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Humboldts Preußen. Wissenschaft und Technik im Aufbruch

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significance of these objects and situate them in relation to laboratory practice, and the chemical residues found in the excavation have yet to be analysed. The description of the artefacts is complemented by Anderson's chapter on Hope's professorship, which argues that he was in some respects constrained by Black's legacy, having followed his illustrious predecessor in prioritising teaching over research.

The volume arose from celebrations of the two-hundredth anniversary of Crawford's appointment in 1713; it really covers only the first century of Edinburgh chemistry teaching. A final chapter by Andrew J. Alexander discusses several nineteenth-century professors, but all too briefly. Even within these chronological limits, there are many avenues of investigation that remain unpursued. Little is said about the theory of heat, for example, and almost nothing on the practical dimensions—beyond pharmacy—of Scottish “philosophical chemistry.” The Edinburgh professors' links with agriculture, manufacturing, bleaching, and the other chemical arts are unexplored. The contributors are well qualified to analyse the wider context in which Scottish chemical pedagogy unfolded, but volumes conceived in the spirit of commemoration often lack a sharp historiographic focus, and the authors have mostly published their best work on the topic elsewhere. The book is attractively presented, with colour illustrations of the newly uncovered artefacts, but the coverage is uneven and less comprehensive than the subject deserves.

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Humboldts Preußen. Wissenschaft und Technik im Aufbruch. By URSULA KLEIN. Pp. 336, illus., index. Wissenschaftliche Buchgesellschaft: Darmstadt. 2015. €50. ISBN: 978-3-534-26721-7.

At the end of the eighteenth century and during the early stages of its industrialisation, Prussia witnessed the emergence of a special social group that embodied a thriving combination of civil servants, technicians, and scientists. They believed that the study of nature and technological innovation go hand in hand, and that further stimulation of this symbiosis through state regulation would eventually serve the common good. Ursula Klein, already known for her studies of chemical experts and hybrid savant-technicians, packs her former narratives together and weaves them into a detailed and well-researched portrait of this class.

The backbone of Klein's story is the biography of the young Alexander von Humboldt. She shows that Humboldt found ample opportunity at the Freiburger Bergakademie and in his career as a mining official to put his cameralist ideals into practice. He performed several inspections of mines and salt works, reported on many deficiencies, and came up with specific recommendations to improve the industry. He proposed wood-saving measures, experimented with new amalgamation methods, and founded a mining school. Nature, technology, and public service were intimately connected for Humboldt. It is refreshing that Klein refuses to frame Humboldt's early career into the teleological perspective of his *Weltreise* and *Kosmos*. As a result, we are able to see his mining career not as a mere opportunity to assemble and try out his scientific toolkit, but rather as the realisation of a set of ideals shared by so many of his generation. Indeed, take a contemporary like Franz Carl Achard, who built on Marggraf's discovery of sugar-containing beet roots and effectively turned it into a working sugar factory in response to an increasing Prussian population. In a similar fashion, after his discovery of uranium, the renowned chemist Klaproth almost immediately used it to produce a new pigment (“Urangelb”) which he, without hesitation, introduced at the Royal Prussian Porcelain Manufactory. Moreover, Klein discusses the ways in which the Prussian state tried to cultivate these initiatives. New Prussian departments (mining and smelting, for example) were founded and officials like Minister Friedrich Anton von Heintz were eager to draw young, capable men like Humboldt into state service.

However, the fact that much of Prussia could be characterised by a general sense of ambition and optimism does not mean that it accurately reflects the state of affairs. Especially in the light of Andre Wakefield's discussion of German cameralism, we should be careful not to mistake the grand narrative of prosperity for the recurrent mess that went behind it. And indeed, Klein also points to a spoilt culture among many civil servants in Berlin, in which hierarchy and ignorance, rather than actual ability played the upper hand. Likewise, the wish by many to establish a mining academy in Berlin was so frequently hindered that it did not become reality any sooner than 1860. Yet, it appears to have been people like Heinitz, and the generation of hybrid savant-technicians and cameralists like Humboldt and Achard, who, despite many difficulties, made actual serious attempts to practice what they preached. Humboldt took it as his social and moral responsibility to employ his knowledge of the chemistry of air to invent a miner's lamp and respirator to make the life of his servants a little more comfortable. It is hard to push this episode aside as hollow cameralist rhetoric.

This book highlights a significant number of valuable cases that will undoubtedly enrich the ongoing discussions concerning chemical expertise and sites of chemistry. But it does more than that. It first and foremost serves to illustrate the intriguing interconnection between state, science, and technology in late eighteenth-century Prussia, which, according to Klein, poses an "impossible split" (p. 16) to our contemporary minds. Living in a time in which the close association between these domains is no longer obvious, we can easily be haunted by false stereotypes of theory and praxis when we think about history. Indeed, this book helps us to rid ourselves of these stereotypes, and presents us with a much needed and historically grounded alternative.

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Pure Intelligence: The Life of William Hyde Wollaston. By MELVIN C. USSELMAN. Pp. 424, illus., index. University of Chicago Press: Chicago. 2015. \$35. ISBN: 978-0-2262-4573-7.

Wollaston, one of the great chemists of the early nineteenth century, is little known today, in part because a biography firmly based on letters and papers never got written until now. By repute, he was accurate, austere, cautious, and reserved; but someone who published papers on fairy rings and on why the eyes in portraits follow you around demands attention, and Usselman's wonderfully rounded, detailed but very readable study brings him to life. A most ingenious contriver of optical and chemical instruments, an analyst deemed infallible and nicknamed "the pope," a reluctant doctor who abandoned medicine for chemistry, he was certainly shy, but with unpretentious people who broke through his formal manner he relished sociability and was a firm friend. One of these was Smithson Tennant, with whom he set up a secret business in a laboratory behind his London house to prepare and sell malleable platinum. They boldly cornered the market for raw powdery platinum, smuggled out of South America, and Wollaston devised a carefully controlled process of purifying, heating, and hammering it. The physical labour on his part, with his assistant John Dowse whom he trained, was immense as they scaled-up the process; and it was several years before the product could be marketed—some for scientific equipment, more for the touch-holes of the best guns, and then for boilers used in making sulphuric acid—making Wollaston from about 1815 a wealthy man. The process, in the course of which he isolated palladium and rhodium, was kept secret from colleagues, who might be rivals, until Wollaston on his deathbed disclosed it to the Royal Society.

Wollaston simultaneously pursued investigations in crystallography. In analyses, often using minute quantities, he prepared crystalline derivatives and identified them from their forms, which he believed were unique, inventing the optical goniometer to measure crystal angles accurately. He had wooden models made of crystal forms; and also (in the footsteps of Robert Hooke) demonstrated how close-packed spheres, and then spheroids, could