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Kate Buss

Peter Fowler continues his argument for History of Science being taught as part of Science lessons. John Taylor gives us good news about the proposed Perspectives on Science A/S level and Peter Ellis asks for help in compiling an international issue of breakthrough. I went to the theatre and was yelling 'Scientriffic' along with the best of them while Martin Monk considers history of science books aimed at middle school pupils.

I am always pleased to receive items for *Forum* by mail or e-mail. The dead line for the next issue is 6 January 2003. Please note my amended e-mail address.

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Viewpoints

Why Teach the History of Science in Science? (Part 2)

Peter Fowler

Introduction

In the first part of this article, I started to look at a set of alternative reasons for teaching the History of Science (HoS) other than the demands made by the National Curriculum for England and Wales. I suggested that there is a much broader set of issues relating to the integration of HoS into teaching and thinking about teaching. These include 'political' issues (concerning European culture) and curricular issues (concerning the development of a more dynamic approaching to teaching and learning, including the learning of particular skills, such as 'empathy'), which are necessary for a balanced understanding of HoS and, indeed, Science. There are, however, other fundamental reasons as to why HoS should be taught in ordinary science lessons.

Humanism v Rationalism

One of my colleagues in the Science Department at the Frances Bardsley School (FBS) for Girls (in Romford, Essex, England), Linda Brook, pointed out to me that, as a relatively new teacher to the profession she felt "torn in two" by the rationalistic demands of the National Curriculum (NC) and the humanistic way of teaching she had learnt at teacher training college. Linda said that the National Curriculum for science was overwhelmingly knowledge-based, while the methods she was trying to use were based on the process of learning. The structure of schemes of work and curricula and the volume of content therein were forcing Linda to change to a more transmission-based way of learning, taking her away from a more pupil-centred approach which she knew was better for her and her pupils.

Before I continue to show how this is relevant to the teaching of HoS, I need to explain what *I* mean by 'humanism' and 'rationalism'. Broadly-speaking, a rationalistic approach to education is knowledge-centred, where the knowledge consists of a set of fixed, hierarchical context-free ideas or models of reality. McLean (1990) says that this implies a more transmission-based approach to instruction, where knowledge is transferred from the textbook into the pupil's head in the same form. A humanistic approach is more pupil-centred, focusing a lot more on the process of learning and understanding. It is therefore more compatible with cognitive approaches to learning.

McLean (1995) has said that the two approaches need not be antagonistic. This is not what Linda Brook and I have found at FBS. We, and other science teachers, feel a terrific tension between what we feel we should be doing and what we feel the NC demands. I would argue that by concentrating on 'process', a humanistic approach to instruction is a dynamic approach. A rationalistic approach, on the other hand, concerns a more-or-less fixed body of knowledge (as far as education is concerned, and at least in the short term) and patterns of thinking, and is therefore more static. The two educational 'traditions' are somewhat incompatible as far as science teaching is concerned. This is because Science is, at least partly, a rationalistic enterprise. On the other hand, the moral and legal framework in which we work as professionals is humanistic (see the 1944 Education Act and the 1988 Education Reform Act, although they have been superseded by the 1996 Education Act).

The History of Science, on the other hand, contains elements of humanism and rationalism, as long as a balanced approach is taken (Fowler, unpublished). Clive Sutton (2000), when looking at books on the HoS, has said that there are three elements of 'good' HoS. I would extend Clive's idea (for teaching purposes, at the moment) to say that HoS should include something about the people from the past and their stories (the humanistic element) as well as scientific knowledge and understanding (the rationalistic element). What holds them together is a third element which focuses on the contexts in which past discoveries took place and in which the people lived (a naturalistic element). A humanistic approach to the teaching of HoS would look at the processes of change within key historical figures and the public, in general, in relation to values, attitudes and modes of thinking because of the change in the rationalistic science knowledge and understanding. This type of approach would also need to look at the similar changes pupils undergo when learning to understand new ideas. A more cognitive and social approach to teaching and learning is therefore a vital part of teaching HoS.

HoS can therefore resolve some of the conflict that Linda Brook and I encounter when we teach Science by allowing a more balanced approach to instruction as well as giving a context and framework within which the two antagonists, humanism and rationalism, can be brought together on an equitable basis.

Paul Feyerabend

Paul Feyerabend (deceased) was a philosopher and a critic of Science and is often seen by some writers as a bete-noir. This should not put off anyone who is serious about HoS from reading (or trying to read) some of his work: Feyerabend has constructive ideas about how Science should be taught, ideas which include HoS in Science teaching.

One of Feyerabend's criticisms of Science is that, as I read it, within science teaching Science ideas are often analysed in isolation from any context. Science teaching tries to understand

the idea, e.g. forces, particles, the cell, etc. from within the idea, rather like learning to use a mathematical algorithm such as long division. Evidence is 'used' to fit the idea, or the idea is induced from the evidence. There is no particular justification for that particular idea in the first place; other ideas, whether they are from history, philosophy, religion, etc., or whether they are a 'wrong' idea, are not considered.

If I put myself in the place of the pupils, I would argue that, even though the evidence supporting a particular science idea may be understood by pupils, the science 'idea' explaining the facts or phenomenon being taught needs justification. The idea has been taken out of its historical context and become more abstract and less understandable, particularly for average and below average ability pupils.

The effect is to wrap the idea around pupil, teacher and the learning process, so that they become the victims of it, rather than controlling it and eventually mastering it. A more objective view is needed: one from 'outside' the original science idea. So Feyerabend says that we should all learn about alternative explanations of natural events and phenomena, even if they are, now, completely false. The view of the world seen through the framework of the alternative, historical idea can provide a more authentic justification for the present scientific idea. It is also, in my opinion, a more authentic way of teaching science: it relies less on trust than on rational argument. It also allows pupils own preconceived ideas and explanations to made public, if they are allowed to be expressed alongside other science explanations. This enables the possibility of a more constructivist/cognitive approach to teaching and learning.

However, a note of warning. In lessons, teachers must also look at the justification or context of the alternative ideas. This involves using empathic-type skills to look at why people and scientists held the views they did in the past. The change of perception given by new ideas or evidence should then be taught, so the both the 'old' and the 'new' science explanations are justified. Likewise, pupils own naive views need to be justified before they are investigated. This gives parity and credence to historical and present scientific explanations and thus helps prevent a view of HoS as one of progression. As teaching time is short, this can only really be done if modules have the HoS ideas incorporated into their themes.

Science from Pupils 'Perspectives'

A few years ago, I carried out some (unpublished) research looking at pupils' views of different occupations (e.g. nurse, solicitor, shop assistant, scientist, etc.) in relation to how they viewed themselves. The pupils had to choose 10 words from a list of 30 to describe each occupation and themselves. The aggregate 'top ten' words described scientists quite accurately, in my opinion: hardworking, logical, determined, etc. However, comparing this list to the list of words with which they described themselves, there were very few similarities. It seems that pupils' views of themselves have very little correspondence with how they view scientists. This was true across all age ranges and abilities. I would argue, therefore, that the pupil world-view and the view that pupils have of Science, as represented by their views of the occupation of 'scientist' are also very different.

How can this be explained? School pupils are growing and changing from 11-16: change brings uncertainty and complexity to life. Pupils are learning to live in the social world consisting of an ever-changing network of friends and relationships. There are concerns are

about status and identity within the family and outside of it. And yet control of much of what pupils do is out of their control (when control over their lives is what is needed to cope with stress) and in the hands of other people (mainly adults). The pupils' world is complex, confusing, chaotic, variable, uncertain and *human* concerning the concrete things of life - a life which requires an intuitive problem-solving, crisis-management mode of thinking.

The scientific world *as it is presented through science lessons* is very different. It is about simplified, organised models of the real world where variables are few and controlled and the human dimension is restricted; it is in fact a rationalistic view of the world. To pupils, Science is simple, abstract, controlled and *inhuman*, requiring a logical, rational mode of thought to predict, plan, analyse and evaluate all activities. If I were a pupil (and thankfully I am not) I would picture the world of Science as an inaccessible mist, out of reach, above my head: it can not be reached, it can not be grasped - it is unreal and unworldly, even irrelevant.

Because pupils may have a such a view of Science, it is important to try and bridge the gap between this and the pupil-world view. Fortunately, as has already been discussed earlier, HoS can be used to bridge this gap because it incorporates the rationalism of Science and the humanism of human affairs. This is because HoS is complex, human, concrete, etc. a mixture of both the pupils' view of Science and the pupils' view of their world. The connection between the two can be achieved by connecting the pupil to the past through skills (e.g. empathy); by connecting the pupil to their own learning through an evaluation of the methods of instruction used in lessons; and by connecting the pupil directly to the world outside of the school by undergoing tasks that have real-life consequences for the pupils.

And so, using HoS in science teaching can strengthen learning in science lessons. A far stronger argument for including it in teaching than the demands of the Science National Curriculum for England and Wales.

For a full list of references, and any comments or suggestions
please contact Peter Fowler by e-mail: **petfow@hotmail.com**

News items

WELLCOME SUPPORT FOR PERSPECTIVES ON SCIENCE

The Perspectives on Science project (for the creation of a new AS level in the History and Philosophy of Science) has been awarded a sizeable grant from the Wellcome Trust. This is to cover the costs of course development. The project team is currently evaluating the trial materials which were published earlier this year. The evaluation phase of the project is supported by the British Society for the History of Science. A feedback meeting for teachers interested in the course is to be held later this term.
For more details please contact Dr. John Taylor **jlt@rugbyschool.net**

A NEW BREAKTHROUGH - A MULTICULTURAL EDITION

Peter Ellis would like some help in assembling a special edition of breakthrough.
He writes:

One request I have received on many occasions at science teachers' conferences is for resource material on science in other cultures. In previous issues of *breakthrough* I have tried to meet this demand with articles on African-American scientists, metal technology in Africa and features on Egyptian and Japanese Nobel prize winners. However there does seem to be a demand for more resources that look at the development of science in other cultures. I am hoping to produce a *breakthrough* special edition and would appreciate articles on any aspects of this topic, for instance,

- Arabic, Indian, or Chinese science and technology;
- profiles of non-European, non-white scientists
  e.g. Satyendra Bose, Sin-Itiro Tomonaga.

Articles should be aimed at either 11-14 year olds or 14-16 year olds and should be no more than 4 pages of A4 including pictures, questions / activities. It is useful if articles can be tied to topics in the KS3 or KS4 science curriculum. It would be most helpful if the articles included black and white pictures (line drawing are best) which are free of copyright. As usual I am prepared to pay £10 per printed page.
My deadline is rather tight - I would like to have all the material in by the end of November.

Contact me either by e-mail - **PREllis18@aol.com**,
or by phone - 01235 772638,
or by writing to Brecon Cottage, 33 Newbury St., Wantage OX12 8DJ.
I look forward to reading your articles.

ENGINUITY AT IRONBRIDGE

Ironbridge has joined the ranks of science centres with a new Enginuity display that aims to explain engineering to key stages 1 to 4. Housed in a giant Victorian shed it features 'Scan-its' where visitors aim an infra red beam at certain marked exhibits to find out more about them. Lots of button pushing is on offer.

NEW DIRECTIONS FOR THE SCIENCE MUSEUM

Lindsay Sharp has now been director at the National Museum of Science and Industry (NMSI) for two years. He has recently written a book *In the 21st Century What Role Should a Museum Play?* which has been distributed to staff . In it he says museums must be thought provoking not didactic, inclusive across society, sustainable financially and environmentally and attract more visitors. Not unfamiliar aims but how to achieve them?

In London Sharp has a master plan including redisplay and reinterpretation of much of the collections and the installation of new shops and cafes between the displays. Starting at the Exhibition Road end this will take 15 years. There are plans for a new building at the west end of the Science Museum site called the Dana Centre. This space is intended to appeal to visitors in their 20s and will include a bar, broadcast facilities and places for discussions rather than displays.

At York, the Railway Museum should have a new exhibition space on the 'future of Mobility' and a new museum and store at Shildon. The Wroughton site just outside Swindon which is currently largely storage will be developed.

BBC's 100 GREAT BRITONS

More than 30,000 people responded to a poll conducted last year by the BBC to find 100 great Britons. BBC2 viewers will be able to vote for the ultimate Great Briton in a series of programmes this autumn. It is interesting to see how many and which scientists are held in popular esteem.

Now rank from 1-20 as “great Britons” these people in the BBC’s listing.

David Attenborough,
Charles Babbage,
Alexander Graham Bell,
Isambard Kingdom Brunel,
William Caxton, James Cook,
Charles Darwin,
Michael Faraday,
Alexander Fleming,
John Harrison,
Stephen Hawking,
Edward Jenner,
John Logie Baird,
James Clerk Maxwell,
Isaac Newton,
George Stephenson,
Marie Stopes,
Alan Turing,
Barnes Wallis,
James Watt, and
Frank Whittle.

Write 200 words on why you chose your numbers 1 and 20.

Send your rationale to Kate Buss at **cwbuss@aol.com**.

DIRAC CENTENARY

from the Bristol Evening Post

The Institute of Physics has produced six dramatic cartoon posters celebrating the birth of a softly-spoken Bristol physicist. The futuristic style of the pictures is actually rather appropriate for a man who foretold the future of science. Paul Dirac, who was born in Bristol 100 years ago predicted the stuff that propels star ships in science fiction movies and influences much modern technology, like computers. The Institute of Physics, is marking the centenary with six Japanese cartoon-style Posters. The images explore Dirac's life work and legacy using a punk female character and a Gotham City-style background designed to appeal to younger people. The posters explain how Dirac created the Dirac Equation when he combined relativity - the physics of objects travelling close to the speed of light - and quantum mechanics - the physics of the very small. From this equation he predicted antimatter and spin- two discoveries which produce amazing results today. Antimatter for example is used in hospitals to see inside patient's bodies by scanning and spin is used in computer video games and key hole surgery.

Dirac was awarded the Nobel Prize in 1933 and died in 1984. He also made the discoveries on which many electronic devices are based, such as mobile phones. But Shuk Kwan Liu, of the Institute of Physics, says that because Dirac was a quiet character, he has been overlooked. "Dirac was a recluse and therefore his genius has mostly gone unnoticed. The posters aim to make people as familiar with Dirac as with Newton. Rather than go for traditional posters with photos of physicists, we thought a modern cartoon style would attract the kids more."

The web site link for the posters including a download facility is:
http://education.iop.org/Schools/supteach/dirac.html

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Forthcoming Events

ASE ANNUAL MEETING
3-5 January 2003, University of Birmingham, UK.

Peter Ellis writes:
The ASE Annual Meeting is back in Birmingham this year and once again the BSHS is making a contribution. This time we are lucky to have two speakers from the Centre for the History of Medicine at the university. Their talks are as follows:

Friday 3rd. Jan. 11.30 a.m. Jonathan Reinarz,
Manufacturing Medics - medical education in Birmingham 1825 - 1900.

Sunday 5th Jan. 11.30 a.m. Robert Arnott,
DNA: Disease and the Ancient World - using DNA analysis to look at diseases of the past.

I am sure they will both be very interesting talks.

We will also be having an exhibition stand as usual. This year the exhibition marquees will be grouped around the clock tower at the centre of the campus. We will be using the new display stand purchased by the BSHS. It is a lot more stable and versatile than the previous set. I am hoping that we will also have some new artwork to attract the attention of passers-by. Help is always appreciated in manning the stand. If anyone can give some time over the three days of the conference then please contact me either by
e-mail - **PREllis18@aol.com**,
or by phone - 01235 772638,
or by writing to Brecon Cottage, 33 Newbury St., Wantage OX12 8DJ.

SEVENTH INTERNATIONAL HISTORY, PHILOSOPHY & SCIENCE TEACHING CONFERENCE
30 JULY – 3 AUGUST 2003, University of Winnipeg, Manitoba, Canada
Call For Papers

Proposal deadline: 1 April 2003

Paper proposals (500 words maximum) should be submitted by email, as an attached file (WP, MS Word, RTF, or TXT only), to the program chair, by 1 April 2003. Please name your submitted file with the surname of the first author. Early submission is encouraged.

Registration Forms and full details for paper submission and accommodation will be forwarded to those who inquire by mail, e-mail or via the websites.

e-mail: **stinner@cc.umanitoba.ca**
or web: ***www.ihpst.uwinnipeg.ca*** and ***www.ihpst.org***

Reviews

Tales of Blooming Science

While booking tickets for the Ballet at the Bristol Hippodrome recently I noticed a curious listing of Johnny Ball's 'Tales of Blooming Science' for one Wednesday in June, daytime only. I then noticed a passing reference to Science Year's sponsorship of Johnny Ball's touring show. When I consulted with my daughter's teacher (year 6) she said they had gone in the past to these shows but found them pitched at a younger audience. This year's offering firmly stated late key stage 2 and key stage 3 as the target audience so I took my 3 silver award science club members for an out of school afternoon treat. Arriving at the theatre we were presented with a goody bag containing plenty of A2 posters summarising the show and teachers notes backing up the script with a feedback questionnaire. Clearly Johnny Ball is bit of science communication zealot producing a new touring show every year for the last few years. This one told the stories of (26 in the teacher's notes or 18 on the student's poster) scientists from the past. They were loosely grouped into 5 themes *Pressure and Power*, *Electrical Power* and *19th Century Movers and Shakers*, then after the interval *The Science of Life* and *The Power of the Atom*. Apart from Marie Curie the only woman represented is Rosie (I understood that she preferred to be known as Rosalind) Franklin.

As a pay back for an afternoon out of school the children had to write a review so I reproduce these below:

Emma Kingston aged 11 writes:

> This two hour musical performance explains how people's discoveries make such a difference to our world of science. The scientists who make these discoveries are not always geniuses but ordinary people like you and me, who have set themselves a task that they want to complete. The show includes people like John Dalton, Michael Faraday, Marie Curie, Sir Isaac Newton and Charles Darwin.
>
> I enjoyed this performance because of the way it was shown, using jokes and fun ways to understand what they were explaining. It was relaxing and good fun.
>
> My favourite part was the scene which showed what happened to President Garfield who had been shot, Alexander Graham Bell had invented a metal detector which was used to find the bullet, but it also detected all the bed springs underneath him as well.
>
> Fact: Did you know that giraffes have the same number of bones in their necks as us?

Francesca Buss aged 11 writes:

> Some *Did you know?* s that I picked up from watching Tales of Blooming Science.
>
> *Did you know?* The story of Newton having the apple hit him on the head may not be true but his friend told him about it and it got him thinking.
>
> *Did you know?* If there was a tub of water the size of five people if it was evaporated the gas would fill the whole theatre. Wow!
>
> *Did you know?* There is no hydrogen in the air because it's too light.
>
> *Did you know?* People did not like what Darwin said and found out, like men once were like apes and that the world was older than the Bible stated.
>
> *Did you know?* A giraffe has the same number of bones in its spinal column as us humans.
>
> *Did you know?* The first message by telephone, "Come here, Mr Watson, I need you." was made by mistake because Alexander Graham Bell had spilt acid on his trousers when he

was working on the telephone and the receiver was where Mr Watson was working and he heard it through the telephone.
Did you know? Bell also made a type of metal detector which nearly saved President Garfield because he had a bullet in his chest and they were trying to find it but they detected the bed springs as well.

It was a brave attempt to cover a vast range with only three actors and some slightly amateurish props which when they didn't quite work was covered up well (as my daughter noted). I was impressed with the energy that the 3 actors put in to this musical / pantomime which went well despite a few wobbly moments when the pace slackened. They used tried and tested techniques to keep the audience with them, from awful puns to inviting children up on stage to help with experiments to throwing sweets into the audience. It didn't help that the huge auditorium(the Hippodrome seats over 2000) was almost empty with only about 200 there. Touring shows have to fit onto their smallest stage but need to expand to cover this, the largest. It was a shame more children hadn't come, the ticket price of £5 seemed reasonable but the tail end of the year and no clear links to the National Curriculum probably meant hard pressed teachers couldn't justify the trip.

I wondered how today's youth used to the extremely polished graphics of computer games and zappy television shows would react. There is no doubting Mr Ball's enthusiasm for engendering a love of science. Perhaps I'm getting jaded but I felt his approach was rather old fashioned, perhaps his daughter Zoe could advise him on making it cooler. That said the children I spoke to enjoyed the show and professed to have got a lot out of it. If nothing else the names of historical scientists including Otto Von Guericke from Magdeburg (said rhythmically in a cod German accent) should now be familiar to more people. And yes, I did think they had pitched it about right for the age group - no mean feat in itself.

The posters have plenty of text, largely brief 'facts' some of which purists might dispute, such as 'Brunel built 3 ships.' The illustrations include several from the show recalling it to mind, including Mendel's pea flowers, so why not use flowers that at least look like peas not daisies? The teachers notes deliberately make no mention of National Curriculum requirements and would consequently not be much used. However, there are some ideas for demonstrations but not really enough detail or background to form the basis of a lesson plan. The notes might provide a different angle, e.g. Von Guericke and Dalton's ideas, when already covering a topic like the Atmosphere. Johnny Ball's approach to scientists in history is to latch on to any idiosyncrasy as a way into explaining their contribution, thus we learn of Dalton's colour blindness and that Voltaire put about the story of the apple falling on Newton's head. Included are some of the song lyrics, but not those of the best action song involving Watt's sun and planet gear, I'd have liked to try that one out at home!

More information from ***www.johnnyball.co.uk***

Reviewed below are some books from the Hodder series *Super Scientists* and *Scientists who made History*. We hope to carry further reviews in future issues. My 11 year old daughter did indeed curl up and read one *Super Scientist* and echoed Martin's comments on the attractive layout of *Scientists who made History*.

Super Scientists
Reviewed by Martin Monk
Words along Wires: the story of Alexander Graham Bell.
Text by Peter Hepplewhite, illustrated by Alison Still. Hodder Children's Books. 2001. ISBN 0-7502-3633-7 46 pages with glossary. £4-99. .

Pictures Through the Air: the story of John Logie Baird.
Text by Anthony Masters, illustrated by Linda Clark. Hodder Children's Books. 2001. ISBN 0-7502-3635-3 46 pages with glossary. £4-99.

The Comet of Doom: The story of Halley's Comet.
Text by Andrew Donkin, illustrated by Gillian Hunt. Macdonald Young Books. 1998 ISBN 0-7500-2533-6. 47 pages with glossary. £4-50.

As far as I could see there is no indication of the target readership for these books. But a cursory glance tells you they could be targeted on years 5 to 9. Because this range of readership runs across the Key Stage 2/3 divide the publishers are quite right to be less directive than the National Strategy for Science (reviewer rolls his eyes in apoplexy). The give-away is that every page carries an illustration as well as text. So 9 to 13 year olds are encouraged to make these books ones that they select to read by virtue of the copious illustrations. The drawings are a mixture of black and white and colour.

What about the Super Scientists? Well they are stories for British readers of some of the British heroes of science and technology. I am not at all sure that the story of John Logie Baird would elicit the same recognition for children in California, South Africa or Papua New Guinea. I would agree with the series title in that Halley was a super scientist. But I can't place Bell and Baird in this category and would rather term them technologists. Bell was successful and entrepreneurial. Baird is presented as a romantic failure. The inclusion of Baird in Hodder's pantheon of Super Scientists is interesting because it does show that you do not have to be a financial (or even technical) success to contribute to the advance of your field.

The story telling strategy employed in each book is to have a younger contemporary of our Super Scientist relate the story. The Bell story is told by Harriet, a fourteen year old pupil/patient who had became deaf through scarlet fever. (Echoes now in the MMR discussion.) The Baird story is told by fourteen year old Alex, Baird's apprentice. The Halley story has Rob, a ten year old who 'liked to think of himself as Halley's assistant'. At first, this strategy struck me as being useful for making the scientist/technolgist appear human and approachable. But then I wondered if slightly older readers (say fourteen year olds) might see through it and find it patronising ?

Where the three authors may not have wished to be patronising, they did allow themselves the bittersweet indulgence of pathos and moralising. At the end of the Bell story Harriet regrets that as she is deaf she could never use the telephone, the one thing that made her

teacher a Super Scientist. At the end of the Baird story Alex does not have the money, promised to him by Baird, to pay for his studies at university. The unvoiced moral is that the University of Life is a far better place to learn. Book learning can not supplant inventiveness and personal courage. The Halley story is only a small part of the story of the comet. The last pages of the book project us forwards to 2061 when Edward, "...not the smartest kid in his school, or even the most hardworking, but he was perhaps the luckiest," is on a school trip to an orbiting space station to view Halley's comet. Edward pushes his way forwards to the front of the crowd. "The boy gazed up at the beautiful silver visitor and somehow found it hard to look away." ....THE END... not a dry eye in the house. I read this as, 'go forth and do likewise. Make the study of nature your passion so that you too find it "hard to look away".' I was moved to a lump in my throat by these story telling strategies. And, at the same time, in seeing how my emotions were being manipulated, I was slightly alarmed. I puzzled over whether the authors could be so deliberately knowing in their craft?

In the case of Bell and Baird, where there are biographical details these are presented as one page listings of dates and events from birth to death. In the case of Halley's comet, the two page timeline for the comet runs from 240 BC to 2061, when the comet is next due to return. Each of the stories in these three books either takes us to, or gives us hearsay of, developments and key events. None of the stories are strictly biographies as events are related through the eyes of our young guide. This also personalises the story and adds more opportunities for pathos and moral lessons. Harriet (our young guide, now an old lady) comments how, in her husband, she found someone who was kind and, "just like Eliza Bell (Alexander's mother) my deafness wasn't important to him." In a similar way we learn that Alex (Baird's assistant) "failed his medical when he'd been called up for the army, just as Baird had before him."

The Halley's comet story is somewhat different. (Andrew Donkin's book was published before Hodder took over Macdonald Young.) Andrew gives us other things to mull over. Rob - our guide - is younger than Harriet or Alex. Times are more precarious, people are more superstitious. On the 19th of September 1682 at 11:38 p.m. we eavesdrop on Rob and his much older friend Edmund Halley. There is something of Cinema Paradiso in the scene.

> "I was telling my dad about the comet being no danger and that," said the boy.
> "What did he say?" asked Halley.
> "He just gave me a thick ear and told me to get supper ready."
> Halley adjusted the telescope as he had a dozen times already that night, making sure the comet was central to the viewer. Without needing to be asked Rob handed him a pencil and the astronomical chart.

How economical can an author get? In a few lines, without being explicitly taught, we have learnt something about: class differences; superstition and science; technique and equipment; recording observations; antisocial night time working conditions; collaboration; master and disciple relationships. Wow.

Of course the learning is subliminal and indeterminate. To turn it into something more substantial we have to talk about what it is we understood from the encounter. And this brings me to the question of how a science or history teacher might use these texts. What can one do with such texts? The texts themselves offer no suggestions. There are no tips for teachers. One assumes the series editor(s) saw youngsters quietly curling up with a good

read rather than visualising a school room with 30 or so mobile pupils. The first requires schools to stock their library. The second requires materials to be distributed around the room: class sets.

At nearly £5 a book, class sets would be a bit pricey when one considers that each story is about just one Super Scientist. £5 for a Super Scientist reader with half a dozen contrasting Supers would be more palatable. I mean pocketable. With a class set we could all read the same text, all paw over the same picture, all have an opportunity to add a voice to the class discussion. Okay, one could do this with photocopies but the publishers wouldn't like it.

Assuming that we have broken the law, what then? Well I would do whole class reading, for about 10 minutes only, at the end of a double period across several weeks on a topic that was linked to the Super Scientist's work. I would do the usual around-the-room reading, stop, look at the pictures and discuss what we understood about:

- the incident itself;
- the characters in the story;
- their motivations and circumstances
- the life of scientists in general;
- science as an activity;
- etc.

I would try to make it an end of a double period treat. I think the treat is in it not being science but rather about science. Or rather, in not being about science but in being about scientists. Or yet again, in not being about scientists but in being about people like you and me.

Scientists Who Made History Series
Albert Einstein.
Saviour Pirotta. Produced for Hodder Wayland by Whit-Thomson Publishing. 2001 ISBN 0-7502-3887-9. 48 pages including index. £5.99.

Unlike the other three books reviewed above, this is intended for a Key stage 3/4 reader. Although there is nothing to indicate that on the text. So how do I know? Well it is the old business of layout and design, text and illustration. There is far more text than in the other three books. The illustrations stand apart from the text but complement it by carrying their own contribution in terms of information. The layout and design does not present one continuous narrative but rather a more complex pattern of interrelated items. The illustrations rely quite heavily on photographs rather than line diagrams or water coloured sketches. The life, and the science, presented here is done so in an altogether more complex way. As well as a two page time line there are a glossary, index and suggestions for where to find further information - some books, some web sites.

The emphasis of the major part of the text (12 double page spreads) is on the life Albert Einstein, the circumstances of his life, the social and political events. But if one thinks about it, Einstein himself probably spent more of his life not working on puzzles from the natural world but doing other things: like reading, travelling, writing for political causes. It is easy to slip into the notion that because someone produces one startling idea, they must have been working on that ALL their waking hours. Obviously this can not be true.

Somewhat less of the book is devoted to Einstein's contribution to science (8 double page spreads). Einstein's handling of an explanation of Brownian motion, the photoelectric effect (for which he was awarded the 1921 Nobel prize) and his theories of special and general relativity are covered. However, one quibble I also have with virtually every other popular book on general relativity. I am never happy with the type of diagram on page 27 which purports to show general relativity at work. The diagram is of a grid of lines on a depressed rubber sheet. I am convinced it is misleading. The grid of lines harks back to the old field explanation for gravity. Einstein's genius was in breaking with this field view. His radical departure was to treat space and time as a continuum. For this one needs different diagrams (Minkowski type diagrams) to express different relationships. The text does start and end with double page spreads on science. At the opening we have science in the nineteenth century and revolutions in science. At the end we have the legacy of Einstein with photographs of the mushroom cloud of a nuclear explosion, the top of a nuclear pile in a power station and a laser beam.

Now, the $64,000 question: how could one use this in teaching science at KS3/4? mmmmm! Can I ask a friend ? (to mix my quiz shows).

The natural phenomena that Einstein was able to describe and explain are not part of Science in the National Curriculum at KS3/4. So my usual approach of starting with the phenomenon will not work here. Unless, unless one starts with the general problems of motion and the nature of light. Pupils will have heard of Einstein as he is so much a cultural icon, that it is possible to treat Einstein's work as an extension to the study of either motion, gravity or light. But even with this as a starting point, there remains the question: what will the pupils do? Will they just read the text, or answer some form of comprehension exercise (which their teacher still has to construct); write a newspaper article/obituary; pretend to be Hans Albert (Einstein's first son) and write a letter to a friend; or photocopy bits to make an A3 collage of 'Einstein the Man'; write a script for a radio play, or what? Did Saviour Pirotta and Hodder Children's Books think about the use of the text as a teaching resource. Or did they think adolescents would just curl up in a corner and read it?

Who's Who in Science and Technology: a guide to famous scientists.
Text and Drawings by Bob Fowke, Hodder Children's Books. 2000 ISBN 0-340-75293-9 256 pages including index. £5.99

Guess who's picture is on the front cover? No it is not Lise Meitner, or Mary Sommerville, or even Jocelyn Bell Burnell - who all have entries in this directory. Yes, it is the archetype himself, Einstein. Einstein the elderly, twinkly eyed, with a moustache that probably carried half his breakfast and that shock of white hair that hadn't seen a barber for at least six months. Is it any wonder that children see scientists as mad old men?

Although this is an interesting book to dip into and suitable for KS3/4 pupils I am reminded of Oscar Wilde's quip on being proudly shown the Niagara falls by his north American hosts. Dear Oscar is reported to have enquired, 'Is that all it does?'

Resources

THE ROYAL SOCIETY OF CHEMISTRY LIBRARY AND INFORMATION CENTRE

The RSC Library and Information Centre (LIC) is the largest information resource in the UK specifically devoted to chemistry and related areas. It developed from the library of the Chemical Society, founded in 1841, and is located at the Society in Burlington House, Piccadilly, London. The LIC is open from 9.30am to 5.30pm, Monday to Friday, to RSC members and LIC Corporate Members. Non-members are welcome to visit us but may be liable for a day charge.

The LIC contains :
-2,000 periodical titles (630 current)
-25,000 volumes of text and reference books
-a special historical books and images collection
-CD-ROM services
-Electronic journals

The LIC provides:
-the Chemical Enquiry Help desk
-Document Discovery and Delivery service
-flexible user options
-facilities for visiting researchers
-helpful and experienced staff

For researchers visiting Burlington House, the LIC offers the chance to access the web, RSC electronic journals, and an expanding collection of CD-ROM's at dedicated workstations. Staff are on hand to give assistance if you are unfamiliar with this technology, and a brief guide to important chemistry resources on the Internet has been produced to help you "surf the net".

LIC Historical Chemistry Collection

The LIC houses an impressive collection of historical books and images, which is viewable on appointment. There are approximately 8,000 prints, portraits, photographs in books, and slides, which are currently used by speakers, authors and publishers of printed and multimedia works. Over 2,000 of these images can be viewed via the LIC catalogue on the web. In addition, there are some 3,000 historical chemistry books from the 13th to 19th centuries, including 41 books by Boyle, 14 by Faraday and 7 by Dalton. A full biographical and historical chemistry information service is available to assist in research and documentation. A short annotated guide to some of the sources of information on this subject is available on request.

Royal Society of Chemistry,
Burlington House, Piccadilly, London W1J 0BA
Tel. 0207 437 8656
Fax. 0207 287 9798
e-mail. **Library@rsc.org** web site. ***www.rsc.org/library***

THE WILLIAM HERSCHEL MUSEUM

19, New King Street, Bath, is a fully restored Georgian town house and garden. It captures the unique atmosphere of everyday life for an 18th century middle class family. It was also the home of the German born brother and sister William and Caroline Herschel. They earned a living as musicians and earned their place in history as astronomers. It now features the Star Vault, a DVD presentation taking you on an incredible voyage of discovery through the universe. It brings the history of the house to life telling the story of the Herschels, of William's discovery of the planet Uranus and his tireless work on his telescopes. It shows how Caroline strove to combine keeping house with her own passion for astronomy. A variety of 2 hour workshops are offered for pre-school through to key stage 2.

Contact Debbie James
Tel. 01225 446865
www.bath-preservation-trust.org.uk

THE MUSIC OF THE SPHERES

Following its mention in the last issue, Colin Axon points out that a more up to date page with more information on the Music of the Spheres is at:
http://www.bath.ac.uk/~cescja/Play/Play.htm
e-mail: **C.J.Axon@bath.ac.uk**

SCIENCE AND EDUCATION

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Robert N. Carson
The Epic Narrative of Intellectual Culture as a Framework for Curricular Coherence

Maria I. Cotignola, Cleclia Bordogna, Graciela Punte & Osvaldo M. Cappannini *Learning Difficulties of Thermodynamic Concepts:*
Are They Linked to the Historical Development of the Field?

e-mail: **m.matthews@unsw.edu.au**