

HANS CHRISTIAN ØRSTED AND THE ROMANTIC
LEGACY IN SCIENCE

BOSTON STUDIES IN THE PHILOSOPHY OF SCIENCE

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HANS CHRISTIAN
ØRSTED AND THE
ROMANTIC LEGACY
IN SCIENCE
IDEAS, DISCIPLINES, PRACTICES

Edited by

ROBERT M. BRAIN, ROBERT S. COHEN
AND OLE KNUDSEN

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FOREWORD

This volume owes its origin to the perception of a puzzling paradox.

Hans Christian Ørsted, the great Danish scientist and philosopher, was one of the founders of modern physics through his experimental discovery in 1820 of the interaction of electricity and magnetism—a key step and model for the further unification of the forces of nature. Followers such as Maxwell and Einstein were, and today searchers worldwide are, enchanted by the hope for a completion of that grand program.

In addition to Ørsted's discovery of electromagnetism, his work in science included other fields, chiefly high-pressure physics and acoustics. Moreover, he belonged to that fascinating group of seekers who were deeply engaged in the Romantic tradition of the Nature Philosophers, influenced by Immanuel Kant and by religious, literary, and aesthetic currents.

The scientific and philosophical speculations by Ørsted and his circle also quickly stimulated the imagination of other philosophers and scientists. Among the latter were prominently André-Marie Ampère and Michael Faraday, whose work launched the transformation of civilization often called the Second Industrial Revolution, based on the invention of motors, generators, and the pervasiveness of electricity in modern life.

But paradoxically, there has long existed, especially in the English-speaking world, what one may justly term an “Ørsted invisibility.” His experiments merit hurried mention in textbooks and class lectures; but few scientists or historians of science have been aware of the important intellectual influences by—and on—Ørsted, of his historical eminence and consequence of his work. Only a select group of scholars have taken up the particular character of thought of the early and mid-19th century that animated Ørsted and his circle, an epoch when researchers in physics, chemistry, biology, and geology enjoyed the pursuit of unity among the sciences as well as with philosophy, religion, the arts, literature, and music.

One cause of that “invisibility” was of course that Ørsted published in a variety of European languages, but mostly in Danish and untranslated, which was a barrier to scholarship in the English-speaking community. Therefore, at least two things had to be done. One was to assure that an English translation of a large part of Ørsted's writings would become available. The book was issued in 1998 by Princeton University Press, *Selected Scientific Works of Hans Christian Ørsted*, translated and edited by Karen Jøved, Andrew D. Jackson, and Ole Knudsen, with an introduction by Andrew D. Wilson. With its extensive and authoritative introduction, and the translation of 79 of Ørsted's articles and other documents,

the book was acclaimed by reviewers and other scholars, presenting to them at last a display of the full panoply of Ørsted's spectrum of interests and achievements. It was now far more clear than before that Ørsted's commitment to the principles of Romantic philosophy and aesthetics, acquired through his extensive travels and cosmopolitan connections throughout Europe, remained integral to his scientific research throughout his career. He thus functioned as an illuminating "probe" of European science in the Romantic age.

Now the next step could be taken: an international symposium on "H. C. Ørsted and the Romantic Legacy," held at Harvard University in May 2002. Some two dozen scholars from the USA and six other countries made presentations at the meeting that was cosponsored by the History of Science Department at Harvard University, the Program in Science, Technology, and Society at Massachusetts Institute of Technology, and the Royal Danish Consulate. The organizing committee consisted of Robert M. Brain, Alan M. Brandt, Erwin N. Hiebert, Ole Knudsen, John E. Murdoch, and myself (as chair). The symposium was generously supported financially by an anonymous foundation, as it also had helped in the genesis of the previously mentioned book of the selected scientific works of Ørsted; and both these efforts owed greatly to the key interventions of Ms. Yoyo Tesdorpf Jones. Needless to say, whatever merit this collection has is owing to its authors and its editors, Professors Robert M. Brain, Ole Knudsen, and Robert S. Cohen.

After the presentations at the international symposium, the authors undertook the task of revision and completion in light of the discussions at the conference, resulting in the book now before you. We are confident that the volume will serve several ends, especially at this time when the interplay between science and the cultural and social conditions of the times is attracting the attention of scholars as well as lay persons. The collection should deepen our understanding of the relation between the sciences and the philosophical, religious, and aesthetic currents at the time of Ørsted and his contemporaries. Second, it should illuminate the Europe-wide networks of collaboration and dispute. And it will shed new light on the experimental practice of science during that period.

Last not least, one may hope for the next, third step in that project of promoting "visibility": that this wide-reaching collection will encourage further scholarly work on an era that has too long been largely in the shadows of academe.

Gerald Holton
Harvard University

INTRODUCTION

As Goethe knew, there is a cosmopolitan bias in science which extends to the writing of its history. The great metropolitan centers of learning dominate the Story, a condition scarcely altered by the turn to local micro-histories. Around 1800, and still to a surprising degree around 2000, geography can be a great handicap in the scientific republic of letters. Still, some work from the scientific periphery proves so luminous, authoritative, and compelling that it gains a place in the metropolitan canon. Such was the case with several of Hans-Christian Ørsted's scientific works, most notably his discovery of the interaction of electricity and magnetism. This towering pillar of modern physics has earned a place in all histories of science, and set in motion the great researches into electrodynamics and electrotechnology that decisively transformed both physical science and modern life. Yet perhaps because of his origins on the European scientific periphery, the full measure of Ørsted's scientific achievement, which spanned a broad range of topics in the physical and chemical sciences, remains largely unwritten. Fortunately, this has begun to change, as several fine scholars are involved in probing research into Ørsted's career and the broader European scientific and philosophical world in which he lived. The present volume aims to further this project, with contributions from many of the leading specialists on Ørsted and the romantic era in the sciences, as well as essays from nonspecialists who have caught some of the fever of this area of research.

Ørsted was one of the most prolific and innovative thinkers of his era, the fertile cradling period of European modernity spanning the late Enlightenment and the political upheavals of 1848. Ørsted was, moreover, a European cosmopolitan, a multilingual traveler, and avid correspondent with colleagues across Europe in an age when science still centered largely on the life of the great metropolitan academies. In both his generational and pan-European affiliations Ørsted resembled his contemporary Alexander von Humboldt, who lived from 1769 to 1859. Both men were scientific polymaths and broad-gauge intellectuals, as comfortable in the salon as in the laboratory or academy, with interests ranging widely over literature, the arts, and politics. Not surprisingly, Ørsted and Humboldt befriended and even collaborated with many of the same people, including youthful collaborations with Johann Wilhelm Ritter and the German romantic philosophers of Jena, and with several illustrious French savants of the Paris Academy of

Science. As scientists, moreover, both men struggled to reconcile the post-Kantian philosophical orientation of the German-speaking world with the experimental and analytical acumen of the French. Yet Ørsted, who mastered the German language in his youth, was more drawn to purely philosophical questions than was Humboldt. Ørsted also remained a more devoted—and skilled—experimentalist than the German savant, whose mature concerns centered more on scientific exploration and methods of gathering, calculating, and representing data from the field. As a result, the tensions between German philosophy and French experiment became more pointed and less clearly resolved with Ørsted than with Humboldt. For this reason many historians have viewed Ørsted as Humboldt's equal or better as a scientific critic.

Both Ørsted's cosmopolitanism and his independent critical abilities make him an effective probe for the historian of science to discover unseen themes, connections, and faultlines in early 19th-century European science. We have tried to organize both this volume and the conference that engendered it with this feature of Ørsted's career in mind. We have sought, on the one hand, to account for Ørsted's formation in his native Denmark, where, apart from his travels, he lived his entire life and exerted great influence over thought, society, and institutions in what historians have called Denmark's "golden age." On the other hand, we have endeavored to show how from this "center on the periphery" in Copenhagen Ørsted gained an unusual overview of contemporary European science and by turns encountered frustrating obstacles and decisively shaped the scientific life of the larger metropolitan centers. The organization of the volume follows from these two poles.

We open the volume with several essays on Ørsted and the context of his life in golden age Denmark. Most accounts of Ørsted's scientific and intellectual career begin with his doctoral dissertation on Kant's philosophy of science, but Andrew D. Wilson's essay argues that Ørsted's road to the critical philosophy was laid in his early education in Lutheran catechism and theology. Well before he encountered Kant, and with the salons and academies of Berlin and Paris nowhere in sight, Ørsted received a rigorous schooling both at home and from a German wig maker named Christian Oldenburg and his Danish wife. Wilson shows how Oldenburg imparted a mastery of the German language to Ørsted and his brother Anders Sandøe, along with a thorough grounding in the rationalist Christian apologetics of the German philosopher Christian Wolff and like-minded Danes such as Peder Rosenstand-Goiske and Christian Bastholm. All of these thinkers sought to fend off the criticism and mocking jibes of free-thinkers and skeptics with a theology that reconciled reason and revelation. Wilson demonstrates how this theological movement, particularly Bastholm's turn to nature and a "theology of Kraft" (force) gave Ørsted a theological perspective which drew him quite naturally to Kant's dynamical theory and, later, to Schelling's *Naturphilosophie*. Breathing so deeply the winds of the *Aufklärung*, it is hardly any wonder that Ørsted, and other young Danes, devoured the German philosophical and literary works that appeared in the foment of the 1790s.

The essays of Arne Hessenbruch, Karen Jelved and Andrew D. Jackson, and Anja Skaar Jacobsen consider Ørsted's career against the background of the great

changes in Denmark over the course of his lifetime. Like many European countries, Denmark underwent a monumental transformation between 1777 and 1851, moving from an absolute monarchy and broadly manorial economic relations to a constitutional democracy with sweeping political and economic freedoms. Throughout this period, as Jacobsen shows, all of the outstanding European philosophical debates, like those over phrenology and *Naturphilosophie*, coursed through the academic and intellectual circles of Copenhagen. Hessenbruch situates Ørsted's career in the middle of the vast changes that swept Denmark in his lifetime. In particular, Hessenbruch shows how Hans Christian and his brother Anders Sandøe, arguably Denmark's greatest jurist, shaped many of the key legal, social, and institutional conditions of this great transformation. Historians of science have largely ignored the close relations between the Ørsted brothers, described by contemporaries as inseparable as Castor and Pollux. Hessenbruch remedies this lacuna, showing how the fraternal bonds were reflected in the brothers' shared vision of an enlightened and just society. While they supported the continuation of the absolute monarchy, the Ørsted brothers championed an ethos of personal self-cultivation (*Dannelse*) and liberal public institutions in both law and education that would mediate communication between the government and the general populace. While Anders Sandøe helped bring about vast political change through the advisory functions of the assemblies of the Estate, Hans Christian worked through the Copenhagen Polytechnic Institute, where he served as a professor and director. The efforts of the Ørsted brothers and their allies provided indispensable conditions for the new Danish institutions that were established after the peaceful abolition of absolutism in 1848—the basic framework that marks the great successes of modern Denmark to this day. Yet in 1848 this was little recognized, as a more radical new generation branded the Ørsteds and their cohort as reactionaries, refusing to acknowledge the liberalizing achievements of the generation of the late Enlightenment. Hessenbruch's essay shows that there was a good deal more to Ørsted's life than philosophical pursuits, and suggests many fruitful lines of further historical research for Danish social history, history of technology, and the history of education.

No account of the Ørsteds or their cohort can gain any traction without positioning their relation to Kant and to the post-Kantian debates that swept Central European philosophy in their youth. Indeed, the brunt of the slim literature on Ørsted in English concerns the precise nature of his relation to Kant and to post-Kantian philosophers like Fichte and Schelling. Paul Guyer's essay takes up some of the key issues of the later Kantian philosophy that informed these debates, namely Kant's attempt to salvage a role for teleology or purposive explanations in natural and moral philosophy. Kant argued for teleological reason on the basis of heuristic principles which hinged, like much of his later philosophy, on elaborations of the differences between determinative and reflective judgement, and related concepts of constitutive and regulative principles.

These questions suffused Ørsted's dissertation on Kant's *Metaphysical Foundations of Natural Science*, which, as Keld Nielsen and Hanne Andersen recount, became the basis of the young man's philosophy of nature and the basis of his early reputation as a physicist in Denmark. From about 1799 the Ørsted brothers

became the editors of *Philosophisk Repertorium*, the leading journal disseminating Kantian philosophy in Denmark. Hans-Christian's interest in the problems of the philosophy of nature of the critical philosophy was unique in his country in those years—most Danish Kantians concerned themselves with the moral and aesthetic which Kant had posed. Dan Charly Christensen traces the key philosophical steps through which Ørsted brought the different kantian strands together by fusing the concept of force with the theory of musical aesthetics. Chladni figures provided the empirical basis for Ørsted's reasoning, but Kantian categories enabled Ørsted to articulate what would become the constant centerpiece of his philosophical creed throughout his career. While the wider European public knew Ørsted best through his electromagnetic researches, Danes were more likely to associate him with his philosophical acoustics and musical aesthetics, leading Søren Kierkegaard to quip that Ørsted's face reminded him of “an acoustic figure well-bowed by Nature.”

Michael Friedman shows how Kant's extensive recourse to regulative categories of reason to justify empirical natural science still left much of the natural world unaccounted for—a deficit that post-Kantian philosophers like Schelling, and scientists like Ørsted and Johann Wilhelm Ritter, would strive to fill. Kant's most egregious shortfall was in chemistry, which the philosopher deemed unscientific. Ørsted, who had trained as an apothecary, sought to carve out a legitimate place for chemistry within the Kantian dynamical theory of matter. The demand became all the more urgent when the new science, electrochemistry, associated with the experiments of Galvani and Volta, became known in Europe during the late 1790s. Kant had not known this work, but for the new generation the new electrochemistry was viewed as nothing short of a revolution in the sciences. Friedman shows how Schelling made intelligent and plausible philosophical moves which aimed to resolve the deep tensions in Kant's philosophical system and to provide a metaphysical framework for the new kinds of empirical investigation opened up through electrochemistry and electromagnetism. Ørsted and Ritter drew inspiration and encouragement from Schelling's nature philosophy, even while they found his empirical grasp of the new sciences worthless and even risible.

Around 1800 there were other new natural phenomena to reckon with besides the galvanic experiments, and many found Schelling's philosophy a useful resource for these, too. Once chemistry was provided with a proper philosophical basis it could begin to bolster disciplines such as geology and mineralogy. The extension of Schellingian matter theory to the earth sciences was precisely the task of Henrik Steffens, Ørsted's friend and countryman (Steffens was from Norway, which was still under the Danish crown). Steffens journeyed to Germany even before Ørsted, using a Danish stipend intended for study at the renowned Freiberg Mining Academy to undertake a furtive apprenticeship with Schelling in Jena. Although Schelling was the primary focus of his study in Jena, Steffens partook of the rich scientific culture which Olaf Breidbach describes across the university. *Naturphilosophie*, as Ernst Hamm's essay shows, gave the young geologist what he needed to recast his science in new terms. Hamm demonstrates many of the steps by which Steffens transformed a vast body of empirical science, with natural phenomena spanning physics, chemistry, and natural history, into a “scientific

geology,” by which he meant a species of *Naturphilosophie*, a system of dynamic polarities which narrated both the history of nature and human history unfolding together out of a common inner law.

Ørsted appreciated Steffens’ science in his youth (later appraisals were mixed), but pursued his own naturphilosophical quest largely through experimental questions. Both his training as an apothecary and his increasing skill as an experimenter—increased significantly through a stint of collaboration with Ritter in Jena—drew Ørsted to the path of experimentation. But his penchant for experiment also derived from his views on the shortcomings of Schelling’s empirical statements. Everything in *Naturphilosophie* demanded that the system find its fulfillment in the particular object, either in the material work of art or in the human cognition of material nature. Yet, many of Schelling’s admirers among the romantic circles in Jena stood convinced that philosophy could not fulfill its ambitions alone, without the help of empirical art or science. Robert Brain’s essay contends that Ørsted and other natural philosophers affiliated with Jena romanticism set out to conceptualize experiment as the necessary counterpart to the philosophical system, in direct analogy with the mediating concept of the art work.

Ørsted maintained the assumption of a direct analogy between aesthetic intuition and the intuition of nature throughout his life—it was a central theme of his last great statement, *The Soul in Nature*. Yet just as his formulation of his approach to chemistry was supported by the appearance of galvanic phenomena, Ørsted’s convictions about the primacy of beauty and the sublime in nature were helped by the serendipitous appearance of the acoustic figures of Georg Lichtenberg and Ernst Florens Friedrich Chladni, which seemed a perfect fit for the nature-philosophical insistence on the role of aesthetic intuition in natural knowledge. Ørsted devoted much of his scientific labor to these phenomena, and as Lorraine Daston argues, they formed the basis for his mature notion of a “physics of the beautiful” that would demonstrate a new kind of experimental science based on the cultivated “inner sense” in the scientist. Ørsted, like other romantic nature philosophers, believed that this inner sense was a genuine sense like hearing or sight, with a bodily and mental component. It also straddled the divide between sense and reason, and crucially, Daston argues, conscious and unconscious awareness. Daston shows how Ørsted’s “physics of the beautiful” sought to cultivate this inner aesthetic sense, and in so doing, laid the groundwork for a rational theory of the unconscious that would culminate in Hermann Helmholtz’s musical acoustics of the latter half of the 19th century. Daston’s argument strikes a chord resonant with an observation made by Michael Friedman about the indispensable vanishing act of *Naturphilosophie* in nineteenth-century science. The crucial concepts and discoveries in both acoustics and electromagnetism that Ørsted bequeathed to the late 19th century grew directly out of *Naturphilosophie* as their indispensable touchstone, yet this philosophy disappeared almost entirely from the view of those who followed Ørsted (in the case of Helmholtz, it appeared only as an object of scorn and derision).

Ørsted’s natural affinity with German thought put him at odds with the very different French approach to natural science. Yet, in an age when ethnonational self-consciousness set the standard for all cultural and intellectual work it was

not simply enough for a Dane to position himself as an intellectual offshoot of the larger Lutheran nation to the south. Until 1814 Denmark remained an ally of Napoleonic France, and it was against this friendly political backdrop that Ørsted's first visit to Paris took place. Ørsted was, moreover, deeply impressed by the experimental skill of French scientists, by whose standard he judged experimental science throughout his life. As we mentioned above, Ørsted's dilemma in many respects paralleled that of Alexander von Humboldt, who was frustrated by French scientists' lack of a sensibility for nature's dynamic unity. Michael Dettelbach explores Humboldt's dilemmas, arguing that the Prussian savant's own nationalistic impulses were most evident in questions surrounding questions of national religion and the national state, and the place of natural science in both. This was a question that Ørsted also felt keenly, and tried to mediate in Denmark in a variety of contexts, including his dispute with the Lutheran populist theologian N. F. S. Grundvig, and through his labors on behalf of the Copenhagen Polytechnic Institute.

Ørsted's complicated relations with the Parisian pole of the scientific world stood in contrast to his reception in England. One might expect that the relatively robust development of literary and philosophical romanticism in England might have made it fertile soil for Ørsted's nature-philosophical approach. Trevor Levere's essay, for example, shows just how involved were British scientists and poets like Thomas Beddoes, Samuel Taylor Coleridge, and Humphry Davy with the German post-kantian and romantic thinkers from whom Ørsted drew inspiration. But Ørsted's writings did not receive a hearing in Britain until his discovery of electromagnetism, and even then it was through his correspondence and personal connections that his experimental skill gained esteem. Even Michael Faraday confessed to difficulties understanding Ørsted's electromagnetic experiments in his English-translated articles, although the great natural philosopher eventually mastered and incorporated them into his own researches. Ørsted's philosophical writings fared even worse, as Gordon McOuat's oral presentation shows. After years of experimental correspondence with the British electricians and natural philosophers, Ørsted imagined that his philosophical dialogue *The Soul in Nature* would receive a dear welcome when he sought to have a translation published in 1848. McOuat shows the utter distaste of British natural philosophers for a scientific work that began with beauty and the sublime, then built to discussions of morality, spirit, genius, and reason and religion. The book barely made it into print, and when it did it fell flat. After reading it Charles Darwin noted in his diaries that he found it "dreadful," a verdict that seemed to speak for all of Britain.

Taken together these essays show how Ørsted's career illuminates the differentiated map of European scientific cultures in the early 19th century, as well as the modalities through which scientific communication crossed or scuppered on national frontiers. But the fact that Ørsted hailed from the periphery should not be taken as a sign that he was a passive participant in these international relations of science. On the contrary, like his countryman Niels Bohr a century later, the Danish savant was a willful and sometimes wily mediator in European science, who tried to turn his peripheral position to his advantage in shaping the course of scientific discussions. Kenneth Caneva's essay details Ørsted's strategies with

a wealth of examples, showing how in his correspondence he often tweaked the work of others to serve the position he wished to defend. Reviewing Jakob Joseph Winterl's *Prolusiones*, for example, he turned Winterl's treatise into a species of dynamical *Naturphilosophie*, which he set up to refute Lavoisier's chemistry, contrary to all of Winterl's intentions. Ørsted, as an intrepid traveller, knew an unusually wide variety of scientists' works through firsthand personal contact, and he showed great skill in shaping the nuances of their presentation to suit his own agenda. Caneva shows how Ørsted managed to use his position to preside over the conventional terminology and usage surrounding different people's experiments, especially in the decisive translations from the still provincial German to the metropolitan French. Ørsted's renderings often amounted to a kind of diplomatic compromise, as he expunged what he deemed misuses by Germans of *Naturphilosophie* in order to make its fundamental philosophical virtues—what he called “its living presence”—more palatable in Paris.

Many of the essays in this volume emphasize elements of continuity in Ørsted's scientific and philosophical creed, while others call attention to important changes in attitude, view, and style over the course of his career. If Ørsted maintained a core commitment to some version of a Kantian or Schellingian philosophy of nature throughout his life, he certainly distanced himself from several features of this worldview with which he flirted in his youth. Roberto de Andrade Martins' essay shows the close allegiances between Ritter's researches on the magnetic effects on chemical reactions and the more extravagant features of Schelling's philosophy, especially the quest for polarities within natural phenomena of all sorts. In Ritter's zealous investigations the discovery of polarities soon revealed correspondences and symbols or analogies reminiscent of the emblematic worldviews of Renaissance hermeticism. Martins makes manifest Ørsted's fascination with his friend's sidereal quest, and highlights the numerous instances when cautious expressions of broad agreement with Ritter's emblematic polarities entered his own writings. Yet it is clear that Ørsted regarded Ritter's self-experimentation as excessive, and many of his conclusions hasty and unfounded, an assessment that sharpened in the years following Ritter's early death. Martins asks whether Ørsted's changing opinion resulted more from his judgement that Ritter was a poor experimenter or because of changing cultural circumstances. The answer might well be both—yet it remains to be determined how much of Ritter's work the mature Ørsted could still find agreement with. Ole Knudsen's examination of Ørsted's work on the compressibility of liquids and gases provides a rare glimpse into the experimental pursuit which dominated the mature scientist's increasingly rare research time between 1818 and 1845, and which remained the preeminent work in the field until that of P. W. Bridgman in the 20th century. This research showcased Ørsted's experimental talent and delight in inherent challenges of laboratory work in the absence of any considerations of *Naturphilosophie*. Nevertheless, as Knudsen shows, Ørsted's manner of posing the question put to the test the dispute between atomistic and dynamical conceptions of matter—the core issue of physics that had concerned him since his dissertation—which he believed his experiments answered affirmatively in favor of the latter.

If Ørsted maintained his adherence to the core of his Kantian philosophy of physics, he seems to have held to a similar belief in the spiritual and religious aspirations of *Naturphilosophie*. Throughout his writings Ørsted observed the many goods that natural science brought both individuals and societies, from social and economic goods to the personal rewards that rigorous intellectual training conferred. But before all these, or rather, subordinate to these, was its theological function, its ability to serve as a “way from nature to God.” If the interest in natural theology was bred in the bone, as we have seen from Wilson’s essay, it fully entered the flesh through the “blessed philosophy of Schelling” and the kindred *Naturphilosophen* whom Ørsted encountered early in his career and never completely abandoned. Many of Ørsted’s scientific papers, especially those that began as lectures, combine a form of rigorous and modern experimental reportage like that to be found in the *Comptes Rendues* of the Paris Academy of Sciences with a series of philosophical reasonings that lead one beyond the experiment at hand to a sort of communion with the Godhead. What made Ørsted rare, if not unique, among scientists with a taste for *Naturphilosophie* was his stern insistence not only on experimental rigor but on sobriety and rationality in philosophical matters. Nobody would dispute that Schelling’s philosophy was rational, indeed rationalist, of course, but the frequent excesses in the writings of both the philosopher and his followers could be easily dismissed as “aesthetic blatherings,” to invoke the words of Emil Du Bois-Reymond. Not so with Ørsted, in whose work *Naturphilosophie* sits easily with the kind of *Naturwissenschaft* characteristic of European science after his death in 1851. This presumed virtue might have been a vice for Ørsted’s place in the history of science: too *naturwissenschaftlich* for the devotees of Schelling, too *naturphilosophisch* for the practices of the late 19th and 20th centuries, Ørsted nearly vanished in the faultline between them. Frederick Gregory’s essay explores Ørsted’s uniqueness in this regard, pointing out that Ørsted worked in a world where very terms for a scientific researcher in German—*Naturhistoriker*, *Naturforscher*, *Naturkenner*, *Naturwissenschaftler*—were in transition. Ørsted’s interests in experiment, dynamical concepts, and philosophical systematics put him way out ahead of the fading dominance of natural history around 1800. But when a settlement for these fluctuating categories emerged after 1850 it left Ørsted’s natural philosophy in a strange position, still recognizable in its experimental rigor, but utterly passé in its insistence on philosophical systematics and the spiritual aims of science. As religion, moreover, it was viewed as bland and attenuated, especially compared (in the Danish case) with the fiery popular pietism of Grunvig or the acrid passion of Kierkegaard’s theological polemics. Still, David Knight’s essay reminds us that more British scientists cared about the spiritual around 1850 than we might think (the coupling of “soul and nature” comes from a verse by John Herschel, for example)—they just became increasingly uneasy talking about it in public. Natural theology in Britain was usually more thoroughgoing than Ørsted’s offerings in *The Soul in Nature*, and it did not obviously share the British versions’ sense of high church holding on for dear life against fire and brimstone, on the one hand, and a growing atheistic radicalism, on the other. Steering clear of those disputes, Knight observes, what scientists like John Tyndall and James Glaisher did retain from Ørsted’s brand of scientific religiosity was the

vocabulary of the scientific sublime. “Reverence and awe, reason and progress,” Knight writes,” are key words: like a mighty army moves the Church Scientific, but solitariness would be the characteristic of the spiritual experiences of its soldiers.”

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