Philosophical Intelligence: Letters, Print, and Experiment during Napoleon's Continental Blockade

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Abstract: This essay investigates scientific exchanges between Britain and France from 1806 to 1814, at the height of the Napoleonic Wars. It argues for a picture of scientific communication that sees letters and printed texts not as separate media worlds, but as interconnected bearers of time-critical information within a single system of intelligence gathering and experimental practice. During this period, Napoleon Bonaparte's Continental System blockade severed most links between Britain and continental Europe, yet scientific communications continued—particularly on electrochemistry, a subject of fierce rivalry between Britain and France. The essay traces these exchanges using the archive of a key go-between, the English man of science Sir Charles Blagden. The first two sections look at Blagden's letter-writing operation, reconstructing how he harnessed connections with neutral American diplomats, merchants, and the State to get scientific intelligence between London and Paris. The third section, following Blagden's words from Britain to France to America, looks at how information in letters cross-fertilized with information in print. The final section considers how letters and print were used together to solve the difficult practical problem of replicating experiments across the blockade.

> ***During this period, so little intercourse was there between France and England, that months often elapsed between the publication of a scientific discovery in one country and its being known in the other. And, perhaps, owing to this state connected with war, less delicacy was observed by men of science in the two countries, in engaging in researches which they had not themselves originated, thereby producing an active competition, which on the whole probably was for the advantage of science.***
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> **—John Davy,** ***The Collected Works of Sir Humphry Davy***

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Ten people who speak make more noise than ten thousand that are silent.
—Napoleon

London, 20 November, the year 1806. After a long vacation, the Royal Society has gathered at Somerset House in the Strand to inaugurate another winter season in the British scientific world. The reading of the paper proceeds as it always does; today's item is the Bakerian Lecture by the chemist Humphry Davy on the "chemical agencies of electricity," setting out connections between the power of galvanic batteries and the forces that bind matter together. But the Society's measured rhythm belies the tumultuous state of the world outside. News of events on the European continent, arriving in letters and foreign newspapers, has thrown London into a state of excitement and confusion. Napoleon Bonaparte is in Prussia at the head of the Grande Armée, in the midst of another dramatic reconfiguration of the political geography of Europe. London is filled with "reports of victories and disasters" (the *Times* newspaper declared that morning), "so numerous, so nicely balanced against each other, but at the same time so unauthenticated, that we should only trifle with the laudable anxiety of the public by repeating them." A few weeks before, Napoleon humiliated Prussia with decisive victories at Jena and Auerstädt, triumphantly entering Berlin less than a month after the Prussian king's rather unwise declaration of war. Now, with Prussia still fighting on in the east and backed up by Russian troops, London waits to hear which way the scales will tilt. "Possibly the most interesting period which has ever occurred in the history of Europe," declared the *Times*, straining to make sense out of conflicting intelligence clouded by the fog of war.[1]

Scientific exchanges between Britain and the Continent had suffered ever since the beginning of the wars with France in 1793, but these dramatic events ushered in a new phase of difficulty. The day after the Royal Society gathered to hear Davy's lecture, Napoleon issued his "Berlin Decrees" from the humbled Prussian capital. They began with an explicit prohibition on communications with Britain: "The British Isles are declared in a state of blockade. . . . All commerce and correspondence with the British Isles is prohibited. In consequence, letters or packets, addressed either to England or to an Englishman, or written in the English language, will not pass through the post-office, and will be seized." The Berlin Decrees launched Napoleon's grand strategy of commercial warfare, a vast blockade aimed at destroying Britain's economy by cutting off its trade. At its most ambitious, the Continental System (as it would come to be called) sought to enforce the total closure of mainland Europe to British shipping and commerce from the Mediterranean to the Baltic.[2] For the remainder

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[1] Humphry Davy, "On Some Chemical Agencies of Electricity," *Philosophical Transactions*, 1807, 97:1–56; and *Times* (London), 20 Nov. 1806, p. 2, 18 Nov. 1806, p. 2. The first epigraph is from John Davy, ed., *The Collected Works of Sir Humphry Davy*, 9 vols., Vol. 5 (London: Smith, Elder, 1840), p. 3; the second, attributed to Napoleon, comes from *A manuscript found in the portfolio of Las Casas, containing maxims and observations of Napoleon: Collected during the last two years of his residence at St. Helena* (London: Alexander Black, 1820), p. 12.

[2] Pierre Clément, *Histoire du système protecteur en France* (Paris: Guillaumin, 1854), p. 308 (my translation). On the Continental System see Geoffrey Ellis, *The Napoleonic Empire*, 2nd ed. (New York: Palgrave Macmillan, 2003), pp. 109–119; and Kevin O'Rourke, "The Worldwide Economic Impact of the French Revolutionary and Napoleonic Wars, 1793–1815," *Journal of Global History*, 2006, *1*:123–149. The classic study is Eli Heckscher, *The Continental System: An Economic Interpretation* (Oxford: Clarendon, 1922). All these authors have emphasized that the Continental System was never totally effective, with smuggling, corrupt officials, and the lukewarm attitude of many of Napoleon's allies and client states ensuring that some of the banned trade unofficially continued, even before Napoleon himself weakened the system in 1810 by granting licenses for trade with Britain.

of the Napoleonic Wars, it stood between men of science in London and their counterparts in Paris, an imposing barrier dividing the two centers of the scientific world.

But the blockade did not kill scientific communications between Britain and France. On the contrary: this short period witnessed one of the most dynamic episodes of concentrated Anglo–French intellectual engagement (and rivalry) in the whole history of science, in which a new field, electrochemistry, was forged out of active competition between Humphry Davy in London and the French chemists Joseph Louis Gay-Lussac and Louis Jacques Thenard in Paris. The two sides vied with each other in a race for experimental discoveries (eight new chemical elements were isolated between 1807 and 1811), as well as in a larger struggle over the future direction of chemical theory. It was a scientific battle, with nationalist overtones—but it depended crucially on exchanges of information between the two sides.[3] In this article I recover the human agency that went into sustaining these exchanges. I seek to understand how the dynamics of scientific communications under the blockade shaped the day-to-day practice of experimental investigation on both sides of this period's great geopolitical divide.

Behind my story lie broader questions. What is scientific communication, how can we track it across different media, and what practical work does it perform? I approach these problems using a term and concept drawn from the period I study: "philosophical intelligence"—that is, fresh, useful, news-like information about the latest developments in science.[4] Philosophical intelligence was not equivalent to scientific knowledge; it was something more fragmentary, unrefined, and provisional: time-critical pieces of writing (or speech) that made ongoing debate over what counted as verified knowledge possible.[5] For those pursuing electrochemistry in London and Paris, this intelligence might consist of key details needed to replicate a rival's latest experiment, or perhaps a hint pointing toward the next major discovery. Information of this kind has played crucial roles in science from the seventeenth century (or before) to the present. But Napoleon's Continental Blockade is a particularly illuminating period in which to study it, because the blockade brought about an acute and self-conscious concern with problems of information transmission that has left its mark in historical sources. Under the blockade individual acts of communication carried greater weight, because opportunities for getting information through were rare. The blockade stretched the abilities even of expert communicators to the breaking point, and by closely watching their struggles we can learn not just who was communicating but also how and why—and what particular pieces of intelligence were being used to do.[6]

In this article, I concentrate especially on the interface between manuscript letters and print, showing how they overlapped and functioned in combination with one another as carriers of information. In making this argument I seek to join two separate strands in the historiography of science. The first, focusing on letters, has sought to reconstruct the "corre-

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[3] Gay-Lussac's biographer remarked on "how eagerly each side looked to the other for every scrap of information": Maurice Crosland, *Gay-Lussac: Scientist and Bourgeois* (Cambridge: Cambridge Univ. Press, 1978), p. 78.

[4] Other terms also in use by historical actors writing in English around 1800 include "scientific intelligence," "scientific news," "philosophical news," and "scientific information."

[5] The style of analysis I employ here is envisaged as distinct from, but complementary to, studies of the "circulation" of scientific knowledge, which tend to encompass communicative processes operating over longer timescales than the step-by-step reconstruction of the movement of pieces of intelligence that I am concerned with here. See, e.g., the essays in Mary Terrall and Kapil Raj, eds., "Circulation and Locality in Early Modern Science," *British Journal for the History of Science*, 2010, *4*(4); and in Bernard Lightman, Gordon McOuat, and Larry Stewart, eds., *The Circulation of Knowledge between Britain, India, and China: The Early-Modern World to the Twentieth Century* (Leiden: Brill, 2013).

[6] For a broad argument for taking the forms and practices of communication seriously in the history of science see James Secord, "Knowledge in Transit," *Isis*, 2004, 95:654–672.

spondence networks" of particular individuals, from Tycho Brahe in the sixteenth century to Charles Darwin in the nineteenth.[7] The second tradition is the study of print and publishing. Until recently, this meant primarily scholarship about books, but it is now being broadened by investigations of periodical media, like scientific journals, general magazines, and newspapers.[8] Both historiographies have taught us a great deal about how to problematize and historicize practices of scientific communication, but as yet they have had rather little to say to one another. This is strange, because in their day-to-day work scientific practitioners routinely mixed and matched both letters and print when gathering and making use of intelligence. During the Continental System, they gleaned crucial clues about experiments developed on the opposing side from letters— but also from newspapers, journals, and other print sources. I contend that making sense of scientific communication in the Napoleonic world—and therefore, perhaps, more generally—requires the study of print and manuscript together, as different kinds of intelligence-carrying media that nonetheless constantly interacted with and cross-fertilized one another.[9] Information could flow across the porous boundary between manuscript and print with relative ease, and pieces of intelligence that a study of correspondence networks alone might conclude were confined to private letters could in fact turn up in some quite strange and distant places, as we will see.

Nonetheless, my story begins with an archive: the papers of London's most important

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[7] Among many examples see L. W. B. Brockliss, *Calvet's Web: Enlightenment and the Republic of Letters in Eighteenth-Century France* (Oxford: Oxford Univ. Press, 2002); Peter Miller, *Peiresc's Europe: Learning and Virtue in the Seventeenth Century* (New Haven, Conn.: Yale Univ. Press, 2000); E. C. Spary, "Acting at a Distance: André Thouin and the Function of Botanical Networks," in *Utopia's Garden: French Natural History from Old Regime to Revolution* (Chicago: Univ. Chicago Press, 2000), Ch. 2; and David Lux and Harold Cook, "Closed Circles or Open Networks? Communicating at a Distance during the Scientific Revolution," *History of Science*, 1998, 36:179–210. For Tycho Brahe see Adam Mosley, *Bearing the Heavens: Tycho Brahe and the Astronomical Community of the Late Sixteenth Century* (Cambridge: Cambridge Univ. Press, 2007). On Darwin's correspondence see Janet Browne, *Charles Darwin: The Power of Place* (Princeton, N.J.: Princeton Univ. Press, 2002), esp. pp. 10–14; and the Darwin Correspondence Project, http://www.darwinproject.ac.uk/. Recent collaborative endeavors have sought to go beyond a focus on key individual letter writers to reconstruct networks on a larger scale: see, e.g., the Electronic Enlightenment project (http://www.e-enlightenment.com/), the University of Oxford's Cultures of Knowledge project (http://www.culturesofknowledge.org/), and Stanford's Mapping the Republic of Letters project (http://republicofletters.stanford.edu/).

[8] Two now-canonical works on science and print focus on books: James Secord, *Victorian Sensation: The Extraordinary Publication, Reception, and Secret Authorship of* Vestiges of the Natural History of Creation (Chicago: Univ. Chicago Press, 2000); and Adrian Johns, *The Nature of the Book: Print and Knowledge in the Making* (Chicago: Univ. Chicago Press, 1998). For perspectives focusing on periodicals, including journals, see G. N. Cantor *et al.*, *Science in the Nineteenth-Century Periodical: Reading the Magazine of Nature* (Cambridge: Cambridge Univ. Press, 2004); Cantor and Sally Shuttleworth, eds., *Science Serialized: Representations of the Sciences in Nineteenth-Century Periodicals* (Cambridge, Mass.: MIT Press, 2004); Thomas Broman, "Periodical Literature," in *Books and the Sciences in History*, ed. Marina Frasca-Spada and Nick Jardine (Cambridge: Cambridge Univ. Press, 2000), pp. 225–238; Aileen Fyfe, *Steam-Powered Knowledge: William Chambers and the Business of Publishing, 1820–1860* (Chicago: Univ. Chicago Press, 2012); Melinda Baldwin, "The Shifting Ground of *Nature*: Establishing an Organ of Scientific Communication in Britain, 1869–1900," *Hist. Sci.*, 2012, *50*:125–154; Alex Csiszar, "Seriality and the Search for Order: Scientific Print and Its Problems during the Late Nineteenth Century," *ibid.*, 2010, *48*:399–434; Iain P. Watts, "'We Want No Authors': William Nicholson and the Contested Role of the Scientific Journal in Britain, 1797–1813," *Brit. J. Hist. Sci.*, 2014, *47*:397–419; and Jonathan Topham, "Anthologizing the Book of Nature: The Circulation of Knowledge and the Origins of the Scientific Journal in Late Georgian Britain," in *Circulation of Knowledge between Britain, India, and China*, ed. Lightman *et al.* (cit. n. 5), pp. 119–152.

[9] Other historians of the book are already producing illuminating studies along similar lines; see, e.g., Andrew Pettegree, *The Invention of News: How the World Came to Know about Itself* (New Haven, Conn.: Yale Univ. Press, 2014), which reveals how the early modern printed newspaper was shaped by its interconnections with other carriers of news like manuscript news-sheets and merchants' private letters. See also Robert Darnton, *Poetry and the Police: Communication Networks in Eighteenth-Century Paris* (Cambridge, Mass.: Harvard Univ. Press, 2010); and Darnton, "An Early Information Society: News and the Media in Eighteenth-Century Paris," *American Historical Review*, 2000, *105*:1–35.

mediator between British and French science at this time, Sir Charles Blagden. Blagden was above all a letter writer, and the first half of this essay uses a close study of his letters, and his remarkable diary, to reconstruct his correspondence system during the blockade. I show who he was in touch with in France, how he managed to get letters to and fro, and what the rhythm of the exchanges was like. A look at the actual means by which letters were transmitted back and forth reveals that, during the blockade, philosophical intelligence usually hitched a ride with other information, from the diplomatic exchanges of neutral powers to secretive banking correspondence. In the second half of the article I add print media to the picture by looking at specific instances of chemical intelligence traveling between Britain and France in the aftermath of a major discovery, Humphry Davy's isolation of the alkali metals in 1807. I examine the ways letters and print were used together as information sources in London and Paris and even America—including, as my final section shows, in addressing the practical problems of replicating difficult experiments.

Although some features of scientific exchanges during the Napoleonic Wars are unusual or unique, focusing on this moment nonetheless provides a snapshot of long-term trends at work. Viewed in the long perspective, scientific communication stood at a crossroads in the years around 1800, balanced between the premodern world of the Republic of Letters and the processes of specialization, standardization, institutionalization, and professionalization so characteristic of nineteenth-century science.[10] Science in the Napoleonic world was carried on within a fluid and hybridized matrix of different communication techniques and media, in which the old and new coexisted and overlapped.[11] The ancient communication technology of the manuscript letter took on new roles amidst a changing media landscape in which letters could easily pass into print in new scientific journals, general magazines, or daily newspapers—all media that built on seventeenth- and eighteenth-century antecedents but whose proper use in scientific communication remained contested and unclear.[12] Later in the nineteenth century, divisions between communication formats hardened, crystallizing once-fluid boundaries between print and manuscript, formal and informal exchanges, published articles and private letters, and expert and general audiences. But any appearance of stability came gradually, came late, and proved temporary. At the beginning of the twenty-first century, when we face another uncertain future in scientific communications, the developing, makeshift, and hybrid world of scientific media around 1800 is at last approachable on more equal terms.

THE GREAT COMMUNICATOR: CHARLES BLAGDEN'S SCIENTIFIC INTELLIGENCE OPERATION

"I cannot thank you enough, my dear friend," wrote the French chemist Claude Louis Berthollet in August 1808, "for the care that you take to keep us informed of your scientific news. But for you, it would be as if we were living in another world." Berthollet was

[10] On the transitional nature of this period for the history of science generally see Andrew Cunningham and Perry Williams, "De-centering the 'Big Picture': The Origins of Modern Science and the Modern Origins of Science," *Brit. J. Hist. Sci.*, 1993, 26:407–432.

[11] I concentrate on letters and periodical print. Books obviously formed another important medium of scientific communication between Britain and France, but since these were not generally used as bearers of time-critical intelligence I do not discuss them here. On the cross-Channel trade in scientific books during this period see Jonathan Topham, "Science, Print, and Crossing Borders: Importing French Science Books into Britain, 1789–1815," in *Geographies of Nineteenth-Century Science*, ed. David N. Livingstone and Charles Withers (Chicago: Univ. Chicago Press, 2011), pp. 311–344.

[12] On the contested status of the new journals see Watts, "'We Want No Authors'" (cit. n. 8).

exaggerating, but only slightly: the object of his thanks was Sir Charles Blagden, undoubtedly the most industrious go-between linking the parallel scientific worlds of London and Paris during the Napoleonic Wars.[13] When the Continental System began in November 1806, Blagden was fifty-eight years old and, as a longtime friend and supporter of the President of the Royal Society, Sir Joseph Banks, firmly ensconced amongst the elder statesmen of the British scientific community. Originally trained as a physician, Blagden had undertaken original work in chemistry in his younger days but had since carved out a special role for himself as a broker of scientific news.[14] Surveying the pattern of his daily activities, recorded in meticulous detail in the diary he assiduously kept for some forty years, one gets the sense of a man propelled by an almost obsessive drive to keep abreast—and if possible ahead— of the latest intelligence in both the scientific and the political spheres.[15] Bustling and clubbable, conversational and cultivated, devoted to science but no professional, Blagden was in many ways late Georgian England's quintessential leisured scientific man-about-town. He filled his days by reading the newspapers, writing letters, visiting aristocratic salons like Holland House (politically he was a Whig), calling on friends to discuss the latest news of the wars, and attending the Royal Society's meetings and sitting on its Council. Most of all, he relished his almost daily visits to Joseph Banks's library in Soho Square—the informal epicenter of the British scientific world—where he never lost an opportunity to exchange the latest news and gossip with the men of science who congregated there and for whom Banks kept an open house.[16]

In Banks's library Blagden would read out extracts of letters received from France to a few select friends in the London scientific community, beginning the process of circulating the intelligence they contained in Britain. His friends in turn relied on him to forward news of their work (and occasionally printed material) to France.[17] Bladgen did plenty of intelligence

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[13] Claude Louis Berthollet to Charles Blagden, 31 Aug. 1808, Charles Blagden Papers, Royal Society of London (hereafter **RS CB**), CB/1/1/227. On go-betweens in science see the essays in Simon Schaffer, Lissa Roberts, Kapil Raj, and James Delbourgo, eds., *The Brokered World: Go-Betweens and Global Intelligence, 1770–1820* (Sagamore Beach, Mass.: Science History Publications, 2009). The official Foreign Secretary of the Royal Society at this time, Thomas Young, carried on very little communication with the Continent during the war years (the official record of outgoing foreign letters in Royal Society MS/581 contains only notices sent to foreign Fellows on their election).

[14] As early as 1786 Blagden boasted that "it is scarcely possible that any discoveries can be made in England without coming to my knowledge by some channel or another": quoted in Christa Jungnickel and Russell McCormmach, *Cavendish: The Experimental Life* (Lewisburg, Pa.: Bucknell Univ. Press, 1999), p. 294. Blagden has received little scholarly attention, perhaps because of the rather limited extent of his published scientific contributions. He trained as a physician at Edinburgh (where he attended Joseph Black's chemical lectures) and spent 1776–1780 as an army doctor in America during the Revolutionary War, but he had largely ceased to practice medicine by 1806. During the 1780s he was a close colleague and assistant of Henry Cavendish; for a good survey of this part of his life see *ibid.*, pp. 291–298. See also Frederick H. Getman, "Sir Charles Blagden, F.R.S.," *Osiris*, 1937, 3:69–87; and David Philip Miller, "Blagden, Sir Charles (bap. 1748, d. 1820)," in *Oxford Dictionary of National Biography* (Oxford: Oxford Univ. Press, 2004). It was as a strong supporter of Banks during the Royal Society "dissentions" in 1784 that Blagden was elected as one of the Society's secretaries, and although the friendship clearly had its ups and downs (grumbles about Banks are a recurring leitmotif in Blagden's diary), he remained a key Banks ally, acting as a proxy for him in the physical and mathematical sciences. His main scientific output, published entirely in the *Philosophical Transactions* during the 1770s and 1780s, was in studies of heat: he investigated the freezing of mercury, the relationship between salt concentration and the freezing point of water, and the ability of the human body to withstand high temperatures.

[15] My study is built on a general survey of Blagden's manuscript diary during the wars and especially for the period of the blockade (RS CB/3/5–6; hereafter **Blagden Diary**).

[16] In the words of one contemporary, Banks's library was the place where "new discoveries of every kind were communicated and discussed" and "plans suggested and arranged for the general diffusion of scientific information": "Memoir of Sir Joseph Banks," *Investigator*, 1821, 3:374.

[17] Blagden's diary records many instances of letters being read out in Banks's library (e.g., Blagden Diary, 29 Jan. 1805). Blagden was responsible for forwarding Davy's *Philosophical Transactions* papers to France (Blagden to Berthollet, 10 Mar. 1810, RS

gathering on his own account as well: discussions he had with Humphry Davy and other London scientific figures were often carefully noted down in his diary (the tool he used to record and order all kinds of information) so that his interlocutor's opinions could be related in his next dispatches for Paris. Increasingly worried that his communications would miscarry, Blagden kept draft copies of each of the letters he wrote to French correspondents during the blockade years, and on them he recorded details of how each letter was sent.[18] With some detective work, these cryptic and often almost illegible notes (together with many clues in the letters themselves and in Blagden's diary) make it possible to reconstruct how scientific information actually traveled between the capitals of the two warring nations.[19]

Blagden's opportunities for sending letters were limited, and he had to choose his recipients carefully. He had four regular correspondents. The most eminent was Claude Louis Berthollet, an old friend from Blagden's visits to France before the Revolution.[20] The doyen of French chemistry during the Napoleonic period, Berthollet provided a vital link to the Parisian chemical community and, to some degree, to the whole French scientific world.[21] Two other correspondents were members of the Delessert family, a scientifically inclined Parisian banking dynasty: the naturalist, banker, and sugar manufacturer Benjamin Delessert and his widowed sister, Madame Gautier. Blagden's fourth correspondent was Richard Chenevix, an Anglo-Irish chemist of Huguenot background. Despite being "an Englishman" (as he termed himself), with Berthollet's support and protection Chenevix was permitted to live freely in Paris during 1808–1809, after which he returned to England.[22] These four formed a tight group of trusted informants on whom Blagden relied for reports of goings-on

CB/1/1/234) and was also involved in sending full *Philosophical Transactions* volumes to the French Institut National during the blockade: Blagden to Première Classe de l'Institut, 9 Apr. 1807, MS extract in *Pochette* for 27 Apr. 1807, Archives of the Académie des Sciences, Paris.

[18] Blagden relied on his drafts as a personal record of exactly what information he had previously given correspondents. Very few of the fair-copy letters actually sent to French correspondents survive, but the few that do confirm a close correspondence between draft text and fair copy.

[19] My analysis is based on a general survey of the more than one hundred letters Blagden sent to or received from France in the period 1806 to 1812, preserved in the Royal Society archives. It is fortunate that Blagden's Continental correspondence survives remarkably complete from late 1807 to 1812, but, sadly, much of the foreign correspondence outside this period is missing. Although Blagden's papers have in general been well preserved, no letters from Blagden's French correspondents survive at the Royal Society for the period from the beginning of the wars in 1793 to late 1807 (with the exception of three received in 1806) or in the other main collection of Blagden's papers at Yale's Beinecke Library, yet it is clear from Blagden's diary that he was exchanging letters with friends in France during this period. From late 1807 to 1812, however, the Royal Society archive does appear to be complete for Blagden's four main French contacts. (Since both Blagden and his correspondents assiduously relayed the dates of other letters sent and received, it is possible to track exchanges quite closely to exclude much reasonable possibility of missing letters or drafts over a given series of dates.) There are no extant letters from mid 1812 until after the fall of Napoleon in 1814, although Blagden's diary again shows that he remained occasionally in touch with France.

[20] On Blagden's earlier connections with France see Danielle M. E. Fauque, "An Englishman Abroad: Charles Blagden's Visit to Paris in 1783," *Notes and Records of the Royal Society*, 2008, 62:373–390. Blagden also spent most of the Peace of Amiens (1802–1803) in Paris, sending bulletins of news back to Joseph Banks in London.

[21] Berthollet and Blagden were exact contemporaries, born in the same year; their friendship, formed when both were in their thirties, remained warm for the rest of their lives, and Blagden was a frequent visitor to Berthollet's country house at Arcueil after the wars. On Berthollet see Michelle Sadoun-Goupil, *Le chimiste Claude-Louis Berthollet (1748–1822): Sa vie, son oeuvre* (Paris: Vrin, 1977); and Sadoun-Goupil, "La correspondance Berthollet–Blagden," in *Actes du XIIe Congrès international d'Histoire des Sciences*, Vol. 6 (Paris: Blanchard, 1971), pp. 91–97.

[22] Chenevix had been on the Continent when war broke out in 1803; he later spent time in Madrid before his return to Paris late in 1807. See Richard Chenevix to Blagden, 9 Nov. 1807, RS CB/1/3/41. Berthollet is mentioned as his supporter in Chenevix to Blagden, 7 Sept. 1808, RS CB/1/3/56.

in the French scientific world. In return, he used them as privileged conduits for his own news from London.[23]

Among the four, Berthollet was a particularly useful connection. As one of France's foremost chemists, he was an authoritative source for current discussions and the latest consensus within the French chemical community, as well as the finer details of Gay-Lussac and Thenard's experimental work. He also enjoyed political influence, both through formal posts within the Napoleonic State and, even more, thanks to his personal closeness to the Emperor—Napoleon was said to refer to him as "my chemist."[24] When Blagden was accused of being an English spy after his trip to France during the Peace of Amiens (an inconvenient accusation for a broker in *philosophical* intelligence!), Berthollet was apparently able to persuade Napoleon that Blagden's conduct was, as he put it, "not at all suspect."[25]

Getting letters between Britain and France under the Continental System required special measures and privileges of a kind unavailable to most men and women. Since Blagden and other London men of science controlled no routes of their own between London and Paris, sending letters became a problem of creating and harnessing links with individuals who *did* have ways to get correspondence through the cracks in the blockade.

One particularly well-placed group was neutral diplomats, especially Americans. The finely balanced position the United States occupied as a neutral power in the Napoleonic conflict before 1812 ensured a fairly regular cross-Channel traffic in diplomatic communications between the two American ambassadors ("ministers") in Paris and London. From 1803 to 1807, the American ambassador to Britain was James Monroe—the future president—with whom Blagden quickly established a friendship. Harnessing this personal bond, along with Monroe's sympathy for scientific endeavors, as early as 1804 the persuasive Blagden had convinced Monroe to forward some letters to Paris.[26] When Monroe returned to the United States in November 1807, Blagden kept up good relations with his successor, William Pinkney, usually calling on him at least once a week to discuss blockade diplomacy and to sound out opportunities for sending scientific letters provided by the coming and going of American diplomatic couriers. Over the next four years, Blagden delivered many of his letters to Pinkney's residence at Great Cumberland Place; from there they were taken to France by messengers carrying dispatches to the ambassador in Paris, John Armstrong—sometimes, it appears, actually in the diplomatic bag.[27] Letters from France addressed to Blagden traveled

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[23] Most of the letters are in French, although English was sometimes used, particularly in the letters between Blagden and Chenevix. All translations are my own.

[24] The variety of ways science and its practitioners were embedded in the Napoleonic State are traced in Charles C. Gillispie, *Science and Polity in France: The Revolutionary and Napoleonic Years* (Princeton, N.J.: Princeton Univ. Press, 2004). Berthollet had been a comrade of Napoleon's during the 1798 Egyptian Expedition; on the importance of the "old boys from Egypt" to Napoleon see Louis Bergeron, *France under Napoleon*, trans. R. R. Palmer (Princeton, N.J.: Princeton Univ. Press, 1981), pp. 53–54. For "mon chimiste" see Sadoun-Goupil, *Le chimiste Claude-Louis Berthollet (1748–1822)* (cit. n. 21), p. 52.

[25] Berthollet to Blagden, 3 Apr. 1806, RS CB/1/1/218. Writing to Joseph Banks about the accusations, Blagden quoted a letter from Richard Chenevix stating that Napoleon suspected that Blagden was a spy after matters on which they had conversed when alone "subsequently appeared in the English Newspapers"; Blagden was quick to assure Banks that he had "never sent anything from France, directly or indirectly, to the English newspapers." Napoleon was reportedly "angry" with both Berthollet and Laplace for welcoming Blagden in France during the peace, but Berthollet nonetheless continued to defend Blagden against the accusations, which had apparently been put to rest by 1806. See Blagden to Joseph Banks, 29 Sept. 1803, 6 Oct. 1803, in *The Scientific Correspondence of Sir Joseph Banks*, ed. Neil Chambers, 6 vols., Vol. 5 (London: Pickering & Chatto, 2007), pp. 320–321.

[26] See, e.g., Blagden Diary, 20 June 1804; and Blagden to James Monroe, 20 June 1804, James Monroe Papers (microfilm), New York Public Library Archives and Manuscripts. From 1806 Monroe was jointly appointed with William Pinkney.

[27] Meetings with Pinkney are recorded throughout Blagden Diary, 1807–1809. A good example among more than twenty letters

with American couriers going in the other direction. Even though Blagden was careful that his letters contained nothing but purely scientific news and expressions of friendship, the arrangement was still rather delicate, as it exploited the protected diplomatic communications of a neutral state. "I would beg the favour of you to enclose these 2 letters in your paquet [for Paris]," Blagden asked Pinkney in May 1809. He added: "you may be sure they contain nothing improper."[28] The system provided an effective (if irregular) route through the blockade until looming war between Britain and the United States brought an end to it in 1811.[29]

A second route used by Blagden presents a similar instance of philosophical intelligence riding along with intelligence of another kind. The Delesserts, Blagden's friends in Paris, were one of the major banking families of the Napoleonic era and a key part of an international network of Huguenot financiers. Even during the height of the blockade the family maintained a connection (possibly clandestine) with England, and this allowed Blagden to send them letters through a Genevan banker based in the City of London, Charles de Constant.[30] Finally, there was the sole official cross-Channel link between the British and French states during the blockade: the British "cartel" ships that sailed irregularly to Morlaix in Brittany to transport released prisoners of war back to France. These were used to keep up a discreet semiofficial connection between the French Institut National (successor to the Académie des Sciences) and the Royal Society, with the *Mémoires* of the one and the *Philosophical Transactions* of the other exchanged via the cartels along with packets of letters, books, journals, and other material.[31] Joseph Banks and Blagden organized these exchanges together with the entomologist Alexander McLeay, a civil servant who fortunately happened to hold the key position of Secretary of the Transport Office, the naval department responsible for the cartels.[32]

Approval of these semiofficial communications with the enemy was no doubt sought by McLeay or Blagden from the Admiralty or government ministers. It probably helped that Blagden was friends with the Whig politician Charles Grey, who was successively First Lord

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Blagden sent by American messengers to the ambassador in Paris is Blagden to Berthollet, 29 Dec. 1807, RS CB/1/1/223, on which Blagden drafted a note to Pinkney left with the letter. The use of the diplomatic bag is mentioned in Chenevix to Blagden, 30 June 1808, RS CB/1/3/54.

[28] The letters in question were Blagden to Berthollet, 16 May 1809, RS CB/1/1/230; and Blagden to Benjamin Delessert, 16 May 1809, RS CB/1/3/257. The draft note to Pinkney is on RS CB/1/3/257.

[29] As early as 1807 Blagden was deeply worried that the stress put on British–American relations by the British response to the Continental System (the "Orders in Council") might provoke war between the two nations—"the consequences we have so often deprecated," as he put it to Monroe. See Blagden to Monroe, 26 Nov. 1807, James Monroe Papers (microfilm), Library of Congress, Washington, D.C.

[30] Charles de Constant was a cousin of the writer Benjamin Constant; Blagden's diary shows that he made many visits to de Constant to drop off or receive letters and to discuss foreign political and military news (e.g., Blagden Diary, 11 Mar. 1807). Blagden probably also sought the help of another friend, the great London financier Henry Hope, who also carried on banking correspondence with counterparts on the Continent.

[31] E.g., on 29 Feb. 1808 the Institut recorded its reception of the two volumes of the *Philosophical Transactions* for 1807 from the Ministère de la Marine (Admiral Denis Decrès): *Procès-Verbaux des Séances de l'Académie*, 10 vols., Vol. 4 (Hendaye, 1913), p. 23. On the prisoner exchanges see Gavin Daly, "Napoleon's Lost Legions: French Prisoners of War in Britain, 1803–1814," *History*, 2004, 89:361–380.

[32] Blagden suggested that Banks use a particular cartel ship to send the *Philosophical Transactions* to the Institut National in December 1807: Blagden Diary, 3 Dec. 1807. McLeay's involvement is also evident from the diary (e.g., 4 Feb. 1808), and drafts of a few letters show that Blagden sent them by the cartel through McLeay. The cartel route proved invaluable for conveying bulkier material that American diplomats were not always willing to transport, such as journals, transactions, books, and even packets of seeds: Blagden to Berthollet, 4 Feb. 1809, RS CB/1/1/228.

of the Admiralty and Foreign Secretary during 1806–1807.[33] On the French side, the link certainly had Napoleon's direct sanction. "These purely learned communications, authorized by the order and the example of His Majesty [Napoleon] and designed . . . to propagate enlightenment and widen the sphere of knowledge, have always been treated as an exception," wrote the Ministère de la Marine to the Institut National in 1807.[34] From the state's point of view, the exchanges were perhaps rather analogous to the traditional arrangements for the exchange of prisoners of war that the cartels were supposed to facilitate: an agreement between belligerent powers to engage in a mutually beneficial trade in science. They also represented a transitional phase in the state's attitude toward scientific knowledge: science was simultaneously held to be sufficiently important for human progress that it deserved a special exception (no special efforts appear to have been made to facilitate links between classical scholars, theologians, historians, antiquarians, or other nonscientific intellectuals) and also sufficiently benign that making the exception would not compromise state interests. No longer quite the unworldly scholarship of the early modern Republic of Letters, but certainly not yet a jealously guarded cornerstone of wartime economies, science in the Napoleonic era inhabited a tense space in between, uncomfortably balanced between ideals of international community and growing national rivalry.[35]

Nonetheless, despite some semiofficial state sanction, cross-Channel scientific exchange was carried on in a state of constant uncertainty, amid real obstructions and always with doubtful expectations of success. It also depended on ties of personal friendship that were perhaps just as important as the need for scientific information in sustaining Blagden's correspondence across the blockade. In 1808 Madame Gautier apologized to Blagden for not having been able to forward more "news of your friends," "who are distressed that they are not able to keep up more communication with you. It is almost as impossible as it is dangerous. To give even an occasional sign of life or token of friendship is not permitted."[36]

Communication of intelligence about new sciences like electrochemistry depended on personal connections forged before the French Revolution, with Blagden's letters seeking to recapture the spirit of the enlightened Parisian sociability and civility he had enjoyed in the 1780s but from which he was now cut off by space and time.[37] While Blagden and his

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[33] Grey held these posts during the Whig-leaning "Ministry of All the Talents." Blagden's diary records many calls on Grey—then Viscount Howick, later the second Earl Grey, Prime Minister, and now immortalized in the name of a blend of tea—and Grey also loaned Blagden government copies of foreign newspapers to read. I have not been able to trace any record of the British government's consent to the exchanges, which may have been sought and given by word of mouth only. The official letter-books of the Transport Office do, however, record numerous orders for the transport of various "parcels" to Morlaix aboard the cartels, and comparison with Blagden's diary reveals that some of these were evidently scientific material destined for the Insitut National—e.g., a letter to Captain James Rogers, in "Letters to Agent at Plymouth," National Archives, Kew, ADM 98/243.

[34] Admiral Decrès to Jean Baptiste Delambre, 14 Mar. 1808, *Dossier Biographique* for Humphry Davy, Archives of the Académie des Sciences, Paris.

[35] On the tensions between scientific neutrality and national loyalty in this period see Lorraine Daston, "Scientific Neutrality and Nationalism under Napoleon," in *Solomon's House Revisited*, ed. Tore Frangsmyr (Canton, Mass.: Science History Publications, 1990), pp. 95–119; and Elise Lipkowitz, "Seized Natural-History Collections and the Redefinition of Scientific Cosmopolitanism in the Era of the French Revolution," *Brit. J. Hist. Sci.*, 2014, 47:15–47. A rather more rose-tinted view is presented in Gavin de Beer, *The Sciences Were Never at War* (London: Nelson, 1960).

[36] Marguerite-Madeleine Gautier to Blagden, 7 Apr. 1808, RS CB/1/4/29.

[37] Madame Gautier's own role as one of Blagden's key scientific correspondents recapitulated aspects of the Enlightenment Parisian salon hostess acting as mediator and participant in the making of knowledge—a gender dynamic already eroded by the ascendant model of the savant as (male) functionary of the Napoleonic State. On the earlier model see Dena Goodman, *The Republic of Letters: A Cultural History of the French Enlightenment* (Ithaca, N.Y.: Cornell Univ. Press, 1994).

correspondents were certainly imaginative and original in seeking out ways to send their letters during the blockade years, and were able to enlist the help of centralized and powerful wartime states to do so, they were also drawing on a letter-writing tradition of cultured cross-border friendship more characteristic of an age that had already come to an end.

CONVERSATION, COMMUNITY, AND THE RHYTHMS OF CORRESPONDENCE

It was an eighteenth-century commonplace that letters were, as one how-to guide put it, "the copies of conversation," textual mirrors of an imagined oral dialogue between two voices separated by distance.[38] Conversation was Blagden's element, and his communications with his French correspondents—often incorporating technical content, but never with the formality of a scientific publication—were closely tied into his own networks of face-to-face contact in London. When Blagden read letters received from French informants out loud in Banks's library, he was bringing the voices of his correspondents into the heart of the British scientific community. Just as letters from absent relatives were read aloud to the whole family at home, so scientific news could also be made oral and performative, putting the latest Parisian experiments, discoveries, ideas, or gossip back into the realm of word-of-mouth circulation in London.[39] The scientific communities of London and Paris were the two largest in the world, but both revolved around a tightly concentrated nucleus of individuals.[40] Within these centers, oral communication provided a key means of announcing new science—both in informal venues like Joseph Banks's library and in official settings like the meetings of the French Institut. Blagden's letters permitted virtual paper-and-ink conversations between the two centers, synchronizing them and tying them together.

But when looked at more closely, this eighteenth-century metaphor of letters as conversation begins to break down. One way to get a sense of the rhythm of these exchanges is to look at the time interval between when a letter was written and when it arrived. Before and after the wars, letters would usually cover the distance between London and Paris (over 250 miles by road and sea) in about five days.[41] With this measure in mind, the situation under the Continental System does not seem quite as bleak as the laments of men of science might imply, though the increased delay is certainly very marked. Letters between Blagden and Berthollet would generally take a month or more to arrive, and sometimes they would take

[38] Thomas Cooke, *The Universal Letter-writer; or, New Art of Polite Correspondence* (London: Wilson, 1812), p. 18. The notion of letters as written conversation goes back to Cicero; on practices of letter writing in this period see Eve Tavor Bannet, *Empire of Letters: Letter Manuals and Transatlantic Correspondence, 1680–1820* (Cambridge: Cambridge Univ. Press, 2005).

[39] On the reading aloud of letters in the eighteenth century and the blurred boundary between letters and speech see Bannet, *Empire of Letters*, p. 46. Many examples occur in Blagden's diary—e.g., when Blagden read letters from Berthollet to Cavendish (8 May 1808) and Davy (29 Sept. 1808). Blagden probably generally preferred to read from his letters (rather than pass them around for others to peruse) because he considered only certain passages to be news intended for general circulation; the full letter might contain more personal information that was part of a private dialogue between Blagden and his correspondent. In addition, reading the letters out loud drew the attention of listeners to Blagden's access to and control over incoming French news.

[40] On the Parisian side see esp. Maurice Crosland, *The Society of Arcueil: A View of French Science at the Time of Napoleon I* (Cambridge, Mass.: Harvard Univ. Press, 1967).

[41] E.g., Delessert wrote to Blagden from Paris in a letter dated 18 Apr. 1816; it was delivered in London on 22 April (RS CB/1/3/243). Occasionally letters might take as little as three days, as when Delessert wrote to Blagden on 21 Oct. 1815 and Blagden had the letter on 24 October (RS CB/1/3/240). The packet boats that had carried the mail between Dover and Calais were suspended during wartime: Howard Robinson, *Carrying British Mails Overseas* (New York: New York Univ. Press, 1964), p. 59.

much longer or would not arrive at all.[42] Yet simply counting days like this in fact underestimates the difficulties. Letters could not be sent at will but depended on the appearance of infrequent and irregular "opportunities" for conveyance. "I have been waiting for an opportunity to send this which has lain open ever since I began it," Richard Chenevix complained to Blagden regarding a letter he had begun in November 1807; the letter did not reach Blagden in London until mid-March of the next year. Often correspondents wrote letters only when a conveyance was known to be available. "An American ship is about to depart, charged with dispatches, and this letter will surely reach you, I hope, by that route," Madame Gautier informed Blagden on one occasion.[43] Thus we must be careful to picture these opportunities for exchange not as a stable channel by which letters could be slowly but regularly and reliably conveyed back and forth but, rather, as Blagden and his correspondents saw them: a messy, unpredictable stop-start process that required constant attention.

To take a brief concrete example of the Paris–London link at work: at the beginning of July 1808 an American ship called the *St. Michel* left France for England, bearing among its diplomatic dispatches several letters for Blagden from Berthollet, Delessert, Chenevix, and Gautier.[44] Hearing from Ambassador Pinkney that the *St. Michel* remained at anchor down at Falmouth in Cornwall but was soon to return to France, Blagden quickly composed his own letters in reply. These letters then made the return passage aboard the same vessel, together with more American dispatches and the first copy to reach France of John Dalton's seminal treatise on atomism, *A New System of Chemical Philosophy*, a gift from Blagden to Berthollet. Finally, when the *St. Michel* sailed homeward from France in September, the resourceful Chenevix used the ship to send Blagden another letter (via the United States!), which "finally reached me," Blagden remarked dryly two and a half months later, "after having made a rather long detour."[45]

The letters themselves manifest an acute consciousness of the difficulty of transmission, usually beginning with a flurry of dates of previous letters sent and received as Blagden and his correspondents sought to synchronize their unreliable channels of communication and establish what they knew or did not know about one another. Complaints about being starved of scientific news—a kind of information underload—were common: "I have had no news from England for near three months and am in total ignorance of all that you have been doing there in science," Chenevix grumbled to Blagden in 1808. Berthollet had perhaps a little more philosophical resignation: "It costs me much, my dear friend, to receive your news so

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[42] It is possible to get a fairly good sample of the transit times of letters written from France to Blagden using the postmarks some of them acquired when they were posted to Blagden after they were brought to Britain, along with notes of receipt in Blagden's diary and the dates of arrival that are occasionally given in his replies. Transit times ranged from a minimum of three weeks to (in one extreme case) five months.

[43] Chenevix to Blagden, 30 Nov. 1807 (more was added on 15 Dec. 1807; the London postmark is 10 Mar. 1808), RS CB/1/3/42; and Gautier to Blagden, 5 July 1809, RS CB/1/4/34.

[44] Blagden Diary, 19–20 July 1808. Chenevix's letters were dated 15 May 1808, RS CB/1/3/52, and 30 June 1808, RS CB/1/3/54; their receipt by Blagden via the *St. Michel* is noted in Blagden to Chenevix, RS CB/1/3/53. The other letters were Delessert to Blagden, 29 June 1808, RS CB/1/3/222; Gautier to Blagden, 25 June 1808, RS CB/1/4/30; and Berthollet to Blagden, 20 June 1808, RS CB/1/1/225.

[45] The letters Blagden sent aboard the *St. Michel* were Blagden to Chenevix, 28 July 1808, RS CB/1/3/53, 1 Aug. 1808, RS CB/1/3/55; Blagden to Berthollet, 1 Aug. 1808, RS CB/1/1/226; and Blagden to Delessert, 1 Aug. 1808, RS CB/1/3/224. Supporting evidence in Blagden Diary, 1 Aug. 1808. The letter that detoured via the United States is Chenevix to Blagden, 7 Sept. 1808, RS CB/1/3/56; its eventual receipt is noted in Blagden to Chenevix, 19 Nov. 1808, RS CB/1/3/57.

rarely and to give you so little of my own; it is the toll exacted by the circumstances in which we find ourselves."[46]

This unusual pattern of exchange, syncopated and staccato as well as slow paced, had real effects on basic practices of science like repeating experiments. To understand how, we need to dive into some practical problems in electrochemistry and examine how relevant information moved back and forth—not only in letters, but in print as well.

LETTERS INTO PRINT: THE ATLANTIC CAREER OF HUMPHRY DAVY'S DISCOVERY OF POTASSIUM AND SODIUM

In the evening of 12 November 1807, a year into the Continental Blockade, Humphry Davy returned to Somerset House to deliver another paper at the Royal Society. It constituted the first public announcement of what British commentators soon claimed as the greatest scientific event the new century had yet produced: the discovery of two extraordinary metallic elements, eventually christened potassium and sodium.[47] So light they floated on water, so reactive that even ice made them burst into flame, these new substances—"analogous to some of those imagined to exist by the Alchemical visionaries," Davy fancied— had been hidden in plain sight, chemically locked away in the "fixed alkalis," potash and soda. Now they were wrested from their long concealment by the application of the chemically decomposing power of Alessandro Volta's galvanic battery, and their discovery hammered home Davy's assertion, made at the Royal Society a year before, of a deep connection between electricity and chemical affinity.[48] News of the wonderful metals quickly spread in London and, over the succeeding months, through the rest of the scientific world. "I need not say how prodigious these discoveries are," enthused the English chemist Smithson Tennant, "it is something to have lived to know them." The events launched Davy's Romantic public image (it was already his personal myth) as an inspired chemist of "genius" who had, as one acolyte put it, "raised a corner of the thick veil, and untied one of the last knots of the great tissue of wonders."[49]

In Britain, the discovery was much applauded in the general press, becoming the greatest object of national scientific pride since the beginning of the wars with France. Expressing the new vision of scientific discovery as national competition, the reliably jingoistic *Anti-Jacobin Review* declared in 1811 that "all persons are now familiar with the nature and properties of potassium, and with the structure of galvanic batteries," taking pride in how French "national vanity" had "received such a shock" from Davy's electrochemical success. Davy's researches

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[46] Chenevix to Blagden, 15 May 1808, RS CB/1/3/52; and Berthollet to Blagden, 19 Apr. 1809, RS CB/1/1/229.

[47] Royal Society Archives, JBO/39, 12 Nov. 1807, 19 Nov. 1807, pp. 396–417. Some at least of the men of science present were not entirely unprepared for the revelations that evening; true to form, Blagden had a preview of the intelligence from Davy at Sir Joseph Banks's library a week before. See Blagden Diary, 12 Nov. 1807.

[48] Davy Laboratory Notebook, p. 85, Humphry Davy Papers, Royal Institution, London, HD/6. On Davy's electrochemistry and the importance of the discovery of the alkali metals for the Lavoisieran system of chemistry see Robert Siegfried, "The Discovery of Potassium and Sodium, and the Problem of the Chemical Elements," *Isis*, 1963, *54*:247–258; H. E. LeGrand, "Determination of the Composition of the Fixed Alkalis, 1789–1810," *ibid.*, 1974, *65*:59–65; and Colin Russell, "The Electrochemical Theory of Sir Humphry Davy [Pts. I and II]," *Annals of Science*, 1959, *15*:1–25.

[49] "Some Account of the Late Smithson Tennant, Esq.," *Annals of Philosophy*, Aug. 1815, *6*:98 (reproducing a letter written in Jan. 1809); and [Louis Simond], *Journal of a Tour and Residence in Great Britain, During the Years 1810 and 1811*, Vol. 2 (New York: Mercein, 1815), pp. 151–152. On Davy and "genius" see Jan Golinski, *Science as Public Culture: Chemistry and Enlightenment in Britain, 1760–1820* (Cambridge: Cambridge Univ. Press, 1992), pp. 188–235; Christopher Lawrence, "The Power and the Glory: Humphry Davy and Romanticism," in *Romanticism and the Sciences*, ed. Andrew Cunningham and Nicholas Jardine (Cambridge: Cambridge Univ. Press, 1990), pp. 213–227; and David Knight, *Humphry Davy: Science and Power* (Oxford: Oxford Univ. Press, 1992).

had "excited the curiosity and the admiration of Europe; and, notwithstanding the present unnatural and antisocial state of the world, by the Buonapartean war, the name and discoveries of Davy have resounded, not only over France, but through every civilized country."[50]

The *Anti-Jacobin*'s grandiose rhetoric obscured the real labor that went into propagating Davy's discoveries beyond Britain. After Davy had officially announced his discovery on 12 November 1807, London's two main scientific correspondents with links to France hastened to be the first to break the news abroad. Blagden composed his first account in a letter to his friend Madame Gautier on 16 November, writing that Davy had "just analysed the fixed alkalis, and obtained their bases, which possess very singular properties."[51] He wrote a second letter to Gautier with further details on 5 December; both letters were sent via Blagden's special link to her family through the City financier Charles de Constant. Blagden then followed this up with letters sent to Chenevix and Berthollet through the American ambassador on 29 December.[52]

In the event, none of Blagden's letters brought the first news to Paris; that honor fell to his friend and competitor in Continental correspondence, the London-based Swiss physician and chemist Alexander Marcet. Told "in confidence" of Davy's discovery at the end of October, Marcet wrote his own letter to Paris the day after Davy made the news public; it was addressed to his Swiss friend Marc-Auguste Pictet, who was also the editor of a scientific journal, the *Bibliothèque Britannique*. However, Pictet was no longer in Paris but at home in Geneva; and so, unexpectedly, it was a slightly later letter from Marcet, written on 23 November, that actually broke the news in France. This letter arrived in Paris sometime in mid-December, where its report of Davy's experiments—so Madame Gautier informed Blagden—"caused a real stir, and produced great admiration."[53]

But Davy's discovery initially proved tricky to repeat in France using only the details provided in this single letter, inducing a period of uncertainty that foreshadowed later struggles to replicate experiments that would plague chemists on both sides of the Channel during the next few years. After several failed attempts at the École de Médecine and in the laboratory of the chemist Antoine François Fourcroy, Blagden's second letter to Gautier eventually arrived with further details of how to apply the galvanic battery to potash, enabling the young French chemists Gay-Lussac and Thenard to dispel all doubts by repeating the decomposition at the École Polytechnique on 6 January 1808.[54]

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[50] *Anti-Jacobin Review*, 1811, *39*:337–340.

[51] Blagden to Gautier, 16 Nov. 1807, RS CB/1/4/51. Although Davy had shown him samples on 12 November, Blagden only managed to see the experimental production of the metals for himself several days after writing to Gautier: Blagden Diary, 12 Nov. 1807, 21 Nov. 1807.

[52] Blagden to Gautier, 5 Dec. 1807, RS CB/1/4/52; Blagden Diary, 16 Nov. 1807; and Blagden to Berthollet, 29 Dec. 1807, RS CB/1/1/223. Blagden apologized to Berthollet for not addressing him first, noting that "it was easier for me to have my letters sent to her [Gautier] than to you."

[53] Gautier to Blagden, 7 Apr. 1808, RS CB/1/4/29. Marcet appears to have written two letters to France on 23 November, one to his brother-in-law Pierre Prévost (a member of Pictet's circle in Geneva) and another to an unidentified correspondent in Paris who was connected to the French chemists. An extract of this second letter was printed in the *Annales de Chimie* at the end of December: *Annales de Chimie*, 1807, *64*:319–320. It is identified having been written by Marcet in Blagden Diary, 31 Jan. 1808. On the *Bibliothèque Britannique*, another key mediator between British and French science during the Napoleonic Wars, see David Bickerton, *Marc-Auguste and Charles Pictet: The* Bibliothèque Britannique *(1796–1815) and the Dissemination of British Literature and Science on the Continent* (Geneva: Slatkine, 1986).

[54] Chenevix to Marc-Auguste Pictet, 7 Jan. 1808, in Pictet, *Correspondance: Science et techniques*, 4 vols., Vol. 2 (Geneva: Slatkine, 1996), p. 141. Although an account published five months later in *Correspondance sur l'École Imperiale Polytechnique* (1808, *1*:445–448) states that Davy's experiment was repeated in France on 8 December, this is evidently false; it is contradicted by Chenevix's letter and multiple other sources.

Information on the discovery quickly passed into print in France. Both the *Annales de Chimie* at Paris and the *Bibliothèque Britannique* at Geneva had printed excerpts from Marcet's letters at the end of December (like other journals around 1800, they maintained no hard distinction between articles and printed letters). But Blagden and the others in London learned of the successful repetition of Davy's work not from these journals, nor from letters, but from the official Napoleonic newspaper, the *Moniteur*.[55] The *Moniteur* provided a separate and often quite rapid source of French scientific news in Britain during the war years and especially during the blockade, one that frequently outpaced the letters received by Blagden. As an important source of political and military information, the *Moniteur* was a highly sought-after publication in Britain, with issues regularly brought across the Channel by smugglers or agents working for the government or the London newspapers. This situation created a fortuitous windfall for the London scientific community, because the *Moniteur* also contained many scientific articles, often adapted from material read at the Institut National by France's leading savants and frequently containing precise technical details.[56] For example, on 14 January a report was printed in the *Moniteur* containing the news of Davy's discovery together with a paragraph on its successful repetition by Gay-Lussac and Thenard. That issue reached the London men of science in only two weeks, arriving shortly before the end of January, whereupon Blagden was surprised and probably rather annoyed to find that it was not his letter but Marcet's that had broken the news in Paris.[57] Again, philosophical intelligence was hitching a ride, traveling to its destination because other information was already going its way.

While the London scientific community was scanning the *Moniteur* to gauge the response to Davy's discovery in France, others were at work transmitting the intelligence further afield. Enter Frederick Hall, a young American professor of natural philosophy in the midst of a scientific tour of Europe. After spending the earlier part of 1807 sampling the London scientific world (where he naturally met Blagden), Hall journeyed on to Paris, going via Rotterdam on a Dutch ship. The news of Davy's discovery arrived in Paris when Hall was there, and not long afterward he received his own version in a letter from Blagden, delivered through the American diplomats.[58] Moreover, doing the rounds of dining with Gay-Lussac and other French scientific figures during his winter in France, Hall was well placed to catch the crest of a fresh wave of scientific news that broke there in early March. Applying Berthollet's ideas on the variability of chemical affinities, Gay-Lussac and Thenard had

[55] *Ann. Chim.*, 1807, *64*:319–320; and *Bibliothèque Britannique*, 1807, 36:391–393. On the *Moniteur* see André Cabanis, *La presse sous le Consulat et l'Empire, 1799–1814* (Paris: Société des Etudes Robespierristes, 1975).

[56] Copies of the *Moniteur* were available to Blagden and others in Joseph Banks's library, apparently passed on by scientifically inclined civil servants like Alexander McLeay. See, e.g., Blagden Diary, 3 May 1808. On the means by which the *Moniteur* and other foreign newspapers entered Britain during the wars see *The History of the* Times*: "The Thunderer" in the Making, 1785–1841* (London: Office of the *Times*, 1935), pp. 106–107; Edward Porritt, "The Government and the Newspaper Press in England," *Political Science Quarterly*, 1897, *12*:666–683, on p. 676; and Cyrus Redding, *Fifty Years' Recollections, Literary and Personal*, Vol. 2 (London: Skeet, 1858), p. 107.

[57] *Moniteur*, 14 Jan. 1808, pp. 54–56. "Suppose [they] got acct of last expts from Marcet's letter," Blagden noted after seeing a copy of the *Moniteur* at Joseph Banks's library: Blagden Diary, 31 Jan. 1808. Blagden added another arc to the exchange when he told Chenevix in a letter two days later that he had just seen how Davy's work "appears by the *Moniteur* to have been successfully repeated at Paris": Blagden to Chenevix, 3 Feb. 1808, RS CB/1/3/43.

[58] Blagden gave his letter to Hall to the diplomat Robert Walsh to transport: Blagden Diary, 24 Nov. 1807. The letter, dated 24 Nov. 1807, apparently does not survive, and Blagden did not keep a draft copy. Hall was Professor of Natural Philosophy at Middlebury College, in Vermont; his journey is detailed in letters later serialized in his periodical, the *Literary and Philosophical Repertory* (Middlebury, Vt., 1812–1817).

effected an unexpected elaboration of Davy's discovery by producing potassium solely by chemical means. They passed potash across white-hot iron filings inside a bent gun barrel; as liquefied potash flowed through the barrel, it was reduced by the iron, forming potassium. This surprising result provided a welcome boost to French chemistry's self-image after the startling discovery of "the English Lynx," as Davy was subsequently dubbed by the *Bibliothèque Britannique*.[59]

It also provided Hall with a juicy piece of scientific intelligence to send home to the United States. On 24 March he wrote two letters to America, one addressed to the Philadelphia physician and botanist Benjamin Smith Barton and the other to the Yale man of science Benjamin Silliman. In composing them, Hall mixed direct quotations from the letter Blagden had sent him on Davy's discovery with his own description of Gay-Lussac and Thenard's work. The letters arrived in New York on 5 July, after about two months spent crossing the Atlantic, and within a few more days were in the hands of their recipients.[60] What happened next provides a fascinating instance of how information could move fluidly between different kinds of media in the hybridized world of scientific communication around 1800. The audience for Blagden and Hall's words was about to expand massively, through the agency of print.

Although the news of Davy's decomposition of the alkalis seems to have circulated in America somewhat earlier, the two letters from Hall were the first intelligence of the French chemists' new gun-barrel experiment. Both recipients, aware of the value of the news their letters contained, therefore decided to put them into print. For Barton, the editor of the recently founded *Philadelphia Medical and Physical Journal*, the obvious choice was his own publication, and an extract from his letter was reprinted in the issue that was fortunately just about to go to press, appearing in Philadelphia on or about 14 July.[61]

Silliman chose an even faster route to print. He sent an extract of the letter he received to a newspaper, the *Connecticut Herald* of New Haven, which printed it on 12 July. In a ubiquitous process that governed the spread of information in newspapers and other forms of periodical print in both Europe and America, Hall's letter to Silliman in the *Connecticut Herald* (containing, of course, parts of Blagden's letter to Hall) was then taken up by numerous other newspapers and reprinted down the coast from New York to South Carolina. It turned up in Philadelphia on 18 July in that city's *Poulson's American Daily Advertiser*, narrowly missing scooping Barton's publication of the news in his journal (and certainly reaching more readers than he did).[62] We can only guess at reception, but the many editors

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[59] "Preface," *Bibl. Britannique*, 1809, *40*:xi. The experiment was announced at the Institut National on 7 Mar. 1808; see *Procès-Verbaux des Séances de l'Académie*, Vol. 4 (cit. n. 31), p. 25. The gun barrel and iron filings method was an adaption of Lavoisier's well-known experimental procedure for the decomposition of water with hot iron.

[60] Frederick Hall to Benjamin Smith Barton, 24 Mar. 1808, Benjamin Smith Barton Correspondence, American Philosophical Society, Philadelphia, MSS.B.B284d; and Hall to Benjamin Silliman, 24 Mar. 1808, Historical Society of Pennsylvania, Philadelphia, Benjamin Silliman Correspondence, Box 1 (both letters bear dated postmarks from New York). The portions of the two letters containing the news are very similar; many paragraphs are almost identical. But the letter to Silliman included an additional item of Napoleonic gossip, relating how the French emperor had taken such an interest in Davy's discovery, which had been "the principal topic of conversation among the *savans* of Paris," that he had "ordered M. Gay-Lussac, one of the most persevering and distinguished experimental chymists of France, to go over the process of Mr. Davy, in *his* presence."

[61] *Philadelphia Medical and Physical Journal*, 1808, 3:vii–viii. The date of publication is computed from *Poulson's American Daily Advertiser* for 14 July 1808, 22 July 1808, and 30 July 1808. Mention is made of the news of Davy's discovery having previously been in the American papers in the *Connecticut Herald*, 12 July 1808; a possible source for that news is Blagden to Monroe, 26 Nov. 1807, Monroe Papers, Library of Congress.

[62] *Connecticut Herald*, 12 July 1808; and *Poulson's American Daily Advertiser*, 18 July 1808. The letter also appeared, e.g., in Baltimore on 20 July (*North American*); in Washington, D.C., on 30 July (*Washington Federalist*); in Richmond, Virginia, on 26 July (*Enquirer*); and in Charleston, South Carolina, on 2 August (*City Gazette*).

who reprinted the letter certainly judged the discoveries a piece of news well calculated to excite readers' curiosity.

The activity of newspaper and periodical editing, printing, and reprinting multiplied the text of Hall's two letters in America, even leading to their reproduction in some other, less ephemeral media. Words originally written in London by Blagden as part of his letter to Hall appear— copied from printed versions of Hall's letters—in a reference work on pharmacy printed in Boston and in a footnote hurriedly added to update a new American edition of a popular chemistry book directed "particularly to the female sex," the *Conversations on Chemistry*. In an amusing twist, the book's anonymous author, then unaware of the insertion made by the American editor, was Jane Marcet, wife of the Alexander Marcet whose letter had brought the news of Davy's work to Paris.[63]

It remains only to complete the circle. By 23 July, Benjamin Silliman's letter from the *Connecticut Herald* had been reprinted by newspapers in New York City. There, unknown hands put one of these newspapers on a ship bound for England, where the paper found its way to Robert Aspland, the London-based editor of a general-readership periodical, the *Monthly Repository of Theology and General Literature*. Aspland had enthusiastically reported on Davy's discovery of potassium before and was ready to make use of more news on the subject, and so the much-copied letter was duly printed again, appearing in Aspland's October issue.[64] The text was by now so multilayered that it included a quotation from Blagden's letter written to Hall, copied into a letter to Silliman, printed in the *Connecticut Herald*, and reprinted by the New York newspaper that carried the quotation back to England to be reprinted again in the *Monthly Repository*. Sadly, we do not know if Blagden ever read it— or what he made of it if he did.[65]

Possessed of a more extensive picture of how Davy's discovery spread than Blagden or anyone else at the time ever had, we have been able to witness how intelligence about potassium and sodium moved through both letters and print in the shifting media landscape around 1800. The porous boundary between letters and print was not new; it would have been familiar enough to a citizen of the seventeenth-century Republic of Letters like Henry Oldenburg.[66] But scientific intelligence was now moving in print in different channels, rare or unknown in the 1660s— or the 1760s. Letter writing, an ancient technique of spreading intelligence, cross-fertilized with new print forms that had begun to play a role in science only around the end of the eighteenth century, from specialized journals like the *Annales de Chimie* (founded in 1789), to general magazines, to daily newspapers. But despite— or perhaps because of—the advent of these new and seemingly more modern formats, a general fluidity persisted: text from Blagden's and Marcet's letters to France was printed in a popular book, a technical reference work, a specialist chemical journal, a medical periodical, a

[63] James Thacher, *The American New Dispensatory* (Boston: Wait, 1810), p. 33; and [Jane Marcet], *Conversations on Chemistry*, 2nd American ed., Vol. 3 (Philadelphia: Humphreys, 1809), p. 185. On Marcet's book see M. Susan Lindee, "The American Career of Jane Marcet's *Conversations on Chemistry*, 1806–1853," *Isis*, 1991, 82:8–23.

[64] *New-York Commercial Advertiser*, 23 July 1808 (itself reprinted in the *New-York Spectator*, 27 July 1808); and *Monthly Repository of Theology and General Literature*, 1808, 3:574–575.

[65] Blagden's diary is silent on the matter. Possibly Blagden never learned that direct quotations from his letter to Hall (with his name attached) were circulating widely in the United States in newspapers and other publications; but if he did find out, he would almost certainly have been none too pleased. Blagden was always sensitive about the privacy of the intelligence in his letters, complaining to his diary on one occasion that he was "hurt" at seeing part of a letter written to Berthollet turn up in print in the *Annales de Chimie*. See Blagden Diary, 2 Sept. 1805; the letter was printed in *Ann. Chim.*, 1805, 55:84–86.

[66] Oldenburg originally envisaged the *Philosophical Transactions* as a means of disseminating intelligence from the many letters he received; see Marie Boas Hall, *Henry Oldenburg: Shaping the Royal Society* (Oxford: Oxford Univ. Press, 2002).

general magazine, and many newspapers. Print media overlapped not just with manuscripts, but—through abundant reprinting—with other print media as well. Only later in the nineteenth century would the boundaries harden, with certain kinds of writing about science becoming more appropriate to particular print formats and with manuscript and print more and more occupying separate media spheres, in which letters would deal in private intelligence about science in progress and print would be the means of communicating work when it was done.

EXPERIMENTAL REPLICATION AND THE FOG OF WAR

Reprinting by newspapers and magazines brought information about the discoveries of Davy and his French counterparts to large numbers of general readers. Many of these people probably glossed them simply as intriguing curiosities, much like other extraordinary news. In the tight-knit scientific communities of London and Paris, however, fresh intelligence about new developments in the wake of Davy's discovery of the alkali metals had a practical importance and an urgent competitive dimension. Davy's decomposition experiments had opened a new field of inquiry, one in which the whole structure of Lavoisieran chemistry and its elements might (it was conjectured) need to be revised. Davy's brother remembered how, "after the decomposition of the fixed alkalis, doubt naturally spread through every department of chemistry; a salutary doubt, prompting further inquiry and scrutiny, by means of the new powers of analysis."[67] There was a feeling that more great scientific prizes lay just over the horizon, ready for the taking. In this charged atmosphere the chemists of London and Paris worked hard to make good use of scarce scientific intelligence they had from the other side, repeating, challenging, and expanding on one another's experiments.

To see more concretely how the movement of scientific intelligence back and forth across the Channel in both letters and print was bound up with the day-to-day struggles of experimental practice, let us return to the moment in early March 1808 when Gay-Lussac and Thenard hit upon their method of making potassium by chemical means using potash heated with iron filings in a gun barrel. Motivating their invention of the new technique was an idea that potassium might be the means of further discoveries if its extraordinary reactivity could be harnessed to analyze other substances into more fundamental chemical constituents.[68] Davy's method of making potassium and sodium using the decomposing power of the galvanic battery had yielded only small quantities of the new metals; the gun-barrel experiment allowed potassium to be manufactured in quantities sufficient for its use as a reagent in further investigations. Here was an opportunity for the Parisian chemists to recapture the initiative from their upstart English rival and so maintain the preeminence of French science.[69]

Gay-Lussac and Thenard announced their gun-barrel experiment at a session of the Institut National on 7 March. A short note in the *Moniteur* appeared the next day, giving only the barest sketch of the process but hinting at its potential by noting how larger quantities of

[67] John Davy, *Memoirs of the Life of Sir Humphry Davy*, Vol. 1 (London: Longman, 1836), p. 407.

[68] This prophecy was fulfilled in their isolation of boron later in 1808.

[69] Richard Chenevix informed Blagden that Napoleon, having seen Davy's experiments repeated by Gay-Lussac and Thenard, had "laughed a little at the French Chemists for letting such a number of discoveries slip through their hands." Chenevix to Blagden, 2 Feb. 1808, RS CB/1/3/50.

potassium and sodium would make it possible "to study all their relations with other bodies."[70] But this particular issue of the *Moniteur* never reached Britain— or, if it did, it was never seen by anyone with scientific interests. London therefore remained completely ignorant of the French work until the first days of May 1808 (some two months after the gun-barrel experiment was announced in Paris), when an American ship called the *Osage* sailing from France under diplomatic orders finally brought a cache of scientific letters. Unfortunately for Blagden, his correspondents only alluded to the news in passing, assuming he already had it.[71] But the American diplomats also carried a letter for Davy from a Scottish prisoner of war with scientific interests who was detained at Paris, William Cadell, as well as letters for Marcet, all of them containing useful details.[72]

But in this instance news of a discovery reported in letters was not sufficient for the experiment to be repeated successfully at the new site. Confronted with a case like this, historians of science might raise issues of tacit knowledge or even the notorious "experimenters' regress."[73] But early nineteenth-century British men of science preferred to see things in terms of failures of communication. Having soon heard or seen all the letters that brought the news to London, Blagden was dissatisfied with their brevity and lack of "intelligibility" as to the minutiae of the gun-barrel procedure. His fears were borne out when Davy, Marcet, Tennant, and several other chemists tried and failed to replicate the experiment. "We have not been able to succeed in decomposing the alkalies by chemical means without Electricity," Davy confessed early in June, suggesting that "probably there has been some mistake in the communication."[74]

Successful repetition of the gun-barrel experiment taxed the ingenuity of London's most skillful chemists all through the summer of 1808. It was tricky and potentially dangerous to perform even for a chemist who knew the exact procedure, requiring a white-hot furnace, a particular kind of double bend in the gun barrel (one part of which was placed in the furnace while another part was cooled with ice), and a very dry sample of pure potash. But Davy and others were struggling with a much messier problem, which entangled the replication of difficult experimental technique with the problem of trying to make sense of the patchy details of the procedure they had received from France. Because of the extended timescale of

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[70] *Procès-Verbaux des Séances de l'Académie*, Vol. 4 (cit. n. 31), p. 25; and *Moniteur*, 8 Mar. 1808, p. 268. Perhaps deliberately, the *Moniteur*'s paragraph is rather vague on the specifics of what the French chemists actually did.

[71] On the arrival of the *Osage* see *Times* (London), 3 May 1808; and Blagden Diary, 3–5 May 1808. The letters it carried included Delessert to Blagden, 8 Apr. 1808, RS CB/1/3/225; and Gautier to Blagden, 7 Apr. 1808, RS CB/1/4/29. Berthollet had also written to Blagden on 20 March with the news, but his letter did not arrive until even later in May; he too assumed that Blagden already had information on the French method—presumably from the *Moniteur*. See Berthollet to Blagden, 20 Mar. 1808, RS CB/1/1/224; and Blagden to Delessert, 6 May 1808, RS CB/1/3/258.

[72] Blagden heard the letter from Cadell read aloud at Joseph Banks's library (Blagden Diary, 4 May 1808), after which it was also read out at the next meeting of the Royal Society and later summarized in the *Philosophical Magazine* (May 1808, 30:366). Letters to Marcet are mentioned in Blagden Diary, 5 May 1808.

[73] In fact, as explained below, the experiment was eventually replicated to British chemists' satisfaction using only textual information—though with a good deal of work, multiple failures, and a lingering dissatisfaction on the part of the British as to the purity of the potassium they were getting from the French experiment. This success nonetheless drew on a deep base of tacit skills shared by chemists on both sides of the Channel. Classic analyses of the problems of replicating experiments are H. M. Collins, *Changing Order: Replication and Induction in Scientific Practice* (London: Sage, 1985), esp. Ch. 4; and Steven Shapin and Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton, N.J.: Princeton Univ. Press, 1986), esp. Ch. 6. For "tacit knowledge" see Michael Polyani, *The Tacit Dimension* (Chicago: Univ. Chicago Press, 1966).

[74] Blagden Diary, 5 May 1808; and Davy to Lord Webb Seymour, 3 June 1808, Davy Papers, Royal Institution, HD/26/J/3 (copy of original in Aylesbury Record Office).

round-trip exchanges of intelligence in letters between London and Paris, the seemingly obvious solution of asking France for more information did not serve. "We have tried to repeat the experiment here . . . but without success," Blagden wrote to Paris on 19 May, asking Richard Chenevix to "send us the details of the procedure, if you can." Six weeks later, when more trials yielded only an alloy of potassium with iron, he wrote to ask again, blaming the failure on the "imperfect directions" received in London. Unfortunately, neither of these letters ever reached Chenevix.[75] Blagden was able to get his request through only when an American ship—the *St. Michel*, mentioned above—departed for France in early August. Chenevix did not manage to send a reply until 7 September, and it did not reach Blagden until mid-November—by which time the information it contained was no longer useful.[76] In this instance, Blagden's intelligence system had proved insufficiently capable of even the most basic question-and-answer conversation.

During this time, however, further information had arrived from France. More experimental details had come to London in the second half of July, apparently in a letter for Davy, but these failed to clear up the difficulties completely.[77] A fuller account of the procedure also made it to Britain in the *Moniteur* of 27 May, part of a long report on Gay-Lussac and Thenard's work, and its fairly detailed technical description of the gun-barrel experiment clearly proved valuable.[78] Even more useful was an issue of the journal *Correspondance sur l'École Imperiale Polytechnique* that someone in France fortunately sent to Britain, probably on one of the cartel ships. By early October, Davy and other London chemists had finally repeated the French experiment to their satisfaction.[79]

The details of these struggles to replicate the French method of producing potassium illustrate the messy and often chaotic processes that lay behind cross-Channel exchanges of experimental intelligence under the blockade. Letters went astray; issues of newspapers sometimes failed to make their usual rapid passage; correspondents assumed details had already been received or simply failed to elaborate in sufficient depth. Moreover, philosophical intelligence in print crisscrossed and overlapped with intelligence in letters, and any detail, brought by whatever means across the frontiers of war, might end up proving useful. Although all participants regularly complained of how difficult circumstances were, hard work managing information with letters and print did eventually allow experiments originating on one side of the Channel to be satisfactorily replicated on the other. Yet agreement that experiments had been reproduced correctly did not, of course, close down debate but, instead,

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[75] Blagden to Chenevix, 19 May 1808, RS CB/1/3/48, 7 July 1808, RS CB/1/3/44. Blagden attempted, unusually, to send one of the letters via Spain and the other by some unknown route that he apparently did not consider very reliable: Blagden to Chenevix, 28 July 1808, RS CB/1/3/53. Chenevix wrote to Blagden on 30 June and 7 September and did not mention these letters among those he had received (RS CB/1/3/54, RS CB/1/3/56).

[76] Blagden sent letters to both Chenevix and Berthollet on the *St. Michel*, stating that their experiments were still yielding only an alloy with iron and not pure potassium and once again specifically asking Chenevix whether he could "send us any light on this matter": Blagden to Chenevix, 1 Aug. 1808, RS CB/1/3/55. See also Blagden to Berthollet, 1 Aug. 1808, RS CB/1/1/226. For the reply see Chenevix to Blagden, 7 Sept. 1808, RS CB/1/3/56; Chenevix recommended an additional distillation step.

[77] This now-missing letter from France is mentioned in Davy to John George Children, [20 July] 1808, British Library Add. MSS 38625, fols. 1–2, British Library, London. As Blagden's letters to France written ten days later show, it was the problem of the potassium being alloyed with iron that still plagued the London chemists.

[78] *Moniteur*, 27 May 1808, pp. 581–582. Probably it made the trip on the *St. Michel*, as Blagden's diary indicates that it was seen by the London chemists only around 20 July.

[79] See the account printed in *Phil. Mag.*, Oct. 1808, 32:88–92. Even when pronouncing themselves more or less satisfied, the London chemists still complained that there was a little iron combined with the potassium they obtained. Blagden apparently did not see a successful trial of the experiment until Davy showed it to him at the Royal Institution in November; see Blagden Diary, 18 Nov. 1808.

opened it up in other directions. Throughout the rest of the Napoleonic Wars, British and French chemists argued over the details of their field in a series of disputes on issues ranging from the nature of the alkali metals, to Davy's purported chemical "decompositions" of sulfur, phosphorus, and carbon, to the elemental status of chlorine. So much disagreement might have led a pessimistic contemporary observer to conclude that the blockade had badly disrupted the forward motion of science. But in his letters to Blagden, Berthollet, as usual, tried to strike a more optimistic note:

> I am very sensible of the care you take to inform me of anything, as much as is possible for you, of the progress of the sciences. The slowness and the imperfection of communications doubtless retards this progress somewhat, because we would surely fall promptly into agreement, if we had a reciprocal knowledge of the facts on which we establish our respective opinions. Thus it is not surprising, that although we give full justice to the fine discoveries of Mr Davy, we remain in opposition to many of his opinions; besides, science cannot but benefit, because the difference of opinion and discussion serves to multiply the facts.[80]

CONCLUSION

Using the rich resources of Charles Blagden's archive, I have sought to demonstrate some of the ways the Napoleonic Wars are a particularly revealing moment to investigate the history of how problems of scientific communication were expressed and, always imperfectly, solved. The approach has been to start in Blagden's manuscripts and follow news and intelligence outward, tracing the discrete steps by which discoveries were propagated and experiments repeated at a distance across the frontiers of war. The journey has taken us to some unexpected places, deep into the world of periodical and newspaper print as well as along the usual tracks of manuscript correspondence. By following philosophical intelligence at this moment when scientific practitioners were preoccupied with information, tracking the ways it moved through different media and how it was put to use, we can witness how forms of scientific communication were still surprisingly hybrid and fluid around 1800. Letters appear as tools in larger mixed systems of information gathering, in which several different kinds of print media also played a role. This is not to deny that differences between manuscript and print often mattered a great deal, but to suggest that we need to follow the example of Blagden, Davy, and the rest in moving back and forth between the two when tracking scientific information in the past. The modern idea that private letters (or email) represent science in progress whereas print is a finished product is something we should certainly leave behind when we travel to the early nineteenth century.

Nonetheless, the hybridity of communication in the Napoleonic world in fact finds an echo in present concerns. The rise of the Internet has led some observers to conclude that we are entering a "new era" in scientific communications, in which a mixed system of preprint circulation, blogs, wikis, and open data will complement, and perhaps even supplant, the

[80] Berthollet to Blagden, 19 Apr. 1809, RS CB/1/1/229. For Davy's quite widely credited claims to have decomposed sulfur, phosphorus, and carbon see Blagden to Berthollet, 25 May 1808, RS CB/1/1/222; Blagden to Gautier, 29 Apr. 1808, RS CB/1/4/50; and *Observer*, 2 Oct. 1808, p. 2.

established medium of the peer-reviewed journal.[81] Whatever the future may hold, careful historical study of the processes of intellectual exchanges in the past can surely help to put such issues into long-term perspective. But in such work we need not only large-scale maps of correspondence networks or periodical circulation, but also close studies of how communication in all sorts of media actually functioned as a tool to achieve practical scientific goals that historical actors had in mind, whether the taxonomic classification of a new species, the synchronization of metrical standards, or the replication of laboratory experiments. It is by following information on the micro scale that we can calibrate our macro-level pictures of communications in the past, just as the macro picture gives a frame to each small-scale communicative act. By situating the activities of a few scientific practitioners in Britain and France around 1800 within the global geopolitics of the Continental System, I have sought to illustrate how both the micro and the macro shaped the world of science in the Napoleonic age.

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[81] See, e.g., Michael Nielsen, *Reinventing Discovery: The New Era of Networked Science* (Princeton, N.J.: Princeton Univ. Press, 2011).