HPSC0081

Science in the Nineteenth Century

Course Syllabus*

* This may be subject to unforeseen changes. Please always check the Moodle page for the most up to date syllabus and instructions.

2023-24 session | Dr Jenny Bulstrode

Course Information

This module provides an overview of some key topics and methodologies in the study of the history the sciences from 1800 to 1900, with a particular emphasis on the sciences considered in their social, political and cultural contexts. Topics range from bioprospecting and climate activism to electrical physics and experimental design. The module works closely with primary sources, and students will have the opportunity to carry out their own short research project on an aspect of science in the 19th century that interests them.

Basic course information

Course website:	See Moodle
Moodle Web site:	https://moodle.ucl.ac.uk/course/view.php?id=37550
Assessment:	One essay of 3,000 words, provisional deadline: 18 December.
Timetable:	See online timetable https://timetable.ucl.ac.uk/tt/homePage.do
Day, time	Thursday, 14:00-16:00
Lecture room:	Institute of Education - 20 Bedford Way, Room C3.13
Required texts:	See Moodle
Course tutor(s):	Dr Jenny Bulstrode
Contact:	j.bulstrode@ucl.ac.uk
Tutor Web site:	https://www.ucl.ac.uk/sts/people/dr-jenny-bulstrode
Tutor Office:	22 Gordon Square, Room 4.2 (email j.bulstrode@ucl.ac.uk for availability)

Schedule

Seminar No.	UCL Week	Calendar date	Topic
1	6	5 October	Introduction, methods and sources
2	7	12 October	Calibration of time, space and bodies
3	8	19 October	Knowledge transfer and replicating experience
4	9	26 October	Drugs, theft and resistance
5	10	2 November	Balances and the imperial meridian*
6	11	9 November	Reading Week
7	12	16 November	Metrology and telecommunication*
8	13	23 November	Climate science and activism's long history
9	14	30 November	Visual technologies and astronomical imaging*
10	15	7 December	Cross-contextualizing sources
11	16	14 December	Essay presentations

* These sessions will be led by Professor Simon Schaffer, (University of Cambridge).

Aims

- to give students an insight into a range of historical and historiographical influences in nineteenth century science;
- to encourage critical and analytical thought;
- to help students develop skills in peer-to-peer communication and oral presentation;
- to develop skills in written communication.

Objectives

At the end of the course students should:

- have an understanding of major themes in the development of nineteenth century science;
- have a more critical appreciation of the place of science in contemporary society;
- be able to draw together different parts of the course material;
- have an introductory knowledge of historical, philosophical and sociological methods for analysing science;
- have improved their writing skills.

Teaching and Learning Methods

These include assigned reading; lectures; seminars; activities; and presentations.

Assessment

Assessment for this course is through a single written coursework essay of no more than 3,000 words. Provisional deadline to be confirmed: 18 December. Please always check the module moodle page for the most up to date information.

Week 1

Introduction, methods, and sources
Dr Jenny Bulstrode

Instructions for the first seminar:

1) read the three articles in the order set out below
2) use UCL Primary sources to identify a primary source* for history of science in the 19th C
3) be prepared to tell the class about your source as part of introducing yourself and your interests.

N.B. I recommend reading these articles in the order they are set out here.

Andrew Cunningham, 1988, 'Getting the Game Right: some plain words on the identity and invention of science', *Studies in the History and Philosophy of Science Part A*, 19, 3, 365-389. This paper provides an essential methodological introduction to studying the history of science with reference to the nineteenth century. Through critical analysis of what historians of science do when they're doing history of science, Cunningham first proposes an approach informed by this reflection and then trials applying this approach. As you read, note down instructions for yourself as well as any insights which stand out to you. In the seminar, you will be asked to discuss and apply Cunningham's approach to primary sources for yourself.

Andrew Cunningham & Perry Williams, 1993, 'De-Centring the 'Big Picture': The Origins of Modern Science and the Modern Origins of Science', *The British Journal for the History of Science*, 26, 4, 407-32. As the title suggests, this article is concerned with 'big picture' arguments in the history of science – what we might call grand narratives or the big overview stories that make broad sweeping statements. This paper supports you to take the critical source approach developed in Cunningham's 'Getting the Game Right' paper and extend it to critical analysis of secondary literature. As you read, note down instructions for yourself as well as any insights which stand out to you. In the seminar, you will be asked to discuss and apply Cunningham and Perry's approach to secondary sources for yourself.

Sujit Sivasundaram, 'Sciences and the Global: On Methods, Questions, and Theory', *Isis* 2010 101:1, 146-158. This article is part of a now famous special issue in the history of science's foremost journal, *Isis*. Sivasundaram sets a number of significant challenges for historians of science. What are they? Take notes, in the seminar you will be asked to discuss and apply Sivasundaram's approach to primary sources for yourself.

**Primary source:*

A primary source is a first-hand expression or evidence of an event or experience. This evidence can be in the form of the written word, images, artefacts, data, film or sound recordings, and will have been created at some point during the lifetime of the person involved. Using primary sources in your research adds context and credibility to your argument. As Sivasundaram highlights, primary sources must necessarily vary depending on what, where, when, and who is being studied.

A list of all databases available through UCL Library Services that contain primary source content can be found here: Primary sources. What kinds of sources do you find? What kinds of sources are you not finding? Whose voices and priorities are represented? Whose voices and priorities are not represented?

Week 2

Calibration of time, space and bodies

Jenny Bulstrode, 'The industrial archaeology of deep time'. *The British Journal for the History of Science, 49*(1), 1-25. This paper analyses a major mid-19th century debate about the antiquity of mankind that hinged on how to read and interpret evidence. Less familiar or established forms of evidence, such as flints, were particularly hard to read and interpret. The debate over reading and interpretation of flints is ultimately brought to consensus by **calibration** through reference to certain criteria: where do these criteria come from? Why were they chosen? Why were the individuals who dominated this area of research prepared to agree over these criteria? What can we learn from this about Victorian science and perhaps the way so-called 'modern' western science proceeds more generally?

Kapil Raj, 'When human travelers become instruments: the Indo-British exploration of Central Asia in the nineteenth century' in Bourguet, Licoppe and Sibum (eds), *Instruments, Travel and Science: Itineraries of precision from the seventeenth to the twentieth century*, (London; New York: Routledge, 2002), 156-88. This chapter highlights the importance of **calibration** in nineteenth century survey science. Who is doing the calibration? What is being calibrated? How is calibration achieved here?

Simon Schaffer, 'The Eighteenth Brumaire of Bruno Latour' in Studies in History and Philosophy of Science Part A, (22)1, March 1991, 174-92. This article is an essay review of Law and Sheridan's 1988 translation of Bruno Latour's 1984 work *Les microbes: Guerre et Paix*, titled *The Pateurization of France*. The review provides a profound analysis of Latour's writing and thinking as it was developed here on a famous episode in nineteenth century science: Bonapartist chemist Louis Pasteur's ordering of unruly microbe bodies. Here you are challenged to consider how Latour's historical arguments is written and the implications of his approa. What resources does Schaffer show Latour is using to calibrate his argument? How does Latour use these resources to frame his readers' understanding?

Further material

For a seminal analysis of **calibration** in twentieth century science, see Harry Collins, 'Detecting Gravitational Radiation: The Experimenters' Regress' in *Changing Order: Replication and Induction in Scientific Practice*, (London; Beverly Hills; New Delhi: Sage, 1985), 79-112. How is this sociological approach applied by Bulstrode and Raj in their respective chapters, and Schaffer in his essay review article?

For thinking about the way external criteria are used to shape interpretation in art, see John Berger, 1972, *Ways of seeing*, Episodes 1-4. How does this compare with the way archaeologists and surveyors use calibration? How does this compare with the way historical method approaches sources?

For the social construction of the idea that far away is long ago, see Fabian, Johannes, *Time and the other: how anthropology makes its object*, (New York: Columbia University Press, 2014).

Week 3

Knowledge transfer and replicating experience

Bruno Latour, 1986, 'Visualisation and Cognition: Drawing Things Together', in H.Kuklick (ed) *Knowledge and Society in the Sociology of Culture Past and Present*, Jai Press, vol. 6., 1-40. In this chapter, Latour seeks to define what is specific to our modern scientific culture. He argues that there is no natural divide between what he calls 'prescientific' and scientific cultures, only a border enforced by bureaucrats. But the difference in the effects of so-called 'prescientific' and scientific cultures necessitates attention to what has changed. With that in mind, he asks what is it that makes modern science so powerful? What is the means or mechanism of modern science's power? To test his research question, Latour analyses a seminal narrative for 19th century science that describes an encounter between the 18th C French naval officer, comte de La Pérouse and fishermen Latour identifies as Chinese. The chapter became the founding statement of Latour's 'Actor Network Theory' subsequently developed in his book *Science in Action*.

Michael T. Bravo, 1999, 'Ethnographic Navigation and the Geographical Gift', in *Geography and Enlightenment*, D. Livingstone and C. Withers (eds.), Chicago: University of Chicago, 199–235. This reading by Bravo directly engages with Latour's argument, challenging it through critical analysis of crucial historical details. Among other points, Bravo highlights that the fishermen Latour identifies as Chinese are in fact Ainu. Bravo asks how the picture of science and the system of modernity that Latour presents changes when taking into account these important specifics?

Julie Cruikshank, 2005, 'Two centuries of Stories from Lituya Bay: Nature, Culture, and La Pérouse' *Do Glaciers Listen? : Local Knowledge, Colonial Encounters, and Social Imagination*, Vancouver: UBC Press, pp.127-153. This reading by Cruikshank is not directly engaged in critiquing Latour, but it is concerned with how the La Pérouse expedition has been represented more generally. It asks whose histories are we telling? And shows what La Pérouse's famous expedition signified to the Tlingit people of the Pacific Northwest Coast.

ann-elise lewallan and Kaizawa Tamami, 2018, 'Ainu Textiles: cloth weighted with affection and prayer', https://garlandmag.com/article/ainu-textiles/ This online article reproduces an edited selection from lewallen's book *The Fabric of Indigeneity*. The book details how present-day Ainu women in Japan are able to move between "being Ainu" through their natal and affinal relationships and actively "becoming Ainu" through their craftwork. Latour, Bravo and Cruikshank are all concerned with forms of knowledge transmission. Focusing on the sub-section 'Self-craft through replica making' how does knowledge transmission operate in the case of Ainu women's knowledge of textile making?

Primary sources

Nobuko Tsuda is curator at the Hokkaidō Ainu Centre and the first Ainu woman to attain a PhD. You can read a translated excerpt from her PhD thesis, '*Ainu i bunka no kenkyu*' ['A study of Ainu clothing culture'], that details her own experience of the "restoration and transmission" of Ainu textile knowledge, here (chapter 16, free to download).

Both Latour and Bravo refer to the same edition of the La Pérouse narrative – see in particular pages 47-9 of *The Voyage of La Pérouse round the World in the Years 1785, 1786, 1787, and 1788*... Vol. II, (London: Printed for John Stockdale, 1798). The page numbers of this Stockdale edition correspond directly with those cited (Lapérouse 1798, II). For the edition of the La Pérouse source text used by Cruikshank, see: Milet-Mureau, *Voyage round the world… by La Pérouse*… Vol. I, (London: J. Robinson, 1799), The page numbers of this edition correspond directly with those cited (Milet-Mureau, *A Voyage Round the World*...).

Week 4

Drugs, theft and resistance

Gregory Cushman, 'Introduction' and 'The Guano Age' in *Guano and the Opening of the Pacific World: A Global Ecological History*, (Cambridge, Cambridge University Press: 2013), 1-22; 23-74 explores how the production and commodification of guano shaped modern science and industry. Notice how Cushman brings together history's traditional documentary methods and sources with environmental science and material culture (see primary sources below), to frame an argument that both acknowledges the global significance of the long history of guano extraction and the significance for directly impacted Peruvians.

Abena Dove Osseo-Asare, Bioprospecting and Resistance: Transforming Poisoned Arrows into Strophantin Pills in Colonial Gold Coast, 1885–1922, *Social History of Medicine*, Volume 21, Issue 2, August 2008, 269–290. Osseo-Assare's 2008 article and 2014 book describe the development of Europe's pharmacology industry, bioprospecting African people's knowledge and challenged by African resistance. Osseo-Assare shows that one of the many ways Africans successfully resisted this colonial hegemony was through the deployment of poison arrows - developed from hunting techniques - a technology that European colonisers were often powerless to overcome.

Kalle Kananoja, '"Much Better Suited Than We Are, as Regards Their Health Care": African Botanical Expertise and Medical Knowledge on the Gold Coast' in *Healing Knowledge in Atlantic Africa: Medical Encounters, 1500–1850* (Global Health Histories, pp. 80-102). Cambridge: Cambridge University Press, 2021). https://doi.org/10.1017/9781108868020.004 By concentrating on the interaction between indigenous informants and European settlers, this chapter highlights African botanical expertise and medical knowledge on the Gold Coast.

Primary sources:

The Cushman reading opens describing the coat of arms of an indigenous Peruvian guano lord, now held in the British Museum (here). But that's not the only looted heritage from guano mining in the British Museum – one major source was Josiah Harris, an engineer to the guano loading company; another was Thomas Hewitt Myring, who worked for a mining company. Go to the British Museum 'Explore the collections' page: https://www.britishmuseum.org/collection -> search for 'Myring' -> select the suggested option 'Thomas Hewitt Myring' -> add the filter 'On display only'. These are the objects collected by the guano miner, Thomas Myring, that you can see on display in the British Museum. You can find the gallery and case number under the heading 'Location' on the left-hand side. You can also do the same search process by searching for Josiah Harris and selecting the suggested option 'Josiah D Harris'.

https://www.britishmuseum.org/collection/object/E_Af1915-1021-24 Osseo-Asare's article opens describing a warrior of a 'Frafra' community in what became north-eastern Ghana releasing an arrow dipped in poison, and how the arrow pierced the shoulder of a British army sergeant. This Frafa poison arrow in the British Museum was collected by a British army officer while contributing to the British colonial occupation of Ghana. In 2018, Felwine Sarr and Bénédicte Savoy's report on the restitution of cultural heritage pointed out that 90% of sub-Saharan Africa's material cultural heritage is held outside the continent. This includes material cultural heritage of the history of sub-Saharan Africa's science and technology. https://www.about-africa.de/images/sonstiges/2018/sarr_savoy_en.pdf

Week 5

Balances and the imperial meridian
Prof Simon Schaffer

Bruno Latour, 'The force and reason of experiment', in Homer Le Grand (ed.), *Experimental inquiries* (Dordrecht: Kluwer, 1990), 49-80, especially sections 1 and 2
the work of experimentation involves a series of displacements of authority and strength: the example of the trials of strength conducted by French naturalists on Tasmanian people in 1802 indicates how the conduct of the sciences in the field involves an exercise in politics

Simon Schaffer, 'How measures made a difference at the imperial meridian', *Centaurus* 64 (2022), 829-856, especially pp 839-44
the cases of the trials with balances carried out in Egypt from 1799 and in Tasmania from 1802 by French expeditions show how the establishment of significant social and political differences relied on – and aided - the practical work of using and organising measurements in the field

Norton Wise, 'Enlightenment balancing acts, or the technologies of rationalism', in Paul Horwich (ed.), *World changes* (Pittsburgh: University of Pittsburgh Press, 2010), 207-256
how the material construction and symbolic meanings of the balance worked to tie together a range of technologies of rationalism for French practitioners of the sciences around 1800 [pdf available]

Primary source:

François Péron, 'Maria Island: anthropological observations' (1802), in N J B Plomley, *The Baudin expedition and the Tasmanian aborigines* (Hobart: Blubber Head Press, 1983), 80-95
The naturalist François Péron describes encounters and interviews with the Tasmanian people and the conduct of the measurement trials to which he sought to subject them [pdf available]

Week 6

**** READING WEEK ****

Week 7

Metrology and telecommunication
Prof Simon Schaffer

Bruce Hunt, 'Units and standards: the ohm is where the art is', chapter 5 in *Imperial science* (Cambridge: Cambridge University Press, 2021)
on the political and scientific negotiations and constructions involved in making a reliable embodied standard for electrical resistance – and so secure an international telegraphic communications system

Joseph O'Connell, 'Metrology: the creation of universals by the circulation of particulars', *Social studies of science* 23 (1993), 129-73, especially pp 136-47
the construction of a set of universal standards involves the hard work of delegation and representation around practices of *metrology*: the production of such standards then helps secure the world so that scientific practitioners can know it and act upon it

John Tully, 'A Victorian ecological disaster: imperialism, the telegraph and gutta percha', *Journal of world history* 20 (2009), 559-79
the embodiment of resistance standards was entangled with the security of the submarine telegraph cable network – so relied on colonial networks that extracted and almost exterminated the supplies and the work of producing insulation and reliable cables

Primary source:
James Clerk Maxwell, 'Molecules', *Nature* 8 (1873), 437-441
Clerk Maxwell lectures the British Association for the Advancement of Science about the meaning and significance of molecular physics, ending with a clear statement about the relation between theology, morality and standardisation

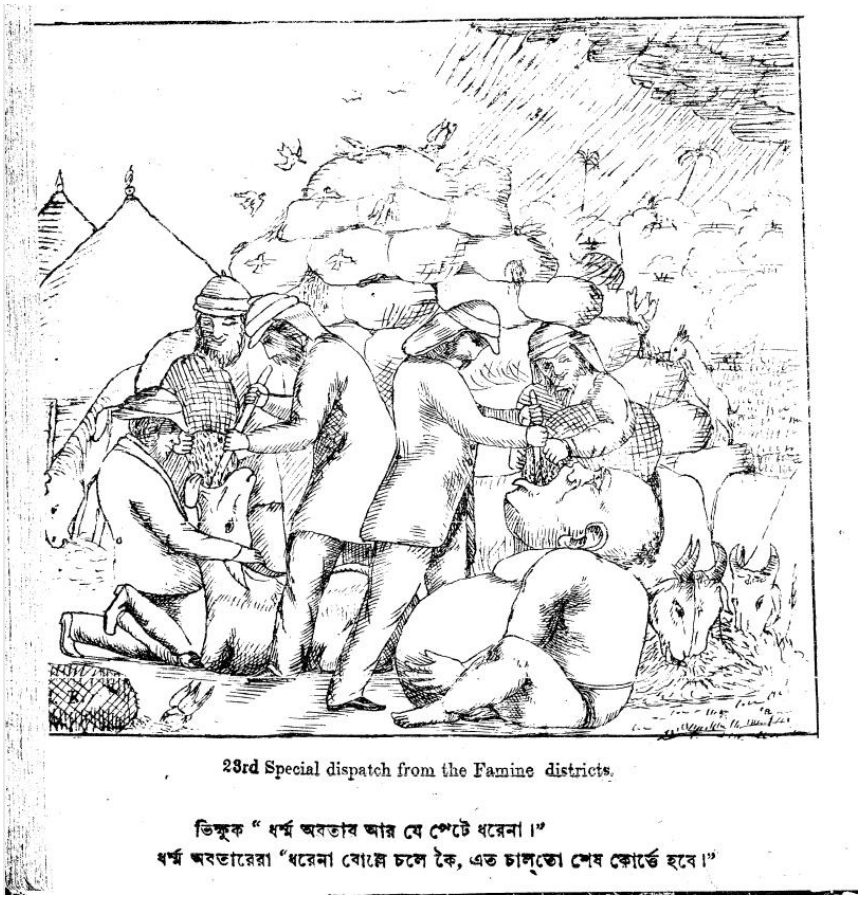
Week 8

Climate science and climate activism's long history

Mike Davis, 'Chapter 1: Victoria's Ghosts', and 'Chapter 7: The Mystery of the Monsoons', *Late Victorian Holocausts: El Niño Famines and the Making of the Third World*. (London; New York: Verso, 2002), 25-59; 213-238. In 'Chapter 1: Victoria's Ghosts', Davis describes how the 19th C Indian famines were a direct consequence of decisions made by British rulers, who used economics to claim that mass death among groups other than themselves was part of a natural cycle. In 'Chapter 7: The Mystery of the Monsoons', Davis describes how this concept of the famines as part of the natural cycle became the dominant state of knowledge in solar physics, with the claim that the Indian famines were cause, not by British mis-rule, but by sun spots. In this formative episode in the history of climate science, Indian political activists held the scientists to account.

Christophe Bonneuil and Jean-Baptiste Fressoz, 'Chapter 11: Polemocene: Resisting the Deterioration of the Earth since 1750' in Fernbach (trans) *The Shock of the Anthropocene*, (London; New York: Verso, 2016). Climate activism has a long history of holding theorists of climate and economy to account. This chapter explores an 'environmentalism of the poor' fighting for social justice and environmental decency, active both in core countries and in the periphery, since the eighteenth century.

Primary source



23rd Special dispatch from the Famine districts.

ভিক্ষুক " ধর্ম্ম অবতার আর যে পেটে ধরেনা।"
ধর্ম্ম অবতারেরা "ধরেনা বোল্লে চলে কৈ, এত চাল্‌তো শেষ কোর্ত্তে হবে।"

'23rd Special dispatch from the Famine districts', shows British officials force-feeding their agents while the rest of the population starves. Caption reads 'Beggar: Your honours, I really can't manage any more.' Basantaka, 1874 vol. 1, issue 8, 116-7 DOI: 10.11588/xarep.00001217

Week 9

Visual technologies and astronomical imaging
Prof Simon Schaffer

Holly Rothermel, 'Images of the Sun: Warren de la Rue, George Biddel Airy and celestial photography', *British Journal for the History of Science* 26 (1993), 137-169
how British astronomers in the mid-nineteenth century tried to use astrophotography directed at the Sun to resolve disputes about the structure and appearance of the solar surface – and how different practices and technologies embody contrasting and often conflicting interests in making images and winning authority both within specialist groups and in the wider public

Geof Belknap, 'Photography at a distance: reproducing the 1874 Transit of Venus enterprise', in Blenkap, *From a photograph* (London: Bloomsbury, 2016), chapter 5 [pdf available]
The visual technologies designed for the popular and the specialist graphic press in the 1870s directed the attention of the astronomical public in very different ways – and manufactured contrasting images both of astronomical observation and also of the status of astronomy

Ludwik Fleck, 'To look, to see to know' (1947), in Fleck, *Cognition and fact* (Dordrecht: Springer, 1986), 129-151
In order to observe, it is necessary to know what is being observed, and this is drawn from shared and trained collective knowledge which derives from membership of a collective – the argument about trained seeing is applied to specialist and generalist ways of seeing in the observational sciences

Primary sources:

Charles Piazzi Smyth, 'On astronomical drawing', *Memoirs of the Royal Astronomical Society* 15 (1846), 23-70
The pre-eminent astronomical image-maker of mid-nineteenth century Britain discusses the technologies for capturing, making and then reproducing images of astronomical objects including planets, stars and nebulae – and addresses the problem of judgment and of selection in using these techniques

Evelyn Noble, 'The life and adventures of station B' (1874), Royal Greenwich Observatory Manuscripts, Tupman Archive, volumes 1 and 2 (Cambridge Digital Library)
two volumes of caricatures, anecdotes and sketches of the Hawai'I expedition to observe the Transit of Venus from Honolulu in December 1874, with remarkable insights into the labour relations and experiences of field astronomy and its social life

Week 10

Cross-contextualizing sources

Preparation for the Week 10 seminar is part of preparing for your assessment.

- Remind yourself of the materials covered in week 1, in particular Sivasundaram's call for cross contextualization of sources in 'Sciences and the Global: On Methods, Questions, and Theory', and the specification for the assessment.
- Identify a primary source on 19th century science, make sure it's one that excites and interests you - this source will be the basis of your assessed essay.
- Prepare an annotated bibliography that puts this primary source in relevant context.
- Prepare a one-slide presentation that introduces your chosen primary source informed by what you have learned in preparing the annotated bibliography.
- Submit your one-slide presentation and annotated bibliography before the seminar.

In the seminar, we will be looking at ways to cross-contextualize your chosen sources.

Week 11

Essay presentations

In preparation for this session, develop the cross-contextualization you began to explore last week.

- Prepare a five-slide presentation in accordance with the presentation instructions on the Moodle page.
- Prepare a one-page plan for your assessed essay.
- Submit your five-slide presentation and one-page plan before the seminar.
- In the seminar you will be required to listen to your peers, take notes and ask questions.