BOOK REVIEWS

Transformations and Survivals

Science in Russia and the Soviet Union. A Short History. LOREN R. GRAHAM. Cambridge University Press, New York, 1993. x, 321 pp. + plates. $29.95 or £30. Cambridge History of Science.

The book opens with a gallery of pictures of famous Russian scientists, among them mythic founder Mikhail Lomonosov, romantic pioneer of non-Euclidean geometry Nikolai Lobachevsky, constructor of the periodic table Dmitry Mendeleev, physiologist Ivan Pavlov, physicist Piotr Kapitza, geneticist Nikolai Vavilov and his violent opponent Trofim Lysenko, mathematician Andrei Kolmogorov, and nuclear-weapons creators Igor Kurchatov and Andrei Sakharov. One might have added 18th-century genius Leonhard Euler and embryologist Karl von Baer (who although not native Russians cannot be excluded from the history of Russian science), geologist Vladimir Vernadsky, theoretical physicist Lev Landau, and space-program director Sergei Korolev. In these figures we find intelligent faces, independent minds, and a very impressive contribution to science.

Now perform an experiment. Let these mantled scholars get together to form, say, the Areopagus of Russian science, and let anybody suggest electing to this symbolic body the head of the Russian government, whoever it be at the moment. I am sorry to say that the most probable response would be unanimous approval. I wish that a photograph of such an enthusiastic proceeding, for instance of Vyacheslav Molotov's election to honorary membership in the Soviet Academy of Sciences in 1946, had also been included so as to present to the reader the other and equally representative face of Russian science.

What about independence of thought, one might ask, and what are the reasons behind this double standard of thinking and behavior? The shortest way to answer is to call to mind the distinction between the state and civil society and to understand that the latter has played a very small role in science in Russia in any era, imperial or soviet. This means that independent institutions of the scientific community, industry, philanthropy, mass media, and public opinion have provided too little support for science to secure that plurality of sources of authority that effectively substitutes for freedom. Only two authorities have been of permanent crucial importance to Russian science—the world scientific community and native political power. A successful Russian scientist has had to meet the standards of both these "reference groups," the first mainly through publications and individual contributions, the second mainly through public activity and administration. The interests and standards of the two authorities have often conflicted, and this makes Russian science an interesting, even ideal, subject for social history.

The election of V. M. Molotov to membership *honoris causa* in the Soviet Academy of Sciences. [*Vestnik Akademii Nauk SSSR*, no. 11-12, 1946]

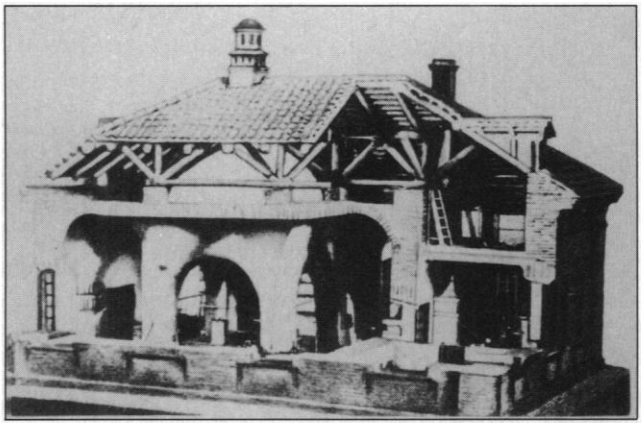
Loren Graham has written a book on the social history of Russian science, the aim of which is to provide an introduction to the subject for a newcomer to it. I think it serves that stated purpose, discussing in a very simple way several key issues, personalities, and events. Instead of giving a chronological narrative, it consists of a collection of essays on general features of Russian science, with impressive and rich factual details given in an appendix. The book also reflects how little of the subject has been studied and how many questions and blank spots remain.

The nation's first important scientific institutions—the St. Petersburg Academy of Sciences (1725), Moscow University (1755), and a larger network of universities (around 1805)—were oases of Western science in an alien, still quite traditional society. They depended completely on the will of the central government to portray itself as a modern European power. The Academy, as a court institution, remained in isolation almost until the end of the imperial period. Universities established closer links with the ever more emancipated society in the first half of the 19th century. The demand for university education grew steadily; the academic career, however, was not attractive to the elite. Graham's biographical essays on Lomonosov, Lobachevsky, and Mendeleev present a picture of the Russian scholar as typically being of very modest and often provincial origins, studying with state financial support in one of the "two capitals" St. Petersburg or Moscow or abroad, and living a turbulent, if judged by the standards of democracies, public life. In the absence of a well-developed native scientific community with its discipline, persons like Lobachevsky and Mendeleev could more easily introduce original and radical ideas.

The situation changed in the second half of the century, especially after the capitalist reforms of the 1860s. Mass media created a cult of science and the public strongly demanded new centers of learning, while the government tried to contain the spread of the political opposition that quickly took hold in the universities. A new generation of professors imported from Germany the idea that their task was not only teaching but doing research, and students and faculty struggled for autonomy. Although public demand for education for women failed to change the rules of university admission, it led to the establishment of the first private and community institutions of higher learning. By 1914 these institutions matched the state colleges in number, though not yet in size. The beginning of the present century saw the emergence of philanthropic interest in science as such and the establishment of the first private research institutions. Graham does not write much about these institutional developments, but he tells a story that illustrates the thesis from another side: the triumphant reception of Darwinism in Russia was shaped greatly by public values and the intelligentsia's oppositional and antireligious views. Consciously and unconsciously, Russian interpreters deviated from Darwin, suppressing Malthusian and stressing Lamarckian themes in his doctrine.

The Communist revolution channeled the process of modernization in another direction. The new government was willing to support science on a much broader scale. For the same ideological and pragmatic reasons, it also wanted to control science much more tightly. Graham explains the complex attitudes toward so-called "bourgeois specialists"—the core of Soviet science politics during the first ten years after 1917. The compromise between scientists and politicians was based on mutual recognition of their spheres of competence: scientists retained a certain amount of professional autonomy and were allowed privately to hold deviating views on general political issues. The cultural revolution of 1928–1931 put an end to this compromise and marked the transition to a totalitarian regime. Communists took administrative control of virtually all scientific institutions and demanded that scientists share their political values. They thought they had achieved effective control of both the professional activities and the political views of scientists: the ascendancy of this "totalitarian" model likewise served well the propaganda interests of their political enemies on the other side of the "iron curtain" and continues to serve post-Communist ideology. Only the judgments rendered concerning it were in opposition—one side claimed credit for virtually all achievements of Soviet science and was blamed by the other for purges, ideological censorship, and other losses.

Graham strives to overcome this Cold War mentality with a carefully balanced picture of achievements and failures. I, too, want to do away with the characterization of Soviet science in terms of the totalitarian model but would prefer another option—shifting attention further from political and more toward social topics and considering the relations between scientists and politicians in terms of interaction and dialogue rather than of control and dependence. Obviously the control could not be really total, and the scientific community developed its own "underground" forms of life and ways of expressing and pursuing its particular interests. Of course, the hidden life is much more difficult to study than the open one, and there has been very little analysis of the scientific community during the Stalin period. Graham, in keeping with the current state of historiography, closes his chapter on the scientific community with the early 1930s.



"A model of Lomonosov's chemical laboratory in St. Petersburg, the first chemical laboratory in Russia, opened in 1748." [From *Science in Russia and the Soviet Union*; courtesy of Institute of the History of Science and Technology, Moscow]

The most apparent organizational feature of Soviet science is the enormous administrative role of the Academy of Sciences. Having begun as the Imperial St. Petersburg Academy, it changed its name after the events of 1917 to "Russian Academy" and quickly reached accord with the new Communist rulers. Ten years later, around 1929, it lost its relative autonomy and became a real Soviet Academy, remaining a scientific institution on a par with many others. Those events have been studied well enough. Much less is known about the transformations that occurred after 1934, when, retaining some features of a scientific society, the Academy began also to fulfill the function of the ministry of science, managing in a centralized manner the whole network of major research institutions in fundamental sciences. This dominance of the Academy is so striking throughout the postwar period that even historical studies have not escaped the temptation of presenting the history of Soviet science as the history of the Academy, tacitly conveying the impression that the Academy was similarly important before the late 1930s. Apart from this reservation I have to correct just one minor mistake in Graham's otherwise very good account of the Academy and its relations with the political authorities: The permanent secretary of the Russian Academy, S. F. Ol'denburg, did not belong to the family of Prince Ol'denburgskii, and his readiness to compromise with the Communist government has to be explained in another way.

Writing on ideology and science, Graham provides a very good short summary of the principles of dialectical materialism relevant to science. He is also convincing when he argues that many good scientists took Marxism very seriously and used it in their work. His best examples are Lev Vygotsky's psychological theory of thought and language, Aleksandr Oparin's theory of the origin of life, Vladimir Fock's philosophy of quantum physics, and Boris Hessen's social approach to the history of science. It is true that Marxist ideology and philosophy were used as cultural resources and also as a strong weapon in scientists' conflicts. I suspect, however, that behind Graham's distinction between "authentic" Marxists and "dogmatists" who used the ideology for primarily political goals hides nothing more than a simple categorization of scientists as "good" and "bad." "Bad" scientist Lysenko, although no less sincere a Marxist than his opponents, suppressed them politically in 1948 and is blamed for dogmatic use of ideology. In a comparable situation in 1950, "good" scientists—comparative linguists—suppressed with the help of Stalin's heavy hand the school of Nikolai Marr, who with his supposedly anti-bourgeois "new doctrine" of the development of language and near monopoly on the field was the natural candidate for Lysenko of Soviet linguistics. The comparative linguists were as ready as Lysenko to use Marxism as a political weapon, but their triumph over Marr's followers did not become famous as dogmatic use of ideology. The lesson is that Soviet political methods of closing scientific controversies could lead to strange and sometimes unpredictable results.

Graham witnessed and reviews attempts at reforming Soviet science made during the Gorbachev era. The Academy proved to be very conservative, confirming its role as the state ministry, while rank-and-file scientists were vigorously demanding reforms, both in general politics and in science. The collapse of the Soviet political system did not lead to the collapse of the Academy, despite the harsh critique leveled at it. It changed its name, again becoming the Russian Academy of Sciences, but remained intact as a bureaucratic organization, although deprived of its former financial prosperity and public prestige. The reader may be interested in whether Russian science belongs only to history or whether some hope can be held for its future. Although the present crisis has produced a huge wave of pessimism, it is much less serious than at least two other Russian crises of this century, when there was much greater reason to worry about the fate of science. Historical experience can support only a few very general predictions: that the more centralized the future Russian political system is, the more it will tend to preserve the Academy as the leading scientific institution, and that a more decentralized and democratic Russia will probably give more preference to the universities. The state remains almost the only source of support for science. Alternative sources can emerge only gradually, along with the development of the civil society.

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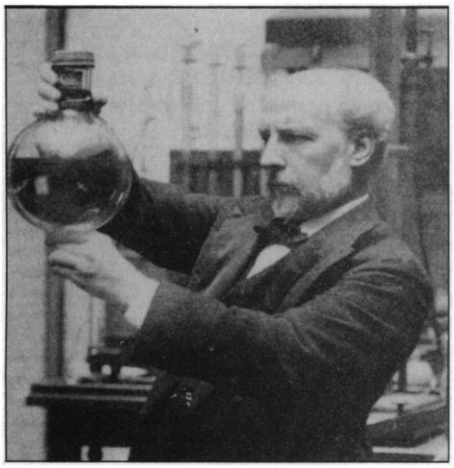
The Physics of Cold

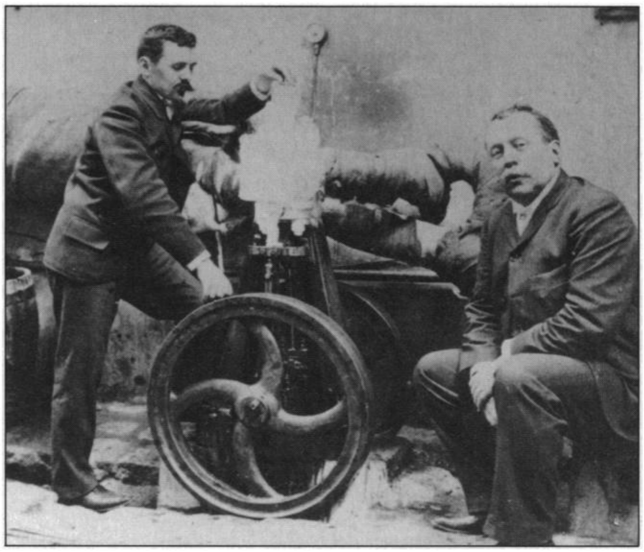
History and Origins of Cryogenics. RALPH G. SCURLOCK, Ed. Clarendon (Oxford University Press), New York, 1992. xxiv, 653 pp., illus. $165 or £95. Monographs on Cryogenics.

Superconductivity. Its Historical Roots and Development from Mercury to the Ceramic Oxides. PER FRIDTJOF DAHL. American Institute of Physics, New York, 1992. xiv, 406 pp., illus. $55.

Cold has been a rather unappealing state of affairs in our Western culture. Nevertheless, many people have been intrigued by it. From the time some poor folk brought ice from the mountains wrapped in dried grass so that the Roman emperors could enjoy their wine chilled in the summer to our days of high-temperature superconductivity, its wonders have been publicly displayed and its mysteries privately pursued. The history of the subject that the master of experimenters, Robert Boyle, found "the most difficult" to work at has been studied very little, and any such attempt is very welcome. So are these two books, though they also represent missed opportunities.



James Dewar and the vacuum flask he invented in 1892. "Sir James Dewar/Is a better man than you are/None of you asses/Can liquefy gases." [Quotation from D. Shoenberg's chapter in *History and Origins of Cryogenics*; picture courtesy AIP Emilio Segrè Visual Archives, W. F. Meggars Collection]



"Georges Claude (on left) and his first air liquefier," around 1902. With improvements, the French apparatus was able to achieve by 1906 a specific production of 0.52 liter per kilowatt-hour, exceeding those of Hampson in Great Britain and Linde in Germany. [From F. M. Dennery's chapter in *History and Origins of Cryogenics*]

Works in the history of the physical sciences should, by definition, be works of *history*. Simplified presentations of abstruse subjects or chronological narratives of published papers do not necessarily qualify. These of course may be very useful undertakings, but truly historical works have a different aim: to pose and trace out answers to questions about how things happened in an interpretative framework that also poses *whys*. This rather pedantic and perhaps self-indulgent observation is set forth to underline my ambivalence about these two books. What there is in the books is interesting—and in some parts the account of developments is quite thorough. But both books leave out so much significant material related to the story they purport to tell that they are seriously incomplete as chronicles, nor do they present any overall argument to support their selectivity.

The compilation edited by Scurlock is an attempt to present the development of cryogenics in universities and industry in various countries of Europe and Asia and in the United States during the past hundred years—an awesome undertaking indeed. The amount of information presented by the 20 contributors is staggering, but amid all this information it is impossible to discern the story line, and one wonders what argument the information supports, what narrative it helps to unfold. Dates, names, details of machines, experimental results are all there and—remarkably for any book—with no apparent mistakes. Most of the papers about the development of cryogenics in the various universities and countries, with the exception of the three about the United States, do not add anything new to what has already been written on their subjects. Most of the papers about particular companies resemble leaflets and technical reports circulated by the companies themselves. No archival material from the companies has been used in writing their "histories," there are no interviews with the key persons, and, most important, there is no presentation of the economic and social issues relevant to the establishment and running of such companies. The development of home refrigerators, for example, with its lasting effects on the everyday habits of millions of people, is thoroughly ignored.

In the preface Scurlock characterizes the volume as "a fairly comprehensive coverage of all the developments in cryogenics since 1877" apart from "a few gaps, notably the former USSR." I do not think it is unfair to say that this is like writing the history of electromagnetism or quantum mechanics without considering Clerk Maxwell or Schrödinger. The work in the former Soviet Union was of such importance in the development of low-temperature techniques, the discovery of new phenomena, and the formulation of theories that I do not think a proper assessment of the history of cryogenics can be made without discussion of it. Almost all the contributions of the Soviet scientists in low-temperature physics were made during the Second World War, and many people not caught in the whirlpool of the Lysenko case came to regard cryogenics as the paradigmatic case of Soviet science. Scientists in the Soviet Union were proud that they had become pioneers in a difficult area with no external help during the most perilous period of their recent history. In this light it is important to understand the team culture and the collaborative efforts, especially in Moscow,