

The British Society for the History of Science

BSHS ANNUAL CONFERENCE

University of Aberdeen

22-25 July 2010



Emergency Contacts Information

King's Hall and Crombie Reception: internal ext 2218 or 01224 272218.

Night Porter: internal ext 2218 or 01224 272218

University of Aberdeen Security
9A Dunbar Street
Aberdeen
AB24 3UD

Emergency: internal: ext 3939 or 01224 273939.

Non-emergency: internal ext 3327 or 01224 273327.

Grampian Police : 0845 600 5700 (non-emergency).

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Welcome to Aberdeen

I am delighted to welcome everyone to Aberdeen and to the first BSHS Annual Conference to be held in Scotland since the event was reinstated in 2003. Whether it is the lure of a productive and inspiring conference or the promise of whisky and a ceilidh that has brought you here I hope you find the next few days a stimulating and profitable experience. I would like to extend a particularly warm welcome to new members of the BSHS and encourage everyone to join Officers, members of Council and the Chairs of BSHS Committees in the Bar after dinner on Thursday where we will be happy to answer any questions you might have about the Society's activities and hear your ideas about how to develop these in the future. As a Society we are fortunate in having an enthusiastic group of volunteers willing to spend their time organising events and promoting history of science more generally and anyone who would like to get more involved in the Society's activities will be eagerly welcomed.

The BSHS Annual Conference could not take place without the support of the host institution and we are all indebted to local organisers, Ben Marsden and Ralph O'Connor for their unstinting efforts. They have done a magnificent job not only in attending to the details that ensure a conference runs smoothly, but also in mobilising their colleagues in the University of Aberdeen Historic Collections to enable us to learn more about the rich resources for our discipline that can be found here. We are indebted to Siobhán Convery, Neil Curtis, Jenny Downes, John Reid, Ian Stewart and Nigel Trewin for agreeing to participate in our meeting and hope that many of you will take the opportunity to join the visit to Marischal College, the Curators and Collections session or just to visit the display in the Old Senate Room that will be open during Friday lunchtime. We thank the Programmes Committee for overseeing the meeting and would like to acknowledge the contributions of Lorna Birnie, University of Aberdeen Conference and Events Office, Rachel Hughes and Kathleen Brebner, School of Divinity, History, and Philosophy, University of Aberdeen and Nicolle Siliwoniuk-Caldwell, Aberdeen Convention Bureau. Malcolm Noble has once again been an exemplary assistant to the organisers and coordinator of our team of stewards, Susan Marshall, Sandra Moffat, Sam Robinson and Lachlan Young. We are grateful for the efforts of our Executive Secretary, Lucy Tetlow in ensuring the smooth running of the meeting and to Liz Bruton, BSHS Web Editor for managing the conference presence on the BSHS website.

The BSHS is entering an exciting period in its own history as preparations for the 2013 International Congress for the History of Science, Technology and Medicine to be held in Manchester move forward apace. If the acronym IUHPS/DHST (International Union for the History and Philosophy of Science/ Division for the History of Science and Technology) is unfamiliar to you at the moment, it will soon become as familiar as the BSHS. We hope that the energy, enthusiasm and fellowship of this meeting will inspire you to start making plans to contribute to the Congress in 2013, the 3 Societies Meeting in Philadelphia in 2012 and the BSHS Annual Conference in Exeter next year.

Sally Horrocks
President, BSHS

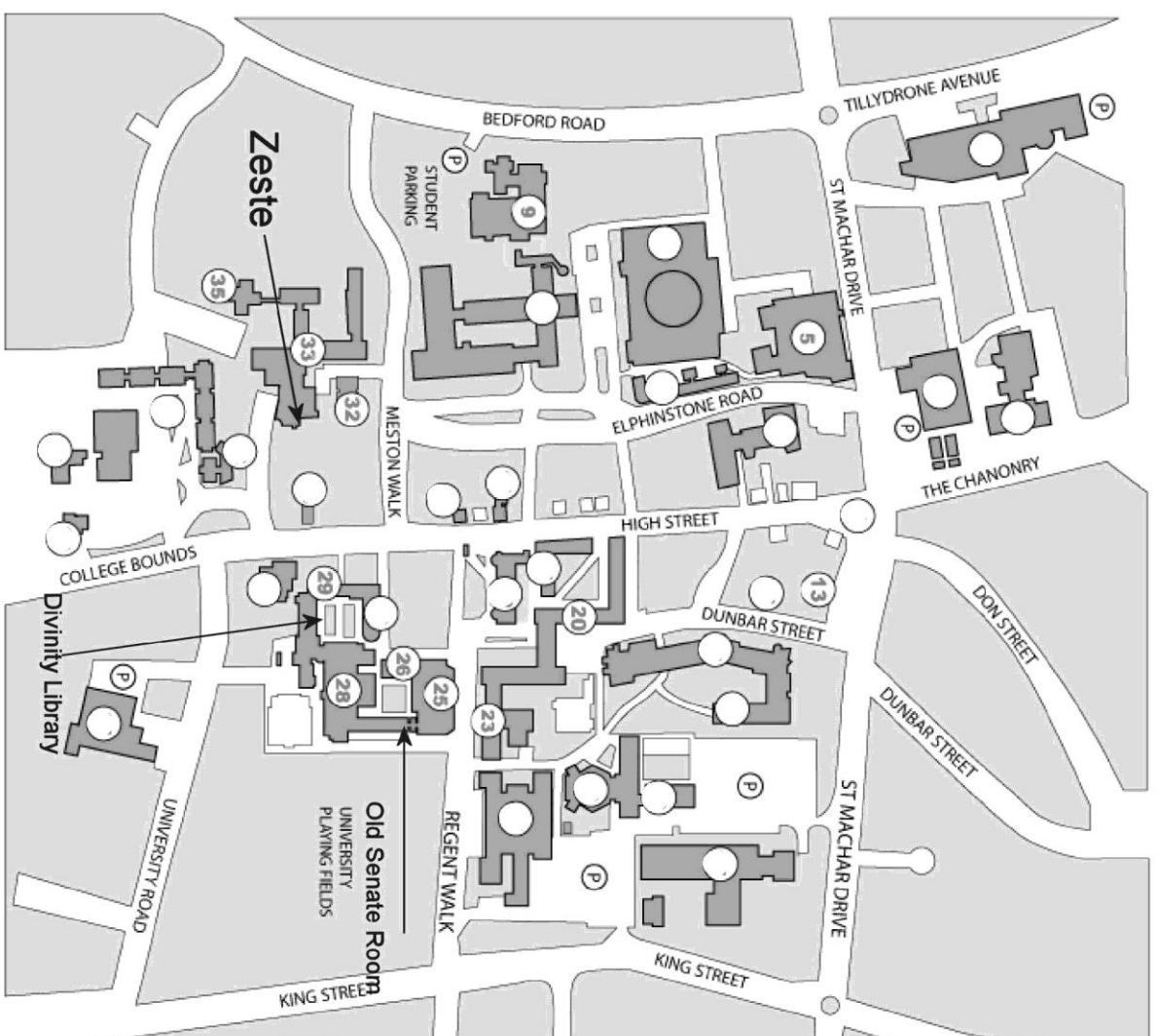
Gazetteer

Bookshop	Old Aberdeen Bookshop, 140 Spital (secondhand) Spital is the southwards continuation of High Street and College Bounds). Blackwells, 99 High Street (near pub).
Breakfast	Breakfast will be served in Zeste, 7-9am Friday and 8-11 Sat and Sun.
Cafe	Auld Toon Cafe, 61 High Street (near pub) sells coffee and snacks.
Cashpoints	Cashpoints: outside 'The Hub' at the top end of Elphinstone Road; or at the top end of the High Street, near the St Machar Bar. By wall at side of St Machar Bar (Bank of Scotland); 2 School Road, other side of roundabout where St Machar Drive joins King Street (Lloyds TSB)
Checking in	People staying in King's Hall or Crombie will all need to check in at the reception in Crombie (in the corridor just next to Tiki Café). The reception is staffed 24/7 by either a receptionist or a porter.
Chemist	Bobbin Pharmacy- 498 King Street, Aberdeen AB24 5ST - 01224 483 783
Drinks machine	A drinks machine is located in the foyer of university library (Queen Mother Library, open 9-5 in July); ground floor of MacRobert building.
Groceries	Spar shop, 45 St Machar Drive (on roundabout where St M Drive joins King Street); Tesco Express, 472 King Street
Internet /wifi	Logins and basic instructions for this are available at the registration desk. We'll try to help where possible, so if you are stuck, please ask.
Library	The Queen Mother Library is open: 09.00-17.00 Monday to Friday; 09.00-13.00 Saturday; It is closed on Sundays.
Newsagent	McHardy's, 39 High Street
Postbox	Nearest one is on High Street by the northernmost block of Taylor Building, sort-of-opposite Auld Toon Café
Printing	Each delegate has £1 of credit on their computer account, used for the wireless. Each page is chargeable at 5p / page or 4.5p/side for double-sided.
Pub	The St Machar Bar, High Street (top end, near junction with St Machar Drive)
Registration	In the Tiki Cafe/Zeste.
Supermarket	Sainsbury's, Berryden Retail Park, Berryden Road (15-20 mins walk west of campus: down Bedford Road then right then immediately left then walk along until you see big retail park).
Taxis	A free telephone is situated in the Crombie Reception, which calls 01224 35 35 35. An alternative is Rainbow City on 01224 87 87 87. On Sunday morning, if you would like to share a taxi to the railway station or airport, please make yourself known at the registration desk, and we will attempt to arrange this.

Maps, plans



Old Aberdeen Campus



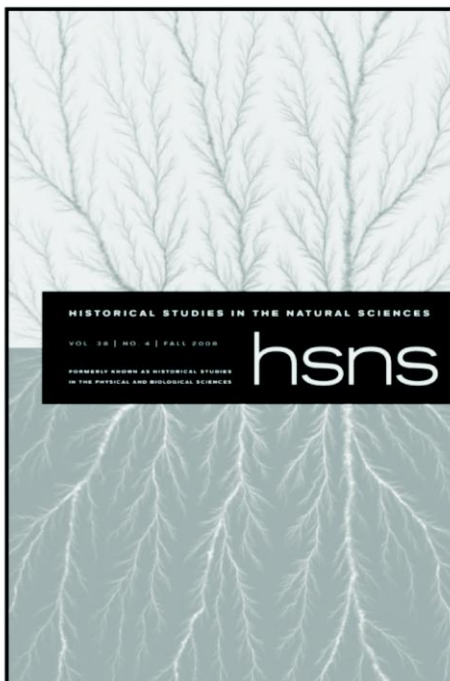
BSHS Conference Locations

- 5. The Hub/Students' Association
- 9. Queen Mother Library
- 13. Security Office
- 20. Taylor Building
- 23. Regent Building
- 25. Elphinstone Hall
- 28. King's Conference Centre
- 29. King's College
- 32. Crombie Annexe
- 33. Crombie Halls
- 35. King's Hall



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DETAILS //

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November

HSNS charts the intellectual and social history of the physical sciences and experimental biology since the 17th century. Widely regarded as the leading journal in the historiography of science and technology, *HSNS* increases to quarterly publication in 2008 to expand its roster of pioneering articles and notable reviews by the most influential writers in the field.

WWW.UCPRESSJOURNALS.COM

Overview of Conference

Thursday, 22nd July 2010

15.30	Registration opens	Zeste (Tiki Cafe)
	Tea and coffee	
17.00-18.00	Plenary Lecture Venetian Technology Transfer: How Galileo Copied the Telescope Mario Biagioli, Harvard University	Regent Lecture Theatre
18.00-19.00	Bar	Zeste
19.00-20.00	Dinner	Zeste
20.00- Late	Bar	Zeste

Friday, 23rd July 2010

8.00-9.00	Breakfast	
9.00-11.00	Academic Sessions 1 Visit to Natural Philosophy Collection	Kings College Conference Centre Meet at 8.30 at King's Hall and Crombie Reception Spaces are limited to 24. Please pre-register for this visit James Mackay Hall
11-11.30	Tea and coffee	
11.30-13.00	Academic Sessions 2	Kings College Conference Centre, Taylor A 26
13.00-14.00	Lunch	James Mackay Hall
	Meet the Editor Session: Jon Agar	Multimedia Room, Kings College Conference Centre
	Display of manuscripts, rare books and artefacts from the University of Aberdeen Collections	Old Senate Room
14.00-16.00	Academic Sessions 3 Special collections session	Kings College Conference Centre Old Senate Room
16.00-16.30	Tea and coffee	James Mackay Hall
16.30-18.00	Academic Sessions 4	Kings College Conference Centre, Taylor A 26
18.00-19.15	Reception, to include whisky tasting	Divinity Library, King's College Quadrangle
19.30-20.30	Dinner	Zeste
20.30- Late	Bar	Zeste

Saturday, 24th July 2010

8.00-9.00	Breakfast	
9.00-11.00	Academic Sessions 5	Kings College Conference Centre, Taylor A 26
9.30	OEK Welcome	Taylor A 31
10.00-11.00	Grants from the OEC	
11-11.30	Tea and Coffee	James Mackay Hall
11.30-13.00	Academic Sessions 6	Kings College Conference Centre, Taylor A 26
13.00-14.00	Lunch	James Mackay Hall
14.00-15.30	Academic Sessions 7	Kings College Conference Centre, Taylor A 26
15.30-16.15	Tea and coffee	James MacKay Hall
16.15-18.15	Academic Sessions 8	Kings College Conference Centre, Taylor A 26
18.30-19.00	Pre-Dinner Drinks and Bar	Elphinstone Hall
19.00- 00.15	Banquet and Ceilidh	Elphinstone Hall

Sunday, 25th July 2010

8.00-9.00	Breakfast	
9.00-11.00	Academic Sessions 9	Kings College Conference Centre
11-11.30	Tea and coffee	James Mackay Hall
11.30-1.00	Academic Sessions 10	Kings College Conference Centre
13.00-14.00	Lunch, (also available "to go")	James Mackay Hall
14.00	End of conference	

Overview of Academic Sessions

	Catherine Gavin Room	Carnegie Room	Multimedia Room	Taylor A 26	Other
Thursday					
17.00-18.00					Plenary Lecture Regent Lecture Theatre
Friday					
9.00-11.00	Ecology and Natural History	The Practice of Alchemy in Early Modern Europe	Nutrition Science and its Applications		Visit to Natural Philosophy Collections, meet at King's Hall and Crombie Reception at 8.30. Limited spaces: register at desk.
11.30-13.00	The lessons of animal regeneration: new studies in late C19th and early C20th Biology	Translating Technologies	Astronomy	Machines and Metaphors	
14.00-16.00	Early Modern astronomy in context	Bullets and bodies: C20th forensics in theory and practice	Beauty and Wonder		University of Aberdeen Curators and Collections, Old Senate Room
16.30-18.00	Science on Stage and Screen	Technologies of Evolution Studies: contextualising contemporary techniques	Rhetoric and Representations	Psychology	
Saturday					
9.00-11.00	John Tyndall and His Audiences	Nuclear Science and the Cold War	Artifacts: Material Culture, Music and Sound	Biological and Biomedical Sciences	9.30 OEC Welcome followed by 10.00 Grants from the OEC, Taylor A 31
11.30-13.00	Medieval	Chemistry	Engaging Audiences at Aberdeen Museums	Geology and Earth Science	
14.00-15.30	Bacon	Nineteenth Century	OEC: Making the Perfect Warhorse	Museums and Popular Science	
16.15-18.15	Gender	Darwin and Evolution	Early Modern		OEC: Songs of Science, Zeste
Sunday					
9.00-11.00	Eighteenth Century	Visual	New Perspectives on the Great Exhibition and Crystal Palace		
11.30-13.00	Crossing Boundaries: the practices of marine natural history in the C18th	Instruments on Display	Science and Industry since World War II		

BSHS Annual Conference 2010 Full Listing of Academic Sessions

Please arrive early to ensure that you secure a seat as some sessions may be over-subscribed.

Friday 23 July 2010

Academic Sessions 1

9.00-11.00

Ecology and Natural History

Venue: Catherine Gavin Room

Chair: Sabine Clarke

Of Plants and Volcanoes: Studying the Natural World in Late Colonial Central America, c.1790-1800

Sophie Brockmann

Remaking Natural Knowledge: Recycling in the History of Science & Medicine

Simon Werrett

Science, the South Pole, and the Japanese Expedition of 1910-1912.

William R. Stevenson III

Nutrition Science and its applications

Venue: Multimedia Room

Chair: Ida Stamhuis

Milk, the history of science, and material politics

Peter Atkins

Milk, Mortality and Moral Reform: Canadian Government Nutrition Policy, 1874-1919

Monika Pries-Klassen

Setting Nutritional Standards in late nineteenth-century Germany and the US

Elizabeth Neswald

World War II and nutrition cultures: professional and popular

David Smith

The Practice of Alchemy in Medieval and Early Modern Europe

Venue: Carnegie Room

Chair: Stephen Clucas

The Alchemist's Dilemma: Distilling Practices from Texts

Jennifer Rampling

Trial and Error: Alchemy and Assay in the Middle Ages

Stephanie Seavers

Dissecting manuscripts: Alchemy, Medicine and the Historian

Anke Timmermann

Archaeological approaches to early modern chymistry: old materials, new questions

Marcos Martín-Torres

We would like to thank the Society for the History of Alchemy and Chemistry (SHAC) for sponsoring this session

Visit to the Natural Philosophy Collection at Marischal College.

Please register for this visit at Registration. Participants should meet at King's Hall and Crombie Reception at 08.30.

Academic Sessions 2

11.30-1.00

The lessons of animal regeneration: New studies in late C19th and early C20th biology

Venue: Catherine Gavin Room

Chair: Duncan Wilson

The productivity of cut-and-paste: The Mexican axolotl, regeneration research and the importance of experimental practices

Christian Reiss

Historicizing or analysing organisms (or both)? The Weismann-Morgan controversy over animal regeneration re-examined

Maurizio Esposito

Dominance subverted: Animal regeneration research in W. F. R. Weldon's critique of Mendelism

Gregory Radick

Translating Technologies

Venue: Carnegie Room

Chair: James Sumner

Reconstructing HMAS *Warrego* and
the Transfer of Shipbuilding
Knowledge
Klaus Staubermann
'Somebody fresh to go into the
problem': Metropolitan Vickers, the
Air Ministry, and the axial gas turbine.
Jakob Whitfield
Failure in practice: bankers, blame
and computing technology
Ian Martin

Astronomy

Venue: Multimedia Room

Chair Michael Barany

Exporting Greenwich: the Royal
Observatory as a model for imperial
observatories
Rebekah Higgitt
Automation and Informality in
Modern Danish Astrometry
Karin Tybjerg
Funding radio astronomy in the
Netherlands, 1945-1960
Astrid Elbers

Machines and Metaphors

Venue: Taylor A 26

Chair: tbc

From machine to mind: the xix
century and the interdisciplinarity of
the concept of automatism
Margarida Medeiros
Lewis Mumford, Franz Reuleaux, and
the Archetypal Machine
Richard C Gunn
Hobson and the Machine
Daniel Wilson

13.00-14.00

Delegates are invited to visit a display of
manuscripts, rare books and artefacts from
the University of Aberdeen Collections in the
Old Senate Room

Jon Agar, *British Journal for the History of
Science* editor will host a 'meet the editor'
session in the Multimedia Room

Academic Sessions 3

2.00-4.00

Early modern astronomy in context

Venue: Catherine Gavin Room

Chair: Nicholas Jardine

The construction of astronomical
instruments (c. 1600)
Arjen Dijkstra
"Queen Reason" and the "Slave
Senses" – Astronomy and Geometry
in Thomas Digges' *Alae seu scalae
mathematicae* (1573)
Katie Taylor
Reading mechanics, writing
astronomy: The incorporation of
Galileo's 1638 *Two New Sciences* into
later seventeenth-century
astronomical treatises
Renée Raphael
The Astronomer's Role and the
Natural Philosopher's Role in the
Sixteenth Century Reconsidered: the
Case of William Gilbert
Stephen Pumfrey

Bullets and Bodies: Twentieth-century
forensics in theory and practice

Venue: Carnegie Room

Chair: Graeme Gooday

'Scientific Aids to Criminal
Investigation': The Achievement of
Administrative Objectivity in Forensic
Sciences
Alison Adam
Forensic Expertise, Lay Knowledge,
and the Search for Identity in the
Crippen Case
Fraser Joyce
Insurrection and Innovation: The
Assassination of Lee Stack and the
'Birth' of Ballistics
Nicholas Duvall
Spaces and Traces: The making of the
modern "Crime Scene"
Ian Burney and Neil Pemberton

Beauty and Wonder

Venue: Multimedia Room

Chair: Ralph O'Connor

Alexander Walker and Herbert

Spencer: A Victorian Science of
Beauty?

Antoinette Curtin

"Everything gives way to
experiment": empiricism and beauty
through the history of the Wedgwood
family

Chiara Ceci and Stefano Moriggi

Nebular Visions: Illustrating the
Architecture of the Heavens

Jim Secord

The Fairy-Tales of Science

Melanie Keene

Curators and Collections

Venue: Old Senate Room

Chair: Neil Curtis

Re-uniting the Parts: finding the links
in the Aberdeen collections

Jenny Downes

Revealing the Hidden Collections:
university museums in Scotland

Neil Curtis

Six centuries of medical teaching: the
history of medicine archives at the
University of Aberdeen

Siobhán Convery

Followed by round table where these
presenters will be joined by John Reid and
Nigel Trewin

Academic Sessions 4

4.30-6.00

Science on Stage and Screen

Venue: Catherine Gavin Room

Chair: Sally Horrocks

Butlins and the Bomb: *Uranium 235*,
Class and Nuclear Culture in Postwar
Britain

Jeff Hughes

Lawrence Bragg, C.P. Snow and the
'Two Cultures'

Frank A.J.L James

'The Revealing Eye': The Royal
Society and the Moving Image at the
Time of the Tercentenary

Tim Boon

Technologies of Evolution Studies:

contextualising contemporary techniques

Venue: Carnegie Room

Chair: *Greg Radick*

How to make a dinosaur: The
technologies of fossil preparation

Caitlin Donahue Wylie

Shaping genetic notation: contexts and
identities of the Rhesus blood groups,
1941-1951

Jenny Bangham

Darwin and the Tree of Life: The Roots
of the Evolutionary Tree

Nils Petter Hellstrom

Rhetoric and Representation

Venue: Multimedia Room

Chair: *Stephen Gaukroger*

Representative Practices in Art and
Science, 1880-1914

Chiara Ambrosio

Eighteenth-century instruments as
rhetorical devices

Florence Grant

Natural History in England, 1650-
1720: Representation, Rhetoric,
Poetics, Aesthetics

Alexander Wragge-Morley

Psychology

Venue: Taylor A 26

Chair *t.b.c.*

The Illusion of Intelligence:
Technology, Conjuring, and
"Psychology" in Nineteenth-Century
London

Sarah Kriger

Heads in hands: physiological
psychological rhetoric and laboratory
pedagogy in 1870's Britain.

Tom Quick

Musical Brainwashing: The Dangers of
Music between Cold War Psychology
and Reagan Era 'Satanic Panic'

James Kennaway

Saturday 24 July
Academic Sessions 5
9.00-11.00

John Tyndall and his Audiences

Venue: Catherine Gavin Room

Chair: Efram Sera Shriar

John Tyndall: Lecturing, Authority and Correspondence in Victorian Public Science

Graeme Gooday and Jamie Stark

Working Wonder: Tyndall and the Making of Victorian Scientific Performances

Iwan Morus

John Tyndall and Theology: The Definition and Boundaries of Science

Ursula DeYoung

Following your example at a distance:

The Carlylean balancing of John Tyndall and James Crichton-Browne

Mike Finn

Nuclear Science and the Cold War

Venue: Carnegie Room

Chair: Jeff Hughes

Niels Bohr's Philosophical

Background: a Thematic Proposal

Roberto Angeloni

Joseph Rotblat and the Manhattan Project

Martin Underwood

The atomic cloister: secrecy and the shaping of technical identity, 1940-60

Sean F. Johnston

Dad's Radioactive Army: Scientists, Engineers (and Philosophers) as

Volunteers after Chernobyl

Jon Agar

Artifacts: Material culture, music and sound

Venue: Multimedia Room

Chair: Tim Boon

Music Technology and Physical Effort

Katy Price

Bellowphones and Blowed Strings:

The Auxeto-Instruments of Horace

Short and Charles Algernon Parsons

Aleks Kolkowski

Stockhausen meets King Tubby: The stepped filter and its Influence as a musical instrument on two different styles of music

Sean Williams

The Oramics Machine and Daphne

Oram: Relationships between Instrument and Aesthetic

Mick Grierson

Biological and Biomedical Sciences

Venue: Taylor A 26

Chair: Daniele Cozzoli

"A Cell is Not an Animal": Crossing Species Barriers during the 1960s.

Duncan Wilson

Historiographical considerations on the introduction of protein

sequencing into Spanish biomedical research (1968-1998).

Miguel García-Sancho

OEC Welcome (9.30)

Venue: Taylor A 31

followed by 'Grants from the OEC', *Sabine Clarke*

Academic Sessions 6

11.30-1.00

Medieval

Venue: Catherine Gavin Room

Chair: Anna Marie Roos

Like Stirrups and Sugar: Polydore

Vergil and the Problem of Unknown Inventors

Shana Worthen

Evidence In Medieval Natural History:

Constructing natural knowledge in the

De animalibus of Albertus Magnus

Gwyndaf Garbutt

Human bodies in Ottoman medical texts and images

Rainer Brömer

Chemistry

Venue: Carnegie Room

Chair: *Matthew Eddy*

Pasteurising the brewery: applied science, internal history and trade defence

James Sumner

Chemical Atomism:

Underdetermination Revisited

Hasok Chang

The Relevance of Experimentation in Joseph Priestley's Studies on the Two Electrical Fluids

Elisa Cristina Oliosi

Nineteenth century

Venue: Carnegie Room

Chair: *Iwan Morus*

Great expectations in Modern Times -

Prefaces, intentions and fallacies in science textbooks of the 19th century

George N Vlahakis

Onwards facing backwards- Images of science in speeches and writings of 19th century Greek scientists

Konstantinos Tampakis

Savage Numbers: Counting and the Evolution of Civilisation, 1863--1892

Michael Barany

Geology and Earth Science

Venue: Taylor A 26

Chair: *Leucha Veneer*

An amalgam of contrasting theories behind the obtention of an accurate method of mineral analyses in the 18th Century

Andréa Bortolotto

Aesthetics of architecture and geology in Britain during the first half of the nineteenth century

Allison Ksiazkiewicz

How the Stomach Ruled William Buckland's Geology

David Allan Feller

Museums and Popular Science

Venue: Taylor A26

Chair: *Victoria Carroll*

"Visitors Welcome" – Teylers Museum around 1800

Martin Weiss

Palaeontology in Parts: Serializing Science in the *Penny Cyclopædia* 1833–43

Gowan Dawson

OEC: Making the Perfect War Horse: Exploring Object Centred Events

Venue: Multimedia Room

Elizabeth Hallam and Anna Maerker

OEC

Venue: Multimedia Room

Engaging Audiences at Aberdeen Museums

Jenny Brown

Academic Sessions 7

2.00-3.30

Bacon

Venue: Catherine Gavin Room

Chair: *Koen Vermeir*

Rereading Francis Bacon's *Novum Organum*

Ian G. Stewart

Francis Bacon and mechanical arts: the early Stuart patent system

Cesare Pastorino

Imagination in Bacon's Experimental Science

Doina-Cristina Rusu

Academic Sessions 8

4.15-6.15

Gender

Venue: Catherine Gavin Room

Chair: *David Smith*

Women in Genetics 1900 – 1930: New Scientific Workers in a New Discipline

Ida Stamhuis

Works' Chemist required . . . Woman graduate preferred': gender and scientific employment in Britain during World War II

Sally Horrocks

Electricity, food production, and domestic spatiality in mid-twentieth century Britain

Emily Hankin

Are mothers naturally devoted?: Animal models and the construction of maternal instinct in the French Third Republic

Marion Thomas

A Speculum of Chymical Practice: Isaac Newton, Martin Lister (1639-1712), and the Making of Telescopic Mirrors

Anna Marie Roos

Systems of Belief and Knowledge in the Early Modern Science

B. Thaliath

OEC: Songs of Science

Venue: Zeste

A partial, prejudiced and ignorant history of science in song

Melanie Keene

Mathematicians in love and three-foot rules: WJM Rankine's *Songs and Fables*

Ben Marsden

A Function of the Time: the postprandial proceedings of the Cavendish Society

Jeff Hughes

Darwin and Evolution

Venue: Carnegie Room

Chair: *Fern Elsdon-Baker*

Charles Darwin really was the naturalist on HMS Beagle

John van Wyhe

Wallace, spiritualism, and anthropology at the BAAS: A new interpretation

Juan Manuel Rodriguez Caso

Gavin de Beer and the notion of mosaic evolution

Silvia Caianiello

The evolutionary archive

Katrina Dean

Early Modern

Venue: Multimedia Room

Chair: *Jennifer Rampling*

Vampires and the powers of imagination: a study of the first medical tracts on vampirism (1659-1755)

Koen Vermeir

Poisonous Vapours: The "Sadducismus Triumphatus" and Joseph Glanvill's science of witchcraft

Julie Davies

Sunday 25 July

Academic Sessions 9

9.00-11.00

Eighteenth-century

Venue: Catherine Gavin Room

Chair : *Hasok Chang*

Apologetics in Eighteenth-Century

Europe: Beyond the Great Divide

José Alberto Silva

D'Alembert and Euler and mid-

eighteenth century rational

mechanics: What mechanics does not

tell us about the world

Stephen Gaukroger

18th Century Crossroads: Chemistry

and Medicine, Theory & Practice

Silvia Waisse, Ana M. Alfonso-Golfarb

& Marcia H. M. Ferraz

Dissecting the Soul: William Cullen

and Medical Theory during the

Scottish Enlightenment

Jeff Wolf

Visual

Venue: Carnegie Room

Chair: *Alexander Wragge-Morley*

Linnaeus and the visual

representation of nature

Isabelle Charmantier

Pictures and Pedagogy: the role of
diagrams in Feynman's early lectures,
1949-50

Ari Gross

The image as instrument. Moving

images in Albert Michotte's

Psychological Laboratory.

Sigrid Leyssen

New Perspectives on the Great Exhibition
and Crystal Palace

Venue: Multimedia Room

Chair: *Frank James*

Championing Science and the Great
Exhibition of 1851

Geoffrey Cantor

1851: Struggling To Describe The
Indescribable

Nick Fisher

Ethnology At The Crystal Palace:

Robert Gordon Latham, Visual

Enskilment, And Local Sites Of
Learning

Efram Sera-Shriar

Exhibiting The Visual: Photography

And The Crystal Palace

Geoffrey Belknap

Academic Sessions 10

11.30-1.00

Crossing boundaries: the practices of
marine natural history in the eighteenth
century

Venue: Catherine Gavin Room

Chair: *Anna Maerker*

The zoophyte problem, or, the

chemical animal in natural history

Susannah Gibson

Continents from animalcules

Alistair Sponsel

Classifying imperfection, or, how to
observe marine plants

Anne Secord

Instruments on Display

Venue: Carnegie Room

Chair: *Becky Higgitt*

Power Relationships in Basic
Measurement

Jane Wess

People, weather, objects: New stories
from the stores

Vicky Carroll

"Matter and light- From lightning to
X-rays: Removing the air" Teaching
proposal for the exploration of a
historical scientific instrument
collection

Flora Paparou

Science and Industry since World War II

Venue: Multimedia Room

Chair *t.b.c.*

European oil prospecting in the early
Cold War

Leucha Veneer

The Discovery of the Early
Antihistaminic drugs

Daniele Cozzoli

The making of an entrepreneurial
science: biotechnology in Britain,
1975-1995

Soraya de Chadarevian

Abstracts of Panels

Abstracts of panels are given below, alphabetically by first word of title. The session on University collections are presented under 'University' and 'Visit'.

Bullets and Bodies: Twentieth-century forensics in theory and practice

Ian Burney

There has been much scholarly comment on forensics in the past two decades, driven primarily by analyses grounded in SSK and critical legal studies that have sought to contextualize what many regard as the "new paradigm" of DNA-driven forensic investigation. Forensics in a self-consciously modern cast has also entrenched itself in the public imagination, showcased on highly-rated television shows such as *CSI* and *Waking the Dead*, and this phenomenon has in turn been integrated into scholarly reflections on our contemporary forensic landscape. So familiar is this image of laboratory-driven forensics that we can easily dismiss as wrong or uninteresting previous forms of forensic investigation, especially given the almost complete lack of serious historical attention devoted to twentieth-century forensic practices. Our panel challenges this assumption, by exploring earlier investigative methods on their own terms, examining how they operated and their impact on how crime was investigated and evidence judged.

Crossing boundaries: the practices of marine natural history in the eighteenth century

Anne Secord

This session looks at eighteenth- and early-nineteenth-century studies of those ambiguous marine organisms that straddled the boundaries of plant and animal life, with ambiguity pertaining not only to the natural objects but also the ways of properly investigating them. By being attentive to the practices employed to determine the nature of organisms that could not be directly observed in their natural habitats, the session will open up historiographic questions concerning the definition and extent of eighteenth-century natural history, the basis of theories of the earth, and the limits of classificatory systems.

Early modern astronomy in context

Katie Taylor

Historians often approach early modern astronomy as if it was a self-contained discipline. The reality, however, is that practicing astronomers were engaged in multiple pursuits, from the more practical activities of mechanics and instrument making to teaching and writing on theology, geometry and natural philosophy. As astronomers joined with other practitioners of the mixed mathematical sciences during the period to challenge traditional disciplinary divisions and hierarchies, the distinction between what counted as "astronomy," as opposed to natural philosophy, became increasingly blurred. This panel will highlight new approaches to the history of astronomy that seek to place the practice and content of early modern astronomy in this wider intellectual, social, and cultural world. Individual papers will explore the connections between astronomy and the cognate disciplines of instrument making, geometry, mechanics and natural philosophy.

John Tyndall and his Audiences

Graeme Gooday and Iwan Morus

The natural philosopher John Tyndall was both one of the most successful and one of the most controversial science lecturers of the Victorian period. This seeming contradiction is easily understood if we consider the highly differentiated audiences that he addressed in locations both within and without his base in London's Royal Institution. Our session moves beyond such a facile resolution, however, to consider how Tyndall dealt with the problems he encountered in maintaining effective engagement with such diverse audiences - from the mundane difficulties of weekly lecture preparation to the sustained tensions of the science-spirituality nexus. By considering the strategies he adopted in attempting to overcome these challenges, our papers reveal both how closely networked he was to some key contemporaries and the kinds of boundary work that he undertook in his dealings with them. Several papers in this session draw upon letters recently transcribed in the international John Tyndall Correspondence Project co-ordinated from York University, Toronto.

The lessons of animal regeneration: New studies in late C19th and early C20th biology

Gregory Radick

In our day, animal regeneration – the making of new body parts after injury – has come to be seen as one of the most exciting frontiers of biomedicine. But in the years around 1900, biologists valued animal regeneration above all for its potential to throw new light on the fundamental questions in biology. Heredity, development, evolution, and the methods appropriate in each of these domains: all looked ripe for rethinking and redirection. For the most part, however, this ferment around animal regeneration at the turn of the last century has been obscured in the historiography by attention to other developments, notably the rise of Mendelian genetics. The papers in this panel aim collectively to restore animal regeneration to its proper place as a major interest in biology ca. 1900 and also to suggest how this restoration might lead historians to revise certain commonplace beliefs about the period.

New Perspectives on the Great Exhibition and Crystal Palace

Ejram Sera-Shriar

The traditional view of the Great Exhibition (1851) has been one of a successful celebration of science, technology and industry. More recently scholars have questioned this kind of progressivist master narrative and instead shown that the Great Exhibition and Crystal Palace were perceived in many different and often contradictory ways - a cacophony of voices, rather than a triumphalist narrative. The papers in this session offer three different perspectives incorporating research from several different fields including anthropology, cultural studies, and the history of science, technology and medicine. In doing so, it aims to shed new light on the significance of the Great Exhibition and the Crystal Palace for the development of nineteenth-century science.

Nutrition Science and its applications

Elizabeth Neswald and David Smith

The history of the diverse field of nutrition science has been explored in a number of conferences and books over the past twenty-five years. It can be approached in many ways, for example, via the history of scientific concepts and their applications and interactions with society, via the histories of foods and via major historical events such as wars and famines. Because of the potential impacts of nutrition science upon industries and the activities of governments, medical theory and practice, and everyday life, stories about the history of nutrition science invariably involve controversies. The aim of this panel is to bring together researchers working on different, but overlapping areas of the history of nutrition science, to engage in creative dialogue and explore common themes.

The Practice of Alchemy in Medieval and Early Modern Europe

Jennifer Rampling

The allegorical imagery and densely encoded texts encountered in alchemical works seem to occupy a world unrelated to practical concerns. Nevertheless, alchemists pursued a wide range of practical goals, from transmuting metals to healing bodies: using methods grounded in natural philosophical, medical, and craft knowledge. This interdisciplinary panel investigates both the variety of medieval and early-modern alchemical activities, and the challenge of reconstructing them from surviving evidence. We start with the difficulty of unearthing practice from primarily textual sources, a problem faced not only by historians of science, medicine and technology, but also by the alchemists themselves. The operative dimensions of alchemy are explored further in two papers focusing on alchemy's intersection with related disciplines: metallurgy and medicine. Finally, we revisit the question of sources by considering material evidence for a range of chemical practices, revealed using archaeological techniques. Can these approaches help us decipher – or even replicate – alchemical practice?

Rhetoric and Representation

Florence Grant and Alexander Wragge-Morley

This panel brings together new work in the history of scientific representations that is linked by the broad theme of 'rhetoric and representation'. Our work spans four centuries and various forms of cultural production. It is united by a common concern to offer historical, contextually sensitive accounts of representational practices or strategies developed in relation to the sciences. Our common emphasis on practices or strategies is deliberate; we see these representations not simply as transparent signifiers of what their makers wanted them to signify, but as the outcomes of strategies employed to certain ends. In this broad sense, all of the representations that we discuss are 'rhetorical'. The aim of this panel, however, is not simply to assert that rhetoric and representation are inextricably linked. In these talks we will make specific, historically-grounded arguments about the ways in which our actors sought to make philosophically or scientifically powerful representations

Songs of Science

Mel Keene and Ben Marsden

Over the last few years the BSHS Outreach and Education Committee has been collecting scientific songs. Ranging across historical periods, geographic locations, musical and lyrical genres, disciplinary divisions, and degrees of expertise, many different cultures have embraced the choral possibilities of the natural and technological worlds. In this 'Outreach Day' session our speakers (and singers) will introduce a few outstanding examples of these historic songs of science, exploring the humorous, celebratory, poetic - and bathetic - lyrics that were written to well-known tunes, from Auld Lang Syne to Clementine.

Technologies of Evolution Studies: Contextualising Contemporary Techniques

Jenny Bangham, Nils Petter Hellström, Caitlin Donabue Wylie

This panel considers the historical and cultural context of different technologies used in studies of evolution. But rather than focusing on the material culture of evolutionary science, we put to use a broader notion of technology and consider metaphors, notations and preparation techniques as constructed technologies for making knowledge. Petter Hellström considers how Darwin's tree metaphor formed the basis for his theory of evolution, Jenny Bangham explores how genetic notation is shaped by the contexts in which it is deployed and Caitlin Wylie considers how the techniques of fossil preparation yield and shape data relating to extinct species. By drawing attention to this diverse collection of practices involved in research on evolution, we explore how far the notion of 'technology' can get us when studying these constituents of scientific research

University of Aberdeen Curators and Collections Session

Jenny Downes (Science Curator), Siobhán Convery (MS and Rare books), Neil Curtis (Marischal Museum), John Reid (Natural Philosophy Collection), Nigel Trewin (Geology), and others

The science, technology and medicine collections held by the University and City of Aberdeen include much unique material deriving from the endeavours of scientific and medical practitioners and others since the foundation of King's College in 1495. A significant feature of the collections is their continued association with the University and the links between the varied collections of archives, rare books, scientific instruments and other museum objects. Recent projects have aimed to make these collections more accessible for researchers, as well as increasing the knowledge that curators have of the collections. This session will introduce some of these projects and gather together some of the curators for questions about the collections. There will also be a display of manuscripts, books and objects from the collections in the Old Senate Room, where the session will also take place. For more information on the University of Aberdeen Museums and Collections see www.abdn.ac.uk/diss/historic/museums/

i) Re-uniting the Parts: finding the links in the Aberdeen collections

Jenny Downes

A project funded as a result of the Recognition of the National Significance of the University's museum collections has included the enhanced documentation of the Herbarium, enabling information about collectors and places of collection to be made available to researchers. The project has also revealed many links between the different collectors, whose work spanned the disciplinary divisions into which the collections have come to be considered.

ii) Revealing the Hidden Collections: university museums in Scotland

Neil Curtis

Although the collections of university museums in Scotland include particular strengths in the history of science, many decades of under-investment in their curation has made much valuable material difficult for researchers to discover. A year-long project led by Aberdeen has resulted in descriptions of the entire collections of nine universities to be created which will be made available through popular websites, as well as adding thousands of records of individual objects.

iii) Six centuries of medical teaching: the history of medicine archives at the University of Aberdeen

Siobhán Convery

Successive awards from the Wellcome Trust's Research Resources in Medical History Scheme has seen a major investment in cataloguing the University's extensive collections of medical archives. Scholars and private researchers can for the first time search these internationally important collections, generating interest across the disciplines and beyond academic circles.

iv) Round table: *Nigel Trewin*

Visit to Natural Philosophy Collection at Marischal College

Hosted by John Reid and Jenny Downes

This session provides an opportunity to visit the Natural Philosophy Collection of Historical Scientific Instruments belonging to the University of Aberdeen. This represents equipment used for over 250 years of teaching and research in Natural Philosophy, the name traditionally used in Scottish Universities for Physics. Areas of interest covered include mechanics, optics, electricity and magnetism, sound, heat, astronomy, meteorology, surveying, radiation, X-rays in medicine and crystallography, electronics, computing, properties of materials, precision instrumentation and related subjects. It is one of the best such collections kept by any Physics Department in Britain, both in respect of the range of subjects covered and the continuity over the past two hundred years. Although a few of the items are on permanent display, only a small fraction of the collection is usually accessible. This session is an opportunity to see behind the scenes and discuss the collection with its curator. Further details of the collection are available at <http://www.abdn.ac.uk/~nph126/>

Please note: This visit is limited to 24 people. Please register at Registration if you wish to take part. Participants will meet at 8.30am on Friday 23 July at King's Hall and Crombie Reception

Abstracts of Individual Papers

Abstracts for individual papers are given here, arranged alphabetically by name of first given author.

Alison Adam

University of Salford

‘Scientific Aids to Criminal Investigation’: The Achievement of Administrative Objectivity in Forensic Sciences

Lynch et al. in ‘Truth Machine’ describe the way in which the accepted scientific objectivity of DNA profiling is accomplished against bureaucratic procedures thus ‘administrative objectivity’ is achieved. Scientific objectivity is inscribed on bureaucracy. The achievement of administrative objectivity is of particular interest in forensic sciences as they operate within an adversarial legal system. Rather than reading the history of forensic science as ‘anthropometry, fingerprints, DNA’ the history of forensic sciences can be read as a set of moves to achieve administrative objectivity through the creation of specialist laboratories and the design and development of bureaucratic procedures. Although relatively neglected by historians, the 1930s and 1940s were a crucial time for the establishment of forensic science services in the UK. In addition to Home Office papers which map out the arguments used to set up forensic science services in the UK, the key texts are early forensic science textbooks, the *Journal of Police Science* and a set of pamphlets produced by the Home Office for police officers’ use, with editions running from 1934 to the mid 1960s. The latter were titled: ‘Scientific Aids to Criminal Investigation.’ They are striking, not so much for their detailing of contemporary forensic science analysis (they contain relatively little of that), rather it is their delineation of the administrative roles in the crime scene process which can be read as nascent attempts to create administrative objectivity in forensic sciences.

Jon Agar

STS, UCL

Dad’s Radioactive Army: Scientists, Engineers (and Philosophers) as Volunteers after Chernobyl

Following the Chernobyl disaster in 1986, the engineer Sir Frederick Warner called for the register and organisation of scientific and technical experts who would be willing to enter dangerously radioactive areas in order to assess, act and possibly lose their lives to save others. The list was restricted to those over 65. The response among nuclear engineers and other correspondents varied from enthusiastic to critical. Television, radio and newspapers covered Warner’s proposal. In this paper I make use of recently available archive material to examine the Volunteers for Ionising Radiation (VIR) with respect to various themes of post-war British science. I am interested, for example, in what was seen as relevant expertise. Experts filled many roles, some in support of nuclear projects, and others in regulatory or critical service. The institutionalisation of potential sacrifice also forms an intriguing dimension that might be considered both an extraordinary extension of professional culture. Cultural historian Rebecca Herzig has argued, in *Science and Suffering* (2005), that American scientists in the late 19th and early 20th centuries, that self-sacrifice – from early X-ray “martyrs” to self-jeopardising explorers – functioned in a gift economy, bolstering status. Self-experimentation has been a heroically celebrated and occasionally fraught motif in medical history. I will ask how the Volunteers for Ionising Radiation might be analysed in comparable or very different terms.

Chiara Ambrosio

University College London

Representative Practices in Art and Science, 1880-1914

The years 1880-1914 were a time of intense experimentation in the visual arts. Representative conventions became variable, and artists deliberately departed from a concept of depiction considered as physical resemblance or photographic similarity. Visual representations progressed toward a conceptualization of figures and objects that transcended perceptual data, and the rendering of pictorial objects turned into an experimental practice involving complex visualization processes. This paper explores the interplay between artistic and scientific representative practices between 1880 and 1914. Focusing on two case-studies, the photographer Alfred Stieglitz and the Cubist painter Max Weber, I argue that artistic representative practices at the turn of the 20th century were strongly informed by experimental scientific practices. Stieglitz and Weber explicitly turned to science – chemistry and mathematics – in their quest for a conceptual reformulation of the relation governing representation. Their works suggest that the shift from figurative to conceptual representations in art was triggered by a more significant theoretical shift involving representation as a general philosophical notion, of which artistic and scientific representations are particular instances. By referring to “representative practices”, I stress the pragmatic aspects of what philosophers, in a somewhat restrictive fashion, call “representations”. Rather than a normative quest for the necessary and sufficient conditions for representation, I will propose a historically grounded evaluation of the means and strategies through which artists and scientists devise perspicuous and useful ways of understanding natural phenomena and intervening into them.

Roberto Angeloni

University of Cagliari

The Influence of the Cultural Background on Niels Bohr's Interpretation of Quantum Mechanics

The philosophical climate in which a scientist grows up often has much influence on his work. Even if not immediately obvious to the working scientist himself, this climate is nevertheless of decisive significance for the moulding of his ideas. The aim of my talk is to show the connections between Niels Bohr's attitude to the atomic world and the philosophical influence he was under already from childhood and youth. Already from earliest youth, Bohr had been much concerned with epistemological problems, and later on he fully conceived developments in quantum mechanics as a confirmation on his earliest ideas. In all probability, these ideas derive from the Danish cultural climate of the nineteenth century. Such ideas came to Bohr under the direct influence of the philosopher Harald Høffding (1842-1931). Høffding was a close friend of Bohr's father, Christian, and Niels had the opportunity to deal with philosophical matters since an early age, when he was allowed to listen to their discussions. Later, when Bohr began his university studies, he attended Høffding's introductory lectures. Furthermore, it is related that Niels Bohr together with, among others, Edgar Rubin, later a professor of psychology, used to meet after these lectures to discuss the problems with which they had dealt during the lessons. They all were part of a philosophical club called "Ekliptica". Starting from the analysis of Niels Bohr's historical and social context it shall be possible to shed light on his private and public life as a scientist for ascertaining how the former may have influenced the latter. Bohr's goal of bringing the classical and quantum theories together into a consistent whole implies an *ante litteram* complementary viewpoint, expression of a general conception on the world, by the time of the formulation of the first atomic theory. Bohr later recognized that the indivisibility of the quantum of action forced us to adopt a new mode of description that he did designate as complementary. But complementarity was at all neither a logical nor an empirical consequence; it was rather a peculiar standpoint of condition for description that requires an explanation. I want to highlight that the potential for development possessed by classical conception and the conceptual implication of quantum physics are not principles backed by unquestionable results as they arise from personal convictions or judgements, characterized by continuity and unity. Such ideas or principles were the leitmotiv of the romantic culture of the nineteenth century.

Peter Atkins

Durham University

Milk, the history of science, and material politics

In this paper I will look at twentieth century attempts to bring the natural variability of milk under control, and thereby, in effect, to redraw the boundaries between nature and society. In the name of quality, attempts were made to purify it of dirt and disease, and to impose norms about fat content, but these were constrained by political and material indeterminacy. The paper addresses the stuff in foodstuffs and will build upon my recent book *Liquid Materialities: a History of Milk, Science and the Law* (Ashgate, 2010).

Jenny Bangham

University of Cambridge

Shaping genetic notation: contexts and identities of the Rhesus blood groups, 1941-1951

In the 1940s, the Rhesus blood groups were commonly represented by two rival notations that became the focus of an intense controversy in the medical and scientific literature. In this paper, I use this literature to unpack some of the functions of, and demands made on, notation in science. Blood groups were used in several different disciplinary contexts (medicine, genetics and anthropology) and acquired different identities and functions in these contexts. I argue that different pressures were made on the Rhesus notations in their different local disciplinary contexts and according to the range of practices within disciplines—such as writing text, drawing graphs and diagrams and in verbal articulation. I suggest that the two primary Rhesus notations had different virtues in these local contexts, whether they were being used in verbal or handwritten communication in the clinic, or as “paper tools” for working out genetic crosses in the laboratory. I also argue that the identities of the Rhesus blood groups in these different contexts helps to explain the 20-year persistence of the debate over their notation.

Michael Barany

University of Edinburgh

Savage Numbers: Counting and the Evolution of Civilisation, 1863–1892

Counting is such a familiar and ubiquitous activity that it is hard to imagine how the world would look without it. Yet that very question became pivotal for a prominent group of anthropologists, linguists, and other writers working in Europe and North America beginning in the 1860s. On the heels of a new scholarly consensus regarding the antiquity of man and a fervent debate over the nature and scope of evolution, the problem of counting's origins became a strikingly powerful resource for the disparate collection of scholars trying to trace the course and character of human evolution. Though typically overlooked in the history of race, linguistic, and evolutionary science, counting was perfectly situated to bridge the many scholarly communities thrown together by the search for civilisation's origins. My talk explores the influence of counting's evolution from two perspectives. First, I explain how the deluge of data from explorers and colonists concerning the number words and practices of the peoples they

encountered was mobilised into a resource for the study of man's prehistory. Second, I examine how accounts of the origins of counting contributed to and shaped these studies by furnishing extensively documentable rational models of intellectual progress. At stake was the status of savage numeration---the constellation of numerical and counting practices attributed to peoples viewed as civilisationally inferior. In the continual reconstruction of savage numbers by their wide-ranging investigators, one glimpses the contours of the formation of the new science of prehistoric man.

Geoffrey Belknap

University of Cambridge

Exhibiting the visual: photography and the crystal palace

While there has been significant attention paid to the various forms of interaction between space, display and communication within the Crystal Palace, there has yet to be any work which examines the connection between these categories in broader contexts of science communication. In particular, visual technologies such as photography operated as both objects of display and a source for communicating the exhibition as a whole. A key concern in this discussion will be the ways in which exhibition, print communication and display affected the construction of a photographic community, culminating in the creation of the Photographic Society of London. This paper will therefore first explore the ways in which photographers, photographs and photographic technologies fit within the established historiographic constructs of space, display and communication at the Great Exhibition and later at Sydenham. A larger comparison between the various modes of visual epistemology used at the Crystal Palace and later photographic exhibitions will help further elucidate the ways in which the intent of the exhibition space affected the content and interaction with the objects on display. Finally an analysis will be made of the uses of photographs as privileged visual sources for communicating the exhibitions at the Crystal Palace. Moreover a comparison between periodicals and more specialized print genres, such as the Great Exhibition catalogue and final report, will be made in order to draw out the avenues through which photography, and photographic images, shifted in value and construction dependant on the media through which it was presented.

Mario Biagioli

University of California, Davis & Harvard University

Plenary Lecture: Venetian Technology Transfer: How Galileo Copied the Telescope

As obvious as the link between Galileo's name and the telescope may be today, it is the result of strategic historical narratives initiated by Galileo himself. By the time he started to develop his instrument in Padua in the summer of 1609, telescopes built by different artisans were common throughout Europe. Even Galileo (who was not best known for his modesty) acknowledged that others had produced telescopes before he did. Still, he claimed to have invented his telescope without copying anybody's example, but by relying on 'the science of refraction'. His instrument, Galileo intimated, was different from all others because of the way it had been invented and because of the unprecedented astronomical discoveries it made possible. But new evidence indicates that there may have been substantially less independent invention and more 'technology transfer' than Galileo cared to admit.

Tim Boon

Science Museum London

'The Revealing Eye': The Royal Society and the Moving Image at the Time of the Tercentenary

The Royal Society's tercentenary in 1960 provides a valuable case study in the Society's attitudes to publicity and the public sphere. It can be argued that élite science in Britain was slow to take the opportunity of the new mass media of the twentieth century, and especially of moving image media. But, by 1960, that diffidence was a thing of the past. For the tercentenary, they not only collaborated with the Shell Film Unit over the production of two films, *A Light in Nature* and *The Revealing Eye*, but gained extensive coverage on television. The BBC's Television Talks department produced *Life before Birth*, a five-part series on human reproduction, whilst the Outside Broadcast Department devoted the fifth series of eight programmes of the groundbreaking series *Eye on Research* to the work of Fellows of the Society. In July 1960, the BBC also broadcast the Queen's formal opening of the celebrations from the Royal Albert Hall. On the surface, mutual respect might have seemed to be high, but behind the scenes relations were strained as the Society sought control over science broadcasting, and broadcasters aimed to retain control over their own output. So what view of science, and the Society, emerged from these circumstances?

Andréa Bortolotto

Pontifícia Universidade Católica de São Paulo

An amalgam of contrasting theories behind the obtention of an accurate method of mineral analyses in the 18th Century

This presentation focuses on the ideas of Johann Aneas Cramer (1710–1777), a German scholar with a special interest in works with minerals. His best known book is the *Elementa Artis Docimasticae*, published in Latin for the first time in 1739. In England, a translation by the Royal Society appeared in 1741 and 1764 under the title *Elements of the Art of Assaying Metals*. A detailed study of this text shows that Cramer drew on the ideas of both H. Boerhaave and G. E. Stahls, authors whom historians of science saw for a long time as antagonist to each other. Our research

revealed, however, that the views of Boerhave and Stahls, at first glance so different, constitute a coherent theoretical framework capable of addressing problems like the ones Cramer and his contemporaries raised. Given the significance of Cramer's work during his time, one would expect widespread reference to it in the histories of chemistry, which is not the case. This situation led us to conclude that historians often employ a model which favours the analysis of isolated scientific traditions and, as a consequence, let escape the complexity involved in the discussions from certain historical periods.

Sophie Brockmann

University of Cambridge

Of Plants and Volcanoes: Studying the Natural World in Late Colonial Central America, c.1790-1800

In the mid- to late eighteenth century, the Spanish Crown showed particular interest in natural historical information from its colonies, in the 1790s for instance sending a Scientific Expedition to study the natural world of Mexico and Central America. This paper explores the interaction between such government endeavours and 'creole patriots' in Central America. Just as other Spanish colonies, Central America in this period saw the emergence of such patriots, an ethnically Spanish elite who, though politically loyal to Spain, felt attached to their American rather than European home country. In Guatemala, the Economic Society of the Friends of the Country was the most important association of such men, who stressed that knowledge should be gathered and disseminated in a way that was applicable to the local context rather than the Crown's transatlantic perspective. This paper examines the creation - by Spanish officials - and reception - by the Economic Society - of reports on a range of natural historical topics, from banana trees to volcanoes. Through these case studies, it explores the different vantage points of creole patriots and imperial government regarding the use of such information. However, the Economic Society's members, though often dismissive of knowledge not directly applicable to Guatemala, also welcomed the government's Scientific Expedition as an enrichment to their colony's intellectual life. Thus the paper also shows that the distinctions between 'imperial' and 'local' interests were not always clearly defined, since there was a significant overlap in their sources, areas of interest and methods of information-gathering..

Rainer Brömer

Fatih Üniversitesi

Human bodies in Ottoman medical texts and images

Knowledge of bodily structure and function had been part and parcel of classical medical lore from the Hippocratic corpus and, in some forms, even earlier. However, opening human bodies for didactic or even therapeutic reasons remained a marginal practice until the late Middle Ages in Europe and even longer in surrounding civilisations. Nevertheless, Paul of Aegina's 7th-century surgical treatise widely circulated in the Muslim world, both in Albucasis' 11th-century Arabic adaptation and in Sabuncuoğlu's 15th-century Turkish. The latter work was lavishly illustrated with miniatures demonstrating individual surgical procedures – and yet, there are few indications outside these texts to suggest that many of these operations were actually performed in the redactors' lifetimes. Anatomical treatises in the Ottoman Empire seem to have been comparatively rare, as far as the relevant material has been studied so far, and with very few exceptions, they were devoid of images. One of the more widely known texts is Itaki's "Anatomy of the body" of ca. 1632, which has received considerable attention for its eclectic mix of illustrations drawn from a purely diagrammatic Persian tradition (Mansur ibn Ilyas) as well as from European Renaissance anatomy atlases (Vesalius, Valverde). In stark contrast with these pictorial traces, however, the text of Itaki's treatise does not seem to attest any tangible influence of Italian practices of dissection on the formulation of anatomical knowledge in the Ottoman Empire. This paper analyses the relationship between texts and images in Ottoman human anatomy as well as the tension between traditional teaching and contemporary practice of invasive surgery between the 15th and early 19th centuries.

Jenny Brown

Aberdeen Maritime Museum

Engaging Audiences at Aberdeen Museums

Aberdeen Art Gallery & Museums have broad collections of local science, technology and industry artefacts and a strong track record of public engagement. Providing an overview of these historic collections, this presentation will use case studies to demonstrate how the museums service is engaging the audiences with topics relating to the history of science and medicine. Participants will also be invited to take part in an abbreviated "hands-on history" workshop.

Ian Burney and Neil Pemberton

University of Manchester

Spaces and Traces: The making of the modern "Crime Scene"

This paper considers the construction of "the crime scene" as a novel medico-legal space in the mid-20th century. The modern crime scene as an investigative resource depended on two main conceptual and material conditions: first, its suspension in time and space, which enabled the construction of an analytical site in which the body and its physical context could be subjected to a sequential set of investigative practices undisturbed by decay, contamination

or other physical compromise; second, the conceptualization of the crime scene as a space of disciplined “excavation” of trace evidence shed by the perpetrator. We will also consider how this new forensic regime operated in practice, and how its operations were represented publicly. For this we will focus on notorious case of the serial murderer John Christie (1953), the study of which enables an examination of the ways that murder investigation was re-shaped by new approaches to the crime scene, and by developments in trace detection (hair/semen analysis, body reconstruction, scene excavation). We will show how the forensic investigation led by the pathologist Francis Camps transformed Christie’s home in Rillington Place into a macabre, excavation site, the stage for a prolonged, meticulous, and intensely public search for bio-evidence. By focusing on the multi-disciplinary excavation of the scene and later post-mortem work conducted by Camps and his team, we will present this case as a particularly striking deployment of the new investigative model.

Silvia Caianiello

National Research Council (CNR), Naples, Italy

Gavin de Beer and the notion of mosaic evolution

The paper will deal with the notion of “mosaic evolution” developed by de Beer in his 1954 paper “Archaeopteryx and Evolution”. His authorship of this fortunate expression in later biological theory, however, was and still is mostly unrecognized. I will argue that, notwithstanding its fleeting appearance in de Beer’s scientific production, the roots of “mosaic evolution” lay deep in his thinking and synthetic endeavour. I will also tackle the significance of the “conceptual transfer” of the notion of “mosaic” from development to evolution, as well as its implication for his approach to macroevolution. I will finally investigate some possible reasons for the uneasiness that de Beer’s formulation of his principle might have unleashed at a time of “hardening” of the Modern Synthesis, and its relevance in foreshadowing major Evo-Devo themes.

Geoffrey Cantor

University College London

Championing Science and the Great Exhibition of 1851

The various religious denominations displayed a wide array of reactions to the Great Exhibition, ranging from stern condemnation (for its celebration of material goods and neglect of the spirit) to enthusiastic support of the Exhibition as a divinely ordained event. Among the Exhibition’s strongest supporters were Broad Churchmen, Unitarians, Jews, and Quakers. More surprisingly the Exhibition was warmly welcomed by moderate evangelicals, especially from certain dissenting groups, but none more so than the Congregationalist Church (as Nick Fisher noted in a 2003 paper). Drawing on the books, tracts, and sermons written principally by Congregationalists and also the contemporary evangelical periodical press, including the *Evangelical Magazine*, the *British Banner*, and the *Nonconformist*, this paper sets out to answer the question why moderate evangelical Dissenters were so enthusiastic about the Exhibition, especially its science-based exhibits. Among the themes to be addressed will be evangelical attitudes to science, technology, and industry and their religiously grounded notion of progress in these areas. Also important was their biblically-informed view of the significance of the “gathering of nations” in London during the summer of 1851. Most interestingly, many evangelicals expressed the messianic view that Christ’s second coming would soon occur, and they integrated both the growth of science and the Exhibition itself into this prophetic perspective.

Vicky Carroll

Science Museum, London

People, weather, objects: New stories from the stores

Weather is a subject of intense public interest and often concern. Through dedicated TV channels and web applications we can today access detailed information about weather almost anywhere at any time. In our day to day lives, new technologies are enabling many of us to become ever more adapted to and comfortable with the weather. Yet at the same time, we are increasingly bombarded with alarming messages and imagery about weather disasters, extreme events, and the threats and challenges associated with climate change. Expanding data sets, sophisticated instrumentation, faster computers and stronger international collaborations mean that scientists are becoming increasingly confident in their understanding of weather and their projections for the future. And yet public confidence in weather and climate science - perhaps science in general - wavers. Of approximately 200,000 objects in the Science Museum collections, around 1500 are classed under Meteorology. Here is a vast array of scientific instruments for measuring, recording and representing the weather - from wonderfully ornate nineteenth-century barometers to laminated maps and weather symbols for training 1980s TV presenters. Other Science Museum collections - Space, Transport, Computing, Health, Materials, Domestic Technology - contain further objects which have influenced and in some cases transformed how weather has been experienced and understood - from the satellites to sun lamps, skates to seascapes. This paper explores how weaving stories around iconic and everyday objects and imagery relating to weather can provide new perspectives on contemporary perceptions, experiences and concerns.

Juan Manuel Rodriguez Caso

University of Leeds

Wallace, spiritualism, and anthropology at the BAAS: A new interpretation

From the time of its foundation in 1831, the British Association for the Advancement of Science (BAAS) allowed its annual meetings to serve as a forum for the scientific study of man, including anatomy, physiology and ethnology. But there was no section dedicated to anthropological issues until 1866 -- a year when, as is well known, two societies dedicated to anthropological issues, the Ethnological Society of London (ESL) and the Anthropological Society of London (ASL), were in the middle of a struggle for the domination of the emergent discipline. At such a delicate juncture, the man of science elected president of the new section was Alfred Russel Wallace. A naturalist whose interest in man had led him to embrace transmutation, Wallace had acquired a great deal of experience as an ethnographer thanks to his travels to the Amazon (1848-1852) and the Malay Archipelago (1854-1862). In 1864, he presented a famous paper on the origins of man by means of natural selection. He was not aligned with the ESL or the ASL -- a point which may have weighed in his favour in the considerations about who should serve as section president. At the same time, however, Wallace by 1866 had already begun to express public sympathy for spiritualism, notably in a pamphlet entitled *The Scientific Aspect of the Supernatural* -- an attitude which seemed to clash with longstanding BAAS principles. Certainly it is striking that the anthropology section was absent from the programme at the following year's BAAS meeting. Using previously little-explored documents, this paper will offer a new answer to the question of why Wallace was chosen as section president for the anthropologists in 1866, instead of other people much more involved and better recognized in anthropology, and also perhaps more obviously acceptable in their scientific attitudes and beliefs. The paper will also consider the question of why the section disappeared so rapidly after Wallace's term of service.

Chiara Ceci and Stefano Moriggi

Università degli Studi di Milano Bicocca

"Everything gives way to experiment": empiricism and beauty through the history of the Wedgwood family

Seeking beauty does not mean you get lost in the taste for decoration, but that you imagine the style of an era and the meaning of society. The aesthetic empiricism of Josiah Wedgwood I evolved into a pedagogical approach within the family. For generations after him, boys and girls in his family and their circle, were brought up following these ideals: cultural and political awareness are conveyed by an education leading to freedom and tolerance through his technical and scientific approach to the experience of beauty. In particular, political, cultural and social ideals can be traced in the education of women and in their sensibility to the importance of knowledge as public good for the development of citizenship. From the Grand Tour and many abroad experiences to Sunday schools, Wedgwood women embody an educational attitude almost as a civil duty. They had not just the passion for art, literature, music and openness to sciences typical of the Victorian middle and high classes, but they carried concrete efforts, also due to their common Unitarian background, in the opening and management of schooling centres for poor, filling the lack of state and public institutions. Emma Darwin, née Wedgwood, is one of these women: analyzing some steps of her *Bildungsroman* and then following her life, we can see how the aesthetic education of her youth evolved into her cultural and civil commitments towards society. Even towards her husband's "dangerous idea" she never failed to recognize the social importance of the advancement of scientific knowledge, even when that conflicted somehow with her religious beliefs: this attitude blooms from that cultural seed whereby "everything gives way to experiment".

Hasok Chang

University College London

Chemical Atomism: Underdetermination Revisited

For 50 years after Dalton's initial publication, there was no consensus on atomic weights and molecular formulas. For example, Dalton himself took water as HO, and Avogadro's formula H₂O failed to command wide agreement. The uncertainty came from an inherent circularity between atomic weights and molecular formulas, each being deducible from observable combining weights only with the help of the other.

This is an instance of the underdetermination of theory by evidence, but I argue that the traditional philosophical framework is inadequate for a full understanding of this episode (or others). Early atomic chemistry had not merely a set of competing theories, but competing systems of practice based on different operationalizations of the concept of the atom (e.g., by weight or by volume).

This new framework allows a better understanding of how the underdetermination problem was solved in atomic chemistry. There were indefinitely many systems consistent with known observations, but initially not even one that was perfect if we consider other desiderata. Initial progress was made by having a plurality of systems, each "zooming in" on what it could handle particularly well. After much development, it was possible to "zoom out" to a synthesis of competing systems; in the 1850s and the 1860s, consensus was reached on atomic weights and molecular formulas on the basis of the new concept of valency. However, this was only possible through the renunciation of certain aims (e.g. explaining the mechanism of chemical bonding), addressed by other new systems; the new consensus only opened a new pluralistic era in a different configuration.

Isabelle Charmantier

University of Exeter

Linnaeus and the visual representation of nature

Botanical illustrations became essential in Renaissance herbals to determine the identity of plants which as a rule had more than one name. The Swedish naturalist Carl Linnaeus (1707-1778) shunned the process of illustrating and believed in the primacy of a type specimen and a literary description of a plant. In the preface to *Genera Plantarum* (1736), he wrote: 'I absolutely reject [drawings], although I confess that they are of great importance to boys and those who have more brainpan than brain.' Botanists and historians have long debated Linnaeus's capacities as a draughtsman; while some of his detailed sketches of plants or insects reveal a capacity for two-dimensional drawing and a sure hand, his more general drawings of landscape and people seem childish. The overwhelming consensus, based mostly on his Lapland diary (1732), is that Linnaeus could not draw. Little has been said, however, on the role of drawing in Linnaeus's daily work as seen in his other numerous manuscripts. These, kept at the Linnean Society of London, provide an excellent opportunity to reinvestigate the matter. His interest in classification was defined by the relationship of groups of plants and animals, a context in which visual representation is unnecessary. Yet Linnaeus's manuscripts are peppered with little sketches, maps, diagrams, which help to represent succinctly the information on the page. This paper aims to position these drawings in Linnaeus's working method, in particular during his early years when he established his own system of classification, the sexual system.

Sabine Clarke

Grants for Outreach Work

The BSHS Outreach and Education Committee offers small grants for individuals developing projects. This session is an opportunity to find out about applying for a grant and to share good practice in planning, delivering and evaluating outreach projects.

Daniele Cozzoli

Pompeu Fabra University

The Discovery of the Early Antihistaminic drugs

This paper reconstructs the story of the discovery of the early antihistaminic drugs. According to the historians, the synthesis of the early antihistaminic drugs was due to Daniel Bovet, Anne Staub and Ernest Fourneau at the Institut Pasteur and to Bernard Halpern and Simone Courvoisier at Rhône-Poulenc Laboratories. In this paper, I will show that the decisive step which led to the development of antihistamines in France was not due to scientific reason but to business reasons. Indeed, although Ernest Fourneau, head of therapeutic chemistry at the Pasteur Institute believed that non-toxic drugs could be derived from substances they had synthesized, Rhône-Poulenc started new researches that led to discovery of the first antihistaminic drugs. This was due to the interest showed by Merck & co. Inc. and by CIBA Pharmaceuticals Inc. in developing antihistaminic drugs for the treatment of allergies. I will argue that this case study shows the weakness in Rhône-Poulenc vision when compared to that of Merck & co. Inc. Moreover, I will also use this case study to draw broader conclusions on the role played by business history and by the history of science in reconstructing the history of techno-scientific complexes such as that of pharmaceuticals

Antoinette Curtin

Trinity College Dublin

Alexander Walker and Herbert Spencer: A Victorian Science of Beauty?

Writing in 1836, one year before the official beginning of the Victorian period, Alexander Walker assured his readers that the advent of new scientific tools and theories enabled him, at last, to solve a puzzle that had long troubled the minds of male philosophers: the logic governing the mysterious power of female beauty. The modus operandi espoused by Walker's *Beauty: Illustrated Chiefly by an Analysis and Classification of Women* (1836) more broadly evokes the way in which the century's practitioners of the burgeoning science of "æsthio-physiology" envisioned the nature of their endeavours. Invested in the significance of their own originality, theorists such as Walker, Charles Darwin, Herbert Spencer and Grant Allen claimed authority for their conceptions of beauty through self-conscious use of the term *science*. Yet, despite assertions of new frameworks and methodologies, these discussions remained, most often, backward-looking, grounded in the logic and assumptions of classical and neo-classical aesthetic enquiry. Rather than generating new findings or advancing a modified concept of beauty, these theorists typically repeated extant constructions using a self-consciously "scientific" vocabulary. As a result, the dubious consequence beauty had traditionally been afforded in the evaluation of the female continued little changed, bolstered by the authority assumed by scientific discourse. In this paper I attempt to demonstrate the continuity between Walker and Spencer's constructions of beauty and those of the past, and the myth of their own newness they encouraged.

Julie Davies

The University of Melbourne

Poisonous Vapours: The "Sadducismus Triumphatus" and Joseph Glanvill's science of witchcraft

An influential yet controversial figure, Joseph Glanvill was both a defender of the belief in witchcraft and a leading advocate of the experimental method in England until his death in 1680. These two positions are still somewhat challenging for our modern sensibilities to reconcile, however, this paper will explore the relationship between these facets of Glanvill's thought and the significance of his varying degrees of success in each endeavour. The "Sadducismus Triumphatus" was Glanvill's major treatise on witchcraft published in many revisions from 1668-1681. An analysis of this work will show how Glanvill's approach to the study of witchcraft was founded in the empirical approach being advocated by the newly formed Royal Society of London, a collective founded to advance knowledge of the natural world. It will also demonstrate that a continuing belief in witchcraft was not necessarily incompatible with the epistemological and scientific methods of seventeenth century Britain. In doing so, this analysis will shed light on ways in which further study of Glanvill will enhance our understanding of the relationship between the so called "decline of witchcraft" and the development of modern scientific ideals. For despite his ultimate failure, Glanvill's pursuit of a science of witchcraft clearly contributed toward the increasing standards of empirical evidence and the gradual erosion of the value the British scientific community placed on testimonial evidence.

Gowan Dawson

University of Leicester

Palaeontology in Parts: Serializing Science in the *Penny Cyclopædia* 1833–43

While there has been a great deal of attention given to the form of serialized fiction that was come upon almost accidentally by Chapman and Hall during the initial run of Charles Dickens' *The Pickwick Papers* in the summer of 1836, there has been hardly any consideration of the no less widespread practice of issuing scientific works in serial form. This paper will examine the serial publication of the *Penny Cyclopædia*, which, from its very inception, recruited many leading men of science. Its appearance in weekly and monthly numbers that were arranged in alphabetical order, however, presented particular problems to its scientific contributors as in a serialized format the familiar alphabetical mode of organisation made it difficult to incorporate new information about subjects, like anatomy, that had already been treated in early numbers, and leave others, such as zoology, largely unrepresented until the final concluding parts. Despite these problems with potential obsolescence, though, the paper will argue that both William John Broderip and Richard Owen were able to exploit the *Penny Cyclopædia's* serial method of publication to evoke suspense and expectation in their reporting of paleontological discoveries.

Soraya de Chadarevian

UCLA

The making of an entrepreneurial science: biotechnology in Britain, 1975-1995

The turn to an entrepreneurial attitude in British life sciences is generally linked to the shock following the announcement, in the late 1970s, that American scientists had obtained two patents on a technology able to produce monoclonal antibodies that was pioneered in Britain. The perceived failure of the responsible British authorities to file a patent on the hybridoma technology grew into a scandal that, together with the government-sponsored Spinks Report on Biotechnology that called for a concerted effort in that area, gave a decisive impetus to the creation, in 1980, of the first private-public British biotech firm, Celltech. Much ink and anger has been spent to settle who was to blame for the apparent failure to patent the hybridoma technology in Britain. This paper proposes to move on from the blaming game to take a closer look at the changes put in place in the aftermath of the patenting controversy and in reaction to it. These events allow us to appreciate how profoundly policies, attitudes, institutions and career structures had to change to make space for a commercial attitude that is now openly encouraged and widely practiced. Indeed, the term 'failure', although used at the time, seems to imply that a commercial attitude was already in place; it covers up the stepwise changes and wide-spread debates that accompanied the introduction of a more commercial attitude among researchers and government funding agencies, including the Treasury, in Britain. In the process the very meaning and the aims of public science were at stake.

Katrina Dean

British Library

The evolutionary archive

Accounts addressing the recent history of British evolutionary science have not yet fully benefited from research using archives held at British Library including the papers of W.D. Hamilton, George R. Price and John Maynard Smith. This paper offers a preview of the John Maynard Smith archive, which primarily contains correspondence, original research records and offprint collections. I'll explain how the archive is structured and what work is being undertaken to make it accessible to researchers, and mention some of the challenges. Using the papers as a guide, a survey of the work of Maynard Smith might suggest some potential lines of inquiry in the recent history of evolution and raise issues of more general interest to the history of twentieth century science in Britain. I will also invite feedback about what researchers would find helpful in the way of making these archives more accessible and seek

guidance on priorities. This paper may be of interest to specialists in the history of evolution, of recent British science and anyone who is curious (or has some good advice to offer) about curating contemporary research collections

Ursula DeYoung

University of Oxford

John Tyndall and Theology: The Definition and Boundaries of Science

This paper examines the epistemological issues raised by the many sermons, articles, and pamphlets published in response to John Tyndall's Presidential Address to the annual meeting of the British Association for the Advancement of Science in Belfast in 1874. Tyndall's Address served as a direct statement of hostility towards the claims of established religion as a cultural authority, and this paper argues that the Address played a crucial role in the developing definitions of 'science' and 'theology' as intellectual disciplines and as forces in society. The paper explores issues ranging from the perceived duties of a President in making his opening address to the BAAS to the division between rationality and emotion and the contested borderline separating science from theology. Its evidence spans the spectrum of participants, from obscure preachers to such well-known figures as James Martineau. Acknowledging the revisionist work done by historians such as Frank Turner, Bernard Lightman, and Robert M. Young on the 'war' between science and theology in the nineteenth century, the paper nevertheless emphasises the military language used by participants in the science/theology debates and argues that the conflict, after Tyndall's Address, centred on the epistemology of science: how it could be defined, how much intellectual and philosophical ground it covered as a discipline, and what role it should play in society.

Arjen Dijkstra

University of Twente

The construction of astronomical instruments (c. 1600)

At the end of the sixteenth century Tycho Brahe in Hven (Denmark) attracted students and assistants from all over Europe. Most of these visitors were heavily influenced by Tycho's ideas and they helped to spread these all over Europe. A small group of Dutch assistants had close ties with the Dutch University of Franeker where they centred around the professor of mathematics of that university Adriaan Metius. A remarkable feature in both the printings and writings of the members of this group is that they never seemed to tire of stressing their connection with Brahe. A vivid example of what this could result in was a revolutionary astronomical instrument that was constructed in Amsterdam 'after the example' of Brahe in 1607, by William Blaeu. A small manual how to use the instrument and even build one was printed just a year later in the town of Franeker, by Adriaan Metius. In my paper I will analyze how the construction of this instrument can be seen in a broader perspective. I will show that the instrument was a representation of the scholarly world of mathematics of the time, as well as a unique piece of craftsmanship. To do this I will trace the steps of the creators from their visits to Brahe up to the construction in 1607. This will give a unique insight in the scholarly world of astronomy in the Low Countries at the turn of the sixteenth and seventeenth centuries.

Caitlin Donahue Wylie

University of Cambridge

How to make a dinosaur: the technologies of fossil preparation

Fossils, as evidence of past life forms, are critical to the construction and interpretation of evolutionary relationships between groups. But translating fossils into phylogenetic trees requires the gathering of detailed information from fragile, fragmentary, and partially buried rocks. Preparing these objects for research requires a complex series of procedures known collectively as fossil preparation. Fossil preparation is generally left out of paleontology publications, with the result that preparation techniques and the people who carry them out are unknown, unrecognized, and, to use Steven Shapin's (1989) term, "invisible." Therefore it is difficult to access how preparation technologies enable and shape the transformation of fossils into knowledge about evolution. This talk examines the technologies behind the making of paleontological specimens by interviewing fossil preparators about their tools and methods. Preparators strive to make specimens as complete as possible, durable enough to handle, and free from the encasing rock. Achieving these seemingly simple goals requires detailed knowledge of techniques as well as manual skill. Case studies of twentieth-century fossil preparation projects illustrate the creative combinations of old and new technologies employed to best change each unique fossil into a research-ready specimen. The resulting fossil specimens, constructed by preparators' knowledgeable and skilful use of technologies, provide researchers' primary and perhaps only glimpse of extinct species. Researchers' analyses and comparisons of these invisibly-made fossils then yield the data that crucially form the foundation of our knowledge about past life.

Nicholas Duval

University of Manchester

Insurrection and Innovation: The Assassination of Lee Stack and the 'Birth' of Ballistics

Despite being one of the most prominent aspects of popular imaginings of forensic science, very little work has been undertaken on the history of the use of ballistics in criminal investigations, compared to that of other fields such as latent fingerprint examination and toxicology. In this paper, I will examine aspects of this discipline in the early twentieth century. The investigations which followed the 1924 murder of Sir Lee Stack, governor general of the Anglo-Egyptian Sudan, in Cairo in 1924, will be used as a case study for the development of the discipline during this period. The novel analysis of cartridge cases found at the scene by Sydney Smith, then Egypt's principal medical jurist, allowed the authorities to determine that pistols found in the home of a suspect were the murder weapons, one of the defining moments in the history of ballistics, as described by Smith in his autobiography. It provides an example of the way in which forensic knowledge was produced and techniques were developed as cases progressed, rather than through controlled research projects, which invites applications of Actor Network Theory to forensic science, as practitioner agency was potentially diminished. The paper will also reflect upon the importance of the Egyptian context for the wider development of forensics, since two of the most prominent pathologists of the twentieth century, Smith and John Glaister Jr., led the busy, and very well funded, Cairo laboratory before taking up chairs in the more straitened Edinburgh and Glasgow forensic departments, respectively.

Astrid Elbers

Leiden University

Funding radio astronomy in the Netherlands, 1945-1960

In the first postwar decade, the new field of radio astronomy grew steadily in several countries, including Great Britain, the USA, Australia and the Netherlands. The instruments it used (radio telescopes) required a lot of funding. As radio astronomy originated from wartime radar research, and the first radio astronomers were mainly engineers and physicists trained in radar technology, military patronage and funding were self-evident. There were good reasons to fund radio astronomy during the Cold War. It was supposed to stimulate technological innovations that could be used for military purposes. Moreover, big science projects served national prestige. Especially in the USA, the ties between radio astronomy and the military were very strong throughout the 1940s and 1950s. In my talk, I will analyse the funding of radio astronomy in the Netherlands. The Dutch situation differed strongly from the other countries. It has not been thoroughly studied yet. The Netherlands was the only country where radio astronomers were formally trained as astronomers, and where the research exclusively served astronomical goals. At first sight, there are no clear links with the military or with possible spin-offs. Nevertheless, the government and the Dutch Organisation for Pure Scientific Research (ZWO) provided a huge amount of their science budget for radio astronomy. The question is why – in an era of postwar recovery – they gave radio astronomy such a priority

Maurizio Esposito

University of Leeds

Historicizing or analysing organisms (or both)?: The Weismann-Morgan controversy over animal regeneration re-examined

In 1897 T. H. Morgan performed some experiments on a common crab called *Eupagurus longicarpus*. His intention was principally to understand certain features related to the power of regeneration in the crab's appendages. In particular, he aimed to find out if there was a direct relation between liability to injury and regenerative propensities. As long ago as the 18th century important naturalists, including Réaumur and Bonnet, believed that a relevant relation between propensity to injury and 're-growth' existed. In the middle of the 19th century, the Italian physiologist Michele Lessona, and then Darwin, interpreted this connection in evolutionary terms: natural selection may explain the emergence of regenerative power because the re-growth of injured parts could be useful to the survival of organisms. Yet, at the end of that century, two of the preeminent evolutionary embryologists took opposite sides on the question. August Weismann wholly accepted the Darwinian stance, concluding that 'the capacity for regeneration is not a primary quality of the organism, but is a phenomenon of adaptation'. Morgan completely disagreed. For him, regenerative phenomena were not the outcome of mere adaptations but expressed an inner feature of organic development. Criticizing Weismann, Morgan argued that the fact that regeneration could be useful for the organism was not an explanation of its existence. Why did Weismann and Morgan interpret regenerative phenomena in such different ways? This paper will explore the possibility that the controversy arose from different conceptions of scientific explanation in biology. It will also explore possible sources of those different conceptions.

David Allan Feller

University of Cambridge

How the Stomach Ruled William Buckland's Geology

Perhaps because his contemporaries often took the position that William Buckland's personal habits of presentation and inquiry were not always commensurate with the preferred image of the 'gentleman scientist', important aspects of Buckland's fieldwork methodology have been historically marginalized. The best example of this is Buckland's zoophagy. Buckland's eccentric eating habits, including a vow to sample every member of the animal kingdom, were considered at best amusing, and at worst, vulgar, and so have been historically recorded in that vain. Yet, Buckland's belief that the world was 'ruled by the stomach' extended from his personal habits into his science, and provided a *weltanschauung* which ultimately led to Buckland's most important discoveries, including the parsing of the Kirkland Cave fossil world and the corrected description of the Megatherium. Buckland's preoccupation with the alimentary process directly affected his fieldwork, providing him with three important scientific tools: first, an incorporation of traditional medical and chemical practices for the standardized elemental analyses of geological findings; second, a first-person perspective of an historical environment which in its immersion allowed Buckland to more accurately interpret geological data; and third, a third person immersed perspective from which Buckland could contextualize his findings within an emerging science of geology. Other geologists employed similar theories and methods of immersion and emulated Buckland's zoophagy in their process to similar advantage. Thus, the reclamation of 'eccentricities' such as Buckland's fondness for eating strange animals may illuminate important aspects of fieldwork in nineteenth century geology

Mike Finn

Centre for HPS, University of Leeds

Following your example at a distance: The Carlylean balancing of John Tyndall and James Crichton-Browne

John Tyndall's outlook on the roles of religion and scientific inquiry was a source of debate in his own lifetime, and remains so for modern historians. Whilst espousing strict materialism in scientific study, he viewed the universe as a living thing, elements of which would always remain mysterious and at the root of spiritual beliefs. Frank Turner and Ruth Barton have both suggested that many Victorian men of science, including Tyndall, were deeply influenced in their religious thinking by Thomas Carlyle; a man who held paradoxical views on matters of science and religion himself. This paper will investigate further the practical implications of a Carlylean approach to balancing scientific and religious convictions in a scientific career, by considering events in the lives of two men who were followers and friends of Carlyle: Tyndall, a physicist, and James Crichton-Browne, a psychiatrist. Following his 1874 Belfast address, Tyndall faced criticism for declaring that religious beliefs must hold no weight in any scientific practice. Concurrently Crichton-Browne, an asylum superintendent, led just such an experimental research programme on the brain. However, whilst Tyndall unflinchingly and publicly defended his controversial views until his death, Crichton-Browne later felt impelled to leave the journal *Brain*, which he had helped to found, because he could not tolerate its materialist tendencies. It is thus seen that the Carlylean trait of maintaining a sharp demarcation between spirituality and scientific practice had rather different kinds of problematic consequences for their professional and personal lives.

Nick Fisher

University of Aberdeen

1851: struggling to describe the indescribable

Despite the heroic efforts of Henry Cole to lay out the Great Exhibition in a rational arrangement, it was so vast and variegated and overwhelming in its single building (18 acres + galleries) that it was literally indescribable. Notoriously, the *Times* on 2 May 1851 asserted that the only appropriate comparison for the Opening was the second coming of Christ! Nor was everyday description any easier. It was of course possible to take all summer to go through each class one by one (*Times*, *Morning Chronicle*, *Illustrated London News*), but this piecemeal coverage didn't add up to description. Robert Hunt (in his Synopsis) argued that every visitor needed to find a thread - any thread - through the labyrinth; but this proved elusive, even for professional journalists, who must overall be judged to have failed. With the impossibility of description, journalists tried other strategies, notably epistolary form, and also fiction, which excused the writer from providing any more than a few personal impressions. In this last part of the paper, I centre on Henry Mayhew, who (despite his well-known descriptive skills) tried to cover the Exhibition for the *Edinburgh News* and failed; in his fiction he avoided any engagement with the contents by having Mr and Mrs Sandboys finally abandon their multiple attempts to enter the Crystal Palace! So the legacy of the Great Exhibition remains ambiguous. At the time it was judged an overwhelming success, but (to the surprise of those who expected its fame to outlast the pyramids) it proved to be all too easily forgettable and ephemeral. It was both a 'Great Exhibition' and a heroic failure.

Gwyndaf Garbutt

University of Toronto

Evidence In Medieval Natural History: Constructing natural knowledge in the *De animalibus* of Albertus Magnus

Medieval natural philosophy is often seen as dominated by the authority of ancient philosophers and disconnected from direct observation of the natural world. Some historians even suggest that Medieval scholars were interested exclusively in interpreting the knowledge of previous authorities and uninterested in connecting that knowledge to the physical world. My paper will show that, at least in the case of Albertus Magnus (~1200-1280 C.E.), this view is wholly inaccurate. Albertus Magnus's *De animalibus* (~1268 C.E.) is one of his greatest works on natural philosophy, compiling and assessing information from a wide variety of sources about the physiology and behavior of animals. Peter Harrison has argued that Albertus's inclusion of 'fantastic' animals in this work is evidence that he was more concerned with compiling information taken from ancient texts than representing physical reality. Such a reading astically misrepresents Albertus's project. A close examination of *De animalibus* reveals instead a careful evaluation of evidence associated with each animal via observation, reason, testimony, and experimentation, all employed to determine the reality of claims concerning animals in distant lands. These 'fantastic' animals are not symptoms of a natural investigation dominated by ancient thought, but products of a careful evaluation of evidence and an acknowledgement of the limits of Albertus's own experience. Such a reading of *De animalibus* leads us to a more complete understanding of the creation of natural knowledge in the works of Albertus Magnus and provides the first step toward a reevaluation of the methods of Scholastic natural philosophy.

Miguel García-Sancho

Spanish National Research Council (CSIC)

Historiographical considerations on the introduction of protein sequencing into Spanish biomedical research (1968-1998).

My paper explores the introduction of protein sequencing techniques in Spain with the aim of setting a new perspective in the study of the history and circulation of biology between the 1970s and 90s. I focus on the trajectory of Enrique Méndez, who started his career in the late 60s at the Centro de Investigaciones Biológicas, the first Spanish centre in incorporating a laboratory of molecular biology. He then migrated to New York University and the Roche Institute, where he learnt protein sequencing in the context of investigations of antibody structure. Upon return to Madrid in the late 70s, he established a protein sequencing facility and engaged in collaborative projects at the Hospital Ramón y Cajal, a pioneer in combining research and clinical practice in Spain. At the end of his career, he shifted to the development of kits for the detection of gluten in food processed for coeliacs. Studying protein sequencing in a country which was not involved in its invention shows that the circulation of knowledge and techniques is not historically unproblematic. Protein sequencing was invented by Fred Sanger in the context of purely academic research during the first half of the 50s. However, Méndez learnt an alternative strategy and applied sequencing to medical problems in cooperation with the pharmaceutical industries. The spread of recombinant DNA during the 80s led protein sequencing and other biochemical techniques to be perceived as out of date. Méndez had to seek new horizons in food science and the development of kits to be introduced in the emergent biotechnology market

Stephen Gaukroger

University of Sydney/University of Aberdeen

D'Alembert and Euler and mid-eighteenth century rational mechanics: What mechanics does not tell us about the world

Rational mechanics was a reworking of Newtonian mechanics in terms of very powerful new mathematical resources, which came to a head in the mid to late eighteenth century. With the collapse of mechanist aspirations to provide a theory that would reduce all of physics to the mechanically-characterized interactions between micro-corpuscles, rational mechanics became caught up in a similarly foundational project, albeit one pursued by very different means. There were two components to the project. The first was that the core of rational mechanics consisted of a priori truths. The second was that all of physics was basically mechanics. I focus on the second set of claims, looking at the cases of gravitation and optics, with a view to showing that the gulf between mechanics and physics more generally was unbridgeable

Susannah Gibson

University of Cambridge

The zoophyte problem, or, the chemical animal in natural history

In 1767 the naturalist John Ellis sent a sample of coralline to the chemist Peter Woulfe for analysis; he requested that Woulfe test the sample for the presence of a group of chemicals known as volatile salts. If these salts were present, Ellis would be able to classify corallines as animal; if the salts were absent, the corallines would remain in the vegetable kingdom. In this paper, I will examine how naturalists in the second half of the eighteenth century conceptualised the animal and vegetable kingdoms; in particular, I will focus on the methods they used to investigate the boundary between these two kingdoms. By looking at the array of methods used to study ambiguous organisms such as corallines, corals, sponges and polyps, we can better understand the discipline of natural history. Throughout

the work of Ellis and his contemporaries, we find evidence that natural history was a more complex discipline than is often supposed: it was a discipline that interacted with natural philosophy; that had a strong theoretical basis; that used methods ranging from observation to experimentation; that borrowed from other sciences such as chemistry and physiology. Zoophytes, existing on the border between the kingdoms, were particularly interesting to naturalists but also particularly difficult to study, and so they provide a useful case-study in the ideas and methods of late eighteenth-century natural history.

Graeme Gooday and Jamie Stark

Centre for HPS, University of Leeds

John Tyndall: Lecturing, Authority and Correspondence in Victorian Public Science

John Tyndall's lecturing was the epitome of Victorian 'public science', to use Frank Turner's apposite description. Between his humble accession to a professorship at the Royal Institution in 1853 and his final shambolic lecture there in 1886, Tyndall attained large and diverse audiences both for his lectures and the many books published from them. While several historians have studied Tyndall's lecturing technique and his relationship with these audiences, this paper sheds new light on this work from hitherto unexamined correspondence with William Thomson, and William & Eliza Spottiswoode. We learn from these that Thomson became increasingly deferential to Tyndall as an authority on lecturing technique over the course of his career – maintaining their cordiality even during the bitter priority dispute between Mayer and Joule over energy conversation, on which they took opposing sides. From correspondence with the Spottiswoodes it transpires that they – perhaps rather more than fellow members of the X-club – served as Tyndall's personal confidantes over the enormously demanding schedule he set himself in lecture preparation. As President of the Royal Society, William would regularly recommend lecture opportunities to him to serve irenic political purposes, e.g. working men in Ireland, and offer support to Tyndall when he encountered difficulties with Establishment disapproval of his religious position. Overall we see that whilst Tyndall's surviving letters with hundreds of correspondents reveal him to be a central figure in Victorian science, he also evidently relied upon significant numbers of them for successful management of his public career as scientific authority.

Florence Grant

Kings College London

Eighteenth-century instruments as rhetorical devices

By 1728, the encyclopaedist Ephraim Chambers (c. 1680-1740) recognised a “formed art” of making experiments in England, practiced by lecturers offering courses of experimental philosophy. Lecturers early in the century, such as Willem's Gravesande (1688-1742) in Leiden and Jean Theophilus Desaguliers (1683-1744) in London, contrived a number of instruments to show, illustrate or explain abstract or difficult ideas. In discussing the use of these instruments, lecturers asserted that difficult ideas became easier when “placed before the eyes” – a phrase that appeared repeatedly in contemporary works on rhetoric, to denote the phenomenalisation of ideas through metaphor. Such instruments did indeed appeal to the visual imagination in a similar way, making descriptions more intelligible by making them more vivid. The analogy with tropes in the verbal arts is strengthened if we consider that, in the same period, critics such as Joseph Addison (1672-1719) and Jonathan Richardson (1667-1745) were proposing strict equivalences among writing, painting and poetry as ways of communicating ideas. In this paper I will argue that, as means for presenting vivid images to the imagination, instruments for showing or explaining ideas were akin to the aesthetic and affective strategies of rhetorical style. This characterisation, in turn, allows an interpretation of beauty in eighteenth-century instruments as active in a rhetorical sense. An approach to eighteenth-century instruments through rhetoric allows their physical characteristics to be recognised as one in a series of deliberately layered, sensory and intellectual pleasures that rational entertainments provided

Mick Grierson

Goldsmiths College

The Oramics Machine and Daphne Oram: Relationships between Instrument and Aesthetic

Daphne Oram (1925 - 2003) is considered by many to be one of the most important figures in the development of British experimental electronic music. As first founder and director of the BBC Radiophonic Workshop, she pioneered key principles that are central to electronic music production and sound design. In addition, Daphne Oram invented one of the earliest sound synthesisers, the ‘Oramics Machine’. Over the past year and a half, Goldsmiths College and the Science Museum have been working to understand this device, in terms of its operation and functions, and also in terms of its potential historical significance. Through collaboration with one of the original Oramics engineers, we have come to a basic understanding of its capability. This information, if shown to be correct, could support Daphne Oram's claim that the system is the first graphical electronic computer music composition system, and one of the most historic electronic music devices in the world.

Ari Gross

University of Toronto

Pictures and Pedagogy: the role of diagrams in Feynman's early lectures, 1949-50

Over the past decade historians and philosophers of science have developed an interest in Feynman diagrams, the small, yet immensely powerful visual representations of subatomic events developed by Richard Feynman in the 1940s. However, while historical works like David Kaiser's *Drawing Theories Apart* and Adrian Wüthrich's *Feynman's Struggle* and Dyson's *Surprise Revelation* have told how Feynman diagrams were developed and propagated, there has been little focus on how Feynman himself used (and conceived of) his diagrams, especially shortly after their invention. Furthermore, the focus on "Feynman diagrams" at the expense of the numerous other types of diagrams used by Feynman has narrowed debates over the role of diagrams in scientific thought and the nature of visual reasoning. This paper aims to give a substantive account of how Feynman used diagrams in the first lectures in which he was tasked with explaining his new approach to quantum electrodynamics. A critical examination of unpublished course notes to lectures given in 1949/50 shall demonstrate how Feynman used a spectrum of diagrams in a variety of ways: heuristically, computationally, and as an aid to understanding the mathematical details of his approach. We shall see how Feynman modified each individual diagram to suit particular needs within the context of the lecture, yet how a general visual style allowed him to move between morphologically distinct diagrams with ease. Furthermore, key biographical themes such as the evolving role of diagrams in Feynman's work and the changing types of diagrams drawn throughout his career will be discussed

Richard C Gunn

University of Leeds

Lewis Mumford, Franz Reuleaux, and the Archetypal Machine

This paper has two main aims: first, to come to a better understanding of what the American historian and philosopher of technology Lewis Mumford meant by the term "megamachine"; second, to show that Mumford drew upon the work of the nineteenth-century Belgian engineer and machine-theorist Franz Reuleaux in order to provide a definition of "machine" that included animate as well as inanimate parts. In *Technics and Human Development* (1967) Mumford defined the megamachine as a vast complex of human and non-human parts organised in order to undertake large-scale socio-technical projects. The modern incarnation of the megamachine was the nuclear superpower, but its origins could be found in ancient civilisations, most notably in Egypt where pyramid building was undertaken by a minutely ordered labour force, with each individual worker constituting a component in a great machine. The Egyptian megamachine, argued Mumford, must be understood as the "archetypal machine," pre-dating the machines of industrial capitalism by over 4000 years. He stated unequivocally that the term "machine" should be taken literally, and in drawing upon *Kinematics of Machinery* (1875) he adopted Reuleaux's famous definition of a machine as that which performs work through the constraint of resistant bodies. Mumford's approach thus challenges commonly held assumptions about what a machine is and when large-scale machine systems were developed. I argue that commentators, most notably Leo Marx (1990) and Kenneth Stunkel (2004), have overlooked Mumford's debt to Reuleaux and have thus not engaged seriously with his arguments about the nature of the megamachine

Elizabeth Hallam and Anna Maerker

University of Aberdeen & University of Oxford Brookes

Making the perfect war horse: exploring object-centred events for adult audiences

Around 1820, the French doctor Louis Auzoux developed an extraordinary teaching tool: a life-sized anatomical model made from papier-maché which could be "dissected" into pieces – the forerunner of today's plastic models. Auzoux established a successful global enterprise of artificial human anatomies. In the 1840s, the French public voiced concern over the quality of its military horses, a central technology in nineteenth-century warfare. Auzoux tried to profit from the situation by branching out into making animal models. In correspondence with an army officer in charge of horse-breeding, he developed an almost life-sized model of a horse. The letters between Auzoux and the military horse expert are preserved at the National Archives, Paris; they can be used to situate the Auzoux models in the context of the public debate over the horse as a military technology. We present the story of the horse model, supplemented by objects such as an Auzoux model of a horse hoof, images, video recordings, and primary source texts. We invite the audience to help us explore different activities around historical objects for their suitability to engage adult audiences.

Emily Hankin

University of Manchester

Electricity, food production, and domestic spatiality in mid-twentieth century Britain

The post-war reconstruction of vast numbers of homes and the introduction of electricity placed understandings of domestic space in a state of flux, facilitating new interpretations of the meanings of domestic space in relation to household tasks. For example, the development of the electric refrigerator heralded the advent of a new technology situated in the kitchen and replacing the need for ice boxes and larders for the preservation of food. In this way, the design of the refrigerator was informed by the space in which it was to be used and in turn dictated changes in the

spaces and activities associated with food production. This can also be applied to the electric cooker but smaller and more portable electrical appliances such as the kettle, toaster, or hotplate show how electricity enabled food preparation and production to move beyond the boundaries of the kitchen. The allocation of different spaces to different activities became more flexible with the introduction of electricity. I will be using empirical material from advertising, popular journals, industry, government and consumer publications, mass observation and examples of material culture. I hope to show that electrical appliances associated with food preparation and production were designed and marketed as quicker, easier and more efficient to use than their gas counterparts and commensurable with understandings of the modern home. I will also question whether or not this tallied with the actual experiences of the consumer within the domestic space

Nils Petter Hellström

University of Cambridge

Darwin and the Tree of Life: the roots of the evolutionary tree

To speak of evolutionary trees and the Tree of Life is presently routine in evolution studies. Until the nineteenth century however, the same tree grew in Paradise and was rather a common image in religious discourse. It is only since Darwin that the Tree of Life has also been understood as a genealogical tree of all life, rooted in common origins. Although many see Darwin's tree as a secondary illustration to his theory—an analogy with which to communicate his findings—it is clear from Darwin's private notes that he visualised his genealogical Tree of Life before he developed his theory of descent by natural selection, and before he drew any diagrams to illustrate it. In fact, the tree was not secondary to evolutionary theory; it *was* the theory. Recent studies of prokaryote evolution have called into question the suitability of the tree model and have fuelled anti-arboreal sentiments within parts of the research community. Despite this, the tree prevails as the privileged evolutionary model. Because it is not immediately obvious why a tree is best suited to represent evolution—for a start woodland trees don't have their buds in the present and their trunk in the past—the reasons why trees make sense to us are rather historically and culturally predicated. This paper will thus explore the particular context in which Darwin came to represent the classification and history of life with a tree, and to call his tree the Tree of Life.

Rebekah Higgitt

National Maritime Museum

Exporting Greenwich: the Royal Observatory as a model for imperial observatories

In the first half of the 19th century both the state-sponsored Royal Observatory at the Cape of Good Hope and the privately-run Paramatta Observatory were described as “the Greenwich of the southern hemisphere”. This paper will examine the full meaning of this laudatory tag and ask why, how and to what extent the Greenwich model could be replicated in imperial contexts. In the process it will highlight that an association with what had come to be seen as the virtues of Greenwich – accuracy, routine, reliability, longevity – were as or more important than the physical institution and its work. It is apparent that there was a tension between what might be understood as the necessary or utilitarian outputs of the British Empire's network of observatories and the symbolic importance of recreating a version of the Greenwich Observatory overseas. As with surveying work, founding an observatory could help define a nation or colony and create an impression of permanence: the instruments and observations quite literally placed their location on the map. An observatory could signal the arrival of western science and exist as a defining statement of the processes and results of civilisation. This paper will examine the extent to which these purposes were implicated in the foundation of observatories in the British Empire in the first half of the 19th century and the degree to which they were fulfilled

Sally Horrocks

University of Leicester

Works' Chemist required . . Woman graduate preferred': gender and scientific employment in Britain during World War II

World War II is frequently regarded as an important turning point in the history of women's employment in Britain. Not only did women gain access to new areas of employment during the conflict itself, but lasting changes such as the removal of the marriage bar in professional employment and the employment of older married women, particularly in part-time posts, became firmly established. This paper draws on a wide range of sources including university and national archives to examine the impact of World War II on the employment of women scientists, with a particular but not exclusive focus on chemists. It argues that wartime conditions expanded women's access to some areas of employment, particularly in universities and government research establishments, but that these opportunities represented in many ways a further expansion of openings that had already been established rather than wholly new opportunities, and not all of them proved permanent. Opportunities in industry also increased, as the quote in the title suggests, but the evidence indicates that this was more a response to the difficulty of securing any other staff than an indication of a genuine shift in attitudes towards the employment of women. Overall the experiences of women scientists during this period supports the views of those historians who have argued that war did not represent any fundamental change in opinions or expectations among employers and that official policy served to maintain gender inequalities, not to challenge them.

Jeff Hughes

CHSTM, University of Manchester

Butlins and the Bomb: *Uranium 235*, Class and Nuclear Culture in Postwar Britain

In late 1945, the radical activist, musician and playwright Ewan MacColl scripted a 'documentary play' based on the Smyth Report, the official public account of the Manhattan Project issued soon after the atomic bombings of Hiroshima and Nagasaki. Written for his agit-prop Theatre Workshop group and first produced by his wife Joan Littlewood, *Uranium 235* used a wide range of forms and techniques including parody, pastiche, personification, and musical burlesque to present an iconoclastic history of atomic science and the bomb. Among its first audiences early in 1946 were families at Butlin's holiday camp at Filey in Yorkshire, and patrons of numerous regional community theatres: precisely the working-class audiences that Theatre Workshop sought to reach. Hailed by one critic as 'a kind of working-class dance drama' and by others as a 'modern morality play,' *Uranium 235* toured extensively in the provinces until it was 'discovered' by Sam Wannamaker and Michael Redgrave. It soon transferred to the Comedy Theatre in London's West End, where it completed an extremely successful run in 1952. Against a literature that tends to portray a homogenised postwar 'nuclear culture,' this paper will use the history of *Uranium 235* and its very different contexts of performance and reception to explore the rich and diverse cultural production of the nuclear in postwar Britain.

Frank A.J.L James

Royal Institution

Lawrence Bragg, C.P. Snow and the 'Two Cultures'

Guy Ortolano in his recent excellent study of the controversy that arose following C.P. Snow's 1959 lecture 'The Two Cultures and the Scientific Revolution' overlooked the roles that Lawrence Bragg played in the genesis and continuance of the debate. Understanding Bragg's involvement in its institutional context will be the subject of this paper. Bragg, the youngest ever winner of the Nobel Prize and an accomplished artist, was Director of the Cavendish Laboratory in Cambridge from 1938 until 1953. Whilst at the Cavendish he instigated very well attended arts and humanities lectures for students and was also one of Snow's patrons. There is limited evidence which suggest that Bragg and Snow coined the phrase 'two cultures' on a train between London and Cambridge. Whatever the case there might be, there is no doubt that Bragg, as head of the Royal Institution from 1954, played a crucial role in the developing controversy when he invited Snow to deliver one of the Institution's Friday Evening Discourses on the two cultures at the end of November 1963. Snow in the course of preparing his lecture decided to use the occasion to respond to his critics. Published in the *Times Literary Supplement* in October 1963 as 'The Two Cultures: A Second Look' it formed the basis of his televised Discourse. In this he changed, at Bragg's suggestion, the criterion for what an arts person should know about science from the second law of thermodynamics to understanding DNA.

Sean F. Johnston

University of Glasgow

The atomic cloister: secrecy and the shaping of technical identity, 1940-60

During five wartime years and the following post-war decade, atomic energy was a subject shrouded in secrecy. Identified as a crucial element in military strategy, national status and export aspirations, the research and development of atomic piles (nuclear chain-reactors) were nurtured at isolated installations. Like monastic orders, new national laboratories provided occupational environments that were simultaneously cosseted and constrained, defining regional variants of a new State-managed discipline: reactor engineering. This paper discusses the significance of secrecy in defining the new subject in the USA, UK and Canada – the first three countries to dedicate sustained government funding to the field. The borders and content of the subject developed differently in each country, shaped under the umbrella of security by disparate clusters of expertise, industrial traditions and national goals. The emerging academic discipline was constricted by classified publications and State-sponsored specialist courses. The new experts were categorised largely according to existing occupational niches and union affiliations. And, the context of high security filtered their members and capped their professional aspirations. But these amply-funded and secluded environments traded intellectual segregation for unbounded opportunities. Like children in a toy factory (paraphrasing Alvin Weinberg), reactor engineers explored a new domain, sometimes with scarcely a sideways glance at social, economic or even strategic factors. The ambiguous and capricious goals of the new sites and their specialists gradually were tamed, though, as security measures diminished during the mid 1950s and commercial nuclear power was identified as the primary goal. This work is supported by ESRC grant RES-000-22-2171

Fraser Joyce

Oxford Brookes University

Forensic Expertise, Lay Knowledge, and the Search for Identity in the Crippen Case

On July 13th 1910, police uncovered human remains beneath the cellar of 39 Hilldrop Crescent, sparking an international manhunt for Dr Hawley Harvey Crippen for the murder of his wife. In Crippen's subsequent trial, the identification of the badly-mutilated body became of paramount importance, and its outcome catapulted a young

Bernard Spilsbury to fame. This paper will examine the roles of those who contributed to the task of identifying the body, including a range of medico-legal specialists such as police surgeons, pathologists and microscope experts, and lay participants who provided crucial information regarding the appearance of the deceased. In the weeks and months following the discovery of the remains, several post-mortem examinations and countless police interviews constructed and then successfully combined two seemingly-incomparable images: the lay view of the deceased when alive, and the medico-legal image of the body of the deceased. In the face of this evidence, the defence carried out their own post-mortem examination which led to an intense courtroom battle. Thus this landmark case illustrates the importance of the co-operative efforts between medical and lay participants in establishing identity, the role and implications of medical expertise in court both for the Crown and the defence, and the place of single pieces of evidence in relation to the complete body. In addition, Spilsbury's role will be briefly examined in the light of his recent re-appraisal by biographers, and the controversial findings of modern DNA evidence.

Melanie Keene

University of Cambridge

The Fairy-Tales of Science

Once upon a time, insect fairies could be found fluttering their wings at the bottom of the garden, and the seeds of every flower contained a sleeping beauty waiting to be awoken by a sunlit kiss. The very raindrops that fell from the sky were competing suitors for the hand of an exotic Princess, and plum puddings and cricket bats grew on trees. Princes worked incognito as lift-attendants; gnomes toiled in underground caverns; Aladdin discovered petroleum; knights and nymphs clashed in freshwater ponds; and the curse of a malevolent sprite could only be lifted by solving problems in long division. In these ways, an array of Victorian writers claimed the power of myth and marvel associated with fairy-tales for the newly scientific and technological world. Educational writers enticed their young readers and listeners to learn about the sciences by employing imaginative narrative strategies, fables, and metaphors, and by dressing introductory explanations in the garb of fairy-land. The fairy-tale was appropriated as a suitable means of conveying the wonders of new discoveries and technologies; engine-lights might have replaced the glow-worms, but fears over the potential mechanisation and disenchantment of the world were unfounded. In fact, the fairy-tales of science were claimed as superior to their traditional counterparts - the feats and wonders they recounted were even more astounding because they were true. In this talk I shall introduce and analyse a range of scientific fairy-tales from the nineteenth century to explore the ways in which they reconciled the differing demands of facts and fancy.

James Kennaway

University of Durham

Musical Brainwashing: The Dangers of Music between Cold War Psychology and Reagan Era 'Satanic Panic'

The idea that music could brainwash or effectively hypnotise listeners, making them the willing stooges of their manipulators, has proved highly influential over the last half century. Drawing on fears of supposed Communist techniques raised by the behaviour of POWs in the Korean War, the journalist and CIA agent Edward Hunter coined the terms 'brainwashing' in the 1950s. It soon became the basis for an attack on popular music as literally a Soviet plot to destroy America in books such as *The Marxist Minstrels*. American physicians such as Leon Freedom suggested that Russian abilities in this regard were supposedly based on the work of Pavlov and Luria. At the same time, the CIA itself ran experiments on brainwashing themselves, sometimes involving music. The issue re-emerged in the 1980s, linked less with a Communist than with a Satanic threat. The Heavy Metal music of the era was incorporated into a widespread moral panic in the United States about the (essentially non-existent) danger posed by a worldwide Satanic child abuse conspiracy. Conservative authors argued that Heavy Metal songs often contained Satanic messages recorded backwards, which acted subliminally to brainwash the listener, leading to several trials and congressional hearings on the subject. This paper will consider the American musical brainwashing panics of the postwar period and the interaction between Cold War psychology and psychiatry and the ideologies behind these critiques of music.

Aleks Kolkowski

Brunel University

Bellowphones and Blowed Strings: The Auxeto-Instruments of Horace Short & Charles Algernon Parsons

The quest for louder sound reproduction in the acoustic era (1877 – c 1925) occupied the minds of the greatest inventors and engineers of the age. It is no surprise then, that the most successful and powerful mechanical device to amplify recorded sound - the auxetophone – was the product of combined efforts by no less than Horace Short (of Short Brothers' aviation fame) and Sir Charles Algernon Parsons, inventor of the modern steam turbine engine. Compressed air was modulated by a valve, simulating mechanically the vibrating action of vocal chords; the blast of sound projected by a giant horn. When playing gramophone records, this reproducer could be used in the open air, in large halls, even compete with an orchestra. Parsons' use of the valve on violins, cellos and basses in the early 1900s resulted in the very first externally amplified musical instruments, preceding electronic devices by decades. Despite endorsements from leading musicians and scientists, and in contrast to the success of its gramophone counterpart, the new auxeto-amplified instruments met with open hostility from the musical fraternity and a mixed

response from the press. Parsons, increasingly disillusioned, abandoned his groundbreaking enterprise. It would nevertheless be another decade before mechanical systems of amplification were rendered obsolete by the thermionic valve, microphones and 'wireless' technology. Consigned to a footnote in the biographies of Short and Parsons, neglected by historians and unexplored by organologists, auxeto-instruments remain important in any discussion about the mechanical amplification of sound and early attempts to amplify live music. This paper examines the auxetophone from both organological and historical perspectives: a focus on the invention, its design, function and construction, is complemented by a discussion on the social and cultural context in which this mechanical stentor was created. Parsons' air-powered system is also examined in the light of earlier and contemporary endeavours to increase the loudness of sound reproduction devices and instruments; the introduction of the Auxetophone to scientific circles and through the popular press; the Henry Wood Promenade Concerts of 1906, which featured an auxeto-double bass and the auxeto-'cello recitals of Auguste van Biene.

Sarah Kriger

University of Toronto

The Illusion of Intelligence: Technology, Conjuring, and "Psycho"logy in Nineteenth-Century London

Just as the deftest sleight-of-hand fails to garner applause if its presentation falls flat, the most ingenious mechanical conjuring apparatus does not astound its observers through the operation of its mechanism alone. A good stage illusion must not only physically resemble the object or phenomenon it is meant to represent, it must also take advantage of social and theatrical conventions both to direct spectators' attention to its salient features and to convince audiences to recognize it as representing the desired entity. One particularly illuminating example of such a technology is Psycho, a purported automaton exhibited by the illusionist J. N. Maskelyne at the Egyptian Hall, London beginning in 1875. For over four thousand consecutive performances, Psycho played cards with audience volunteers, and, to this day, no one can say with complete certainty how it did so. Straddling the line between legitimate technological ingenuity and deliberate deception, Psycho was promoted as advanced technology—a machine that could reason like a human being—but displayed as a magic trick. Without its mechanism, the automaton would not have functioned—but the mechanism on its own would not have achieved the success it did. The various contexts in which Psycho's creators both purposely and serendipitously placed it, including those of the scientific community and the contemporary presentation of the human body onstage, helped it to fix itself in Victorian minds as a thinking machine, and modern historians of technology can fully analyze Psycho only by examining its place within those contexts.

Allison Ksiazkiewicz

University of Cambridge

Aesthetics of architecture and geology in Britain during the first half of the nineteenth century

At a time when geology was developing as a scientific pursuit, debates about the origins of architecture were hotly contested. The cave was increasingly becoming a site for geological research, as seen in work by geologists such as William Buckland. The prehistoric remains of animals remained undisturbed in these natural shelters, which for Buckland, offered a 'window into the past'. William Conybeare's satirical cartoon of Buckland crawling into the Kirkdale cave illustrates how a cave space is imagined as a keyhole into an antediluvian world. In architectural treatises of the period, however, caves were described as 'Nature's first architecture'. Some architectural critics of the period argued that all human architecture is derived from the cave's natural form, as such places were Man's native home. Joseph Gandy's watercolour entitled "Architecture: It's Natural Model" (1838), for instance, depicts two ape-like humanoids building a primitive hut at the mouth of Fingal's Cave, an important geological site of the late eighteenth and early nineteenth centuries. Often natural historians and travellers would use architectural language to describe a geological landscape, such as Fingal's Cave or the Scottish Highlands. Nineteenth century geologists adopted architecture's visual regiment because it offered a foundation for how geology is structured in the mind's eye, and represented in text and image. Using the cave and primitive hut as its example, this paper will explore aesthetic and political connections between geology, architecture, and the antiquity of the Earth's denizens for the nineteenth century geologist

Sigrid Leyssen

Universität Basel

The image as instrument. Moving images in Albert Michotte's Psychological Laboratory.

Throughout his research career, the experimental psychologist Albert Michotte (1881-1965) used different kinds of moving images in his experiments on perception, going from photographic 'kinesigrams' in the 1930s, over rotating discs and projections in the causality experiments in the late 30s and 40s, to tilting perspective drawings and cinema in the late 40s and 50s. Recently, different ways in which (moving) images play an important role in scientific practices have been studied. Michotte's work offers a good case to investigate yet another use of moving images in science, i.e. as instruments in psychological experiments on perception. Looking especially at the images used in the experiments on the perception of mechanical causality, it becomes clear that these images were an intrinsic part of the experimental setup. They were especially constructed for presenting a specific stimulus configuration in a well-defined experimental setting. Studying what we could call 'experimental images' in Michotte's laboratory offers a

good way to explore how the image was thought, how it was observed, and how it was active in an experimental context. What can it mean for an image to act as instrument? And what additional functions did come with this role? In Michotte's case, it can be shown e.g. how the intensive working with specific images made certain research questions shift, and changed the framework in which perception was understood. The focus in this paper will be on understanding this productivity of images in their role as instruments in the generating of knowledge on perception

Ian Martin

University of Manchester/ Open University

Failure in practice: bankers, blame and computing technology

In 1969, the BBC's popular science and technology programme, *Tomorrow's World*, predicted point of sale terminals in every British high street shop and looked forward to the advent of a computerised cashless economy. The inspiration for the show's prediction was three ambitious attempts by Britain's biggest banks to introduce new nationwide real-time computer banking systems before 15 February 1971. The banks, threatened by state-sponsored competition, inspired by the success of SABRE, American Airlines' real-time airline reservations system, and pressured by forthcoming decimalisation, chose 'D-Day' as their immovable deadline. In each case, it was US manufacturer, Burroughs, that encouraged the banks, promising them a central super computer linked to a national network of intelligent terminal satellites. Perhaps unsurprisingly for *Tomorrow's World*, its prediction was wildly optimistic. But so too were those of the banks. At the time of the programme's broadcast, one bank had already abandoned its plans, and relations between the other two and Burroughs were being sorely tested. Real-time banking never materialised in the 1970s, let alone by 1971, and by their own measure the banks' projects had to be considered failures. I revisit one of the cases, drawing upon a number oral testimonies, to follow a community of practice as it transgressed established business boundaries in pursuit of a technical ideal. As the community becomes the architect of its own fate, I explore the co-construction and 'interpretive flexibility' of technological failure and consider the final attribution of blame.

Marcos Martín-Torres

University College London

Archaeological approaches to early modern chymistry: old materials, new questions

The more we know about the diversity of theories and practices engaged in early modern chymical laboratories, the more difficult it becomes to attempt generalisations and offer synthetic pictures of historical developments of the discipline. However, our field of research needs broad themes and questions that may allow us to connect and integrate our focused case studies. Otherwise our individual work is at risk of disaggregating and bearing little relevance for other scholars. This paper presents a review of recent research on the archaeological remains of a range of early modern laboratories and attempts to find some common threads, with the hope that they may inspire other researchers to contribute to these broader themes. Rather than focusing only on 'theories of matter' or experiments involving gold, I suggest further areas of chymical activity that connected different practitioners and would therefore benefit from synthetic and integrated approaches. Amongst other themes, I discuss the importance of experiments involving mercury and zinc, as well as allegedly 'chymical' inventions, such as porcelain and lead crystal, that were relevant to chymical theories as much as to the entanglement of technology and science.

Margarida Medeiros

Universidade Nova de Lisboa

From machine to mind: the xix century and the interdisciplinarity of the concept of automatism

One of the most striking ideas that founded modernity through the xix century was the parallel established between man and machine, preceded by La Mettrie "The Machine Man" (1748). The desire of becoming a machine, or simulate certain behaviors based on the use of machines, was contemporary of many inventions that, on the other side, were made to imitate man's body: photography, telegraph, telephone, computer are just some of these examples. This model of a mechanical life crossed the rising of psychological models like Pierre Janet's notion of psychological automatism as well as Charcot's automatic behavior or Freud's repetition automatism. Also, through spiritualist writings like Frederick Myers', 'automatism' or 'motor automatism' were central to understand telepathic behavior and medium trances. This model came to change the view of a 'transparent body', that hold Naturalist science of xvii and xviii centuries, to show a man that is mainly a camera obscura and operates upon automatic behavior, dreams, telepathic communication, concepts that seem to share an identical paradigm. In this paper, I aim to underline the interdisciplinary correspondences between the mechanic/automatic model in different fields, as it was raised in daily life by new technologies, in the psychological discourse on automatism (Charcot, Janet and Freud), and by spiritualists as Frederick Myers. Finally we will show how the automatic model was also the leitmotiv to great literature of the century.

Iwan Morus

University of Aberystwyth

Working Wonder: Tyndall and the Making of Victorian Scientific Performances

In his lecture at the 1870 British Association meeting at Liverpool, 'On the Scientific Uses of the Imagination,' John Tyndall argued that there was more to science than mere logic or empiricism. In fact he rather mischievously characterized the view that this was all science was, as a Tory calumny. Without imagination there would be no science, he averred. In this paper I want to use some of Tyndall's arguments about scientific imagination as an entry point into investigating the genre of Victorian scientific performances, of which Tyndall himself was also a celebrated exponent. In particular – and using some of Tyndall's own performances – I want to investigate the aesthetics of performance and the Victorian sense of wonder. Accounts of spectacular experimental performances were often couched in this way, often invoking comparisons with magic. Historians of Victorian public science have had relatively little to say about the visual culture of Victorian physics with which performers like Tyndall captured their audiences. I want to follow Tyndall's example by looking at how this sense of wonder was practically achieved and what we as historians of physics can hope to gain by making the practices and technologies through which wonder was produced the focus of our narratives

Elizabeth Neswald

Department of History Brock University

Setting Nutritional Standards in late nineteenth-century Germany and the US

In the 1860s Carl Voit and Max Pettenkofer conducted a series of experiments with a healthy male worker to establish the dietary needs of the normal human being. The 'Voit standard' for protein, carbohydrate and fat requirements set the first nutritional norms. This paper follows these norms as they were challenged and elaborated in the late nineteenth and early twentieth centuries by two of his pupils, the German hygienist and nutritional physiologist, Max Rubner, and the American nutritional chemist Wilbur Olin Atwater. Both Rubner and Atwater learned their methods and techniques in Voit's laboratory and did extensive calorimetric research and dietary studies. Both also made the transition from a nutritional theory based on the primacy of substances to one based on calorie consumption. Nonetheless, they promoted different nutritional norms. Americans seemed to need considerably more of everything. By tracing the translation of laboratory nutritional knowledge and calorimetric studies into the differing social and political contexts of turn-of-the-century Germany and the United States, this paper will show how scientific nutritional standards were influenced by cultural, social and political assumptions and traditions. In the field of nutrition research, the scientific was inseparable from the social.

Elisa Cristina Oliosi

Pontifícia Universidade Católica de São Paulo

The Relevance of Experimentation in Joseph Priestley's Studies on the Two Electrical Fluids

The studies about electricity during the 18th century raised intense debates while looking for a theory which explained the phenomena observed regarding materials of various compositions. In the case of electricity, some said that it was made of one single electric fluid – Benjamin Franklin defended this view – while for others like Joseph Priestley two electric fluids were involved. To prove his idea, Priestley performed a long series of experiments in which he verified the presence of electrical sparks and observed their intensity in the materials under analysis. With his experimental observations, Priestley classified the bodies he examined in electric conductors and non-conductors. These results appeared in his books *The History and Present State of Electricity* and *A Familiar Introduction to the Study of Electricity* published in 1767 and 1768, respectively. Experimental work played in this context an important role by providing data employed afterwards to build explanations of electrical phenomena. In this paper, we present some fragments from Priestley's experiments, showing his approach and argumentation in favour of the idea that two electric fluids are constituent parts of any materials

Flora Paparou

University of Athens

“Matter and light- From lightning to X-rays: Removing the air”: Teaching proposal for the exploration of a historical scientific instrument collection

“What are these instruments?” and “which is their place in the history of scientific culture?” were our major questions, while beginning to create educational material for the exploration of a 19th and early 20th century scientific instrument collection of a historical school in Chios. In order to answer the first question, we performed and videotaped experiments, very carefully using the old laboratory equipment. The second question drove us to associate the scientific instruments to important history of science incidents, belonging to either the fields of research or science popularization. From 2003 to 2008, five series of lecture-demonstrations and educational activities were designed and applied to about 5000 visitors, primary and secondary education students, teachers, general public, and second chance school learners. Our first lecture-demonstration prepared in 2003, and renewed in 2010, invites secondary education students of the higher grades to track the history of science path, which led to the discovery of the electron, through the simplified reconstruction of fifteen historical experiments. Through narration and audiovisual presentation the experiments are associated with Crookes's lecture on the nature of radiant matter

(1879), Rontgen's publication on the discovery of X-rays (1896), and Thomson's publications on the discovery of the electron (1897) and on positive rays (1913). As the basic experimental practices, queries and controversies of the times are presented and discussed, this contextual presentation reveals the generation of a notion, instead of the common textbook approach, which is to present the electron as a theoretical fact and use it in problem solving.

Cesare Pastorino

Indiana University

Francis Bacon and mechanical arts: the early Stuart patent system

Traditional interpretations of Francis Bacon's revaluation of mechanical arts have generally been confined to his interest for learned Renaissance sources and technical treatises. These studies reinforce the notion that Bacon's picture of mechanical arts was literary, and that his links with actual artisans and entrepreneurs of his time were negligible or nonexistent. Considering the case of James I's patent system, this paper proposes to shift attention to Stuart society, and to Bacon's concrete interest in economic and institutional activities. Francis Bacon's longstanding involvement with the early Stuart patent system has never been studied in detail. For about two decades -from the end of the reign of Elizabeth, until his political disgrace in 1621- Bacon played an important part in the granting of patents and "privileges" for new inventions. His activity took different forms, but became more demanding in the period between 1607 and 1617, when he was a patent referee, in his roles as Solicitor General (until 1613), and Attorney General (after 1613). This paper analyzes the features of Bacon's responsibilities as a patent examiner. It shows that Bacon reviewed a large number of the patents of invention proposed during James's reign. This work brought him into contact with a variegated network of early Stuart projectors and technical experimenters. This study explores Bacon's links with these individuals, and examines the nature of their projects and of their inventions.

Katy Price

Anglia Ruskin University

Music technology and physical effort

Questions of physical effort and the body in performance have become a prominent theme in discussions of music technology. Ambivalence surrounds the advent of microprocessing and its impact on aesthetics of performance. 'As the apparatus of music becomes less apparent, particularly in the digital domain', David Toop has observed, 'so sound becomes more completely itself, the purest manifestation of a disembodied, time based art.' But, he acknowledges, 'this gain comes with some profound losses. Whether based on false assumptions or deep-seated needs, the sight of musicians playing in real time, engaged in actions that have a discernible link to the sounds they are producing, makes an audience feel a warm glow of communication.' This paper explores one example of a pre-electronic instrument used in performance together with a contemporary electronic device: Ayayay! (2009) by Julio d'Escrivan. Analysis of the performance of this concerto for Pianola and iPhone offers a way into historicised exploration of the tensions surrounding embodied effort in computer music.

Monika Pries-Klassen

Brock University

Milk, Mortality and Moral Reform: Canadian Government Nutrition Policy, 1874-1919

Since the early twentieth century, Canadians have both cheered and condemned government efforts to manage their health. During the early twentieth century governments were forced to take an interventionist role in developing policies regulating the milk supply. An understanding of why the government perceived nutrition policy as vitally important in the past is a link to current government action regarding nutrition. Reformers, medical experts and civic officials alike became involved in the campaign for safe milk. Commercial interests also played a part since manufacturers of baby food and farmers selling their products resisted regulation. The struggle to establish effective policies acceptable to all of these interest groups provides an excellent window into how government nutrition policy first began in Canada. Although the federal government did not have a direct health mandate, parliamentarians were still concerned about the consequences of poor health within the population. Accordingly, they passed laws regarding milk contamination, regulated dairying practices, and addressed child welfare concerns. This paper considers public nutrition policy formation from the broad context in which it took shape by examining how economic concerns, social reform impulses, new scientific knowledge and popular opinion affected government decision-making in regulating the milk supply. This approach acknowledges that nutrition policy reflects broader public concerns and is not produced in a political vacuum. It also offers insights into the nature of the nutrition discourse and the rationale used to justify state intervention.

Stephen Pumfrey

University of Lancaster

The Astronomer's Role and the Natural Philosopher's Role in the Sixteenth Century Reconsidered: the Case of William Gilbert

Robert S. Westman's 1980 article on "the astronomer's role" clarified for a generation the disciplinary distinction between the fictionalist approach of astronomers and the realism of natural philosophers in the early modern period. Some scholars have recently drawn attention to pre-1600 anomalies which challenge the distinction. This paper will reflect on the distinction and its problems, and discuss the markedly anomalous approach to cosmology of William Gilbert (1544-1603), the author of *De Magnete* and *De Mundo Nostro Sublunari Contra Aristotelem Physiologia Nova*. Gilbert was unusual in several ways. First, he was attracted to Copernicanism by natural philosophical considerations and not to any great extent by mathematical considerations. Secondly, he defended the traditional role of the astronomer as the generator of convenient, fictional hypotheses, whilst insisting that geocentric/geostatic cosmology could be disproved. Indeed, Gilbert's attitudes to the relation between astronomy and natural philosophy are an excellent example of a state of knowledge in rapid transition.

Tom Quick

Wellcome Trust Centre for the History of Medicine at UCL

Heads in hands: physiological psychological rhetoric and laboratory pedagogy in 1870's Britain.

This paper addresses the articulation and presence of psychological claims that accompanied the rise to pre-eminence of zoology within nineteenth-century intellectual culture. It contrasts modes of persuasion engaged in by the moral philosophers and self-styled 'physiological psychologists' of the period, and highlights institutional changes that accompanied the (brief) ascendancy of the physiological approach to mind during the 1860's and 1870's. Moral philosophic texts generally seek to establish truth by reference to linguistic consistency - for example through the articulation of accurate definitions and the consistent application of words. In contrast, physiological psychological texts place greater emphasis on the cultural status of non-textual practices. In asserting that mind can only be known through physiology, I claim, the texts of such figures as Thomas Laycock, Herbert Spencer and Alexander Bain invest the tools of physiological investigation with the power to define psychological life. I substantiate this claim with reference to physiological psychologists' and their sympathisers' calls for the formation of a science faculty at the University of London during the 1870's. In a reversal of the elevation of 'head' over 'hand' in early nineteenth-century British pedagogy, highlighted by Barnes and Shapin, physiological psychological texts emphasise the primacy of technical (and especially experimental) over rhetorical skill. In so doing, they contributed to a broader movement calling for the institutionalisation of experimental pedagogy in Britain. I thereby conclude that the acceptance of mind as a physiological phenomenon constituted a condition for the establishment of laboratories as disciplinary spaces that remains under-acknowledged in the relevant historical literature

Gregory Radick

University of Leeds

Dominance subverted: Animal regeneration research in W. F. R. Weldon's critique of Mendelism

The Oxford-based biologist Walter Frank Raphael Weldon (1860-1906) was the most ferocious as well as formidable critic of Mendelism in the early years of the twentieth century. But so strong is Weldon's association with his mathematical friend and former colleague Karl Pearson that Weldon's critique of Mendelism has come to be remembered as 'biometrical' – all to do with measurement of visible characters, bell-curve distributions, Galtonian concepts and so forth. So it comes as a surprise to find that, at the time of his death in 1906, Weldon was at work on a book-length *Theory of Inheritance* which dealt extensively with animal regeneration. For Weldon, this topic held the key to a far more productive understanding of dominance than the Mendelians were promoting. The lesson he drew was that dominance was not a permanent property, as the Mendelians believed, but conditional; what became manifest depended on what was next to what. The capacity of a certain tissue to regenerate a certain limb was manifest only when surrounding tissues were disturbed. For Weldon, the conditionality that characterized dominance in the rest of the body ought to hold for the germinal tissues too. In this paper I shall try to show how Weldon's animal-regeneration interests were integrated in his critique of Mendelism with his better-remembered biometrical interests. I also want to suggest some of the ways in which Weldon's bullish attitude toward animal-regeneration research can help historians think their way out of a number of traps in the current historiography.

Jennifer Rampling

University of Cambridge

The Alchemist's Dilemma: Distilling Practices from Texts

Alchemy was essentially a practical art, whose practitioners sought to achieve marvellous yet concrete outcomes, from potent medicinal elixirs to the 'philosophers' stone' for transmuting metals. Yet most evidence for alchemical practice survives in the form of manuscripts and printed books, rather than apparatus and materials. Furthermore, these textual records are frequently written in encoded, metaphorical language, to the extent that their practical content often seems irrecoverable to modern eyes. Modern historians are not the first to struggle with these intractable materials. In pre-modern Europe, would-be adepts also faced the paradox of accessing correct alchemical

practice through textual exegesis. In consequence, processes altered over time as authoritative writings were reinterpreted in light of new technologies and textual sources, or modified to reflect practical observation and experience. Conversely, observations might themselves be adjusted to fit established tropes, as alchemists attempted to situate their practical findings within well known and authoritative traditions. My paper charts this ‘practical exegesis’ by tracing a single alchemical process over the course of three centuries. Alchemical texts attributed to Ramon Llull were tested and reworked by fifteenth-century English practitioners like George Ripley (d. c.1490), resulting in new works, such as the ‘Vision’, a short poem attributed to Ripley. This allegorical text was later subjected to practical readings by two very different alchemists: the Elizabethan gentleman Samuel Norton, and the seventeenth-century physician and alchemist George Starkey. As this paper demonstrates, the demands of alchemical texts helped create space for new theoretical and practical innovations.

Renée Raphael

University of Cambridge

Reading mechanics, writing astronomy: The incorporation of Galileo’s 1638 *Two New Sciences* into later seventeenth-century astronomical treatises

Among the many transformations historians attribute to the early modern period, two are particularly relevant to the discipline of astronomy: (1) the mathematizing and mechanizing of nature, and (2) the dissolution of the traditional Aristotelian division between the celestial and terrestrial regions. As a mixed mathematical science increasingly devoted to describing local, terrestrial motion in mathematical terms, early modern mechanics was integral to these transformations, which are usually seen as culminating in Isaac Newton’s 1687 *Principia*. While the beginning and endpoints of this story are well known, the process by which these disciplines intersected during the period has been little studied. This contribution seeks to rectify this lacuna by exploring a specific instance in which the content and practices of mechanics were incorporated into astronomical texts. Specifically, I will examine how arguments advanced in Day 1 of Galileo’s 1638 *Two New Sciences*, his final published work which is often considered the foundation of classical mechanics, were applied in seventeenth-century treatises on astronomy and cosmology, particularly in texts discussing the nature of the terrestrial sphere and sunspots. One of my claims will be that natural philosophy served as an intermediate between the two disciplines, linking the questions and concerns of Galileo’s mechanics with traditional questions in astronomy. This argument, in turn, will provide opportunity for reflecting on the identity of “mechanics” and “astronomy” in the period.

Christian Reiss

Max Planck Institute for the History of Science, Berlin

The productivity of cut-and-paste: The Mexican axolotl, regeneration research and the importance of experimental practices

Even though regeneration research has a much longer history, it was only around 1900 that it developed into a large and productive experimental research programme. The existing literature on regeneration research around 1900 mostly tries to approach this history from a ‘theory-centric’ point of view, emphasizing the preformation/ epigenesis dichotomy. But this theoretical discussion was overruled in the early 20th century by the productivity of the experimental systems in use. In concentrating on experimental practices, this paper offers an alternative approach to the history of regeneration research. It will focus in particular on the dynamic configuration between experimental practices, experimental animals and the respective scientists, using the Mexican axolotl as a probe. This animal came to Europe in the 1860s in the course of France’s occupation of Mexico. Due to its neotenic life cycle, it quickly gained popularity all over Europe – a popularity further broadened by its success as an aquarium pet. The axolotl’s regenerative abilities attracted attention right from the beginning, and became a main focus of research in the emerging experimental embryology/ Entwicklungsmechanik at the turn of the century. The paper will have two main aims. First, I want to show how the axolotl became an experimental animal and its subsequent way into the laboratories of embryologists. Second, I will use the example of the German biologist Julius Schaxel to show the growing gap between experimental productivity and theoretical coverage in early- twentieth-century regeneration research and the effects this gap had on Schaxel’s research practice.

Anna Marie Roos

Modern History Faculty, University of Oxford

A Speculum of Chymical Practice: Isaac Newton, Martin Lister (1639-1712), and the Making of Telescopic Mirrors

In 1674, natural philosopher and physician Martin Lister published a new method of making glass of antimony for telescopic mirrors using Derbyshire cawke or barite as a flux. New manuscript evidence reveals Sir Isaac Newton requested samples of the cawke and antimony from Lister via an intermediary named Nathaniel Johnston. An analysis of Lister’s paper and Johnston’s correspondence and its context not only reveals insights about Newton’s work with telescopic specula, but his alchemical investigations. Analysing these sources also contributes to our understanding of the nature of correspondence networks in the early “scientific revolution” in England.

Doina-Cristina Rusu

University of Bucharest

Imagination in Bacon's Experimental Science

Bacon was the first to emphasize the importance of experiments in building a true science. But how is the mind working to be able to produce science? For Bacon there are three faculties of the soul – memory, imagination and reason, concerning with history, poesy and philosophy respectively. Imagination is very important for knowledge transmission and for building a virtuous character. It does so by offering examples capable of representing a model of life. Bacon is defining imagination as “an imitation of history at pleasure”, and this is the reason why Bacon's readers discuss about imagination only in an ethical framework. There is no doubt concerning this ethic function of imagination, but my claim is that it has an important role for the birth of science, because the imagination is the faculty able to see the similarities between things, and to combine and separate parts of the things, the only true methods of science. It is true that these activities are done with respect to mind's pleasure, or according to the laws of nature. In the first case, it is the work of imagination, and if it is done according to the necessity, that it is the work of reason. My arguments are based on Bacon's affirmation that reason is dealing only with general concepts, and it is obvious that experiments are of individuals, even if they can tell us something about species. In conclusion, experiments are not generated by reason, but by imagination, and because of the risk that the latter may transform into *fantasia*, reason's function is to guide it and to protect it from the idols and passions of the mind

Stephanie Seavers

University College London

Trial and Error: Alchemy and Assay in the Middle Ages

In metallurgy, assay is the compositional analysis of a metal. Assay methods were used in the middle ages by Mints (organisations which created, tested and circulated standardised coinage), miners, goldsmiths and alchemists. This paper will show that while assay in alchemical practice was used to uncover some of the secrets of nature, in other contexts, such as the Mints, the same processes established the boundaries between illusion and fraud in metalwork. I will argue that in twelfth- to fourteenth-century Europe, differences in methodological approach towards assay (rather than scientific practice) distinguished alchemy from other crafts (e.g. minting and metalworking) and associated alchemy with fraud because it threatened established methods of identifying natural and artificial materials. Treatises like the *Summa perfectionis* demonstrate how alchemists tested nature through chemical processes such as separation, reduction and purification to discover how materials such as metals could be changed, for instance in weight, purity, or mass. Alchemical assay was a means of testing the permanency and quality of these changes, thus marking progress towards the transmutation of metals into gold. In contrast, Mint assay, as described in the treatises of Richard Fitznigel in the twelfth century and Nicholas Oresme in the fourteenth, was founded on the principle that the essence of nature cannot change but can only be hidden. In claiming to artificially change the inner essence rather than the surface appearance of nature through transmutation, alchemy attacked the very meaning of authenticity, which was founded on the ability to distinguish between nature and artifice.

Anne Secord

University of Cambridge

Classifying imperfection, or, how to observe marine plants

At the end of the eighteenth century, marine beings continued to confound the boundary between the vegetable and animal kingdoms, leading some natural philosophers to propose a fourth kingdom of nature, which would encompass these pelagic oddities. At a time when battles were being fought over national kingdoms, this suggestion was roundly rejected by British naturalists studying seaweeds. I will argue that this connection is not accidental. Within Britain, close observation, even to the point of obsession, became particularly salient during the Napoleonic Wars, when questions about identity, affinity to other classes, vagrancy, and the family, were always near the surface; concerns that also shaped the modes of investigation into the ambiguous nature and classification of seaweeds. Although established as vegetables, seaweeds bore no resemblance to terrestrial plants, went through a baffling sequence of transformations in their life cycle, and required rapid examination as they changed dramatically once removed from sea. Most disconcertingly, in a science of observation like botany, the knowledge of seaweeds had to be built up from partial glimpses—sometimes of only battered and incomplete specimens found amongst the ‘rejectamenta’ of the sea. The shore thus marked not only the boundary between land and sea, but also the limits of standard botanical techniques and Linnaean classification. The difficulty of classifying seaweeds led British botanists to reject system, in favour of a cautious empiricism that was based on visual confidence as well as anxiety about the moral ugliness of natural beings that did not readily fall into natural families.

Jim Secord

University of Cambridge

Nebular Visions: Illustrating the *Architecture of the Heavens*

One of the most significant early Victorian scientific works that made a claim to literary distinction was the Glasgow astronomer John Pringle Nichol's *Views of the Architecture of the Heavens in a Series of Letters to a Lady* (1837). Through striking images and ecstatic prose, Nichol aimed to recreate for readers the sublime experience of viewing distant

evolving nebulae through the largest telescopes that had yet been built. Nichol's descriptions, which 'gave speculation free wing', were closely tied to illustrations, the whole giving science 'the form of Romance.' This paper focuses on the spectacular illustrated edition of Nichol's book published in 1850. This edition was the first he published after recovering, through the water cure, a severe addiction to opium. Not only were Nichol's experiments in prose here at their most daring, but his descriptions were matched by an extraordinary series of 'poetic or symbolical illustrations' by the visionary Scottish painter David Scott. Known today for his fairy paintings and the first illustrated edition of Coleridge's *Ancient Mariner* (1837), Scott was a leading early follower of William Blake, and was at the centre of an intellectual circle in Scotland that included not only Nichol, but also the chemist Samuel Brown, the visiting American Ralph Waldo Emerson, and others who looked to transcend dichotomies between scientific materialism and evangelical religion.

Efram Sera-Shriar

University of Leeds

Ethnology at the crystal palace: Robert Gordon Latham, visual enskilment, and local sites of learning

In the first half of the nineteenth century, ethnologists in Britain relied on the observations of travellers, missionaries and British officers alike for ethnographic material. In most cases the data collected failed to address key areas of ethnological enquiry. Responding to these limitations ethnologists such as Robert Gordon Latham (1812-1888) aimed to improve the observational practices of ethnographic informants travelling abroad, by creating local sites of training where novice practitioners learnt how to observe human varieties in a skilled way. This paper seeks to enlarge our understanding of early ethnological practices by examining Latham's efforts to establish an ethnographic training site at the ethnological department of the Crystal Palace. Latham was appointed Director of the Ethnological Department in 1852, and he transformed the ethnology exhibition into a site of learning. Moreover, in 1854, he co-produced, with Edward Forbes (1812-1854), a handbook entitled *The Natural History Department of the Crystal Palace Described*, which taught visitors how to examine the different ethnographic displays within the department. I will begin my examination by looking at Latham's ethnological writings prior to his appointment as Director at the Crystal Palace, and demonstrate that visual enskilment was a central component of his work. Next, I will discuss the ethnological exhibition, and look at how Latham used the location as a site for observational training. For this I will consider the importance of Latham and Forbes' guide as an important educational tool. In doing so, this paper aims to reconsider the notion of the armchair observer and demonstrate early ethnology's commitment to improving its ethnographic practices and connection to the field.

José Alberto Silva

University of Lisbon

Apologetics in Eighteenth-Century Europe: Beyond the Great Divide

In eighteenth century Europe natural theology can be viewed as a reaction by organized religion – the “established Christianity”, either Catholic, or Protestant – to accommodate the secularization of knowledge and the criticism addressed by atheism, deism and agnosticism. The great Catholic/Protestant divide has been frequently used by historians of science to account for aspects of knowledge on natural phenomena concerning, namely, the relations of the popularization of science and religion. In this paper I will argue for the inability of the Catholic/Protestant divide to explain the use – both by Protestant and Catholic eighteenth century natural theologians – of a common rhetorical ground and a similar argumentation in response to attacks of rationalists and dissenting religious movements. Similarities involve a collection of arguments – the argument of design, the argument of the first cause, the argument of order and perfection, the contingency argument and the gambler or Pascal argument – which were used by most natural theologians and natural philosophers throughout eighteenth-century Europe to justify the harmony between science and religion. God's existence and His attributes structured a rhetorical core, regardless of its association with a Protestant or a Catholic context. In this paper, I will defend this claim by contrasting the arguments voiced by the Protestants clergymen William Derham (1675-1735) or William Paley (1743-1805), to those voiced by the Portuguese Catholic clergyman and natural philosopher Teodoro de Almeida (1722- 1804).

David Smith

University of Aberdeen

World War II and nutrition cultures: professional and popular

This paper explores the relationships between the Second World War and 'nutrition cultures' in the UK: referring firstly to the ways in which nutrition scientists came to conceptualise their roles, and, secondly, to the impacts of nutrition science upon popular conceptions of good and bad food, and food choices. It will be shown that in terms of nutrition science the war proved a watershed: in contrast with the pre-war ambitions of scientists for engagement in the formulation and implementation of scientific nutrition policies which would ensure good nutrition for all regardless of income, after the war nutrition scientists were more concerned with withdrawal to the laboratory, and animal rather than human nutrition. A few also created of rationales for university degrees in nutrition – which also involved depoliticalisation of the field. In comparison to the impact of the war in the professional field, as regards popular cultures of nutrition, any impact of the visible two-pronged thrust of wartime food policy – of rationing and education – was relatively transitory. In the circumstances of deepening post-war austerity there was a clamour for

the loosening of food controls, and when they came the majority of the population reverted to pre-war food habits which were not favoured by the professional consensus – such as the replacement of high extraction by white bread. The section of the population who were ‘nutrition enthusiasts’ in the sense of being purchasers of, for example, food supplements, continued to grow, but this trend had already been established before the war. In these circumstances, the third, less visible thrust of wartime food policy – the alteration of diets by stealth, fortification of foods with vitamins and minerals being the most obvious example – became the favoured strategy of scientists and policy makers. This approach provided the rationale for the later development of such products as artificially sweetened or high polyunsaturated fat foods, and what later became known as ‘functional foods’.

Alistair Sponsel

Harvard University

Continents from animalcules

In his 1778 *Observations Made During a Voyage Round the World*, J.R. Forster became the first person to claim that the corals of the Pacific were capable of forming entire islands. This paper examines the consequences of that idea for naturalists and navigators in the decades around 1800, and argues that Forster's interpretation of coral reefs fundamentally changed both the method and the significance of studying the animalcules that we now call coral polyps. Although the small corals long familiar to Europeans had already been identified as the product of animals, Forster's writings on coral reefs implied that these microscopic animals could create new landforms on a scale that was likely to remodel the entire surface of the globe. Corals thus became immensely important to savants writing new “theories of the earth,” for corals seemed to hold the providential capacity to compensate for the erosion of present continents into the sea by actively building new islands or even continents. More ominously, the growth of corals threatened to create new impediments to tropical navigation and eventually, some naturalists feared, to cut off the prospect of maritime commerce between the northern and southern hemispheres altogether. Forster and his adherents therefore not only offered compelling reasons to study these animalcules, they also implied that there was a great deal to understand about their activities deep underwater that could not be observed directly. Knowledge of the polyps' collective actions came to rely not on direct examinations of the animalcules themselves, but on hydrographic surveys and studies of the elevated limestones of the Pacific.

Ida Stamhuis

Free University Amsterdam / Aarhus University

Women in Genetics 1900 – 1930: New Scientific Workers in a New Discipline

At the start of the twentieth century the first women to have gained access to a university education were looking for ways in which they could make a contribution to science and apply their newly acquired knowledge. This coincided with the emergence and development of new scientific fields, such as radioactivity research and genetics, which were also trying to find a place in the university system. In my paper I will consider these simultaneous developments within universities and explore how they strengthened each other through a reciprocal process in which both influenced each other positively. I will focus on the emergence of genetics and the contributions of women to this new and promising field. There were, for example, individuals and groups in Great Britain, the USA, on the European Continent and in Russia that successfully investigated heredity, mainly within a Mendelian framework. Research by women played an important role; in some cases women were the core contributors to these investigations. By the 1930s the new areas of research were becoming recognized as important scientific fields. But it is notable that this went hand in hand with the reduction of the visibility of women, both in terms of numbers and profile. The developing scientific fields profited from the expertise and dedication of these new scientific workers, but the relationship was not necessarily mutually beneficial.

Klaus Staubermann

National Museums Scotland, Edinburgh

Reconstructing HMAS *Warrego* and the Transfer of Shipbuilding Knowledge

By the end of the nineteenth century Glasgow had become one of the world's centres of naval engineering. Engineers at the Clyde had managed to establish a culture of engineering science, drawing on both theory and experimentation. But Glasgow naval engineers did not only study the theoretical and practical foundations of their discipline, such as thermodynamics or hydrodynamics, but they were also acutely aware of the significance of shipyard skills and practices. When in 1909 the newly established Australian Navy commissioned five torpedo-destroyers, it was not surprising that shipbuilders from the Clyde successfully tendered for the contract. However, the Australian Navy did not simply want to acquire modern warships, they also wanted to learn how to build them. Therefore, two destroyers were built in Glasgow, one, HMAS *Warrego*, was built, taken apart and rebuilt in Sydney, and two more were consequently built in Sydney, based on the experience acquired from reconstructing HMAS *Warrego*. This paper will take a closer look at the skills and practices of shipbuilding at the Clyde, examine the Australian Navy's reasoning behind the rebuilding of HMAS *Warrego* and try to understand the underlying conceptions of skill transfer and engineering practice of this project.

William R. Stevenson III

University of Hawaii at Manoa and International Research Center for Japanese Studies, Kyoto

Science, the South Pole, and the Japanese Expedition of 1910-1912.

In November 1910, Shirase Nobu (1861-1946) sailed from Tokyo Bay aboard the *Kainan Maru* in a bid to become the first person to stand above the South Pole. As is well known, the Japanese explorer was not alone, for the British, the Norwegians, and several others nations were all equally intent on reaching the heart of the Antarctic. What made the Japanese unique was that their nation had no history of polar exploration. To compensate for their lack of experience, they turned to European and American precedence, choosing in particular the example of Ernest Shackleton and the British Antarctic Expedition of 1907-1909. This decision required that the Japanese adopt a philosophy of modern exploration built around the pursuit of science. The meaning of science, however, was subject to wide interpretation, and perhaps none defined it more broadly than Shirase and his fellow explorers. On this centennial anniversary of the departure of the *Kainan Maru*, I propose to examine the role of science in the Japanese expedition. Specifically, I will look at how interpretations of science became the central point of contention prior to the departure of the expedition, how foreign scientists then shaped the character of the expedition during brief stays in Wellington and Sydney, and finally, after failing to reach the pole, how science became central to Shirase's desperate search for international relevance and legitimacy.

Ian G. Stewart

University of King's College

Rereading Francis Bacon's *Novum Organum*

Francis Bacon's *Novum Organum* (1620) is a classic of what is typically hailed as a quintessentially *English* form of empiricism/inductivism in opposition to Cartesian rationalism. Building on the meticulous work of the late Graham Rees (most forcefully in recent volumes of the *Oxford Francis Bacon* series), my paper will begin with the starting point that Bacon was committed to a *secret* but complex system of natural philosophy, one that he never published explicitly, but which informed much of what is written in the *Novum Organum* and his other natural philosophical works. As a result, two features of the *Novum Organum* together require us to rethink this classic text, and the 'classic' Bacon. First, there is the clear intent of the work to establish not simply a new 'methodology' for the study of nature, but a new intuition of what sorts of questions may and may not be asked, questions deeply informed by that secret natural philosophy. Second, the carefully constructed forays into 'induction' are clearly forms of training or apprenticeship of the reader, an apprenticeship Bacon himself announced in *Novum Organum's* preface by describing himself as a "high priest of sense...and a learned interpreter of its oracles." The similarities of *this* Bacon to the Descartes of the *Discourse*, *The World*, or even the *Meditations* force us to rethink some common categorizations in our accounts of early-modern science and philosophy that typically set these two thinkers in opposition to one another on methodological grounds.

James Sumner

University of Manchester

Pasteurising the brewery: applied science, internal history and trade defence

In 1916, members of the Institute of Brewing gathered to hear their acknowledged "Master", the Burton chemist Horace Tabberer Brown, reminisce on fifty years of change in the industry. Setting the scene, Brown portrayed the brewery culture of the 1860s as blindly empirical, its associated literature offering only "fatuous" speculation. This claim dismissed a remarkable wealth of antecedent studies in brewery engineering, metrology, hydrostatics and analytical chemistry; to Brown and his disciples, however, this early work lacked essential features of "scientific brewing". Brewing scientists' collective sense of an internal history arose with the embryonic research communities from which the Institute developed; and those organisations arose alongside vitalist theories of fermentation. The crucial event, most agreed, was the 1879 translation of Louis Pasteur's beer research into English: Brown's "forcing tray", which significantly extended the validity of experimental knowledge in the brewhouse, was an elaboration of Pasteur's aseptic apparatus. In this paper, I consider these brewers' foundational narrative as an indirect response to longstanding patterns of teetotalist attack, newly dangerous amid the restrictions of the First World War. Pasteur's admirable focus on the quality and commercial viability of French drinks, argued the British brewers, was literally being lost in translation: the delicacy which transformed *Études sur la Bière* into *Studies in Fermentation* was symptomatic of Britain's decline as a site for applied science. Aligning closely with the industrial engagement of the Technical Schools and the new provincial universities, they presented brewing as an indispensable field for the generation of natural knowledge.

Konstantinos Tampakis

University of Cambridge

Onwards facing backwards- Images of science in the speeches and writings of 19th century Greek scientists

Greece in the nineteenth century was a study in contrasts and antinomies. Nationalism and xenolatry, democracy and favouritism and finally enlightenment and conservatism were some of the elements that created the amalgam that was Greek intellectual life. In this environment, the small number of Greek scientists, the majority with studies in prestigious European institutions, worked almost exclusively in the University and in the Polytechnic School of

Athens. In this study, our aim is to examine the image of science they painted when they gave the inaugural speeches of their professorship. Since an inaugural speech was paramount to a programmatic declaration, they are in this case prime historiographical material to document the working of a scientific community deeply embedded in an ideologically laden environment, where strong scientific institutions were absent and Normal Science in the Kuhnian sense was all that could be hoped for.

Katie Taylor

University of Cambridge

“Queen Reason” and the “Slave Senses” – Astronomy and Geometry in Thomas Digges’ *Alae seu scalae mathematicae* (1573)

The history of astronomy is often thought of as having a close relationship to the history of mathematics. This is perhaps because the two disciplines were closely linked historically. Moreover, historians of the two disciplines – astronomy and mathematics – have traditionally tended to work in similar ways. In this paper, I will apply an approach perhaps more familiar to historians of science than to historians of mathematics in order to examine the somewhat fractious intersection between astronomy and geometry in Thomas Digges’ *Alae seu scalae mathematicae* (1573). In particular, I will offer a discussion based on a consideration of the practice of astronomy, as accessed through close reading of Digges’ text. The body of the *Alae* exploits the potential for application of geometrical methods in astronomy. This is tempered, though, by an appendix which highlights and seeks to rectify the discord between geometrical theory and observational astronomy. Thus, Digges recognised a tension between astronomy and geometry, even as he sought to bring them into contact. This raises a broader question about the mathematisation of nature. How could abstract mathematics be applied to the physical world at all? The tension between geometry and observational astronomy evidenced in the *Alae* forces us to think carefully about the ways in which the theory of mathematics was melded with the practice of investigating nature. Cases like Digges’ remind us that the mathematisation of nature was not unproblematic.

Babu Thaliath

University of Cambridge and Gerda Henkel Stiftung, Düsseldorf

Systems of Belief and Knowledge in the Early Modern Science

This paper will be an investigation into the historicity of episteme in the early modern development of natural sciences, in particular of Classical Mechanics, as represented in the works of Kepler, Descartes, Gassendi, Galileo, Newton, Hooke and others. While founding the modern natural sciences, philosophers and scientists of early modern age attempted to extricate the first principles or the axiomatic premises of natural sciences from beliefs or even dogmas, which were historically bequeathed from the scholastic tradition, in order to establish them as pure and irrefutable knowledge. Pure scientific knowledge should prove to be entirely objective, independent of subjective beliefs or perspectives and as such, ahistorical. In other words, the advent of natural sciences in the early modern age was facilitated by the radical establishment of a knowledge system that could supposedly overcome and replace every system of belief passed down from the late scholastic tradition of natural philosophy. The ahistorical trait of scientific knowledge was best characterized by the epistemological finality of axioms, to which the early modern sciences tended in their methods, of both induction and deduction. However, the pure and ahistorical status of episteme, as generally accepted in the early modern history of natural sciences, appears from the outset to be a problematic assumption. Some of the axiomatic foundations of early modern natural sciences seem to assume tacitly a residual fact of belief. They do not appear to be adequately supported by a consistent system of episteme that should methodologically be premised on an epistemological finality of scientific investigations; i.e. they were based on insufficiently grounded assumptions that seemed to have gained a paradigmatic recognition and legitimacy in the history of science. It will also discuss the historical background of the conflict between belief and knowledge systems (drawing from the Platonic distinction between doxa and episteme) and will mainly focus on how a belief system is implicit in many of the axiomatic foundations of early modern science. My investigation will also be initiated through the historic-semantic distinctions between belief and knowledge that characterized the advent of natural sciences in the early modern age.

Marion Thomas

Université de Strasbourg

Are mothers naturally devoted?: Animal models and the construction of maternal instinct in the French Third Republic

In *Mother Nature: A History of Mothers, Infants and Natural Selection* (1999), the American anthropologist Sarah Blaffer Hrdy challenges the idea that mothers are naturally devoted. Two decades earlier, in *L'Amour en plus*, the French philosopher Elisabeth Badinter had argued along the same lines, albeit dismissing an evolutionary perspective, but emphasizing the role of socio-political factors in the definition of motherhood. For instance, Badinter had showed how a Manichean representation of the late XIXth century mother mirrored the ideology of the emerging French Third Republic, rather than an unchanging and biologically determined female nature. My aim is to challenge both theses based on my analysis of debates among late XIXth century French naturalists (including Fabre, Perrier, Giard), at a time when feminism was blooming. First I examine how the views on female nature and feminism of

these naturalists shaped their views on maternal instinct. I show how there were different representations of women and different views of feminism, and these all correlated with their views on animals. Finally, I argue that these correlations were not simply extrapolations from « nature » to humans because in some cases these naturalists were aware of the same animal behaviours and yet gave them different emphasis when discussing human implications. Based on this panorama of diverse representations of maternal instinct founded on a variety of animal models, I argue that naturalistic explanations of maternal instinct were flawed and I arrive at conclusions much closer to Hrdy's sociobiological stance than the polarized view adopted by Badinter

Anke Timmermann

University of Glasgow

Dissecting manuscripts: Alchemy, Medicine and the Historian

Many medieval and early modern medical practitioners showed a keen interest in alchemy, not merely in its ultimate cure-all, the elixir of life, but also regarding its various potential applications in medical diagnosis and therapy. Perspectives on alchemy in all its forms changed constantly, and varied between doctors throughout the period. Alchemically-inclined individuals outside the medical professions also conceived of alchemical processes in metaphorical terms, including medically-inspired conceptions of material bodies. Alchemy and medicine, although certainly not congruent or inseparable, wove their narratives and practices around each other in many different ways. While Paracelsian alchemy as the origin of modern pharmacy has been researched in some detail to date, historians of science continue to face a bewildering, motley mass of surviving manuscripts which conjoin the traditions of alchemy and medicine in medieval and early modern times. A considerable number of these are notebooks written by unknown or historically unidentifiable individuals, produced and kept for private use and interspersed with personal symbols and shorthand expressions. Are alchemo-medical manuscripts responsive to methodological approaches from different disciplines, or do they merit a sensitivity peculiar to their form and content? Just how is it possible to discover writers' and readers' attitudes and approaches to alchemy and medicine in the surviving materials? This paper investigates the material, conceptual and practical conditions of a selection of anonymous English alchemo-medical manuscripts dating from the fifteenth to seventeenth centuries, and the implications their forms and contents carry for researchers in and beyond the history of science.

Karin Tybjerg

Kroppedal – Museum for Astronomy, Archaeology, Modern History

Automation and Informality in Modern Danish Astrometry

In 1950's the Danish Astronomical Institute built a new remote observatory – Brorfelde. One of the main instruments was a new meridian circle and it was one of the last important instruments of earth-based precision measurement of the heavens. In 1987 it was moved to La Palma on the Canaries as part of a British-Spanish-Danish cooperation. In many ways the Carlsberg meridian circle was a boundary instrument. At the end of the long history of grand meridian circles dominating observatories in the 19th and early 20th centuries, but at the forefront of automating readings. It lies at the cusp between national astronomy and large international observatories. Between in-house technical workshops where astronomers participated directly in instrument construction and observatories operated by specialized technical staff. This paper will show that the success of the instrument in the 1970's and 80's lay in its boundary nature and the curious combination of a close-knit and informal village culture at the remote observatory and the automatisisation and de-personalisation of the operation of the instrument.

Martin C. Underwood

University of Cambridge

Joseph Rotblat and The Manhattan Project

Joseph Rotblat was invited in 1939 to work at Liverpool University with James Chadwick. Towards the end of 1939 Rotblat began experiments in Liverpool which demonstrated that the nuclear bomb was feasible. At the beginning of 1944 Rotblat joined the Chadwick group at Los Alamos, New Mexico to work on the Manhattan Project, which was developing the atomic bomb. At the end of 1944 he resigned and returned to England. In his seminal paper 'Leaving the Bomb', Rotblat says 'And so, on Christmas Eve 1944, I sailed for the United Kingdom....I packed all (emphasis is mine) my documents-research notes as well as correspondence and other records in a box....Chadwick personally helped me put the box on the train to New York. But when I arrived there a few hours later, the box was missing. Nor, despite valiant efforts, was it ever recovered'. Rotblat's Archive is housed in the Churchill Archives Centre, Churchill College, Cambridge University and has recently become available. This Archive contains a considerable body of papers from Rotblat's time at Los Alamos. In summary, these papers contain; Plan of an experiment to determine the capture cross-section of ²³⁵U A method for neutron energy measurements Notes on an experiments to determine some nuclear constants Monthly report These anomalies are discussed.

John van Wyhe

National University of Singapore

Charles Darwin really was the naturalist on HMS Beagle

For decades the orthodox view amongst historians of science has been that Charles Darwin was not the "naturalist" or "official naturalist" during the 1831-6 voyage of HMS Beagle but instead Captain Robert FitzRoy's "companion", "gentleman companion" or "dining companion"; that is, foremost a companion and only secondarily a naturalist. Although this view has been upheld by many able historians and repeated in countless accounts of Darwin, this presentation will argue that it is incorrect. Almost everyone educated in the history of science will be highly suspicious of such an argument. The "companion" interpretation is one of a number of distinguishing views that card-carrying historians of science believe to correct earlier views. The "companion" hypothesis has, after all, opened up the history of Darwin and the Beagle voyage to far richer social and contextual approaches. Nevertheless the "Darwin was the captain's companion" view can be demonstrated to be incorrect. The original journal articles which established this view cannot stand up to critical scrutiny. The ship's surgeon was not, as is almost universally claimed, the "official naturalist". Whether we consider the appointment of the Admiralty, the title for Darwin all contemporaries used before, during and after the voyage, "official" or private, or what Darwin actually did during the voyage, "naturalist" is, I will argue, the overwhelming conclusion

Leucha Veneer

University of Manchester

European oil prospecting in the early Cold War

There is a great deal of secondary literature covering the expansion of geology and geophysics in the postwar period, especially in the US, and much of it examines the developments, both theoretical and applied, that led to the wide acceptance of the theory of plate tectonics, as well as the growing dominance of experimental geophysical methodology over observational geological fieldwork. There is, however, a paucity of material covering developments in applied fields such as mineral prospecting. In this paper, I shall consider the expansion of oil prospecting in Europe in the years following World War II: how it was driven by national, political and commercial needs; how it was facilitated by the development of an array of new practical techniques, such as neutron logging; how it was enhanced by the explosion of new areas of study, such as oceanography. This study is part of a broader investigation into the history of geophysics during the Cold War in the context of the project "The Earth Under Surveillance", which is sponsored by the European Research Council

Koen Vermeir

REHSEIS-SPHERE

On the Divine Magnet. Reflections on Magnetic Theology in the Seventeenth Century

In this paper, I will study a curious offspring of the magnetic philosophy. In the wake of *De Magnete*, interesting practices around what could be called the onset of a "magnetic theology" were developed by Jesuit as well as Puritan authors. I will analyse what these diverse figures had in common, as well as their different approaches to this subject. Tracing this tradition will allow me to detail crucial differences and changes in the early development of natural theology. Magnetic theology does not fit into the conceptual categories and developments recently outlined in the historiography. Neither can it clearly be subsumed under one of the current day categories of 'science' or 'religion'. In particular, this paper will challenge Peter Harrison's claim that a literal attitude to nature followed from a literal reading of the bible. Indeed, I will argue that a literal attitude to nature could well go together with allegorical religious practices

George N Vlahakis

National Hellenic Research Foundation

Great expectations in Modern Times - Prefaces, intentions and fallacies in science textbooks of the 19th century

The authors of science textbooks usually express their personal views, their ambitions and their ideological orientations in the prefaces of their textbooks. It is also in the preface that they take the time to justify the structure, the context and the language they used in their book and it is there that they try to convince the prospective reader for the success of their venture. Usually, the reading of the book proves that their assertions were just Great Expectations. In this paper, we examine the prefaces of selected 19th century science textbooks, which were used in Europe and in the USA, in order to see if the pessimistic view of Charles Dickens can be said to characterize these ambitious but perhaps incomplete attempts

Silvia Waisse

Pontifical Catholic University of São Paulo

18th Century Crossroads: Chemistry and Medicine, Theory & Practice

The views on the mutual relation between theory and practice in 18th century science can be approached in connection with the contemporary perspectives on the relation between chemistry and medicine and the emergence of modern chemistry. A key-agent in these crossroads was Herman Boerhaave, who was acknowledged by both his contemporaries and modern scholars as the one who first linked together medical theory and practice (*methodus*

empiricus-rationalis) and helped catalyzing the transformation of alchemy into modern chemistry, precisely through an accent on both theory and practice and their mutual connection. However, a clear understanding of how theory and practice were conceived of is still lacking, consequently, also of how they were connected. This paper will analyze through chemical and medical examples how Boerhaave represented the relation between theory and practice. His empirical activity was grounded on the notion that the properties of substances depended on the weight and shape of their components. This ground concept as well as its practical application emerged from Boerhaave's particular synthesis of theories and methods recently developed, particular within the context of the British and Italian new mechanical natural philosophy. Boerhaave's own elaboration would allow him to relate the theory and practice of science, medicine and chemistry on sound epistemological grounds rather than through an eclectic systematization, as it has been traditionally claimed.

Martin Weiss

Leiden Observatory

"Visitors Welcome" – Teylers Museum around 1800

In 1784 Teylers Museum opened to the public in Haarlem in the Netherlands. While the fact that it was – in principle – accessible to all is remarkable in itself already, what is even more intriguing is the fact that for a long time after it first opened, its "crowd puller" were scientific instruments. The pièce de résistance on display was the largest electrostatic generator that had ever been constructed. It is even considered to have been the largest scientific instrument in the world at the time. Visitors who came to see it, or even have it demonstrated to them, could also admire the museum's collection of fine art, fossils, minerals and books, all housed in a magnificent, purpose-built building. The museum's first director, Martinus van Marum, performed research at the museum and corresponded with eminent academics like Lavoisier, Joseph Banks, and Goethe. Although these three are not known to have visited the museum, von Humboldt, Cuvier, and even Napoleon Bonaparte did. On the basis of visitors' accounts, the museum's guest book, and van Marum's concise memoirs I would like to give an impression of a visit to Teylers Museum during the first decades of its existence. Issues such as how many, what sort of, and why visitors came to the museum will be addressed, as well as the question of how important these visitors actually were to the museum and van Marum. By addressing these issues more can not only be learned about the concept of a "museum" in history, but also in what ways "the public" became increasingly important to science.

Simon Werrett

University of Washington

Remaking Natural Knowledge: Recycling in the History of Science & Medicine

Recycling has played an important role in post-war environmentalism, yet equivalent practices of salvage, re-use, and recovery have a much older history. This paper explores the history of recycling and its significance in the history of the sciences and medicine. Exploring sites such as chemical laboratories, coffee-house auctions, flea markets, and dust heaps, I examine the changing relationships between recycling, science and medicine from the seventeenth to the twentieth centuries, and consider how practices of thrift, repair, re-use, and recovery helped shape a range of scientific and medical ideas, techniques and instruments in this period. I also ask how historical studies of recycling in science might assist in current environmental debates, and consider the value of focusing on the repair and re-use of material culture in science for current discussions of the 'circulation of scientific knowledge'.

Jane Wess

Science Museum, London

Power Relationships in Basic Measurement

The paper forms part of a project to produce an innovative interpretation of objects from the Science Museum's collections for a lay adult audience. The project is looking at mathematics in society in its widest sense, using the framework of motivations. This perspective enables both a global and a local approach, and both historical and contemporary topics to be included. One important motivation under consideration is power. The standardisation and application of basic measurement is fundamental to the quantification upon which much mathematics rests. This paper explores the power relationships in the use of artefacts concerned with basic measurement. The paper will select case studies ranging from the establishment of the Avoirdupois system in England in the Tudor period to the surveying of Africa at the turn of the last century. The power of the potential to control through the measurement of time by instruments will also be included, as will power through capacity measurement and the testing of specific weight in alcoholometry. The paper will endeavour to aw together some common threads and construct an argument regarding the power context of the use of these various artefacts and instruments.

Jakob Whitfield

University of Manchester

'Somebody fresh to go into the problem': Metropolitan Vickers, the Air Ministry, and the axial gas turbine.

In 1938 the British Air Ministry awarded a development contract for a company to work on gas turbine proposals that had been drawn up at the Royal Aircraft Establishment (RAE), the state aviation research institution. Perhaps surprisingly, the partner chosen was not an existing aero-engine manufacturer, but the Manchester electrical

engineering firm Metropolitan-Vickers (MV). My talk aims to explain this choice. I will outline the relationship that the RAE had with the Royal Air Force and the aviation industry, summarising the support that the Air Ministry gave to engine development. Drawing on histories of RAF strategy, I will place government engine research policy in the context of the changing international and operational environment of the late 1930s, as the UK rearmed. With reference to its institutional history, I will explain how the research establishment was able to do independent design work on a gas turbine, despite the RAE's traditional role as advisor to the aero-engine industry. Using the MV - RAE correspondence held at the Manchester Museum of Science and Industry, as well as Aeronautical Research Committee papers from the National Archives, I will show why an electrical engineering firm was chosen as a development partner. Drawing on the correspondence, I will explore the tensions in the collaboration between a research establishment and an industrial manufacturer, including how the RAE's aerodynamic theories were transformed into engineering hardware.

Sean Williams

University of Edinburgh

Stockhausen meets King Tubby: the stepped filter and its influence as a musical instrument on two different styles of music.

Technical specifications, however accurate, offer only part of an explanation of the performance of electronic musical instruments. My paper examines two stepped filters, the Maihak W49 Hörspielverzerer, and the MCI "Big Knob" filter respectively used as musical instruments by Karlheinz Stockhausen in Germany in the 1950s and 1960s, and by King Tubby in Jamaica in the 1970s and 1980s. By comparing technical and compositional specifications with findings from empirical research made possible by the existence of these instruments in museum collections, I show how discrepancies between the two suggest ways in which the affordance of these instruments has affected the music made with them. The design and physical characteristics of the instruments is a vital part of what constitutes the sonic output of both of these musicians, and these subtleties are only able to be exposed through study of these historical artefacts.

Daniel Wilson

Birkbeck College, University of London

Hobson and the Machine

This paper examines the early writings of JA Hobson, the prolific new-liberal theorist and heterodox economist. Hobson (1858-1940) is best remembered for his theory of 'underconsumption' and his coruscating attack on Imperialism, but I argue that his work also contains contributions to the history and philosophy of technology. Hobson began his career with a set of works on the history of industry and the workplace which culminated with his 1894 book, *The Evolution of Modern Capitalism: A Study of Machine Production*. This text has been ignored by recent scholars of Hobson (who drop the sub-title) and neglected entirely by historians of technology. The text puts forward a view of machines which is articulated through a set of evolutionary and organic metaphors as it attempts to make sense of the role of technology in history and its proper place in a future society. This paper will outline the way in which Hobson's thought developed through this early attempt to analyse technology and asks why it has proved so difficult, more generally, to assimilate theories of technology into the wider project of historical explanation. It suggests that a heterodox thinker such as Hobson - drawing on a range of intellectual traditions, on the boundary of different disciplines - was well-placed to offer a holistic account of technology, but that such an account runs contrary to a more dominant trend; that is, to separate the function and the meaning of technology into different realms of inquiry as part of a 'technological settlement' that has prevented such discussion from taking place. This paper will, therefore, offer a reading of a little-known text by a significant author, placing it within a broader, theoretical framework for thinking about technology.

Duncan Wilson

University of Manchester

"A Cell is Not an Animal": Crossing Species Barriers during the 1960s.

This paper sheds new light on the cultural history of postwar biology by examining the controversy that followed the creation of human-mouse hybrid cells in the 1960s. I demonstrate how the transgression of species barriers resonated with contemporary belief in the 'biological revolution' stemmed by advances in genetics, cell biology, transplant surgery, and reproductive medicine. But I also show that popular coverage of hybrid cells reflected anxiety at the sinister potential of postwar biomedicine. In newspaper and television reports that envisaged monstrous chimaeras, hybrid cells became a synecdoche for what one writer called *The Biological Time-Bomb*. Stung by this criticism, their creators, Henry Harris and John Watkins, established distance between hybrid cells and chimaeric organisms - claiming in *The Times* that "*a cell is not an animal*". But this assertion falls short when we consider that their work involved direct attempts to engage with public discussion of the 'biological revolution', and with longstanding fascination surrounding the human-animal boundary. As I show, Harris and Watkins deliberately fused cells from two species long regarded as antithesis - *i.e.*, human and mouse - in order to cause a popular sensation. And in public discussion of hybrid cells, Harris overlooked their scientific implications, stated his aim was to "to cross the frontiers of nature", and predicted the creation of human-animal chimaeras. Far from arising out of

ignorance and misreporting, as Harris and Watkins claimed, the sensational public portrayals of hybrid cells were inextricably bound to scientific practices and rhetoric.

Jeff Wolf

The University of Edinburgh

Dissecting the Soul: William Cullen and Medical Theory during the Scottish Enlightenment

The soul held great significance for the early modern thinker. Not only was it critical to understanding Divine Providence, but it also exemplified Man's place in God's creation—a topic of central importance to natural philosophers and medical theorists alike. In this paper, I will examine medical theorizing about the soul by William Cullen, the most eminent Scottish physician during the latter half of the eighteenth century. In so doing, I will show how medical disputes about the soul in Scotland were determined by much more than technical questions in the craft of medicine or hair-splitting in natural philosophy. They were also a way for physicians to establish their cultural authority and professional identity, amidst a clamour of competing theological, philosophical and medical perspectives. In short, to construct a 'science of MAN', as David Hume (and friend of William Cullen) hoped, Scottish physicians during the Enlightenment had first to anatomize the soul.

Shana Worthen

University of Arkansas at Little Rock / Canterbury Christ Church University

Like Stirrups and Sugar: Polydore Vergil and the Problem of Unknown Inventors

One of Polydore Vergil's pressing concerns was for the inventions for which no inventor was known, such as stirrups and confections of sugar. Among other mentions of the problem, he devotes a chapter (3.xviii) in his influential 1499 *De inventoribus rerum* to the subject of inventions whose inventors are not known. This interest in an absence, the corollary of new, growing interest in histories of who invented what, tells us as much about changing concerns in the fifteenth century as does the popularity of what *De inventoribus rerum* does contain. In this paper, I will contextualize this striking development with the development of histories of invention more generally, by comparing authors from Hugh of St. Victor, author of a much-copied and revised chapter on invention, to Guido Panciroli, who wrote on lost inventions, as well as unknown inventors. Polydore was one of the first authors, along with John Wheathamstede, to write a book-length treatment of the subject of invention and their inventors, in the second half of the fifteenth century. These texts reflect a major shift in attitude towards the history of invention, one which continued to gain momentum in the following centuries. He noted in particular "how much glory and reward are due those who by their own skill have at some time devised something useful". (*On Discovery*, ed. B. Copenhaver, 2002) The quest to search out these missing inventors was a tribute, for Polydore, to the glory they were owed.

Alexander Wragge-Morley

University of Cambridge

Natural History in England, 1650-1720: Representation, Rhetoric, Poetics, Aesthetics

The natural historical representations made by members of the Royal Society, ca. 1650-1720, were 'rhetorical' in at least two senses. First, we can describe the thick folio volumes written by men like John Ray as 'rhetorical' because they were directed to designed philosophical and theological ends. Second, these books were rhetorical because their main form of representation was structured by an aesthetic that draws on intertwined contemporary ideas about poetry and rhetoric. This talk will deal with the verbal, graphic and sculptural representational strategies employed by 'describers' of natural things like John Ray, Nehemiah Grew and Robert Hooke. I will discuss the sensory models implicit both in the observations upon which these representations had their foundation, and in the relationship between readers or viewers and the same representations. Do the representations that we can find in the natural historical folios of this period suppose an indiscriminate 'picturing' of media information on the retina and imagination, or is an altogether more inscriptive and purposive sensory model in play? The answers that we can give to this question have important consequences for the meanings of the natural history of Ray's place and time. I will show that its representations, whether achieved verbally, graphically, or sculpturally, may profitably be interpreted with the aid of contemporary ideas about style in rhetoric and poetry and, by extension, painting and sculpture. Natural historians like Ray, Grew and Hooke wanted their representations to 'inscribe' images into their readers' imaginations. Style could determine their success or failure.

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Caitlin Wylie - University of Cambridge

The Singer Prize

The British Society for the History of Science invites entries for the 2010 Singer Prize



The Singer Prize, of up to £300, is awarded by the British Society for the History of Science every two years to the writer of an unpublished essay, based on original research into any aspect of the history of science, technology or medicine. The Prize is intended for younger scholars or recent entrants into the profession. The Prize may be awarded to the writer of one outstanding essay, or may be awarded to two or more entrants. Publication in the *British Journal for the History of Science* will be at the discretion of the Editor. Essays under consideration elsewhere or in press are not eligible.



Previous Winner of the Singer Prize

The 2008 BSHS Singer Prize was awarded to **Ms Melissa Smith** (CHSTM, University of Manchester) for her essay entitled "Architects of Armageddon: Scientific advisers and civil defence in Britain, 1945-68". The Prize was presented at the Society's Annual Conference at the University of Leicester in July 2009 and a revised version of the essay has now been published in the *British Journal for the History of Science* (June 2010).

General Rules: Candidates must be registered for a postgraduate degree or have been awarded such in the two years prior to the closing date. Entry is not limited to British nationals.

Essays must not exceed 8,000 words (including footnotes following the style guidelines in the *British Journal for the History of Science*), must be fully documented, typewritten with double-line spacing, and submitted in English. Use of published and unpublished primary material is strongly encouraged, and full and correct use of scholarly apparatus (eg footnotes) is expected.

Entries: 1 paper copy of the essay should be posted to arrive not later than 15 December 2010. Essays must not bear any reference to the author, either by name or department; candidates should send a covering letter with documentation of their status and details of any publications. A further copy of the essay, again without any reference to the author, should be sent as a pdf by email to office@bshs.org.uk before 15 December 2010

Entries should be sent to:

Ms Lucy Tetlow, BSHS Executive Secretary, PO Box 3401, Norwich, NR7 7JF.

Enquiries by email secretary@bshs.org.uk

Further information about the Singer Prize can be found on the BSHS website, www.bshs.org.uk

(Photo, courtesy of James Sumner, shows Melissa Smith being presented with her prize by Jeff Hughes, BSHS President, at the National Space Centre in Leicester during the 2009 Annual Conference)

Meeting Annoucement

2012 Three Societies Meeting. *Philadelphia, USA, 10-13 July*

Every four years the History of Science Society, the British Society for the History of Science, and the Canadian Society for the History & Philosophy of Science meet jointly in mid-summer for multi-day sessions on the history of science. The "Three Societies Meeting" alternates among the US, Canada, and the UK. The History of Science Society will serve as host in 2012 and, thanks to a proposal submitted by the Philadelphia Area Center for History of Science, Philadelphia will provide the venue for this Three Societies Meeting, which will be held 10-13 July.

The conference will attract hundreds of historians of science to Old City for the meetings. The main venues for the sessions will be the meeting rooms at the American Philosophical Society, the Chemical Heritage Foundation, and the University of Pennsylvania. Attendees will stay in Old City hotels. Dorm rooms will be available as low-cost alternative housing.

About the Philadelphia Area Center for History of Science: The Philadelphia Area Center for History of Science is a consortium of educational and cultural institutions using the exceptional resources of the Philadelphia area to promote public and scholarly understanding of the history of science, technology, and medicine. For further information about the consortium and its members, go to www.pachs.net.

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British Society for the History of Science Annual Conference, 2011

14-17 July 2011, University of Exeter



The BSHS Annual Conference will take place at the University of Exeter from 14 – 17 July 2011. The conference will take place at Queens Building, located on Streatham campus close to the city centre with its magnificent 12th century cathedral. A former private botanical garden and arboretum, Exeter arguably

possesses one of the most beautiful campuses in Britain. Accommodation will be available on campus with en-suite facilities. Further information about the facilities at Exeter is available at <http://www.exeter.ac.uk/visit/>.

The programme will include parallel themed sessions, plenary lectures, education and outreach activities, and a Conference Dinner at Holland Hall overlooking the Exe valley. A more extensive social programme is being developed by the local organisers, including trips to the Jurassic coasts and Cornwall, where the University of Exeter has additional campuses. There will also be the opportunity for delegates to explore the many attractions to be found in the city, including its links with the history of science.



The University of Exeter has a strong presence in interdisciplinary studies of science, especially at the intersection of history of science and history of medicine. Two research centres, the Centre for Medical History and the ESRC Centre for Genomics in Society, bear witness to a vibrant research community. A call for papers with more information will be published in the autumn on the BSHS website, www.bshs.org.uk

For inquiries, please contact bshsExeter2011@bshs.org.uk.



The 24th International Congress for the History of Science, Technology and Medicine will be held in the University of Manchester on 22-28 July 2013. Following the 2nd Congress in London (1931), famous for the contribution from Soviet scholars, and the 15th in Edinburgh (1977), this will be third occasion that the Congress will be held on these islands.

The theme of the meeting is 'Knowledge at Work' and preliminary details of the Congress, including key dates for the submission of proposals for panels and papers, can be found at:

<https://www.meeting.co.uk/confercare/ichst2013/index.html>



SOCIETY FOR THE HISTORY OF ALCHEMY AND CHEMISTRY

This year marks the 75th anniversary of the Society for the History of Alchemy and Chemistry (SHAC), founded in 1935. With a broad international membership, the Society fosters understanding of the history of alchemy and chemistry worldwide through a variety of scholarly activities, including publication of *Ambix*, the leading learned journal in the field.

The Society sponsors a wide range of projects through its annual Award Scheme, from conferences and seminar series, to exhibitions and scholarly editions. Research grants are also available for postgraduates and postdoctoral researchers, while the SHAC Graduate Network connects students and early career scholars through a series of international workshops and events. Members receive *Ambix* three times a year (including free access to the digital back catalogue), in addition to the twice-yearly newsletter, *Chemical Intelligence*.

The subscription rate for 2010 is £27 (£16.50 for students).

Further details of grants, prizes, and forthcoming events can be found at our website, www.ambix.org. For information on membership please contact the Treasurer, John Perkins: E-mail shacperkins@googlemail.com.



Joining the BSHS

The British Society for the History of Science welcomes members from all backgrounds, in the UK and internationally. Current members include academics, writers, students, museums professionals, schoolteachers and anyone with an interest in some aspect of the history of science, technology and medicine.

BSHS sponsors conferences (including its own annual conference each summer), a leading quarterly journal, a newsletter, and several prizes. It is also very active in the field of outreach and education, and seeks to promote the history of science, technology and medicine at all levels.

All members of the Society receive:

- the quarterly *British Journal for the History of Science* with research articles and reviews of the latest books in the history of science, technology and medicine
- our newsletter, *Viewpoint*, carrying all the latest news and views from the field, three times a year
- reduced rates to attend conferences and meetings, with substantial reductions for student members
- the opportunity to apply for a range of grants offered by the Society
- electronic access to forthcoming articles and back volumes of the *British Journal for the History of Science* via the Cambridge Journals Online service. This special access gives members access to all past, current and forthcoming articles; comprehensive search functions; customised accounts to save articles or request citation alerts; and RSS feeds and advance notice of future issues.

In July 2013, BSHS will host the International Congress of the History of Science, Technology and Medicine at the University of Manchester.
Information on how to join can be found at <http://www.bshs.org.uk/membership>



Call for Themed Conferences

The BSHS is not planning to hold an annual conference in either 2012 (the Three Societies Meeting will be held in Philadelphia) or 2013 (the 24th International Congress for the History of Science, Technology and Medicine will be held in Manchester).

BSHS Programmes Committee therefore seeks offers from individuals and departments to organize smaller themed and one-day conferences in 2012 and 2013. Conferences may be themed on any aspect of the history of science, broadly defined. Organizers of approved conferences will receive organizational support and advice from BSHS Programmes Committee and the BSHS will subsidize student attendance. Eligible attendees will be able to apply for support for travel to these conferences from the Butler-Eyles Fund.

The BSHS Programmes Committee also invites proposals for joint conferences with other organizations and applications for sponsorship of meetings.

For details of BSHS procedures for sponsoring conferences, go to:
<http://www.bsbs.org.uk/conferences/bsbs-support-events>

For details of previous BSHS-sponsored events go to: <http://www.bsbs.org.uk/conferences/other-bsbs-meetings>

Plenary session at the BSHS-sponsored third annual conference on Science and the Public, June 2008, Victoria Baths, Manchester

Photo courtesy of James Sumner



Credits and Acknowledgements

Local Organisation

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The British Society for the History of Science is a company limited by guarantee, registration number 562208 in England; registered charity number 258854.
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Information in this handbook is based on that available on 10 July 2010. Whilst every effort will be made to achieve the advertised programme, the Society reserves the right to change any aspect of the programme and other arrangements where good reason calls for this to be done.

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