7, 51–56; Jan S. Štěrba-Böhm (1935) *Bohuslav Brauner* (Prague: Česká akademie věd a umění), with bibliography of Brauner; S.G. Schacher (1973) ‘Brauner, Bohuslav’, in *Dictionary of Scientific Biography*, vol. 2 (New York: Scribner), 428–30; Soňa Štrbáňová (2003) ‘Brauner, Bohuslav’, in Dieter Hoffmann, Hubert Laitko, Staffan Müller-Wille and Ilse Jahn (eds.) *Lexikon der bedeutenden Naturwissenschaftler*, vol. 1 (Heidelberg and Berlin: Spektrum Akademischer Verlag), 249–51.
47. Richard Abegg und Friedrich Auerbach (eds.) (1905–13) *Handbuch der anorganischen Chemie in vier Bänden* (Leipzig: Hirzel). Brauner’s chapters are in vol. II, 1, 1908; vol. II, 2, 1905; vol. III, 1, 1906; vol. III, 2, 1909; vol. III, 3, 1907; vol. IV, 2, 1913.
48. Brauner’s extensive correspondence is kept at the Archives of the Museum of Czech Literature (PNP–Památník národního písemnictví). PNP, Brauner Bohuslav, Personal Papers, Correspondence.
49. Bohuslav Raýman (1852–1910) specialized in organic chemistry and biochemistry, and was *dozent* at the Czech Technical University (1978) and professor at the Czech University (1890).

50. Only a fragment of Raýman’s correspondence has been preserved; it is kept in the Archives of the Museum of Czech Literature (PNP), PNP, Raýman Bohuslav, Personal Papers. On Raýman’s correspondence, see Soňa Štrbáňová (2011), ‘Raýmanova osobnost ve světle jeho fondu v Literárním archivu Památníku národního písemnictví’ [Raýman’s personality as reflected in his papers kept at the Literary Archive of the Museum of Czech Literature], *Práce z dějin Akademie věd*, 3, 161–182, abstract in English, 173–174; His correspondence with Emil Fischer is described in Soňa Štrbáňová (1986) ‘Tschechische Beiträge zur Entwicklung der Biochemie: B. Raýman und K. Kruis’, *Philosophische, historische und wissenschaftstheoretische Probleme in Chemie und Technik*, Geschichte u. Organisation der Wissenschaft, Kolloquien Heft 57 (Berlin: Akademie der Wissenschaften der DDR), 147–58. For his correspondence with Kekulé, Friedel and Wurtz see, for example, Soňa Štrbáňová and Jan Janko (1991) ‘Die Umstände der Nobilitierung F.A. Kekules’, *Chemie in unserer Zeit*, 25, 208–13; Štrbáňová and Janko, ‘Kekulé’s character’; Soňa Štrbáňová (2005) ‘Correspondence strengthening the network of a scientific school: unknown letters of the French chemists C. Friedel and C.A. Wurtz to the Czech chemist B. Raýman’, in Horst Kant and Annette Vogt (eds.) *Aus Wissenschaftsgeschichte und -theorie* (Berlin: Verlag für Wissenschafts- und Regionalgeschichte Dr. Michael Engel), 257–76. These papers also contain references to Raýman’s biography.
51. In 1907 the unified Česká společnost chemická pro vědu a průmysl (Czech Chemical Society for Science and Industry) had 630 members. See Štrbáňová, ‘Czech Lands: Chemical Societies’, 65.
52. Beside foreign honorary members, the Society had foreign corresponding members like Gustav Janeček from Zagreb, Sima Lozanić from Belgrade, Bronisław Pawlewski from Lviv and Jule Tourtel from Tantonville near Nancy. Tourtel, unlike the three others, was not a chemist, but a brewer, co-owner (with his brother Prosper) of the famous brewery at Tantonville in the Lorraine, where Pasteur also carried out some studies.
53. Štrbáňová, ‘Vztah české a světové chemie’, 21.
54. More on this in Soňa Štrbáňová (1989) ‘Congresses of Czech naturalists and physicians in the years 1880–1914 and Czech–Polish scientific collaboration’, *Acta historiae rerum naturalium necnon technicarum*, 21, 79–122.
55. For more details see Štrbáňová, ‘Congresses’; Hlaváčková, ‘Čeština v medicíně a na pražské lékařské fakultě’.
56. Soňa Štrbáňová (2009) ‘The role of Czech chemists in the reception and dissemination of the periodic system in Europe’, unpublished paper from the conference Consumers and Experts: The Uses of Chemistry (and Alchemy), Sopron, Hungary.
57. Quoted from (1952) *Dopisy Dimitrije Ivanoviče Mendělejeva českému chemiku Bohuslavu Braunerovi* [Letters of D.I. Mendeleev to the Czech Chemist B. Brauner] (Prague: Technicko-vědecké vydavatelství), 69–70.
58. *Dopisy Dimitrije Ivanoviče Mendělejeva*, 68–69.
59. Noteworthy is Brauner’s mixed parentage, which endowed him with all-embracing capabilities. The carrier of his ‘chemical genes’ was his German mother, Augusta Braunerová (1817–1890), whose father was Karl A. Neumann (1771–1866), the first professor of chemistry at the Prague Polytechnic, and whose grand-uncle was Caspar Neumann (1683–1737), one of the great figures in the European history of chemistry, professor of chemistry in Berlin and friend of G.E. Stahl. The father of Bohuslav Brauner was František August Brauner (1810–1880), a lawyer who became one of the most influential Czech politicians after 1848. Brauner’s

- sister Zdenka Braunerová (1858–1934) was a recognized modern artist, and his other sister, Anna, was married to a well known French writer, Elémir Bourges (1852–1925), winner of the Goncourt Prize.
60. Královská česká společnost nauk.
 61. PNP, Raýman Bohuslav, Personal Papers.
 62. A close friend was the most prominent Czech poet of his generation, Jaroslav Vrchlický. Raýman's correspondence kept at the PNP and the Archives of the Academy of Sciences of the Czech Republic discloses that he tried in vain for several years to obtain the Nobel Prize for Vrchlický.
 63. Stanovy České Akademie (cit. Note 39).
 64. Josef Hlávka (1831–1908) Czech architect and benefactor, founder and first President of the Czech Academy; see above.
 65. Beran, *Vznik České akademie*, 42–43.
 66. Beran, *Vznik České akademie*, 79.
 67. (1910) 'Životopisy nových členů' [Biographies of new members] *Almanach ČAVU*, 20, 46–47.
 68. Beran, *Vznik České akademie*, 54. The paragraphs that most accentuate the 'Czech character' of the Academy and the restriction in its communications to the Czech language are § 1 and § 5; Stanovy České Akademie (1890), 73, 76–77.
 69. I am indebted for this information to Dr. Martin Franc. Hlávka was a member of the Old-Czech Party, but within the Academy no political tensions were noted.
 70. Vlasta Mádlová (2011), Bohuslav Raýman a Česká akademie věd a umění [Bohuslav Raýman and the Czech Academy of Sciences and Arts], *Práce z dějin Akademie věd* 3, 197–208, English summary 197.
 71. Bohuslav Raýman (1901) 'Vlastenectví a věda' [Patriotism and science], *Živa*, 11, 80–82, here 81. Emphasis in the original.
 72. On this topic compare, for example, Antoaneta Balcheva (2010) 'Utopias in Search of National Identity', in Richard Vašek and Jan Rychlík (eds.) *Formování moderních národů ve střední a východní Evropě v 19. a 20. století* [Shaping of the modern nations in central and eastern Europe in the 19th and 20th centuries] (Prague, Sofia: Masarykův ústav a Archiv AV ČR), 167–72.
 73. For instance, Bohuslav Brauner reported regularly about the Russian chemical publications in the *Journal of the Chemical Society*.
 74. These chemists were Bohuslav Raýman, Bohuslav Brauner, Emil Votoček (1872–1950) and, as a corresponding member, Otakar Šulc (1869–1901), who was included for just one year because of his premature death. Raýman, Brauner and Votoček were a strong formation due to their scientific, teaching and organizing positions in the Czech scientific community and their international reputations.
 75. In 1907 the total membership of the Chemical Society was 630, of which 60 per cent were industrialists and industrial corporations.
 76. For brief discussion of this issue, see Soňa Štrbářová and Antonín Kostlán, 'To be a good son of one's nation or get involved in supranational scientific network? Cases of chemists and historians in the Czech National Revival', in 3rd International Conference of the European Society for the History of Science, Vienna, 10–12 September 2008, *Abstracts*, 120–21; Antonín Kostlán, 'To be a good son of one's nation... Czech historians between national program and scientific style', in XXIII International Congress of History of Science and Technology, Ideas and Instruments in Social Context, 28 July–2 August 2009, Budapest, Hungary, *Book of Abstracts*, 628.

8

Fault Lines and Borderlands: Earthquake Science in Imperial Austria

Deborah R. Coen

Our knowledge of a natural phenomenon, say of an earthquake, is as complete as possible when our thoughts so marshal before the eye of the mind all the relevant sense-given facts of the case that they may be regarded almost as a substitute for the latter, and the facts appear to us as old familiar figures, having no power to occasion surprise. When, in imagination, we hear the subterranean thunders, feel the oscillation of the earth, figure to ourselves the sensation produced by the rising and sinking of the ground, the rocking of the walls, the falling of the plaster, the movement of the furniture and the pictures, the stopping of the clocks, the rattling and smashing of windows, the wrenching of the door-posts, the jamming of the doors; when we see in mind the oncoming undulation passing over a forest as lightly as a gust of wind over a field of grain, breaking the branches of the trees; when we see the town enveloped in a cloud of dust, hear the bells begin to ring in the towers; further, when the subterranean processes, which are at present unknown to us, shall stand out in full sensuous reality before our eyes, so that we shall see the earthquake advancing as we see a wagon approaching in the distance till finally we feel the earth shaking beneath our feet, – then more insight than this we cannot have, and more we do not require.¹

In *Contributions to the Analysis of Sensations* (1886), Ernst Mach famously argued that the goal of physics is to build up a description of the world out of the most basic components of human experience. The scientific observation of an earthquake involved all the forms of sensation explored earlier in Mach's treatise: movement, sight, time, even tone. In this way, seismology could serve as a test of the capacity of Mach's psycho-physical programme to produce practical knowledge in real environments, beyond the laboratory, as his evolutionary epistemology demanded. In other respects, however, Mach's choice of example is confounding. Having spent most of his life