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VIEWPOINT

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H^2O: The Stuff of Life?

A deep-dive into the history of water

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Editorial

Water: the stuff of life? This issue takes a look at the scientific, technological, and medicinal significance and impacts of water throughout history.

First, Amelie Bonney explores how scientific experts responded to large-scale water poisoning caused by arsenic in the early 19th-century French wallpaper and dye industries. Then BSHS Executive Secretary Lucy Santos reflects on the medical and therapeutic uses of radium at spas across the world in the early 20th century. Finally, Editorial Assistant Jennifer Farquharson considers a series of key watery moments in the history of engineering, investigating how engineers have fundamentally changed the way we interact, explore, and live alongside our waterways

Also this issue, James Sumner discusses the digital history of science following the award of the BSHS Ayrton Prize, and BSHS Postgraduate Officer Jemma Houghton gives advice on running a Twitter conference. Our interview this issue is with *BJHS* Editor Amanda Rees.

Let us know what you think of the issue on Twitter @BSHSViewpoint or by email. Contributions to the next edition should be emailed by 15 August 2020 to viewpoint@bshs.org.uk.

Hazel Blair, Editor

BSHS Publications in 2020

As you will know from the President's recent newsletter, the COVID-19 pandemic has severely affected the printing and distribution of journals worldwide. As a result, there are delays affecting the distribution of print copies of *Viewpoint* in 2020.

Additionally, given the pressures and constraints that the pandemic is imposing on the Society and our contributors at present, we are delaying production of the next issue of *Viewpoint* until the autumn.

The October issue will be a 'bumper' version, with extra content, and the print version will be accompanied by a physical copy of this current issue.

The *BJHS* is also affected by these problems, but you will eventually receive print copies of all issues published in 2020, and all content remains available via Cambridge Core. Details on accessing this content online will have been sent you by the Society. Please contact us if you are experiencing any problems.

Blue Plaque for Frankland

In 2019, English Heritage erected a blue plaque for chemist Sir Edward Frankland (1825 -1899). Frankland was responsible for improving understanding in several areas of chemistry.

In 1852, Frankland helped to establish the basis of modern structural chemistry with his theory of valency, or they combining power of elements as the form chemical compounds or molecules. In 1868, he also worked with scientist and astronomer Joseph Norman Lockyer, which eventually led to the discovery of helium in the Sun's atmosphere.

Frankland's work also had an important impact of public health. Following the cholera outbreaks in 1865, Frankland was appointed as London's water consultant and later became a member of the Royal Commission on the Pollution of Rivers. He improved the understanding of water contamination by pollution including raw sewage and industrial waste, and researched methods of water purification. His work led to several closures of contaminated water sources, and improvements in the management of reservoirs, filtration, and the implementation of hygiene legislation.

Image: Maull & Polyblank via Wellcome Collection / CC BY 4.0 Cropped.

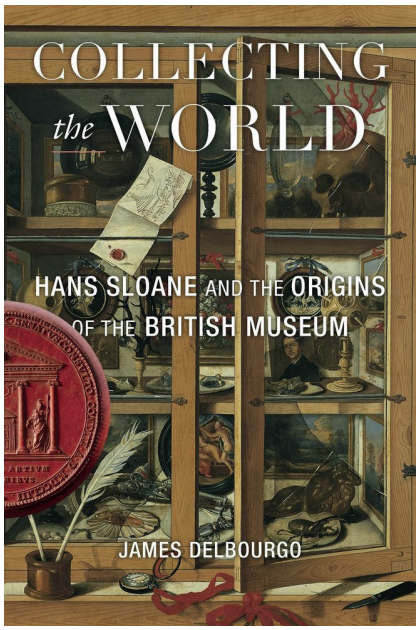
The plaque was erected at 14 Lancaster Gate in Bayswater, London, where he lived from 1870-1880.

BSHS Hughes Prize

The BSHS's biennial prize for popular history of science writing was held in 2019. The prize was renamed from the 'BSHS Dingle Prize' to the 'BSHS Hughes Prize' for the late Professor Jeff Hughes, to celebrate his commitment to public engagement with the History of Science.

The jury for the first BSHS Hughes prize was chaired by Dr Jane Gregory and included Matthew Cobb, Allan Jones, Sadiah Qureshi, Katherine MacAlpine, Alison Moulds.

There was a strong field of nominations for the prize which the jury whittled down to a shortlist of five outstanding books: James Delbourgo, *Collecting the World: Hans Sloane and the Origins of the British Museum*; Lee Alan Dugatkin and Lyudmila Trut, *How to Tame a Fox (and Build a Dog)*; Merve Emre, *What's your type?: The Strange History of Myers-Briggs and the Birth of Personality Testing*; John Gribbin and Mary Gribbin: *Out of the Shadow of a Giant: How Newton Stood on the Shoulders of Hooke and Halley*; David Quammen: *The Tangled Tree: A Radical New History of Life*.



The final winner was James Delbourgo, for *Collecting the World*. The jury commended this 'intensely researched and elegantly written book' for contributing to 'broader cultural debates about heritage, science, and identity in the world today' and recommend it to readers interested in the history of museums, Restoration England, medicine or international trade. •

OEC Project Grants

Each year the BSHS Outreach and Engagement Committee offers small project grants of £200 that are intended to kick-start engagement events and opportunities that might not receive funding from other sources.

Two project winners in 2019 were awarded the funds to support digital engagement with the history of science, technology, engineering, and medicine. Alex Longworth-Dunbar (University of Manchester) is setting up a podcast on the history of technology. Sarah Qidwai (University of Toronto) and Glen Moran (University of Birmingham) are creating an online resource for the public that explores the history of Islam and theories of evolution.

A third 2019 winner used the project grant to pilot a public engagement activity for primary school children on the history of food science. The set of activities, titled 'History of a Balanced Diet', involved plenty of hands-on food chemistry. The session was trialled at an event held in St Hilda's Community Centre, Boundary Estate in Tower Hamlets, London. •

New OEC Members

The Outreach and Education Committee have appointed two new postgraduate members to the committee. Welcome to Eleanor Armstrong (UCL) and Lenka Sediva (Durham) who will be contributing to our work in delivering grants, fellowships and prizes, while bringing discussions around the history of science, technology, engineering, and medicine to new publics. •

Ashmolean Emotions

Talking Emotions is an interdisciplinary public engagement project based at the University of Oxford and at the Ashmolean Museum of Art and Archaeology. It brings together doctoral and early career researchers to investigate the history of emotions.

Through discussions of museum objects from the Ashmolean's collections, researchers will explore how understandings of emotions have been shaped by scientific theories across time and space, from Galen's humoral theories to Darwin's evolutionary study of emotions.

From 4 May to 18 June, thematic gallery talks will take place on Mondays and Thursdays from 12.30pm to 1pm. These talks will also be shared as podcasts (podcast.ox.ac.uk). Further information at www.ashmolean.org/events and on Twitter via @TalkingEmosOx. •

Repatriation resources

Johanna Parker has created a brief online reference resource in her new blog for the BSHS website. Parker outlines key writers on the debates surrounding repatriation of human remains in museum collections. It is a must-read for researchers and anyone who wants to understand what repatriation means to individuals and communities. The references refer to work on indigenous repatriation in from academics based in Australia, New Zealand, the US, and Germany, as and Parker links to Australian government legislation. For more information, see *www.bshs.org.uk/repatriation-a-short-guide-to-some-of-the-resources* •

Cover Image: José Manuel Suárez via WikiCommons / CC BY SA 2.0. Cropped.

Dangerous Decoration: from Green Wallpapers to Toxic Water

Amelie Bonney explores how scientific experts responded to large-scale water poisoning caused by arsenic in early 19th-century French wallpaper and dye industries.

In 1775, Swedish pharmacist Carl Wilhelm Scheele discovered a green pigment composed of copper arsenite. Improved by the German chemists Russ and Sattler, Scheele's Green and Emerald Green took on particular popularity in France. These eye-catching and affordable colours were used for a plethora of goods such as soaps, textiles, children's toys, candles, and wallpapers throughout the 19th century.

Yet these new shades of green came at a price. They contained arsenic, a poisonous by-product of the copper-mining industry. This substance was connected to widely popularised cases of criminal poisoning, and to industrial accidents affecting the natural environment. It soon became the focus of investigations and debates about public health, industrial hazards, and water pollution.

Toxic uncertainties

In the summer of 1836, the Faubourg St. Pierre neighbourhood of Nancy in France became the site of the emergence of a strange phenomena, which needed investigation. A young carpenter named Gillet, his wife and three children suddenly developed headaches, nausea, swollen legs, fatigue, and digestive ailments without any identifiable cause. Evoking criminal poisoning cases, these symptoms prompted local police authorities to appoint several expert witnesses to find the culprit.

While the police initially suspected a domestic servant of attempting to poison the family, pharmacist Henri Braconnot (1780-1855) and physician Charles Haldat (1770-1852) incriminated an insalubrious courtyard. This space was filled with waste and a well containing stagnant, marshy water, home to mysterious 'animalcules' which they saw as vectors of disease. As for the chemist and industrialist Jean Darcet (1777-1844), he claimed that noxious vapours in the family's home had caused the symptoms. All three experts recommended cleansing the courtyard, condemning the well and ventilating the family's home to cure them.

Haldat and Braconnot did initially suspect the neighbouring wallpaper business owned by Noël of contaminating the groundwater. They used arsenic and copper oxide in the preparation of Emerald green, after all. But their experiments confirmed that the local water was perfectly drinkable. 'My analysis proved that this water was of good quality and did not contain any poisonous substances', Braconnot reported to anatomist François Leuret (1797-1851), the chief physician of the Bicêtre hospital in Paris and editor of the *Annales d'hygiene publique et de médecine légale*, an influential hygienist journal.

At a time when the absorption of poisons and their chemical properties remained widely debated among the scientific and medical community, it is not surprising to find that Leuret used this incident to promote hygienist theories. He argued that insalubrious living conditions and filth were the main causes of disease. Neo-hippocratic theories of disease and moral considerations prevailed, as toxic substances remained elusive and hard to measure, while poisoning symptoms remained conflated with other ailments.

Measuring toxicity

Two years later, in February 1838, the mysterious disease suddenly resurfaced. This time, it affected the entire neighbourhood, causing the death of the local pharmacist's mother. The local population petitioned the police for further scientific investigations. Together with François Simonin, a member of the Public Health

Board (*Conseil d'Hygiène*) of Nancy, Braconnot once again examined local water-pumps and wells. But this time, the two men made use of a brand-new tool for detecting arsenic: the Marsh Test.

'I took advantage of this incident to evaluate the excellence of this new method' Braconnot reported to Leuret, adding that his experiment yielded 'a large shimmering quantity of metallic arsenic'. Using this method, they were able demonstrate that the water in local wells contained large quantities of arsenic oxide as well as alumina and potash. These substances were used abundantly by Noël's wallpaper manufacture. Their investigation revealed that the dangerous substances found in the water periodically stagnated before infiltrating the wells of neighbouring homes, causing sporadic nuisances which were difficult to monitor. The new Marsh Test thus proved crucial to demonstrating that the wastewater of Noël's firm was toxic. It changed the way in which environmental hazards were evaluated and measured in early 19th -century France.

The case of Noël's wallpaper firm was widely discussed in the press. It publicised the perception of arsenical colours as an environmental and sanitary hazard, but with limited results. The accident had a strong impact on Braconnot and Simonin, who continued to openly criticise the chemical industry and its environmental and sanitary effects. In the aftermath of the accident, Braconnot urged local authorities to monitor this type of industry in order to guarantee public health and safety. The local Board of Public Health thus recommended that the water of the affected wells be analysed annually to prevent further accidents from happening. But its decision to limit surveillance to a single business instead of focusing on the dangers posed by arsenic green meant that industrial interests were largely safeguarded. It didn't take long before another wallpaper firm owned by Pierre-Hippolyte Huin-Thervay caused groundwater poisoning in the same neighbourhood of Nancy.

Troubled waters

In 1862, an even worse incident occurred in the city of Lyon. Fifteen residents of the Pierre-Bénite neighbourhood developed skin rashes, digestive ailments and impairment of their nervous functions. Three of them died as a result. The dye manufacturer Renard Frères et Franc was soon suspected, as they produced fuchsine, a red aniline dye, which when produced created large amounts of arsenic waste. But neither the local Board of Public Health nor the judicial committee entrusted with the case were able to make the link to the outbreak of deaths and disease. Official reports served the interest of the dye industry as scientific experts involved in the inquiry argued that sickness and deaths were caused by an epidemic rather than by groundwater poisoning. This terminology could be easily used to minimise the effects of industrial pollution.

Two years later, toxicological analyses of three further victims revealed that arsenic was present in their bodies. An extended analysis of neighbouring wells revealed that they all contained arsenic originating from the dyeworks. Even though Renard Frères et Franc had attempted to purify the water of arsenic by storing it in reservoirs containing lime before draining it, each litre of water that left the factory still contained an average of 3 grams of arsenious acid. It then stagnated in an open pit formed by the river Rhône, eventually infiltrating the groundwater.

In 1866, the pharmacist and chemist Alphonse Chevallier (1793-1879) published an extensive article on the risks involved in the preparation of fuchsine. He was in favour of promoting production methods that avoided the use of arsenic. But he recognised that 'in the present time, commercial considerations often take precedence over hygienic ones'. Instead of promoting further regulation of the trade, he provided a list of precautionary measures to mitigate groundwater pollution – new technologies might be used in order to avoid the burial of arsenical waste, for example. 'Even if these measures do not fully avert accidents', he concluded, 'they should prevent most of them from happening if they are implemented with the utmost care'. Chevallier's statement thus illustrates how the hazards of arsenic groundwater poisoning were minimised and rationalised through a rhetoric based on technical and scientific progress, which endures to this day. •

Above *Pharmacist Henri Braconnot (1870-1855).* Opposite Page *Numerous wallpapers contained toxic arsenic pigments, such as William Morris's 'Daisy' pattern from 1864.*

Amelie Bonney
University of Oxford

Radioactive Waters

BSHS Executive Secretary **Lucy Santos** reflects on the medical and therapeutic uses of radium at spas across the world in the early 20th century.

The discovery of the radioactive substance radium in the late 19th century prompted a flurry of experiments to scope the limits of its potential applications. Scientists and, in turn, medical practitioners and entrepreneurs would struggle to understand the complicated properties of radioactive elements. By the early 1900s the curious and still mostly unfathomable properties of radium would find expression in a wide range of products and services that were aimed at the general consumer: from the deadly to the bizarre (the O-Radium Hat-Pad 'whenever you are wearing your hat, you are subjecting your hair to beneficent rays') to the simply fraudulent.

Most products were based on the theory of mild radium therapy, proponents of which argued that exposure to radium in small doses (usually administered by drinking radium-laced water or by breathing in radium emanations) caused a small amount of stress to biological organisms. This strain would trigger a chain of physiological reactions that worked as a potent metabolic catalyst to improve joint movements, boost the immune system, and a host of other positive changes.

In 1904, Pierre Curie and Albert Laborde tested water from 19 hot mineral springs in France and Austria and declared that most were radioactive. Wherever deposits of radioactive rocks were to be found potentially so was radioactive water.

In the United States, this was confirmed in the cities of Hot Springs (Arkansas), Saratoga Springs (New York State) and Springdale (Colorado) – amongst others. In Britain, Bath, Matlock Bath, Harrogate, Matlock and Buxton were only some of the spas established as having radioactive waters of one kind or another.

Above *A couple trying radium water in Jáchymov, circa 1920s.*
Opposite (top) *Aerial view of the Radium Palace, Jáchymov.*
Opposite (bottom) *The author having a radon bath, Bad Gastein, Austria, 2018.*

St Joachimsthal

The people of St Joachimsthal, a large town in what was then the Austro-Hungarian Empire and is now the Czech Republic, were quick to exploit the 1905 news that their waters were radioactive, and to capitalise on the growing interest in the use of mild radium therapy in medical treatments.

St Joachimsthal had long been known for the valuable minerals found deep within the 'Ore Mountain' range, which dominates the skyline behind the town and runs along the northwest border between the Czech Republic and Germany. In the 18th and 19th centuries, their mines had been known as the source of uranium: used in some medical treatments but more commonly for its use in glassware (adding uranium salts to mol-

Image: Sonee Photography

ten glass can create a range of beautiful colours). But in the early 20th century St Joachimsthal was more famous as being the source of 'pitchblende': the residues used by Marie Skłodowska Curie as the source of the twin discoveries of radium and polonium only a few years earlier.

In 1906, town physician Dr Leopold Gottlieb set up the world's first purpose-built radon spa, The Experimental Spa Institute (Versuch-Heilbadanstalt): two freestanding metal bathtubs in his office, which was in the house of the baker, Adolfa Josefa Kuhna, in the town's main square.

Gottlieb's business of offering radioactive water therapies quickly thrived: a mere 30 patients in 1906 had increased to 228 in under two years. The water treatments seemed to be doing an excellent job, with Gottlieb widely publishing the claim that from a sample of 105 patients, 25 had been completely cured while 50 per cent 'showed improvement.'

The Experimental Spa Institute's report, although carefully couched in the scientific terminology of the time, is rather vague on detail: we do not know, for instance, how Gottlieb defined 'cured', whether the patients were rechecked in a year, or whether they remained 'cured' in five. But prevailing medical thought was cautiously on his side and his practice increased in popularity.

The Radium Palace

Other accommodations sprang up around St Joachimsthal, including the luxurious Radium Sanatorium Hotel and Dependence (quickly renamed the Radium Palace Hotel), which opened in 1912. This grand building boasted 300 rooms, 85 bathrooms, cultivated gardens, tennis courts, garages with living accommodation for chauffeurs, and spectacular leisure and dining facilities.

The Radium Palace Hotel also offered an extensive range of radium treatments. The prescribed treatment plans were elaborate and usually recommended a holistic approach to health: combining bathing in radium water, drinking radium water, walking, and healthy eating – all of which were administered by trained attendants and skilled personnel.

The water for patients at the Radium Palace was pumped from the mines by a series of pipes that brought it directly to the hotel basement. From there the water was directed into one of the fifteen semi-private bathing areas dedicated to radium therapies. There were also four other treatment rooms which had their baths installed in the floor: to allow partial baths if, for instance, you needed to bathe just an arm or a leg.

Inhalation

An inhalation room allowed several people to breathe in the radioactive gases at once, or there were six separate cabins for inhalation in private. One inhalation method that seems to have been pioneered in St Joachimsthal was the *Radiumbad mit Inhalation.* This involved a covered bathtub with three holes: one for the patient's head, one for a cooling device, and one for a contraption with an air trumpet at the end of it. The patient would get into the radon water filled bath and – through a complex system of air pressure, diffusion, and condensation – would also get a blast of pure radon gas straight in the face.

At its peak, the Radium Palace Hotel welcomed around 2,500 customers a year including a young J Robert Oppenheimer, future head of the Los Alamos Laboratory, where the first atomic bombs were designed and built in the 1940s. Whilst the Second World War and, later, the Russian atomic bomb project destroyed its spa industry, today visitor numbers to Jáchymov (to give the town its Czech name) are impressive for a place that still proudly labels itself 'as the first radon spa in the world', and a range of doctor supervised treatments are still on offer in its radium-rich waters. Here, what is referred to as the 'bogey named radon' is tackled head-on in their marketing materials:

> *Most people hear mostly negative information about the ionizing radiation... Yet the ionizing radiation in the hands of a medical doctor is less risky than for example penicillin. People still die of an allergic reaction to penicillin. Nobody has died of medical irradiation yet.*

Whilst mining for uranium officially finished in 1990, the area's mining heritage was officially recognised in 2019 when the Erzgebirge region was named a World Heritage Site by UNESCO in recognition of its mineralogical past.

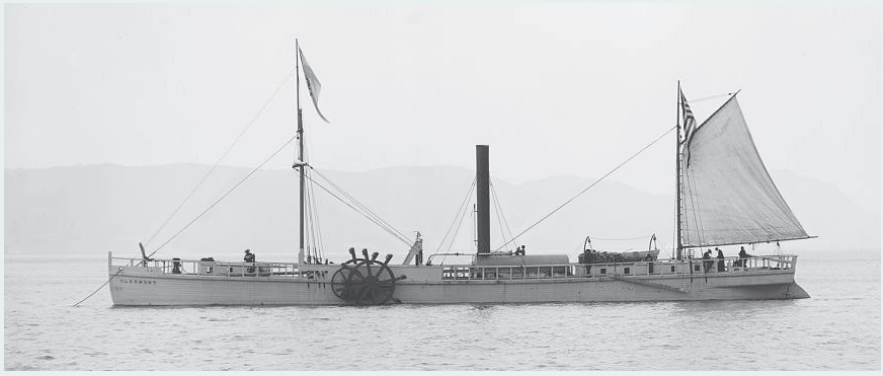
Lucy Santos
BSHS Executive Secretary

Lucy's debut non-fiction historical book, Half Lives: The Unlikely History of Radium, will be published by Icon Books in July 2020.

Water & Engineering: Inventions that Changed the World

Engineers have fundamentally changed the ways we interact, explore, and live alongside our waterways. Advances in propulsion, navigation, underwater exploration, and structural engineering connected a world often separated by water. *Viewpoint*'s Editorial Assistant **Jennifer Farquharson** explores a series of key moments in the history of engineering.

Engineering is 'the creative application of knowledge to drive innovation in design, productions, construction and maintenance of structures and machines.' Whether structural, civil, chemical, or mechanical, the ingenuity behind engineering has been responsible for some of the key moments in the history of science, medicine, and technology, and our waterways have played no small part in these advances.



Above *A replica of the North River Steamboat*

Image: The Detroit Publishing Co. collection / Library of Congress.

Power and propulsion

The rise of industrialism in Britain revolutionised transport. For sea travel, this meant moving away from sail power, first developed in ancient Mespotamia.

Thomas Newcomen's atmospheric steam engine, and the later improvements made by James Watt with the addition of a separate condenser and the introduction of rotary power, made steam a viable power source for transportation. In 1701, engineer Robert Fulton partnered with US congressman Robert Livingstone to start work on a steamboat using a Boulton and Watt Engine. In 1807, the North River Steamboat reduced the time it took to sail from New York to Albany from four days to 32 hours.

Later, in 1858, Belgian inventor Jean Joseph Étienne Lenoir created the first commercially successful combustion engine to power vehicles including boats. He developed it from a converted steam engine, and it burned coal, gas and air. Lenoir later created the motorboat in 1861, and a petroleum engine in 1883 to power small boats.

Navigation

The pursuit of accurate and reliable navigation was a key concern of sailors for millenia. Ancient civilizations used a variety of techniques, including celestial navigation and geographical markers. In China, they sampled mud off the sea floor. Austronesians observed the flight patterns of birds and the state of the sea, and the ancient Greeks invented the astrolabe which helped mariners tell time and location.

The Han Dynasty in China developed the first magnetic compass. It was made from naturally magnetised

Above *Upside-down marine chronometer by Charles Frodsham of London, c.1844–1860.*

Image: LLadd Observatory Collection/CC BY-SA 4.0

Underwater Exploration

Although submarines were developed with milatristic purposes in mind, underwater exploration vessels have been integral to the investigation of oceanography, marine biology, geography and more.

A prototype submersive vessel was built by Russian inventor Yefim Nikonov in 1721 by invitation of Peter the Great, but the first functioning submarine was designed by British mathmetician William Bourne and built by Dutch inventor Cornelius van Drebel. It was made of a wooden frame covered in leather, with oars sealed by leather flaps. It submerged to 12-15 feet in the Thames River, and one passenger was rumoured to be King James I.

Robert Fulton developed The Nautilus for Napoleon Bonaparte, in 1801. It was made of copper sheets over iron ribs, and although it had a sail and mast for surface propulsion, it used a hand-turned propeller for propulsion underwater. It also used ballast tanks (invented by Nathanial Symons in 1747) and could last three hours underwater with four men aboard.

A similar submersive vessel was designed in the 1860s by Julius H. Kroehl and Ariel Patterson. The Sub Marine Explorer was a hand-powered submersible built for the Pacific Pearl Company. The Sub Marine Explorer used water ballast tanks and pressurised air chambers, but was eventually abandoned in Panama in 1869, because of issues with decompression sickness.

The first deep sea exploration with a diver was carried out in 1930 by William Beebe and Otish Barton, using a bathysphere. They observed marine life like shrimp and jellyfish and forged the way for future explorers like Jacques-Yves-Cousteau.

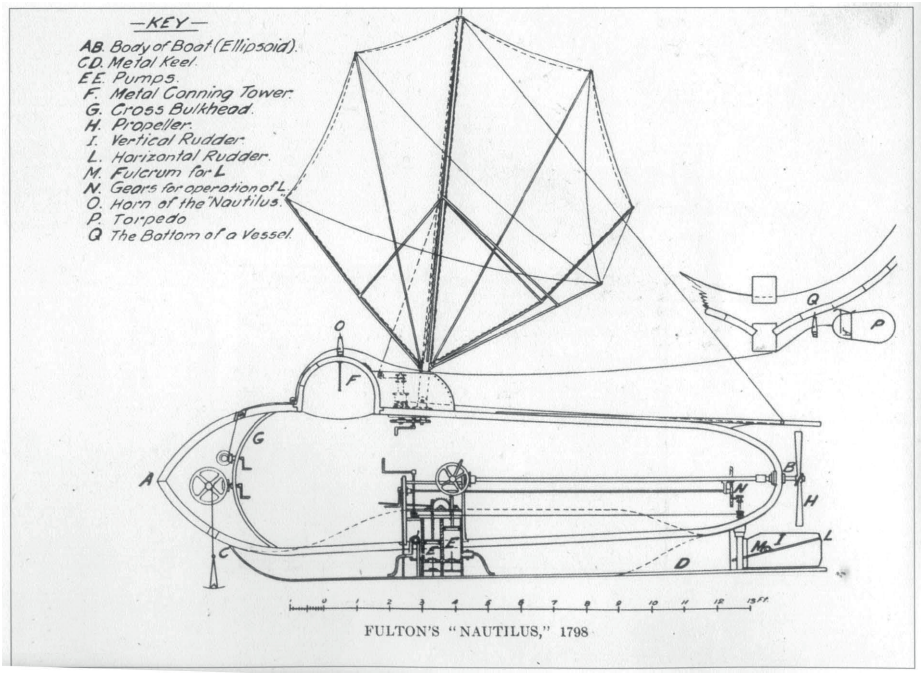


Image: LLadd Observatory Collection/CC BY-SA 4.0

lodestone, but it wasn't used for navigation in China until the 9th- 11th century. This meant that mariners could navigate in overcast weather conditions which obscured the stars, the sun, and geographical landmarks. Seafarers could safely travel further, creating more opportunities for trade and exploration.

However, another major issue facing sea navigation was the Longitudinal Problem. Conditions at sea made it difficult to calculate longitude the way that latitude could be calculated on land. Choppy seas, any uncertainty around a ship's exact location, and the environment needed to carry out the work made this nearly impossible. So sea travel continued to be uncertain and dangerous.

In 1714, the British Government offered a prize of £20,000 for a solution to this problem, and in 1764, clockmaker John Harrison (1693-1776) invented the marine chronometer. The chronometer used a fast-beating balance wheel controlled by a spiral spring, to minimise the impact from a ship's motions. The accuracy of Harrison's chronometer was proved after British naval officer and explorer Captain James Cook (1728-1779) used it to circumnavigate the globe in 1779. Cook reported that his longitudinal calculations were accurate within 8 miles. This remained a central tool to ship navigation until radar in 1935 and GPS in the 1970s.

***Below** Han Dynasty lodestone compass.*

Image: WikiCommons/CC BY-SA 3.0

Below *The Grand Canal, China*

Image: Lawrence Siu via Flickr/CC BY-SA-NC-ND 2.0

Structures

Isambard Kingdom Brunel was one of the most important engineers of the nineteenth century. As well as developing propeller-driven steamships, Brunel was integral in the development of British transport links, including bridges.

In his work with the railway, Brunel designed several bridges which connected the country across waterways, including the Royal Albert Bridge over the River Tamar, the timber-framed Somerset Bridge over the River Parret, and the the Windsor and Maidenhead Railway Bridges over the River Thames.

Brunel also helped the building of the Thames Tunnel, although removed himself from the project after an accident left Brunel severely injured and killed several workers.

Canals were another means by which engineers used waterways to connect countries. The Grand Canal of China was built from the 5th century, and today is still the longest and oldest canal in the world. It is protected by UNESCO World Heritage Status. It connected two rivers and was used to ship grain and supplies.

The main building period of canal infrastructure in Britain began in the late 18th century, although there were earlier canals, such as the Exeter Canal built in 1566. Engineer James Brindley was employed by the Duke of Bridgewater to design and build canals to improve the market for his coal mines in Lancashire. A canal was completed in 1761 and was built over the River Irwin via the Barton Aqueduct. Brindley also built the 'Grand Cross' of canals, linking the Severn, the Mersey, the Humber, and the Thames.

In Scotland, a series of canals were also built, including the Forth Clyde (1790), the Crinan (1801), the Union, (1822), and the Caledonian Canal (1822). James Watt was employed for part of his career as a surveyor, planning our potential routes for Scottish canals. One of these canals included the Caledonian Canal design by engineer Thomas Telford to improve communications with the Highlands of Scotland. It meant that sections of the Crinan Canal had to be redesigned, and several roads and bridges had to be built. •

> "Pound locks were invented by Chhiao Wei-Yo, in 983, and the mitre gate was designed by Leonardo Da Vinci (1452-1519).

Jennifer Farquharson
Glasgow Caledonian University

Jennifer joined Viewpoint *in 2019 as Editorial Assistant. She is a Content Officer at Historic Environment Scotland and has interests in historical outreach and education. Jennifer holds a PhD in Scottish mental health history in the 19th and 20th centuries.*

Digital Engagement: Resources and Developments

James Sumner discusses digital history of science following the award of the BSHS Ayrton Prize. Then BSHS Postgraduate Officer **Jemma Houghton** gives advice on running a Twitter conference.

The life-changing global shift to remote online communication caused by the Covid-19 pandemic will no doubt greatly increase awareness of, reflection on, and innovation in the field of digital engagement. Yet the field has always been a fast-changing one. The 2019 BSHS Ayrton Prize, awarded by the Outreach and Engagement Committee every two years for 'outstanding web projects and digital engagement in the history of science, technology and medicine', received far more entries than in previous years, several of them based on approaches that were simply unavailable even a few years ago. This article briefly surveys some of the entries received, together with some longer-established projects, to give a sense of the possibilities that might serve as groundwork for times to come.

Prizewinners

So impressive was the range of Ayrton Prize entries that the judges chose two joint winners – one grounded firmly within the established history of science community, the other approaching the issues from a very different place. The Darwin Correspondence Project is a long-standing project well-known for its traditional research and outreach, but the prize reflects particularly its contribution to online engagement across a variety of audiences, delivered in such a range of formats that almost any likely visitor to the site would find something that was on their wavelength somewhere.

The other joint winner, Excavating AI, is a commentary on the ImageNet Roulette app that caused a media stir in 2019. The app used artificial intelligence to match the features of users' faces to a large human-compiled object-recognition database and label them with automatically generated description terms. The often alarming results promote increased awareness of a variety of issues – the reductiveness of formal categorisation, the implicit bias of observers, and the subtle agency of trust in technology – which have clear resonances with HSTM themes. The relevance of this kind of work was not something the OEC had even considered when the Ayrton Prize was launched, but the judges saw it as particularly valuable.

Wikipedia

The range of entries showed a number of trends. Several were built around improving coverage of under-represented groups in the historical record, particularly women. This might not seem an obviously 'digital' concern, but in practice it's now largely co-ordinated and promoted through online platforms. Most visibly, a number of projects work to improve coverage on Wikipedia, which has phenomenal reach to general audiences. The University of Edinburgh's project, which received a runner-up commendation from the Ayrton Prize judges, uses the creation of online biographies of women in science, technology, and medicine across Scotland as a way to increase engagement with open online systems among librarians, academic staff, and students.

The Edinburgh project builds on past efforts such as the Wellcome Collection's hosting of a Wikimedian in Residence, Alice White, a past editor of *Viewpoint* who continues to work on digital engagement at the Wellcome. Opportunities for correcting under-representation are not limited to funded projects, however. Another Ayrton entry, the Women's

Left *'The Treachery of Object Recognition, 2019. Dye sublimation print (15 × 12 ½ in). This work, by artist Trevor Paglen (who co-wrote Excavating AI with the AI researcher Kate Crawford) takes René Magritte's famous visual comment on the ambiguities of representation and subjects it to the blunt judgment of the ImageNet object-recognition algorithm, with 'accurate' but disturbing results.*

Image: Copyright Trevor Paglen / courtesy of the artist and Metro Pictures, New York.

Engineering Society's Engineer of the Week series, shows what can be achieved by a single volunteer author working with a straightforward blog platform.

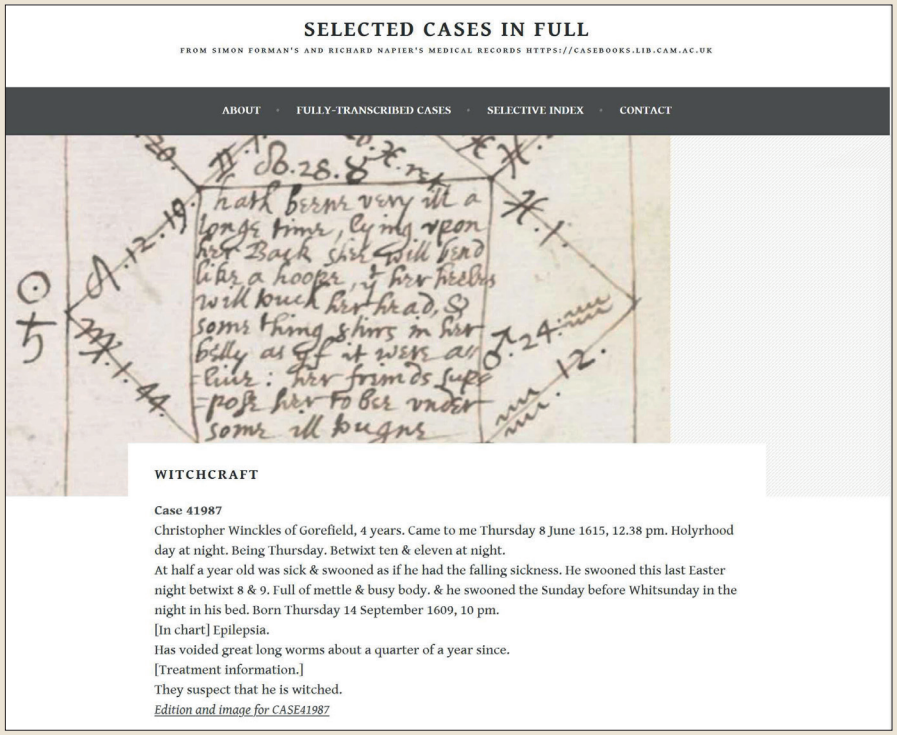
Podcasts

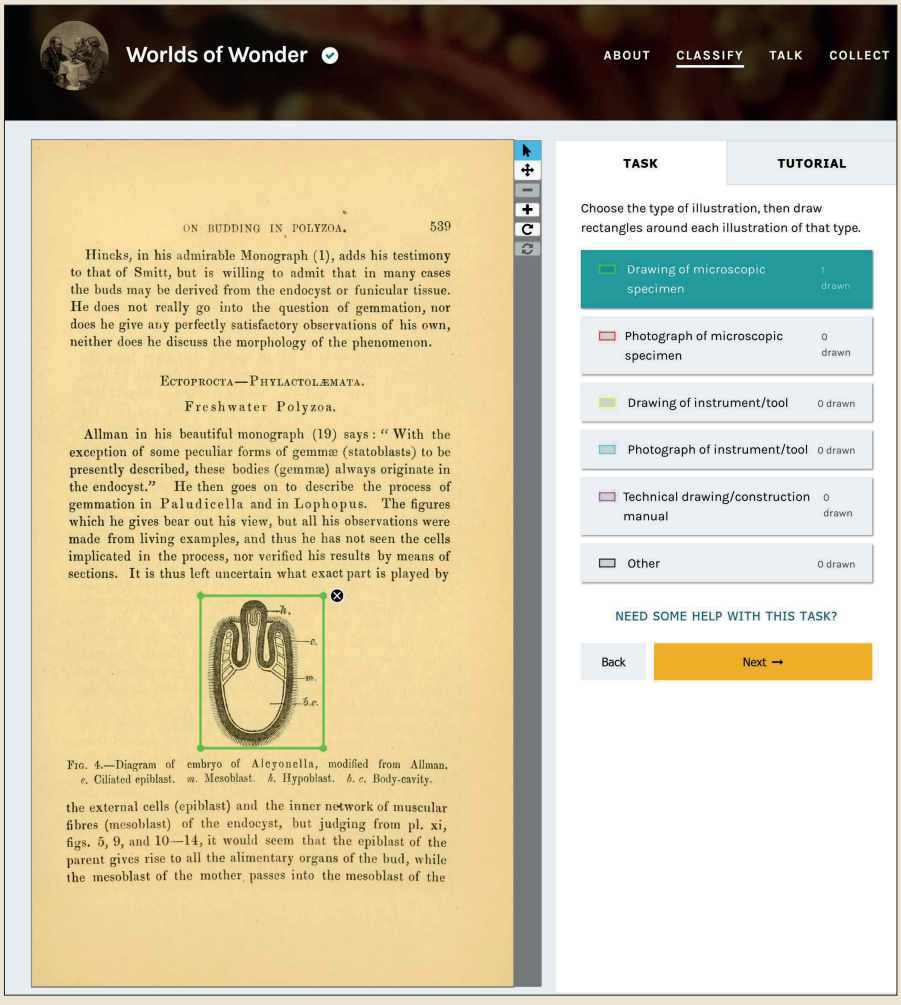
Audio podcasts have been a big growth area for public engagement in recent years. The sciences and engineering now boast a community of lively, engaging presenters and interviewers, and many professional organisations have committed resources for high-quality production and online support materials such as transcripts. Science podcasts often discuss the contexts of scientists' working lives in ways that will appeal to historians, and some feature a lot of historical content.

The Ayrton Prize judges awarded a runner-up commendation to the Genetics Society's podcast, Genetics Unzipped, for an impressive display of consistently accessible coverage which often draws deeply on academic HSTM research. Another Ayrton entrant, the Ada Lovelace Day Podcast, focuses on both the current and historical achievements and careers of women in science and engineering, while the Nature Podcast, which focuses mainly on science news, includes a monthly 'PastCast' devoted to historical topics. Podcasting also lends itself to bringing existing engagement activities to a broader audience: the History of Science Museum in Oxford offers a podcast of its public lecture series.

Public engagement

Another approach where historians can tap into established work in STEM engagement is citizen science, which allows volunteer members of the public to contribute directly to research, usually remotely and online, often performing tasks such as classification or transcription. Direct public participation was, of course, once quite general in fields such as natural history, and indeed the recent Constructing Scientific Communities project was inspired by the potential parallels between nineteenth- and twenty-first-century practice. The Zooniverse platform, originally built with STEM research in mind, now hosts a broader range of projects such as Worlds of Wonder, which uses volunteer crowdsourcing to identify nineteenth-century microscope illustrations. This kind of work can be done perfectly well without a dedicated online platform, however. Railway Work,





Above *A sample case facsimile and transcript from* Casebooks, *and one of the classification training tasks for volunteers in* Worlds of Wonder.

Life and Death a nice example of an online archive based on volunteer contributions, presents its findings in various ways, perhaps the most useful of which is a simple downloadable spreadsheet file.

One of the most interesting outcomes of the Ayrton judging process was discovering how some of the more extensive projects' content has been adapted to different audiences. Most strikingly, Casebooks, based on the medical records of the seventeenth-century astrologers Simon Forman and Richard Napier, maintains resources useful to IT-literate professional historians, including the full dataset as a GitHub repository; but is also the basis of Astrologaster, a bawdy and irreverent videogame which has received positive reviews from the gaming community.

Some projects have digital engagement technologies as the subject as well as the medium. An interestingly reflexive example is the Minitel Research Lab, dedicated to the Teletel/Minitel system which famously provided the French public with online instant messaging and home shopping in the pre-Web 1980s. The site engages a significant community of enthusiasts who regard Minitel as a living technology, and aims to provide an archive of not only historical but current developments. Oral history seems to lend itself particularly well to work in this area: the Archives of IT project has developed around a series of interviews with people who influenced the development of technology in the UK.

Multiple media

Video is currently less well developed than audio, but will undoubtedly grow a lot in the era of remote communication. One project to note is Crash Course History of Science, which brings an informal YouTube vlogging style to content based largely on James McClellan and Harold Dorn's textbook *Science and Technology in World History* (1999). There are also projects that use multiple media to good effect, and once again this sometimes features as subject matter. Sound and science: digital histories, on acoustic engineering and its relationship with music and wider culture, is a digitisation project which presents documents, object photographs, and audio.

Mobile apps have strong potential for historians in one key area: the interpretation of specific geographical locations. A number of history-of-science-themed guided walking tours already exist for cities around the world: one of the more extensive projects is Curious Edinburgh, offering a whole series of tours adapted to different audiences. There have been many attempts to combine this kind of approach with virtual reality/augmented reality platforms, which might allow, for instance, an in-situ viewing of a hospital or laboratory as it stood in former times; but this has so far proved hard to translate into practice. Given the extraordinary demands of the 2020 emergency, and the increased attention to remote communication it will prompt, however, we may assume that the near future will see major changes in the possibilities of digital engagement. •

James Sumner
University of Manchester

Hosting a Twitter Conference

The BSHS's first Twitter conference began at 7am on Wednesday 20 February 2020. Over the next 14 hours, 33 academics in 12 countries shared their research on the social media platform

Embracing the international nature of this medium, the theme of the conference was 'Global and International Histories of STEM' and it saw a fascinating array of topics, covering everything from 'The extra-terrestrial life debate and the Muslim world' to 'Religion and ecology in early modern natural science'.

Twitter, with its 280 character limit, is a space for communicating short, engaging pieces of text (pictures and videos may be shared too). Below is a brief guide for organising future academic Twitter conferences based on things we did, things we wished we had done, and the lessons we learned in the process.

Size

One of the benefits of a conference without travel is that essentially anyone who can access Twitter can take part. Consequently, the scope of the conference is something that needs consideration early on. Parallel sessions are unfeasible on platforms like Twitter as they would be chaotic and complicated to follow. However, as with normal conferences you can spread the papers over multiple days. Alternatively, being an online event means that you are not solely constrained to the standard '9 to 5'.

> "One unexpected problem was 'shadow-banning'.

Time zones

When organising a digital conference on an international scale, the primary factor shaping the programme is time zones. Our BSHS Twitter conference involved speakers ranging from GMT+11 to GMT-8. As a result, expanding the conference beyond a '9 to 5' format enables those in other time zones to engage and contribute.

Language

The global nature of Twitter means one must consider the question of conference languages. During the call for abstracts, we included an option for languages other than English. Since all of our speakers stated that their preference was for English and this was our first attempt, the BSHS conference itself was tweeted only in English. Going forward, however, it is worth considering tweeting papers in multiple languages. Twitter also has a useful auto-translate function which may help participants engage with one another across language divides.

Social media guidelines

It is important to have a set of guidelines for social media use. The BSHS social media policy can be found at: www.bshs.org.uk/about-society/social-media-policy.

Sensitive topics

Whilst the majority of those engaging with a Twitter conference are likely to be other academics and interested parties, it is important to remember that anybody can view and engage with Twitter. Thus, for papers coving sensitive topics or images, begin the thread with a warning and all official retweeting of the paper to commence with that tweet.

Tweeting or retweeting

One of the biggest considerations for the practical running of the conference is whether the tweets will be published from a central account or the speakers' accounts. Tweeting from a central account enables makes the conference easier to follow. It also has the added benefit of providing a level platform for the speakers, so that those with fewer followers reach a wider audience. Unfortunately, in our case the volume of tweets issued from a single account led to the 'shadow banning' of our account (see below). The other option is to retweet the papers tweeted from personal accounts. It is important either way to note that the accounts disseminating 'papers' need to be public, otherwise not everyone can view the content.

The 'papers' themselves

Our general guidelines for the BSHS papers were predominately an adaption of the fantastic Underpinning Museum Twitter Conference in 2018. The most important aspects to consider are:

- An easily recognisable conference hashtag that is not too long, eg. #BSHSGlobalHist. Bear in mind, however, that the hashtag should be individual enough to distinguish it from other previously- or commonly-used hashtags.

- Consistent requirements for tweets, namely that each tweet should be numbered and contain the hashtag. It is also important to state how the numbering of tweets will work - 1, 2, or 1/12, 2/12 – as this will impact the number of characters the speakers will have.

- The maximum number of tweets. For example, the BSHS conference had a range of 6 to 12 tweets per paper.

- Each 'paper' contains introduction, body, and conclusion tweets, and is essentially a condensed version of a conference paper.

Accessibility

The tweet format enables a lot of creativity in presentation: GIFs, emojis, photographs, videos, memes, and more can be used. However, with the primary visual element to Twitter, consider ensuring the conference is accessible to those who are colour-blind or visually impaired. This can be achieved with image descriptions (for which twitter allows a maximum of 420 characters), audio transcripts, and well contrasted colours for images conveying information through colour.

Managing the day

On the day itself there are two important aspects to take into consideration. Firstly, while individual tweets can be scheduled beforehand on sites like Tweetdeck and Hootsuite, threads cannot be managed in this way. As a result, if you want the papers to be in the form of threads (which is useful for following the papers as all a speaker's tweets will be grouped together), then they will need to be tweeted live on the day.

Secondly, with Twitter being an online platform that anyone can engage with, it is important to have moderators. This role mainly involves keeping an eye on the discussions and to report any 'trolling' (aggressive behaviour) to keep the conference an open and friendly space.

Shadow banning

One unexpected problem was that our Twitter account became unusable around 2pm as it was caught by a 'shadow ban' (see www.shadowban.eu). Twitter management has not released much information on how and why it uses shadow banning: the main purpose seems to be to reduce spam, but it's done automatically and was presumably triggered by the fact we were tweeting a lot, and/or at regular intervals. A shadow-banned account appears to be working to its owner, but other people can't see tweeted threads. On discovering the problem we switched to tweeting from the BSHS OEC account, which survived for the rest of the conference, but in the mean time we lost part or all of four papers, though they did become accessible after the ban was reversed. Unfortunately, it's hard to see how to avoid this problem unless Twitter itself provides clearer guidance, but we recommend having multiple accounts available.

Twitter conferences provide an interesting option for engagement with an international community as well as a creative outlet for sharing research in a non-standard paper format. This practical guide has been designed as a starting point for anyone wishing to organise a Twitter conference. A second article in the *British Journal for the History of Science* will soon follow as a reflective examination on the BSHS Twitter conference and the use of Twitter for this purpose. All the #BSHSGlobalHist papers have been collated on the Society's website. See www.bshs.org.uk/bshsglobalhist-the-papers. •

Jemma Houghton
University of Manchester

Viewpoint Interviews...

Amanda Rees, Editor of the Society's *British Journal for the History of Science*.

Who or what first turned you to the history of science?

Originally, I thought my interest in history of science came from an absorption with the history of social science methodologies. It was only in the last ten years or so that I realized that it actually grew out of the fact that I've been obsessed with science fiction since I was around eight years old. Science fiction is all about the relationships between society, science and technology, about showing how these relationships change across cultures and over time, and how different configurations of socio-techno-science are produced by and produce different ideas of what it is to be human. So I blame John Wyndham, frankly.

What is your best dinner-table history of science story?

When I was an undergraduate studying social and political science, I applied for scholarships to go to the USA because I wanted to study the history of science. I was too stupid to realise that there was a whole department devoted to the study of the history and philosophy of science right next door to the building in which I was then working.

Which historical person would you most like to meet?

I don't think there's any I'd actually like to meet. Having conducted research on both living and dead scientists and scholars, dealing with the latter is usually much less stressful. But I would like to listen in on meetings between particular historical personages – I'd like, for example, to hear Katherine Johnson talk with Octavia Butler, or Alistair Hardy debate with Richard Dawkins (who, I acknowledge, is not yet dead).

What are your favourite history of science books?

Do they have to be factual? When I taught Scientific Revolution courses, I loved to assign Richard Garfinkle's *Celestial Matters*, which imagines what it would be like explore space in a real-life Aristotelian universe – and Ted Chiang's stories often have a strong history of science flavor (see 'Seventy-Two Letters' – golems, eugenics and the industrial revolution – fabulous). Factual books: Strum and Fedigan's *Primate Encounters* (Chicago, 2000), because of the way in which it ties together conversations between STS scholars and scientists. And oddly, since I'm certainly not an early modernist, Shapin's *A Social History of Truth* probably did most to influence my thinking and writing as a postgrad.

If you did not work in the history of science, what other career would you choose?

Well, I worked as a civil servant in the Welsh Office for a while, between my undergraduate and postgraduate degrees. That was when John Redwood was in charge of it, which a) dates me and b) possibly suggests why I wouldn't want to be a civil servant again. I've worked behind a bar, managed a shop, and taught secondary school (in Ukraine) – but I'm not particularly keen on returning to any of those. If I wasn't a historian, I think I'd like to create knitting patterns. I'd like to see how you could combine colour, yarn and stitch pattern to encode a story that satisfied sight and touch as well as the sense of narrative.

What has been your best career moment?

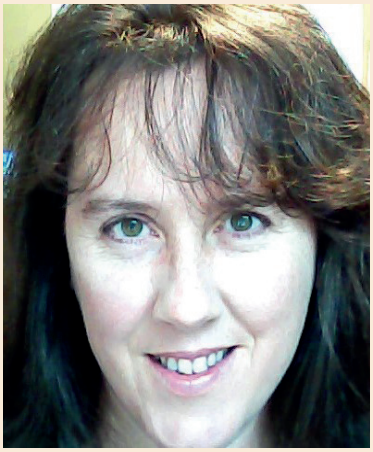
Either getting a permanent job or becoming Editor of the *BJHS*.

And worst?

Depending on the time of day, see above...

What would you do to strengthen the history of science as a discipline?

Looking to the future of the discipline is a key part of the work we're doing on the new Forum section of the *BJHS*. This is based on a series of initiatives begun by my predecessor, Charlotte Sleigh, on which I intend to build. 'Science in Translation' and 'New Perspectives' are both aimed at least partly at decolonizing the discipline, encouraging knowledge of and interest in non-Anglophone areas and topics amongst the journal's readerships. Broadening the remit of the discipline in this way can only strengthen and improve the critical scholarship that has been at the heart of the history of science since its inception.



However, I also want to strengthen the public face and role of the history science – and one key strategy for doing this will be 'Dialogues', where historians sit down for conversations with practicing scientists and businesspeople. I hope that these conversations will explore the different ways in which knowing about the history of science can improve both present day practices and future prospects for science and industry.

How do you see the future shape of the history of science?

The short to medium term looks difficult for our own discipline and for the humanities more generally: we will have to work hard to maintain our own research and support our colleagues, especially those on precarious contracts, during what looks to be a period of abiding intellectual and financial austerity. It's for this reason that I'm so keen to create and foster links between history of science and potential scientific and industrial partners, in order to showcase the capacity of history to contribute to the global future. It's also one reason why collegiate institutions like the BSHS are so incredibly important – after all, if we don't hang together, the chances are pretty good that we will all hang separately. •

The British Journal for the History of Science

- Clare Hickman, 'The want of a proper Gardiner: late Georgian Scottish botanic gardeners as intermediaries of mediecal and scientific knowledge'
- Emily Hayes, 'Fashioned in the light of physics: the scope and methods of Halford Mackinder's geography'
- Pierre Verschueren, 'Cécile Morette and the Les Houches summer school for theoretical physics; or, how Girl Scouts, the 1944 Caen bombing and a marriage proposal helped rebuild French physics (1951–1972)'
- Eilis Kempley, 'Julian Trevelyan, Walter Maclay and Eric Guttmann: drawing the boundary between psychiatry and art at the Maudsley Hospital'
- Oliver Hill-Andrews, 'A new and hopeful type of social organism': Julian Huxley, J.G. Crowther and Lancelot Hogben on Roosevelt's New Deal'
- Paul Merchant, 'What oral historians and historians of science can learn from each other'

www.bshs.org.uk/publications/bjhs

Viewpoint: the Magazine of the BSHS

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Editor: Hazel Blair. **Editorial Assistant**: Jennifer Farquharson.
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