Prior to becoming a secretary of the Royal Society in 1784 Charles Blagden (bapt. 1748–d. 1820) served as a surgeon in the British army during the Revolutionary War in America. In the two unpublished letters of 1778 discussed here, Blagden provides his Welsh friend John Lloyd (1749–1815) with a vivid description of the current state of affairs in America, from a British perspective, and with insights into continuing scientific endeavour in a time of war. The letters illustrate the attempt that two men made to keep alive an intellectual life and are testimony to the rapidity with which matters of scientific interest could be disseminated in the eighteenth century, even during a major international conflict.

**Keywords:** Charles Blagden (1748–1820); John Lloyd (1749–1815); American Revolution; eighteenth-century science; *Gymnotus electricus*; Philadelphia

Charles Blagden was baptized at Wotton-under-Edge in Gloucestershire in 1748 and, having studied medicine, became a Fellow of the Royal Society in 1772. He served as a surgeon in the British army during the American Revolution but returned home in 1780. Shortly afterwards he was appointed one of the secretaries of the Royal Society, a post he held from 1784 until 1797. His scientific contributions were made in experiments on the effect of extreme air temperatures on the human body, and on the nature of water, with a dozen papers published in *Philosophical Transactions*. Blagden died and was buried in Paris in 1820.¹

His friend and correspondent John Lloyd was born in 1749 in Wales and became a lawyer, politician and ‘dilettante’. Interested in many fields of study, he was a member of the London-based Honourable Society of Cymmrodorion and was elected a Fellow of the Royal Society in 1774 with Charles Blagden as one of his sponsors. Lloyd was known as ‘The Philosopher’, he was a close friend of Joseph Banks and his scientific and other interests were widely represented in an extensive library. At his death in 1815 it held over 10,000 items and took nearly a fortnight to sell.²

The two letters from Blagden to Lloyd reproduced here were written in America during the Revolutionary War. They now form part of an extensive collection of John Lloyd’s correspondence held at the National Library of Wales in Aberystwyth.³ The first letter

* paulframe2@btinternet.com
Letter 1, which is clearly dated, was written in Philadelphia. The second (hereafter Letter 2) has neither date nor place of composition indicated. We are fortunate, therefore, that during his time in America Blagden wrote regularly to Joseph Banks in London. Although unedited, these letters were published in the Bulletin of the New York Public Library in 1903 and from them a calendar of Blagden’s movements in America between 1776 and 1780 can be made. The calendar (see table 1) helps us to interpret the content of the first letter between Blagden and Lloyd and allows the likely date and place of composition of the second to be determined.

Letter 1 is dated 21 January 1778 and endorsed ‘Philadelphia’; its opening sentence makes clear that Blagden had picked up letters in New York, including one from John Lloyd, while travelling from Rhode Island en route to ‘join the army’. From the calendar of his movements we can see that he ‘spent the greatest part of August [1777] at New York’. The British army under William Howe, however, boarded transports in New York in early July 1777 with the fleet of 260 ships sailing from Sandy Hook, just south of New York, on 23 July. So clearly Blagden did not sail with the main flotilla, which landed at the head of Chesapeake Bay on 25 August, ready for the assault on Philadelphia. Instead, he must have sailed from New York in late August and arrived at the head of the Chesapeake in early September, just after the main fleet. By that time the army had disembarked and begun their march toward Philadelphia. Following the Battle of Brandywine Creek on 11 September 1777, the British entered and occupied the city on 26 September. Ships were then moved from Chesapeake Bay into the Delaware River, the better to support the army in its occupation. This was a dangerous transit that involved passing ‘several [rebel-held] forts and the massive barriers known as chevaux-de-frise that the Americans had anchored in the riverbed, with iron-tipped timbers capable of slashing open a ship’s bottom’. By October 1777 Blagden was ‘aboard a miserable Transport crowded with sick, who are dying every day of various disorders but all complicated with scurvy, & incapable of relief . . . We lie off Newcastle in the River Delaware, very ill supplied with every kind of refreshment’. Relief was at hand, however, for in December

<table>
<thead>
<tr>
<th>Date/Period</th>
<th>Location/Movement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1776</td>
<td>aboard Pigot Hospital Ship at Five Fathom Hole, Charlestown</td>
</tr>
<tr>
<td>1777</td>
<td>New York</td>
</tr>
<tr>
<td>1778</td>
<td>Newport, Rhode Island</td>
</tr>
<tr>
<td>1779</td>
<td>off Newcastle in the River Delaware</td>
</tr>
<tr>
<td>1780</td>
<td>Philadelphia</td>
</tr>
<tr>
<td>1776</td>
<td>at anchor near Reedy Island in the River Delaware</td>
</tr>
<tr>
<td>1777</td>
<td>New York</td>
</tr>
<tr>
<td>1778</td>
<td>New York</td>
</tr>
<tr>
<td>1779</td>
<td>New York</td>
</tr>
<tr>
<td>1780</td>
<td>Soho Square, London</td>
</tr>
</tbody>
</table>

(hereafter Letter 1), which is clearly dated, was written in Philadelphia. The second (hereafter Letter 2) has neither date nor place of composition indicated. We are fortunate, therefore, that during his time in America Blagden wrote regularly to Joseph Banks in London. Although unedited, these letters were published in the Bulletin of the New York Public Library in 1903 and from them a calendar of Blagden’s movements in America between 1776 and 1780 can be made. The calendar (see table 1) helps us to interpret the content of the first letter between Blagden and Lloyd and allows the likely date and place of composition of the second to be determined.

Letter 1 is dated 21 January 1778 and endorsed ‘Philadelphia’; its opening sentence makes clear that Blagden had picked up letters in New York, including one from John Lloyd, while travelling from Rhode Island en route to ‘join the army’. From the calendar of his movements we can see that he ‘spent the greatest part of August [1777] at New York’. The British army under William Howe, however, boarded transports in New York in early July 1777 with the fleet of 260 ships sailing from Sandy Hook, just south of New York, on 23 July. So clearly Blagden did not sail with the main flotilla, which landed at the head of Chesapeake Bay on 25 August, ready for the assault on Philadelphia. Instead, he must have sailed from New York in late August and arrived at the head of the Chesapeake in early September, just after the main fleet. By that time the army had disembarked and begun their march toward Philadelphia. Following the Battle of Brandywine Creek on 11 September 1777, the British entered and occupied the city on 26 September. Ships were then moved from Chesapeake Bay into the Delaware River, the better to support the army in its occupation. This was a dangerous transit that involved passing ‘several [rebel-held] forts and the massive barriers known as chevaux-de-frise that the Americans had anchored in the riverbed, with iron-tipped timbers capable of slashing open a ship’s bottom’. By October 1777 Blagden was ‘aboard a miserable Transport crowded with sick, who are dying every day of various disorders but all complicated with scurvy, & incapable of relief . . . We lie off Newcastle in the River Delaware, very ill supplied with every kind of refreshment’. Relief was at hand, however, for in December
we find him in Philadelphia where, on 28 January 1778, he wrote his letter to John Lloyd. The letter provides a vivid description of Philadelphia at this time and the efforts being made to maintain an intellectual life in the city.

No date or place of composition is indicated on Letter 2 but the former can be approximated and the latter determined from Blagden’s letters to Joseph Banks. In a letter written ‘at anchor near Reedy Point in the River Delaware’ on 12 June 1778, Blagden notes that ‘we expect every moment to get under way in order to proceed for New-York with the sick’. In the same letter he asks Banks: ‘Thank Mr. Lloyd for his remembrance of me in a very instructive letter which I hope to have the pleasure of answering on our arrival at New York’. After eight months in the city, the British began evacuating Philadelphia in early June 1778 with a flotilla of ships, of which Blagden’s clearly formed a part, sailing down the Delaware. The last British troops marched out and headed for New York on 18 June. In a letter to Banks of 20 July, Blagden notes that, soon after writing his letter of 12 June, he left the river and ‘had a favourable passage to New-York, where the other Ships, & the Army arrived within a fortnight’. This suggests that he arrived in New York near the end of June or by the first week of July at the latest. Blagden also records in this letter that a French Fleet under Charles-Henri-Théodat d’Estaing had anchored at Sandy Hook ‘on the 11th’ July. Given the less certain intelligence concerning this fleet in his letter to Lloyd – ‘it is suspected that the French is near this coast’ – we can confidently assert that Blagden wrote his second letter to Lloyd sometime between reaching New York in late June and the French fleet’s arrival at Sandy Hook on 11 July.

Letter 2 contains more discussion than the first on scientific matters, and two issues are central: a controversy over lightning conductors and the arrival in London of electric eels. The question of lightning conductors related to a long-standing argument within the Royal Society over the merits of pointed or blunt conductors for the protection of buildings. The former were advocated by Benjamin Franklin and the latter by his ‘pugnacious’ opponent in the Royal Society, Benjamin Wilson. The matter became a more important and public issue in May 1777 when, during a time of war with America, the gunpowder store of the Ordnance Board at Purfleet on the Thames was hit by lightning. Pointed rods had been installed at Purfleet on the Royal Society’s recommendation. Blagden appears to have learned of the event from ‘some English Magazines’ and on 15 December 1777 he wrote to Banks on the subject: ‘I do not conceive in what manner the circumstance that Penfleet [sic] Magazine was struck by lightning can possibly determine the question about blunt & pointed conductors: and I hope the Royal Society will not give its enemies further occasion of triumph, by entering into a public dispute.’ His hope was not fulfilled. The dispute became even more public when Wilson, urging the use of blunt conductors, set up a large experiment in the Pantheon in London to illustrate and prove the dangers of pointed ones. It is this exhibition that Blagden comments upon in his letter to Lloyd. George III was present at Wilson’s display and seems to have been won over to the blunt rods, perhaps partly in response to the fact that pointed ones were favoured by the now inveterate rebel Benjamin Franklin.

Live electric eels, *Electrophorus electricus*, or *Gymnotus electricus* as they were often called at the time, were successfully brought to London for the first time by George Baker in August 1776 and were displayed in London that year and in 1777. Baker had made an earlier attempt to bring over live eels in 1774 but all the specimens had died. Joseph Banks, who had been very keen to obtain a specimen, notes in a letter to John Lloyd of 5 November 1798: ‘Tell old Baker that I had an Electrical eel sent to me this
year from the Governor of St. Vincent’s who procured it from the [main\textsuperscript{18}] but it did not arrive alive his were the only ones that were ever brought over.\textsuperscript{19}

When read in conjunction with Blagden’s letters to Joseph Banks, the letters to Lloyd illustrate various points raised by Iain Watts in his 2015 paper on the transmission of ‘philosophical intelligence’ in a time of war.\textsuperscript{20} The period discussed by Watts runs from 1806 to 1814, when Napoleon attempted to enforce ‘an explicit prohibition on communication with Britain’ through a blockade that came to be known as the Continental System. As Watts reveals, partly through a consideration of Blagden’s correspondence with fellow scientists in France, the blockade often resulted in severe delays but ‘did not kill scientific communication between Britain and France’.\textsuperscript{21} The letters from Blagden to Lloyd and Banks reveal a similar situation with regard to the Revolutionary War in America. Delays and frustration at a lack of information are a frequent refrain but, although letters were often subject to considerable delay – while awaiting a ship to take them, while en route by sea, or because of the difficulty in getting mail that had arrived in the country to those involved with the army (as the opening lines of Letter 1 illustrate) – communication did not stop.

Philosophical intelligence is defined by Watts as ‘fresh, news-like information about the latest developments in science’ but it ‘was not equivalent to scientific knowledge; it was something more fragmentary, unrefined, and provisional’. It was intelligence that ‘might consist of key details needed to replicate a rival’s latest experiment, or perhaps a hint pointing toward the next major discovery’.\textsuperscript{22} Letter 2 to Lloyd exemplifies this type of communication when, for example, Blagden discusses the Purfleet incident and suggests another means of protecting a building against lightning strikes, and when he queries certain details of the experiments carried out on *Gymnotus electricus*.

Watts also emphasizes the importance of both letters and print in disseminating scientific information in the Napoleonic period, and this importance is certainly evident in Blagden’s correspondence from the American revolutionary period. As he records in a letter to Banks written on the same day as Letter 1 to Lloyd (21 January 1778): ‘It appears by some *English Magazines* that Wilson, not content with publishing on the subject of knobs and points, has been exhibiting experiments in such a conspicuous theatre as the Pantheon.’\textsuperscript{23} He also notes in Letter 2 of having read the pamphlet that Wilson had written and published describing these experiments.

There are significant differences between the Napoleonic and American revolutionary conflicts. Not least is the absence of a major blockade of American or British ports and the fact that America comprised a series of colonies in revolt, rather than an opposing unitary state.\textsuperscript{24} There were loyalists as well as rebels in America, and British control of substantial territory continued, including the occupation of New York and, at the time of Blagden’s writing to Lloyd, Philadelphia. Both these cities had links to the sea and so passage to Britain. It is less surprising therefore that the transfer of philosophical intelligence, at least between the British, continued apace at this time. It was, however, subject to delay and for many of the same reasons as in the Napoleonic period.

More significantly, the Blagden correspondence with Lloyd and Banks supports Iain Watts’s contention that letters were just one part of a larger mixed system of information gathering. Not only should we leave behind ‘[t]he modern idea that private letters (or e-mail) represent science in progress whereas print is a finished product . . . when we travel to the early nineteenth century’, but we should also do so when we travel to the late eighteenth century.\textsuperscript{25}
LETTER 1

Charles Blagden to John Lloyd, 21 January 1778

Source: Casgliad Llyfrgell Genedlaethol Cymru/National Library of Wales Collection, John Lloyd Letters, Wigfair 16, NLW MS 12416 D, f. 50 (published with permission, licence 1599).

Addressed to: John Lloyd Jun’r Esq’r Of Hafvadunos Denbighshire, 26 his Chambers in the Temple London.27

Dear Sir,

At New York, in my way from Rhode-Island to join the Army, I was very agreeably surprised at finding many old letters which I had given up for lost, & among them a most obliging one from you, dated above a twelvemonth before.28 My sincerest thanks are due for your attention to inform me of so many curious events in the lines of our common studies, and I regret extremely that your letter did not reach me sooner, as by an early acknowledgment of the favour I might have stood some chance of getting it repeated. Amidst the noise & tumult of war, the feeble voice of science can scarcely be heard, though in the happier days of peace this was her favourite residence in the western world. The college here29 is provided with mathematical Instruments that would not disgrace an European University; of these a very elaborate Orrery made by an American, M’Rittenhouse,30 is the principal subject of boasting among the Professors. It is, I believe, by far the most complete machine of the kind that ever was executed; almost every known circumstance of the motions of the heavenly bodies, even to the shifting of their nodes, is imitated according to the best calculations. The machinery by which this prodigious complication of motions is produced, seems to be contrived with such exquisite simplicity, & such happy care to avoid all superfluous work, as to do great credit to the Maker’s ingenuity in mechanics.31 However, as an Orrery is at best but a gross assistant to dull capacities, not an instrument by which any improvement can be made, I cannot help wishing that Mr Rittenhouse’s labour & skill had been more usefully employed.32 As the necessaries of life are prodigiously dear in this town, nearly triple the London prices, the inhabitants are almost compelled to fall upon some means of procuring a support by their industry. This necessity has produced two proposals for public Lectures, one course on anatomy by an old fellow named Chovet,33 who by having lost his teeth can scarcely be understood across the table, & intends to demonstrate upon wax-work; the other course by Dr Smith, Provost of the College, on natural philosophy illustrated by experiments. As Dr Smith is really a sensible well-informed man, & has the command of a pretty good apparatus, his lectures may be worth attending.34 All this is finely contrasted by proposals for public rooms, assemblies & plays: these last have actually begun, & perhaps, if a hard frost should once more fix the Delaware, may be interrupted as at Boston, by a sudden bombardment.35

Not knowing where to direct to you exact [faded and unreadable] inclose this in a cover to my Brother.36 Letters addressed to me at Head Quarters are the most likely to be received early.

I am, dear Sir,

Your obliged Friend & obed’ Serv’t

C Blagden.

Philadelphia

Jan’r. 21, 1778.
Dear Sir,

Your most obliging Letter by the Trident\textsuperscript{37} gave me a variety of information on several curious subjects, much more explicitly than I had ever received it before, for which accept my sincerest thanks. The electrical sense of the Gymnotus\textsuperscript{38} is an equally singular & surprising fact with respect to the powers of animals, & seems to be confirmed by a very decisive experiment: however, I should be very glad to learn, whether in forming the communication between the two glasses with water, it was ever tried if the animal could perceive any difference between a bent wire, & a bent stick of sealing wax. If the animal shewed expressions of attempting to give a shock when the former was used, but lay quiet when the two ends of the latter were put into the glasses, it would be an additional proof to what you mention of his curious electrical sense. I have read Wilson’s very confused pamphlet on his electrical experiments in the Pantheon,\textsuperscript{39} which, you well know, do not by any means decide the point in debate; however, I have no doubt but that the exhibition of them was very well calculated ad captandum vulgus.\textsuperscript{40} Why the Building at Purfleet was at all damaged, I have not yet been able to comprehend to my perfect satisfaction; but it has always appeared to me that the only security to which a prudent man would willingly trust his House is frequent metalline communications through every part of it; that if the readier passage afforded by the rod should not be felt in the prodigious effort of a large & highly charged thunder-cloud, the lightning should at least have many channels through the house by which it could pass off without doing mischief in its course.\textsuperscript{41} The great augmentation of the shock\textsuperscript{[sic]} from Wilson’s conductor by applying a great length of wire, is likewise related so indistinctly, that I cannot satisfy myself whether it be a new fact in electricity or not.\textsuperscript{42} About a week ago we had extremely hot weather here; in town the Thermometer rose to nearly 95, in the shade, but exposed to the heated air that was passing through the streets. It was excessively distressing & made me very ill.\textsuperscript{43} Philadelphia is at length evacuated. Our Army effected their march through the Jersies with the loss of between three & four hundred men, a loss that was about doubly repaid upon the Rebels.\textsuperscript{44} We consider ourselves as upon the eve of some important movements, but cannot judge what they will be. It is suspected that the French is near this coast, & our large ships here are now at Sandy Hook ready to sail, & perhaps have sailed, in pursuit of them.\textsuperscript{45}

I am, my dear Friend,

Your obliged & very humble\textsuperscript{[?]} serv\textsuperscript{\dagger}

C Blagden.

John Lloyd Esq\textsuperscript{\dagger}
Charles Blagden: letters from America

NOTES


3 The collection contains a substantial number of letters from Joseph Banks and two from William Herschel, who made a telescope for John Lloyd, but no other letters from or to Charles Blagden were found.


5 Ibid., p. 414.


10 Ibid., p. 414.

11 Ibid., pp. 421–422.


14 Ibid., p. 415.


18 Perhaps the ‘Spanish Main’, the common term for the Caribbean Sea in earlier times.


21 Ibid., pp. 750 and 751.

22 Ibid., p. 751.


Hafodunnos, Llangernyw, Denbighshire in Wales.

Lloyd was admitted to the Middle Temple on 12 November 1770: *op. cit.* (note 2).

There is no record of this letter in the surviving Blagden correspondence at the Royal Society or British Library collections, or in the Lloyd correspondence held in the National Library of Wales.

The College of Philadelphia (now the University of Pennsylvania).

David Rittenhouse (1732–1796) was a ‘clockmaker, optician, instrument-maker, and self-taught astronomer’ (*McCulloch, op. cit.* (note 6), p. 80). Elected to the American Philosophical Society in 1768, he became City Surveyor of Philadelphia in 1774, a member of the Pennsylvania Assembly, and state Treasurer between 1779 and 1787. He was Director of the U.S. Mint between 1792 and 1795. [www.archives.upenn.edu/people/1700s/rittenhouse_david.html](http://www.archives.upenn.edu/people/1700s/rittenhouse_david.html) (accessed 8 May 2017). Rittenhouse also built an orrery for the College of New Jersey (now Princeton University).

The orreries built by Rittenhouse ‘show the solar and lunar eclipses and other phenomena for a period of 5,000 years either forward or backward’. [www.archives.upenn.edu/people/1700s/rittenhouse_david.html](http://www.archives.upenn.edu/people/1700s/rittenhouse_david.html) (accessed 8 May 2017).

The orrery at Philadelphia was acquired from Rittenhouse in 1771 and used as a teaching instrument for about fifty years before becoming something of a historical curiosity. Today it is displayed in the Special Collections Centre at the University of Pennsylvania: ‘Rittenhouse’s carefully designed planetarium served a pedagogical purpose for the College of Philadelphia – to train students to study and observe the movement of matter across the night skies’ (David N. McKnight, ‘The Rittenhouse orrery: a marvel of history, science and craftsmanship’, [https://www.library.upenn.edu/docs/kislak/orrery/PASOrreryArticle.pdf](http://www.library.upenn.edu/docs/kislak/orrery/PASOrreryArticle.pdf) (accessed 8 May 2017)).


Born in Aberdeen, William Smith was elected a member of the American Philosophical Society in 1768 and taught natural philosophy and ethics at the College of Philadelphia. He was an Anglican minister, and Professor of Ethics (1754–1791) as well as Provost of the College. [www.archives.upenn.edu/people/1700s/smith_wm.html](http://www.archives.upenn.edu/people/1700s/smith_wm.html) (accessed 8 May 2017).


Probably his younger brother Richard Blagden: Miller, *op. cit.* (note 1).

In a letter to Banks of 12 June 1778, Blagden notes seeing the *Trident* pass by while ‘At anchor near Reedy Island in the River Delaware’: *op. cit.* (note 4), p. 421.

Although reclassified many times, its taxonomic designation today is *Electrophorus electricus* (Family: *Electrophoridae*, Suborder: *Gymnotoidei*, Order: *Gymnotiformes*). It was commonly called *Gymnotus electricus* in the eighteenth century.


*Ad captandum vulgus*, meaning ‘to appeal to the crowd’, reflects what is known of Wilson’s showmanship and experiments, as well as Blagden’s view of them.

See introductory text to this article and reference at note 15 for a discussion of these issues.
According to Hackman, *op. cit.* (note 16): ‘The discharge could be augmented by connecting to it a second conductor consisting of 3,900 yards of copper wire.’

Blagden was an inveterate chronicler of the weather and his letters to Joseph Banks from America are particularly detailed in this regard: *op. cit.* (note 4). For a general outline of the significance of weather reporting at this time, see Jan Golinski, *British weather and the climate of enlightenment* (Chicago University Press, 2007).

The British evacuated Philadelphia in June 1778, with the last British troops departing on 18 June. The troops then marched through New Jersey heading for New York, all the while harassed by the Americans under General Lee and Lafayette. On 28 June a battle was fought at Monmouth, with the Americans retreating until halted by Washington’s direct intervention. The British then resumed their march, and heavy rain on 29 June and exhaustion prevented the Americans from following. Rakove, *op. cit.* (note 8), pp. 151–153.