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# Contents

# Editorial

**Martin Monk**

The examination season is upon us. And as you read through this fortieth issue of Education Forum thousands of youngsters – and some not so young – will be sweating after swotting. Although many will have taken examinations in science, very few will have been asked questions to test their knowledge, understanding and skills in the history of science. In this issue we turn our attention to the history of science in science examinations. We also have a report on how a group of European science teachers have been working together to improve and disseminate ideas on the teaching of the history of science. In the Forthcoming Events there is a reminder of the Education Section day that will be running at the BSHS conference in York.

Saturday 6th September is the deadline for copy to be with Kate Buss for the next issue of Education Forum. cwbuss@aol.com

# Viewpoints

## Assessment of the History of Science: Edexcel GCSE Specimen Papers

Peter Fowler

**Introduction**

Edexcel have produced two sets of specimen papers, one for the 'traditionally assessed' examination (Specification A) with two *unhighlighted* HoS questions, and one for the modular examination (Specification B) with five HoS-containing questions which are highlighted as such. (Autumn 200))

It is important that HoS is assessed effectively at GCSE level otherwise teachers have no real incentive to introduce a balanced approach to teaching HoS in their lessons, in spite of evidence and protestations that HoS is essential for a better understanding of Science. HoS will just be seen as context to the science content of lessons, rather than it being 'taught' as an integral and vital part of science education, contributing to the understanding of science ideas and Science in the wider context.

I shall look at the possibilities for HoS in GCSE examination assessment by way of the statements about HoS in Sc1 of the science National Curriculum; then I shall examine whether the potential has been reached before looking at possible reasons for the gap between 'dream' and 'reality' that exists.

**The Dream (history of science)**

The Science NC clearly gives scope for a broad and balanced approach to teaching HoS in secondary science lessons. In the double science key stage 4 section of Sc1 ("Scientific Enquiry", "Ideas and evidence in science" p.46) "(p)upils should be taught how scientific controversies arise from different ways of interpreting empirical evidence." This gives plenty of scope of looking at alternative ideas about phenomena. The example given is Darwin's theory of evolution, where the different ways of interpreting the same evidence at the time and previously, the evidence Darwin actually used to clarify and justify his ideas and why the idea was so controversial can and quite easily be looked at. Moreover, the context (how it influences the "scientific work" and its "acceptance") should also be taught as expressed in the statement immediately underneath the above.

So clearly, as far as the NC is concerned pupils should have opportunities to learn about different scientific ideas and their "historical" contexts, as well as the people who were involved.

**The Reality (more science content and distortion)**

In specification A of the Edexcel Double Science there are two Ideas and Evidence questions with an historical element: one biological and one chemical. I shall analyse the biological question in detail, first, and then derive an overall conclusion from this specific example incorporating the other questions. I will also look at possible exceptions to the general 'rule' and whether they agree with the overall conclusion, and possible reasons for them.

The biological question concerns Darwin and Malthus and consists of an unquoted block of text briefly describing Malthus' essay on the human population and how Darwin used Malthus' idea to develop his (Darwin's) idea of Natural Selection. (This is Q9. in the Foundation paper on p.9; Q2 in the Higher paper on p.64) The text is used as a basis for the questions that follow.

Q(a.i) asks what is meant by the phrase "the adult population tends to remain stable from generation to generation". This can be answered without Sci K&U from general knowledge, but could be counted as testing purely science content knowledge from the kS4 course. I would therefore class this question as a comprehension / recall question. Part (a.ii) asks "why fish lay thousands of eggs rather than just a few". This science content harps back to KS3. However there is a clue within the block of text: "… its offspring if they survive". So again this question is a comprehension / recall question. Part (a.iii) asks what causes "small variations between individuals of a species" – a quote form the block of text – and part (a.iv) asks what is meant by the phrase "natural selection", both of which demand factual recall of the correct answer from the science content again.

Q(b) is a multi-choice question asking pupils to pick out a false statement about Evolution from three true ones, i.e. "Nature plays an important part in artificial selection" which is obviously wrong and is based on science content, not history of science content or skills. And finally, part (c) asks about how scientists disseminate science ideas – again a factual

recall/general knowledge recall-type question based on content from Ideas and Evidence other than HoS.

Overall then, this question uses HoS as the context and relies on comprehension and/or factual recall of only science content. No HoS content or skills are being assessed. This falls far short of the potential expounded in Sc1 of the NC. Therefore this question shows a gap between what could be assessed in HoS and what is actually tested. This applies to the majority of the other questions in the Edexcel specimen questions with two exceptions.

On p.127 there is a purely higher tier question in the Chemistry paper for candidates taking double and triple science only. It tries to contrast the differences between the ancient Greek's idea of atoms and John Dalton's idea. Part (a) asks: "Why was John Dalton's theory more scientific than that of the ancient Greeks?" This can be answered by comprehension of the text of the question which, however, says that the ancient Greeks "had no experimental evidence of atoms but they liked the idea." I would suggest that this is a distortion of HoS as far as atomic theory is concerned. Also, part (b.iii) asks pupils to explain why "evidence for the existence of atoms was indirect" when referring to the objections of Ostwald and Mach to atomic theory.

Both of these appeal to the interplay of ideas and evidence with an appeal to some sort of knowledge of HoS. However, there is a contraction of context to Mach, Ostwald and the "tragedy"of the ancient Greeks (Democritus(?)) reasons for accepting atoms. So the influence of HoS in the assessment is very weak. This is even more so if Q5(b.i) is considered: "Explain how the work of Lavoisier showed that the phlogiston theory was wrong." I think that the sort of HoS that comes across to pupils through the use of such assessment items is not the sort of thing I would be teaching in my lessons. However, it is the sort of thing that can be constructively criticised. So there may be hope.

A little ray of sunshine does appear in the third paper of the Physics paper (given only to Physics GCSE students) which says: "Give an outline of what the $\alpha$-particle scattering experiment involved and how the results led to this the nuclear model of the atom." (sic). This obviously requires only factual recall and some understanding to answer it, but it is factual recall of HoS.

Therefore, if the politics are "played right" there is the hope that with some persuasion Edexcel could improve the assessment of HoS knowledge, understanding and skills. To do this however, the possible reasons for the gap between the " dream" and the "reality" need to be identified.

**Reasons for the gap between dream and reality**

I can think of four possible reasons for the gap existing. Firstly there could be some Edexcel-as-an-organisation factor that maintains the HoS-as-context orientation within assessment. It should be noted that such an orientation appears in the specimen papers of two separate specifications (Science A and Science B) which were presumably written by two different sets of examiners. Edexcel would have moderated the work of the two groups. Therefore, I would surmise so far that there is nothing 'within' the individual writers that could contribute to the

gap – it has to be within the Edexcel 'system'. One way to confirm this would be to look at the ways other examining boards tackled the issue, to see whether the phenomenon was peculiar to Edexcel or a general trend across all examining boards. This would have to be backed up by interview evidence from people at Edexcel to confirm the inference.

A second possible reason is that there are exam regulations that the exam boards have to follow. In fact there are assessment objectives (AO1, AO2 and AO3) which act as a framework within which the exams have to be constructed. At the back of each set of specimen papers there is a grid specifying how much of each question has to fall within each assessment objective, and the actual marks allocated for each question by the exam writers.

The content of the assessment objectives can be found in the specifications:

AO1 Knowledge and understanding
Candidates must be able to:
1. recognise, recall and show understanding of specific scientific facts, terminology, principles, concepts and practical techniques
2. demonstrate understanding of the power and limitations of scientific ideas and factors affecting how these ideas develop
3. draw on existing knowledge to show understanding of the benefits and drawbacks of applications of science
4. select, organise and present relevant information.

AO2 Application of knowledge and understanding, analysis and evaluation
Candidates must be able to:
1. describe, explain and interpret phenomena, effects and ideas in terms of scientific principles and concepts, presenting arguments and ideas clearly and logically
2. interpret and translate, from one form into another, data presented as continuous prose or in tables, diagrams and graphs
3. carry out relevant calculations
4. apply principles and concepts to unfamiliar situations, including those related to applications of science in arrange of domestic, industrial and environmental contexts
5. evaluate scientific information and make informed judgements from it.

AO3 Investigative skills
Candidates must be able to
1. devise and plan investigations, drawing on scientific knowledge and understanding in selecting appropriate strategies
2. demonstrate appropriate investigative methods, including safe and skilful practical techniques, obtaining data which are sufficient and of appropriate precision, recording these methodically
3. interpret data to draw conclusions which are consistent with the evidence, using scientific knowledge and understanding, whenever possible, in explaining their findings
4. evaluate data and methods.

The grids at the back of the books of specimen questions have limits to how any marks can be allocated for each assessment objective:

| Specification | AO1 (recall) | AO1 (other) | AO2 | AO3 | Total |
|---|---|---|---|---|---|
| A | 17-21 | 34-41 | 28-39 | 0-5 | 90 |
| B | 12-14 | 41-45 | 27-36 | 0-7 | 90 |

The difference between the two specifications is because "B" is modular and a proportion of AO1 is assessed in module tests throughout the course.

From the data above, I would suggest that there would have be limited scope for assessing HoS in exam questions, and it is therefore not surprising that HoS is only used as context to questions. Only AO1.2 AO2.4 have any direct relevance to HoS. To improve the assessment of HoS in exam questions, it would need to be made more explicit in the assessment objectives.

The third reason is related to the above. There is so much to be assessed that there may not be enough room within an exam paper to assess HoS directly, unless it is a specific part of the relevant specification.

Lastly, the fourth reason is more radical and has no direct evidence. But it is a possibility that should be considered: that is, what is being observed is the difference between two paradigms. One is where HoS can only be seen as context to science education with the focus on factual content and a neglect of the process of science in society within education. In other words, HoS is a side issue in science education. The other is where there is more of a focus on the process side of science (and I am talking about how science fits into society not about 'Process Science') and recognises that the HoS in science education is an important issue.

The evidence that I have is purely circumstantial and anecdotal. One instance I could site is the way HoS has been portrayed in school science textbooks (even though it is improving all the time). More anecdotal evidence comes from my department's experience of HoS. Everyone in my department has known about my activities in the BSHS for years and yet they have never sought to try to introduce HoS into their own teaching, let alone ask my advice. I have even had HoS worksheets I produced for my colleagues to look at placed back in my own pigeonhole in the staff room. It may be me. And internal politics is certainly a factor. But if a sizeable number of people in science education are not prepared to even consider HoS as an important issue, then HoS will never be a part of mainstream science education.

Now, this may be a bit hysterical and the word 'paradigm' may be a bit strong. But taking a stance such as this could be a useful way of analysing the situation about exams and of finding solutions to the problems, if indeed problems exist.

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# Ideas & Evidence in AQA GCSE examinations

Peter Ellis

The examination papers reviewed are the specimen papers provided the Assessment and Qualifications Alliance (AQA) for the awarding body's Science Double Award Specification B (Coordinated). This specification sets separate examinations in Biology, Chemistry and Physics at Foundation and Higher Level. The Ideas and Evidence questions found in these papers and described below are also used in the specimen papers for the separate science awards and the terminal examinations of the Science: Double Award Specification A (Modular).

Questions testing Ideas & Evidence skills are not identified as such in the examination papers or mark scheme.

*Note:* The answers to the questions in italics are those given in the mark scheme which accompanies the specimen papers.

**Paper 1 (Biology) Foundation & Higher**

Q16 (Foundation), Q6 (Higher). The questions concerns the hormones controlling ovulation and a monitoring device women can use to test their own hormone levels.

(c) Hormones can be used to control human fertility. Describe the benefits and problems that might arise from using hormones in this way. [4 marks]

Benefits: *3 from: can prevent unwanted pregnancy / can treat infertility (in females) / economic benefits from smaller families / reduced pressure on resources or reduced population growth problems.*

Problems: *3 from: may promote promiscuity / risk of multiple pregnancy / spread of sexually transmitted diseases (or named example) / health risk side effects / expensive (with explanation)*

Q17 (Foundation), Q7 (Higher)

Giraffes feed on the leaves of trees and other plants in areas of Africa. They are adapted through evolution to survive their environment. [picture of giraffes feeding]

(To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words)

(a) Explain how Jean-Baptiste Lamarck (1744-1829) accounted for the evolution of the long neck in giraffes. [3 marks]

1 mark: *change in the environment or reaching for food or stretching led to more use of neck (and legs)*

1 mark: *use led to increased size or characteristic acquired during lifetime*

1 mark: *this characteristic was passed to offspring.*

(b) Another scientist, August Weismann (1834 – 1914) wanted to check Lamarck's explanation. To do this he cut off the tails of a number of generations of mice and looked at the offspring. His results did not support Lamarck's theory. Explain why.

[2 marks]

1 mark: *changes to body do not affect genotype or genes*
1 mark: *acquired characteristics are not passed to offspring or the offspring were born with tails or inheritance has to be genetic.*
*[Note: if the quality of English is poor or the ideas are not well expressed, a maximum of 2 marks is awarded]*

**Paper 2 (Chemistry) Foundation & Higher**

Q10 (Foundation), Q2 (Higher)
Part of the Periodic Table, which Mendeleev published in 1869, is shown below
[Table showing part of early form of Periodic Table with horizontal periods and vertical groups and asterisks marking missing elements]
Use the information on the Data Sheet to help you answer this question.

(a) Some elements in group 1 of Mendeleev's Periodic Table are not found in Group 1 of the modern Periodic Table. Name two of these elements. [1 mark]
*any two from H, Cu, Ag (two required for 1 mark, symbols must be written correctly)*

(b) Which group of elements in the modern Periodic table is missing from Mendeleev's table? [1 mark]
*any one from Group 0 /Noble gases/ group 8/group 18/Inert gases/ rare gases/Transition elements or metals*

(c) Mendeleev left several gaps in his Periodic table. These gaps are shown as asterisks (*) on the table above. Suggest why Mendeleev left these gaps [1 mark]
*spaces left for elements which had not been discovered or gaps left so that elements could be placed in columns with other elements that had similar properties*
*(one sensible suggestion based on their knowledge of the Periodic Table)*

(d) Complete the following sentence:
In the modern Periodic Table the elements are arranged in order of their .. *atomic* ..or ..*proton*.. numbers [1 mark]

Q14 (Foundation), Q6 (Higher)
One definition of an element is :
"A substance that cannot be broken down into simpler substances by chemical methods."
The table shows some of the "substances" which Antoine Lavoisier thought were elements. He divided the "substances" into four groups. He published these groups in 1789. The modern names of some of the "substances" are given in brackets
[Table of Lavoisier's acid-making, gas-like, metallic and earthy elements]

(a) Name one "substance" in the list which is not a chemical element or compound [1 mark]

*light or caloric or heat*

(b)(i) Name one "substance" in the list which is a compound. [1 mark]
*any one from: lime, magnesia, barites, argilla, silex (or their modern names or formulae)*

(ii) Suggest why Lavoisier thought that this "substance" was an element. [1 mark]
*no methods available at that time to split compounds into elements or unable to split up the substance*

(c) Dimitri Mendeleev devised a Periodic table of the elements in 1869.
A modern version of this table is shown on the Data Sheet.
Give two ways in which Mendeleev's table is more useful than Lavoisier's. [2 marks]
*any two from: Mendeleev's table – contains only elements/divides metals and non-metals/contains far more elements which were discovered later/groups elements according to their properties/puts elements in order of atomic number or mass number or the table includes these numbers/an use it to work out or is linked to electronic structures/left gaps for missing elements which had not been discovered.*

**Paper 3 (Physics) Foundation and Higher**
Q11 (Foundation), Q3 (Higher)
Wegener's theory of continental drift is now generally accepted.

(a) Complete the sentences below by adding the missing words.

At one time it was thought that mountains like the Cairngorms were formed because the Earth's crust shrank as the Earth ..*cooled down*.. .It is now thought that the crust of the Earth is split into a number of pieces called ..*plates*.. which are moving because of ..*convection* .. currents in the Earth's mantle. [3 marks]

(b) (To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words)

Wegener suggested that all the separate continents on earth once formed a single land mass.
Describe the evidence that supports this idea. [2 marks]
*Edges of land masses fit closely together*
*Edges of land masses have similar rocks/fossils*
*(Only 1 mark awarded if quality of English is poor)*

**A commentary on these questions and the suggested mark scheme**
The questions listed are the only ones from these specimen papers that I consider to have any relationship to Ideas and Evidence (I&E) either from the history of ideas or contemporary issues. The marks awarded on these questions total 9 in paper 1 (Biology), 8 in paper 2 (Chemistry) and 5 in paper 3 (Physics). This gives a total of 22 out of a maximum mark for the three papers of 270 i.e. 8%. This is more than the required 5% but some of the questions listed do not test I&E skills. In fact I would contend that none of the questions listed provide a good test of the four I&E statements given in the National Curriculum for Science.

Paper 1 Biology Q16(F) can be considered to be tackling the ethics of hormone treatments and hence cover part of I&E statement (d).

Paper 1 (Biology) Q17(F) part (a) is a simple statement of Lamarck's theory without any reference to how it was communicated or the context in which it was proposed. Part (b) does in a small way look at the interpretation of evidence (I&E statement (b)).

Paper 2 (Chemistry) Q10(F). Parts (a) and (b) of this question simple require pupils to demonstrate their familiarity with the modern periodic table and pick out differences in Mendeleev's table. Part (c) does consider Mendeleev's ideas but bears little relation to the I&E statements. Part (d) is simple recall of modern chemical knowledge.

Paper 2 (Chemistry) Q14(F). Parts (a) and (b)(i) simply test pupils understanding of the terms element and compound. Part b(ii) could be considered as testing I&E statement (b) since it considers how new evidence affects ideas (i.e. when it became possible to break down substances they ceased to be considered as elements). Comparing the usefulness of Lavoisier's and Mendeleev's tables (part (c)) does not seem to explore any of the I&E statements and the answers provided are merely statements of knowledge about the Periodic table.

Paper 3 (Physics) Q11(F). In part (a) only the first missing word is concerned with alternative theories. The second and third missing words are derived from knowledge of plate tectonic theory. Part (b) explores Wegener's theory but does not consider any alternative explanations so is difficult to fit into the I&E framework.

There is no differentiation in the questions as all of them appear on both the Foundation and Higher papers. Thus there has been no attempt to test the more developed skills of Higher tier students.

I would contend that questions of this quality do a disservice to the promotion of Ideas and Evidence in the teaching of science. For the most part they require a trivial knowledge of both historical ideas and figures and contemporary issues. They do nothing to develop students' understanding of the methodology of science or its importance to the modern world. I sincerely hope that the I&E questions used in the examinations in June will be of a higher quality.

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# The history of science in the AQA examination Science for Public Understanding.

Martin Monk

Science for Public Understanding is new to AQA. The course was only offered nationally in 2000. The examination has two papers. The titles and content of these follow the clear break that appears in the published textbook written to accompany the course (Hunt & Millar, 2000). The papers are:

- Issues in the Life Sciences;
- Issues in the physical sciences.

The time allowed for each paper is 1 hour and 15 minutes. Both papers, and the questions on them, are compulsory. For both the 2001 and 2002 examinations, the Life Science paper carried 4 questions, the Physical Science paper carried 5. Nearly all the questions are in the structured short answer format. That is candidates are presented with some information in the form of a table, graph, text or image and asked questions that follow from the initial information. The candidates answers are written in spaces left on the question paper. Marks awarded follow each part of a question and can help the candidate to judge the extent of answer required. Generally, the sequencing of the parts to any one question show progression. Earlier parts often require candidates to demonstrate their comprehension of the information presented. Middle sections of a question carry tasks that involve recall and application of knowledge. Often the last part of a question requires the candidate to evaluate by weighing evidence and giving an opinion. To anyone familiar with the Bloomian taxonomy of the cognitive domain (Bloom, 1956) this sequencing would be appropriate. On two sets of the 2001/2 papers, all of the 8 questions on Issues in the Life Sciences and 9 of the 10 questions on the Issues in the Physical Sciences involved contemporary issues. The public understanding represented here is that of modern science, economics, politics and sociology. I found the questions to be both stimulating and challenging. Not surprisingly, the evaluation of the course carried out by Osborne, Duschl and Fairborther (2002) is entitled “Breaking the Mould?”.

Of the 18 questions that have so far been put out in public examination papers only one involves any history. That was question 5 on the 2001 paper 2: Issues in Physical Sciences. The task the question sets the candidates can only be achieved with recall. No information processing skills, in the Bloomian sense, are required. The only thing that looks tricky is the use of the dates 1600 and 1750 to mark watersheds in our knowledge of the Universe. (My guess is that the examiners wanted to mark the publication of The Starry Messenger by Galileo in 1610 and William Herschel’s discovery of Uranus in 1781?) Otherwise, candidates are invited to empty a limited selection of the contents of their memories onto the paper. Here are the parts of question 5.

Until 1600 almost everyone believed that the Earth was the centre of the Universe and that the Sun and planets revolved around the Earth. By 1750 astronomers believed that the Sun was the centre of our solar system and that the Earth and planets rotated around the Sun (the heliocentric model).

(a) Copernicus, Galileo, Brahe, Kepler and Newton are some of the people who contributed to this revolution in understanding.
(i) Choose one of these people and explain how their ideas or observations contributed to the development or acceptance of the heliocentric model. (2 marks)
(ii) State two reasons why some astronomers did not immediately accept the heliocentric model. [2 marks]

(b) Identify two things that we know about the solar system today that were not known in 1750. Choose one of these and explain the evidence for it. [4 marks]

This is the only question that breaks the pattern set by all the other questions. To conform to that pattern the examiners could present candidates with some phenomena, or information that was disputed historically. Such information would need to be presented in tabular, graphical or image form. What could they use? My first stab at suggesting what the information could be is:

- images of the moons of Jupiter taken at different times. This might best be the often represented section from Galileo's own notes or his 1610 book The Starry Messenger.
- images (photographs of sketches) of Sun spots taken at different times. I recall reading in Dava Sobel's book Galileo's Daughter (Sobel, 1999) that it was Galileo's 1629 viewing of the changes in orientation of the axis of rotation of the Sun spots that finally clinched, for Galileo himself, the helio-centric model as being the true one. [I am sure pucka historians will laugh at my source.]

The problem with both of these is that, unlike the information presented in the other questions, the information may not be novel for the candidates. Historical information will have been pawed over, discussed and contested many times before. Modern issues in the Physical Sciences are Issues because of the very fact that discussion and contestation is not yet complete. The final form has not been cast. Is this a problem that can not be overcome? Surely this is what marks out history (the study of what happened then) from sociology (the study of what is happening now) and anthropology (the study of what happens/happened in other places).

To create the disputation, that lies at the heart of the other questions in the SPU examination, in history type questions requires the examiners to shift to tasks for candidates like, "Explain why Galileo made those observations?" and "Explain why he gave his observations the interpretation he did?". Thus we move from history to historiography: an altogether more shark infested water.

The trouble is that science teachers are the very last people who might be able to make this shift. And yet they are the people who are teaching Science for Public Understanding. On page 9 of their evaluation report, Osborne, Duschl and Fairbrother wrote,

> "In addition, our findings suggest that teachers have found it difficult to break free of the modes of interaction with students which are acquired by teaching standard science courses. Too many lessons were observed where explaining the science predominated to the detriment of exploring other aspects of science, in particular the ideas-about-science component and the underlying major science explanations."

Is the Public Understanding of Science, taught by scientists, doomed to be a case of square pegs and round holes?

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# Report

## Why now? Teaching and Learning about European History of Science and Technology

Bert Sorsby and Peter Ellis

**The European context**

A European Commission Comenius grant has enabled teachers and teacher trainers from six European countries to meet to research and develop ways of supporting teachers who want to include more history of science and technology (HST) in their teaching. The three-year HST Project ended last year, and its main outcome is a collection of resources and structures which will support future international HST courses for European teachers. These will run from July 2003 onwards.

From Ireland to Romania, from Norway to Portugal teachers are currently thinking about the place of the history of science in education. Some European countries have taken the lead in adopting a policy of including History of Science in curricula. Why? What place does the history of science have in science education? What initiatives are there and why are they happening now?

Across Europe, and indeed over the whole world, there has been a growing distrust of science and a fall in numbers pursuing science courses in schools and universities. Science has come to be seen as inhumane, remote and the cause of more problems than it solves. A contributory factor to this viewpoint could be the way that science has been taught in the last fifty years. Process and concepts have dominated while the human stories have been ignored.

Bringing the history of science into science teaching redresses the balance. It can be seen that science today is the culmination of the work of a great many people from all over the world over a long period of time. Scientists come from various backgrounds and are driven by different motivations. The "progress" of science is revealed as erratic, governed by

personalities and contexts and not a purposeful unlocking of a library of the laws of the universe. Learning a little of the history of science can make the issues that face us today understandable and restores science to its place as part of human culture.

This philosophy is now part of the English and Welsh science curriculum and in one form or another is present in the curricula in other European countries. It would therefore seem to be sensible for European teachers to get together to discuss how it can be taught, but what avenues are available to support this work?

From 1995 there has been active, financial support for initiatives in history of science and technology education from the European Commission since an EC white paper on education and training stated:

> '*Any action taken by the Member States to introduce history of science and technology into schools and to strengthen the links between research and basic education should be encouraged.*' (CEC,1995:11)

**The HST project**

From September 1999 a group of teachers and teacher trainers from six European countries – France, Ireland, Portugal, Romania, Norway and England - worked closely together on a three year project to produce materials and structures to support and run international teachers' courses in history of science and technology. The History of Science and Technology (HST) for European Teachers Project, was funded by the European Commission through the Comenius action of the Socrates programme. A grant of more than 80k euros, along with matched funding from each of the six partner institutions, enabled us to meet regularly to plan, research, discuss and generate support materials for European teachers who want to introduce more history of science and technology into their teaching.

The work took place in three phases. In Phase 1 we discussed and resolved the basic issues which concerned the overall management of the project. In Phase 2 the partners worked closely together to generate the first draft of a HST Course for European teachers. We produced the first version of a training manual and also a resource manual in which teachers from the various countries contributed work and ideas which they use with their own pupils. These manuals and in-service course structures were trialled in 2001 during a HST course for teachers from nine European countries. Phase 3 saw the modification of the training and resource manuals as well as the generation of extra support materials – a multi-language information leaflet, a CD ROM and a book published by the University of Bucharest. These are now available to support future international courses in HST and to disseminate the work of the HST Project throughout Europe.

The next teachers' course will be held at Hull University, UK July 5-11 July 2003. This course provides an excellent opportunity to meet science and technology teachers from around Europe and to set up links with European schools and colleges. Special daily rates to cover accommodation and subsistence are available for UK teachers to attend the HST Course over the weekend 5-7 July. There are grants of 1500 euros from the European Commission through

National Agencies for overseas teachers and the grant covers course fees, travel accommodation and subsistence. In future years, when HST courses are run in other European countries such as France, Norway, Portugal, Romania and Ireland, these grants will also be available to teachers from the UK.

An important spin off of the HST Project – in Euro-bureaucrat terminology, a 'multiplier effect' - has included the production of a Pupils' Magazine for History of Science and Technology. Three teachers, from Poland, Austria and Italy, who met on the first HST course in 2001, were successful in their bid for a Comenius 1 grant to enable them to set up an online magazine, written b pupils and students, for history of science and technology. Its purpose is for pupils to explore our common European heritage of scientific and technological developments. More contributions by secondary pupils from all European countries are welcome and the website (see the box below) gives more information on how to set about this.

**Some Useful Web Addresses**

- HST website www.hib.no/shof/hst-int/

This site gives more information about the HST Project with links to the next HST Course

- HST Course details appear in the Comenius catalogue at http://comcdb.programkontoret.se/CourseManagement/ASP/CourseInfo.asp?CourseId=4632

Here you can find details of the July 2003 course, including the aims and draft programme. Additional information is on the ASE website at www.ase.org.uk or from the course directors Bert Sorsby at b.d.sorsby@hull.ac.uk or Peter Ellis at PREllis18@aol.com

- National Agencies. You need to apply here for funding to attend courses outside your own country. Contact them via http://europa.eu.int/comm/education/socrates/nat-est.html

- HST European Pupils' Magazine www.glasfachschule.ac.at/hst

For more details please contact Angelo Rapisarda (gange@tin.it) or Bert Sorsby (b.d.sorsby@hull.ac.uk)

**Bert Sorsby** is a lecturer at the University of Hull and director of the HST Project.
**Peter Ellis** is a science teacher and an education consultant for history of science and technology. Both are members of the British Society for the History of Science.

# News items

BRITAIN'S FIRST COMPUTER MUSEUM OPENS IN SWINDON

The first museum in Britain dedicated to computing was due to open in Swindon in the spring. The Museum of Computing @ Swindon is supported by the Science Museum, the British Computer Society, University of Bath, Swindon Borough Council and Clark Holt, Commercial Solicitors. It is located within the Oakfield Campus of the University of Bath in Swindon and its primary purpose will be educational. The Museum is an independent, not-for-profit company limited by guarantee. The Museum does not intend to own a collection of exhibits but there will be active displays and admission will be by arrangement only. Its function will be to act as a showcase for outside exhibitors.

The first exhibition is presented by Bletchley Park Trust and will explain the workings of an Enigma machine. During World War II Bletchley Park (then called 'Station X') was home to the Government Code and Cypher School. As part of its work to break the German's secret codes, the world's first programmable electronic computer (called Colossus) was built there. This helped win the Battle of the Atlantic and provided those planning D-Day with unprecedented detail of the German defences. Now that World War II is part of the school curriculum, a number of schools have arranged visits to the exhibition.

Later in the year a large local private collection of home computers will be on display at the Museum in Swindon. The organisers are also keen that commercial companies should also show their former products.

Steering group members include Prof. James Davenport, University of Bath, James Goddard, the Science Museum, Jeremy Holt, partner at Clark Holt solicitors, Prof. Bob Hopgood, Oxford Brookes University, Prof. Peter Johnson, University of Bath, Doron Swade, The Science Museum, Colin Thompson', British Computer Society.

Further information can be found at www.mocas.rl.ac.uk

ENERGY WEBSITE

James Prescott Joule developed revolutionary ideas on energy and temperature. In 1843, he proposed the mechanical equivalent of heat, which included a constant describing the conversion of heat into mechanical work. The international unit of energy, the joule, is named in his honour.

This website, developed by the Museum of Science and Industry in Manchester, explores aspects of the work of James Joule. It is aimed at those looking to find out more about James Joule, especially A level and higher Education students, adult learners and school students at Key stage 3 and 4 levels.
www.msim.org.uk/joule/index.htm

For more information, please contact Val Smith, Press and Publicity Officer
Tel: 0161 606 0176

THE GALTON COLLECTION

The Galton Collection at University College London contains the scientific instruments of the Victorian scientist, Sir Francis Galton (1822-1911). Galton's inventive curiosity led him in a variety of directions. Indeed modern understanding in statistics, genetics, heredity and criminology were shaped by Galton's work.

We welcome enquiries from researchers, schools, museums and the media. To find out more please visit the Galton Collection website.
http://www.collections.ucl.ac.uk/galton

The collection can be viewed by appointment. Please contact the curator:
Tel: 0207-679-2647
Email: galtoncoll@ucl.ac.uk

UCL also houses **the Galton Archive** of papers and manuscripts.
www.ucl.ac.uk/librarary/special-coll/
To find out more please contact the archivist: email spec.coll@ucl.ac.uk

A **free resource loan box** has been developed to support the teaching of *citizenship* at KS3 & 4. The box includes replica objects from the Galton collection. The box also contains teachers' notes, photocopiable resources and activity suggestions. It provides a fun, hands-on way to explore the areas of Identity, Fingerprinting, Forensic Science and Human Rights. It not only introduces key areas of the Citizenship Curriculum, but also taps into the curricula for science, history, maths and English.

To find out about the Loan Box, book the Loan Box for your school (for up to 2-3 weeks at a time) or enquire about the other educational services offered by UCL Museums and Collections, please contact the Education Officer:
Tel: 0207-679-2151 Email: educationofficer@ucl.ac.uk

PERSPECTIVES ON SCIENCE

This new AS qualification is getting ready to be launched with a hopeful starting date of September 2004. After producing initial trial materials with the support of The Royal Society and receiving very positive feedback from teachers and students we have moved forward to discussions with QCA and Examination boards. QCA is extremely enthusiastic about this broadening AS and hopes that it can accredit it without a pilot stage. We are already in contact with over three hundred institutions with some colleges planning to give all their science students this experience. At present there is a huge amount of work going on developing the materials and writing lessons for the draft specification. We have a substantial grant to do this from The Wellcome Trust and also some support from the Particle Physics and Astronomy Research Council, PPARC.

Becky Parker
bparker@particle.demon.co.uk

# Forthcoming events

BSHS CONFERENCE
THUR. 17th to SAT. 19th July 2003, at St. John's College, York, UK

Details of the provisional programme of talks and events are now available on the web at
www.bshs.org.uk/york2003/programme.html#timetable

The Education Section has meetings on Friday the 18th July and school teachers are to be particularly encouraged to come along.
The current timetable is:

9:00 Textbooks and Science in Schools
11:30 A-S level
14:00 QCA and the twenty-first century
16:30 Teaching the history of science in higher education
18:00 Reception

The conference web site, with registration forms, is to be found at

www.bshs.org.ac.uk/york2003/index.html

B.S.H.S. AND THE CANADIAN SOCIETY FOR THE HISTORY AND PHILOSOPHY OF SCIENCE, AND THE HISTORY OF SCIENCE SOCIETY
5-7 August 2004, Halifax, Nova Scotia, Canada.

If you have not yet booked your summer holiday and you are looking for somewhere interesting to travel to why not take in this meeting.
The program has sessions on the theme of "Circulating Knowledge."

For further details contact the HSS Executive Office at
info@hssonline.org

or the members of the program committee:
Geoff Bunn bunng@hope.ac.uk
Lesley Cormack lcormack@ualberta.ca
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# Resources

PARTICLE PHYSICS AND ASTRONOMY POSTERS
Reviewed by Kate Buss

PPARC, the Particle Physics and Astronomy Research Council, have produced two glossy A1 sized posters for the science lab wall. One is Evidence for the Big Bang! and the other Matter and Antimatter. Aimed at Key Stages 3 & 4 these are brightly coloured, subdivided into 5 or 6 themes and feature photos of young scientists working in the areas with relevant quotes (good role models).

Under Sc1 Scientific enquiry (Ideas and Evidence) some historical scientists are invoked. On the Big Bang poster Henrietta Leavitt and Edwin Hubble are used, a pity they didn't use photos of them. On the antimatter poster Paul Dirac' s photo does appear with a short outline of his contribution to ideas.

I found them interesting, giving a concise account of how we got to our current understanding. I doubt pupils would actually stop to read them, my son wasn't keen, although he found the design appealing there were too many words. Unless a canny teacher puts them where they are close enough to read during boring bits of the lesson or where pupils have to wait. However, as these are free and actually well thought out teachers should ask for copies.

The reverse of the poster contains notes for teachers and 3 worksheets, helpfully these also come as a separate booklet.

PPARC has a wide range of free publications available, see **www.pparc.ac.uk**

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Enquiries regarding circulation or membership of the Society should be made to the BSHS Executive Secretary at the address below. It is stressed that any views expressed in Education Forum are those of the Editor or named contributor and that the BSHS accepts no responsibility for omissions or errors.

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