The newsletter for the Education Section of the BSHS

No 39

Education Forum

February 2003

Edited by Kate Buss

Grant House, North Road, Leigh Woods, Bristol, BS8 3PN
Tel: 0117-973 -1971 e-mail: **cwbuss@aol.com**

Contents

Editorial

Martin Monk

Our editor, Kate Buss, is indisposed and has asked me, as compositor, to finish the task for this issue. I think I speak for us all in wishing Kate a speedy recovery. We value her patience in collecting together our thoughts and making sense of them for the general readership. Get well soon Kate.

In the following pages you will find two reviews of books about the life and work of Rosalind Franklin. This year marks the 50th anniversary of the publication of the structure of DNA by Crick and Watson. A second 'theme' of this issue of Education Forum is a call for the use of local examples of the history of science. This is written about in the notes from Carlos Sierra and the resource, "New Zealand is Different".

Kate is always pleased to receive items for Forum by mail or e-mail.
The dead line for the next issue is 6 May 2003.
cwbuss@aol.com

Viewpoints

Textbook errors in the history of science

By James Williams

Finding an error in a textbook can result in a number of feelings. Annoyance if that error is unwittingly transmitted to students and pupils because you failed to notice it. Euphoria and a little gloating if you are the first to spot it and report it to the publishers and the worst of all feelings, abject horror if you are the author of the textbook.

It comes as no surprise that errors do creep into textbooks as 100% accuracy is striven for but rarely achieved. In the case of science, facts, formulae, definitions, concepts etc can be checked. There are some 'classic' errors such as the commonly held misconception that the liver is the main source of heat in the human body, which resulted from a simple textbook error many years ago. In the case of interpretation, e.g. of historical events, we may accept that there are alternative interpretations of events. In the history of science there are still 'facts' that can be checked, yet many authors fail to do this. As a textbook author I am more than aware of the pressure to 'get it right' knowing that anything I write will be transmitted to thousands of pupils year after year. But it did surprise me to find errors in science textbooks that seemingly went unchallenged. The errors were not about the 'facts' of science they invariable came from those pages dealing with the history of science.

What saddened me most was the way that these errors were perpetuated in different texts and editions of texts and why they had not been picked up in the long, intense and detailed process of writing, proof reading and correction that goes on. Some of the errors noted in this article are glaring and a simple case of poor research, others are surprising, given that the person's involved are so well known to the general public.

Having surveyed a number of key and popular GCSE texts for a forthcoming article on the portrayals of scientists in GCSE textbooks for the Association for Science Education's journal School Science Review (Williams, 2003), a number of errors were found. Questions are raised as to the suitability of these texts for engaging teachers and pupils in the 'Ideas and Evidence' section of the science National Curriculum. The following examples are taken from popular GCSE science textbooks, used by thousands of pupils and teachers.

The use of historical figures in science in GCSE textbooks is invariably not presented with any specific approach in mind. In one series, *Key Science*, an attempt has been made to address the history of science by using the device "Who's behind the science?". In this instance either very brief biographical details are noted or, in place of biographical detail, the person's contribution to the idea, concept or discovery is given. For example page 165 of *Key Science: Chemistry* (Ramsden, 1994) provides a brief paragraph describing the discovery of Oxygen by Joseph Priestley on 1st August 1786. There is neither mention here of Lavoisier and his work, nor of George Stahl's theory of phlogiston. Add to this that other standard historical accounts of Priestley's work describe his production of oxygen from the heating of mercuric oxide in 1774 and Lavoisier's use of the ideas of Priestley in the late 1770s and a far more complex picture than the one described emerges.

On page 51 of *Key Science: Chemistry*, there is a quote from John Dalton "*Matter is composed of atoms*" that is dated as 1808. In *Chemistry for You* (Ryan, 1996) the same event is described and dated as *'around 1805'* (p14). These small discrepancies indicate that problems are being created in the way we approach the history of science with scant regard for the facts produced and readily available from historians and historians of science. Other problems are also evident from the survey, such as the different, yet distinct, spellings of the name of Dmitry Ivanovich Mendeleeff, variously spelled as Dimitri Mendeleev and Dmitry Mendeleev. His name is also commonly seen with a 'y' between the second and third 'e' in the surname. It is recognised that some name spellings will change as foreign names using alphabets distinct from our own are translated into an anglicised form. This effect either needs a brief explanation of why variations in spelling occur or point to the need for a common reference to avoid problems that will inevitably occur as pupils try to research from several books or sources information about such scientists.

Other, more worrying issues also arise, such as incorrect accounts of events, Aplin (1994) states in *Biology for You* that *"(Charles Darwin and Alfred Russel Wallace) recognised (each) other's contribution and acted generously over the matter. They agreed to the joint publication of their ideas"* (p388). In fact Wallace was not aware of the events unfolding in London after the delivery of his essay to Darwin as he was in the Malay Archipelago. He learned of the events surrounding the joint publication at a later date. Neither Wallace nor Darwin 'agreed' on a joint publication. The survey highlights some worrying tends in the treatments of the history of science and the portrayal of scientists in our commonly used textbooks.

Events seem to have suffered from constant and frequent re-telling which lead to slightly altered accounts that, over time, become further removed from fact. In an effort to simplify or reduce text, events, ideas and profiles of scientists sometimes bear little relation to actual happenings. Little information about the context within which a discovery or concept was

made or developed is given and few textbooks give information about the development of the ideas over time.

Perhaps some problems arise from the fact that 'well known' stories and scientists are used to illustrate major events and concepts. Perhaps the fact that they are 'well known' has clouded the judgement of the author who feels so comfortable with their knowledge and understanding of the persons and events that they fail to make even a rudimentary check of the facts.

In conducting the survey of GCSE textbooks some simple conclusions can be reached.

- Key stage 4 physics has a larger volume of unexplained names in the history of science than biology and chemistry.
- The history of science is often included as a non-essential 'add on' and serves little purpose in developing ideas and / or concepts.
- The figures mentioned and elaborated upon are mostly those that have traditionally been used e.g. Newton, Einstein, Darwin, Mendeleeff etc.
- There is little or no attention paid to the context within which the science was developed.
- Few accounts of the lives of scientists are given or how they worked.
- Some information is factually incorrect.

Textbook authors have a duty to ensure accuracy, not just of the 'facts' of science but also to the history of science. If a textbook was published that boldly claimed that chlorine was a safe, unreactive gas or that heavier things fall faster than lighter things, even in a vacuum ,teachers would be up in arms and would rightly boycott the text in question. Yet claims in some textbooks that Alfred Russel Wallace was a forester who agreed publication of the theory of Evolution with Darwin and that they jointly 'presented' their ideas to the Linnean Society in person seem to go unchallenged with little fuss. In fact even when the mistakes are pointed out to some publishers one rarely gets an acknowledgement or a promise that corrections will be made in the next impression / edition.

References

Aplin, D. (1994) *Key Science: Biology* (Stanley Thornes (Publishers) Ltd)
Ramsden, E. (1994) *Key Science: Chemistry* (Stanley Thornes (Publishers) Ltd)
Ryan, L. (1996) *Chemistry for You* (Stanley Thornes (Publishers) Ltd)
Williams, J.D. (2003) Ideas and Evidence in Science: The Portrayal of Scientists in Key Stage Four Textbooks *(School Science Review, in press)*

James Williams is a Lecturer in Science Education at Brunel University
and a co-author of the successful KS3 Hodder Science series of textbooks.
He would be pleased to hear from others of any errors encountered in any textbooks.

James.Williams@brunel.ac.uk

The history of science in science classes: elusive simplicity

Patrick Gavin

The topic of the Earth's magnetic field offers us an opportunity at GCSE, and in more detail at A' level, to cover important and familiar material in an historical context whilst at the same time involving several aspects of physics in the discussion.

Gilbert (1544 -1603)physician to Elizabeth I and to James I, proposed that the Earth's magnetic field might be due to a magnet inside the Earth. He showed that the shape of the field corresponded to the shape of the field of a magnetised iron ball. There are good reasons to support this model. Iron is an abundant element and fairly dense (7,900 kgm^{-3}. ^{56}Fe is the most stable isotope of all.). The average density of the Earth is 5,500 kgm^{-3}; the density of the crust is roughly 2,500 kgm^{-3} (rocks in the form of silicates). It is likely that in earlier geological times the heavier elements would sink towards the centre (The loss of potential energy produces heat.) Thus we want iron, or nickel or cobalt at the centre, and it seems to be there. The requirements for the model appear to be satisfied.

However, the inside of the Earth is very hot and the Curie temperature (this is monsieur Curie) of iron is 770C. Could there be a cold centre? Hardly. Could the Curie temperature be raised at very high pressures? not significantly. Thus the model, plausible as it seemed at first, cannot be correct.

By 1950 it was realised (Elsasser and Bullard) that electric currents, the other source of magnetic fields, must somehow be responsible for the Earth's field. In this model the electric current, or flow of charge, is maintained by a 'self-exciting dynamo', which once started keeps going. The energy source must be the heat of the Earth, which is bolstered by the decay of radioactive isotopes (e.g. ^{238}U, ^{40}K). The simplest mode would have a current travelling in a circle in the equatorial plane, but the actual situation appears to be much more intricate.

The magnetic fields of the Sun and the planets are now attributed to moving charges. The Moon has no magnetic field. The field reversals which are known to have taken place on Earth are more easily accommodated to the electric current model.

The Earth's field varies slightly during the day due to the effect of the ionosphere, which constitutes a charge moving relative to the Earth's surface.

The ordnance Survey map for Lancashire gives magnetic north as $4^{0}00$' in July 2000, moving East at 12' per year (which is, in geological time, fast). The field is also getting weaker.

Patjgavin@hotmail.com

Post-modernism as an epistemological obstacle in the teaching of the history of science: the Latin-American case

Carlos Eduardo Sierra

The Sokal affair (where a bogus article was submitted to a journal of social studies and accepted for publication) is one skirmish in recent crossfire between the natural sciences and social studies. A question follows, “What are the consequences of the Sokal affair for teaching the history of science?” more particularly, teaching the history of science in the Hispanic countries? That this question has not received attention in those countries is perhaps a reflection of unscientific features in the Hisapanic culture. Furthermore, such neglect puts into question the quality of current educational reforms in the Hispanic countries, since the careful teaching of the history of science increases comprehension of scientific concepts by putting them in context.

In Latin America current reforms of science and engineering curricula are driven by the need for economic competitiveness in the world’s markets. Sadly, this situation encourages disdain for concepts of humanness in human development to be found in fields like anthropology, sociology and, of course, history. According to Pedro Laín Entralgo we see a dehumanization of technique. But, technical development implies an historical dimension that necessarily has a human component.

Sokal set out to challenge what he saw as the woolyness of social studies, found particularly in post-modernism. The Sokal affair brings to the fore the potentially harmful effects of post-modernism, all the more so in the case of the Third World where there is a general ignorance of the Enlightenment and its legacy. Edison Otero, the Chilean social scientist, in his analyses of intellectual life in Latin-America, points to the arbitrary underrating of science - and of reason and rationality. We can understand science as knowledge of the world, which is obtained with a scientific method. In Latin America there is an epistemological chasm with respect to the history of science and technology. So, the problem is how to teach the history of science in an unscientific climate. Amongst students, one wants to promote scientific comprehension so as to privilege the thinking processes that make scientific knowledge rather than allowing learners to just be the consumers of the results of scientific study outside their historical contexts.

Latin American pragmatism has led to a foolish devaluation of the work of teaching and the study of the history of science has slipped into, at best, a dilettante activity lacking in creativeness. An awareness of the political dimension has all but vanished. Add to this the ominous influence of post-modernism in the Latin-American academy. We can find such concerns in the work of Colombian intellectuals such as Fernando González and Estanislao Zuleta.

Even though the current problem admits no quick and easy solution there is a guiding principle. Teachers should be promoting scientific thinking by means of teaching the processes that make knowledge together with a corresponding vision of a rational world.

The promotion of such thinking is the natural antidote for the nonsense of the post-modernist ideas, nonsense from the viewpoint of intellectual rigorousness.

Possible starting points can be activities such as: Seminars on critical thinking; use of a theatrical format for the teaching of the history of science and technology; and erudite research on the political role of the history of science for the Latin-American societies.

In the Latin-American context, two local examples of scientific work can be used. One is that of Francisco José de Caldas with his scientific work on the variation of boiling point with altitude in New Granada. A second is the work of Juan Antonio de Mendoza y González, a scientist from New Spain, who worked on thermal and hydraulic engines. The work of these two local scientists can be put into context part of which would be historical. To do this well one needs pedagogic skills. Two archetypes in this respect are Norberto Bobbio and Carl Schorske who have proven fascinating educational styles. They developed these through the overlap of their research with teaching their undergraduate courses.

Effective teaching of the history of science and technology requires a serious intellectual commitment. One should not retreat from the Modern project with its scientific vision of the world. One should be cautious in handling the illusory appearance of post-modernism, whose precarious intellectual rigorousness has its source in a distortion of the original Marxian principles. One only has to re-consider the well-known Lysenko affair to find an excellent example of the unfortunate effects of a slackning in the criteria on intellectual rigorousness. The nonsense put about in the "theory of two sciences" (*bourgeois science* versus *proletarian science*) pre-dates in essence the postmodernist distinction between *great science* and *alternate,* or *democratic, science.* In Latin-American, such misconceptions have a fatal attraction and they infest academic life.

Such a natural affinity is made worse by the undesirable bureaucratization of academic life within the Latin-American university. This has generated a distorted perception of science, its methods, and its philosophy among students and the citizenry. Scientific practice in some universities tends to evoke what amounts to what Richard Feynman termed a"*cargo cult science"*. Such activity imitates the scientific method in its form, but not in its essence. Therefore, it is necessary that the teaching of the history of science and technology in universities should privilege the acquisition of critical and skeptical thinking, cornerstones of the scientific vision of the world.

To change the perception of the world of an unscientific citizenry is a huge task. And the corresponding solution will require a lot of years, since it is a question of educating not only university minorities but also the general public. The fact of the matter is that quite the opposite is to be found in the propagation of postmodern ideas. This is the most valuable lesson that the Sokal affair teaches us us.

Carlos Eduardo Sierra
Processes and Energy School
National University of Colombia

News

NEW BSHS WEB SITE AND WEB PAGES
Education Forum is now available at the new BSHS web site.
For the BSHS web pages go to: **www.bshs.org.uk**

For the Education section web pages go to: **www.bshs.org.uk/educ/index.html**

and for Education Forum go to: **www.bshs.org.uk/educ/ef_oct2002.pdf**

THE IVAN SLADE PRIZE, 2003
This prize is awarded by the BSHS biennially for an essay (published or unpublished) making the best critical contribution to the history of science.

General Rules
Entries will typically be scholarly work that critically engages a prevalent interpretation of a historical episode, scientific innovation or scientific controversy. They should not exceed10,000 words in length and should be accompanied by an abstract of 500 words. There is no age limit and entry is in no way limited to British nationals. Entries should be in English, and should have been published or written in the two years prior to the closing date.

The Prize may be awarded to the writer of one outstanding essay, or may be divided between two or more entrants. Any winning essay(s) not yet placed with a publisher will be considered for publication in the British Journal for the History of Science at the discretion of the Editor.

Essays should not bear any reference to the author, either by name or department. Submissions by email will not be accepted.

Queries should be directed to
the BSHS Secretary, Dr Sally Horrocks,
Department of Economic and Social History,
University of Leicester, Leicester, LE1 7RH.

Tel: + 44 116 252 5070, Fax: +44 116 252 5081.

Enquiries by email are welcome.

BLUE PETER BOOK AWARDS
Lucy Lethbridge's 2001 account of the life of Ada Lovelace written in, "Ada Lovelace: the computer wizard of Victorian England" (£3.99 ISBN190409502X) has been chosen for a Blue Peter Book Award.

Forthcoming events

BSHS CONFERENCE
THUR. 17TH TO SAT 19TH JULY 2003, St. John's College, York, UK.

This meeting marks the resumption of the Society's Annual Conference to which all are cordially invited. Papers are invited in all areas of the history of science, technology and medicine. Suggestions for themed sessions are particularly welcome. Postgraduates are especially encouraged to put papers forward for a postgraduate workshop. BSHS subsidies are available for all registered students. The meeting will also include the President's Address and EGM.

Abstracts of papers (max 250 words) should be sent before 1 December 2002 to Dr Geoff Bunn, BSHS Programme Secretary, Department of Psychology, Liverpool Hope University College, Hope Park, Liverpool, L16 9JD, or
gbunn@onetel.net.uk.

Registration details will be published with the Society's Newsletter in February or available after 1 January 03 at
www.bshs.org.uk/york2003/
or from BSHS Executive Secretary, 31 High Street, Stanford in the Vale, Faringdon, Oxon, SN7 8LH.

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**

50 YEARS OF DNA

To celebrate the discovery of the structure of DNA 50 years ago, several hundred events will be organised this year by a large number of participating organisations, both in the UK and overseas. The programme of events is being co-ordinated by the Medical Research Council which has a dedicated website at **www.DNA50.org.uk**

As part of a national schools initiative, the Medical Research Council (MRC) and the Royal Society have joined forces to devise and implement a schools programme in 2003. They intend to hold science forum events at 11 locations throughout the UK, hopefully linked with the regional ECSITE science and discovery centres. Students aged between 12 and 14 years will be invited to participate in a 'dialogue style' day of discussions, considering real life genetic-related dilemmas with practising scientists, bioethicists and philosophers.

In addition, the MRC will be working in close collaboration with BBCi generating a nationwide web-based debate, attracting the views of young people across the UK and from further afield. Apart from courting enthusiasm and debate, the aim is to draw the attention of policy makers to the views expressed by young people in these meetings. The regional events will culminate in a National Forum in London, where some of the participants and some of the views will be brought together from across the nation. The numerous participating organisations include At-Bristol which will run a special series of workshops for schools and the public. They will also hold teacher training events on gene technology (in association with Biorad and the Institute of Biology).

The Biotechnology and Biological Sciences Research Council (BBSRC) is developing a roving exhibition called DNA in your Garden with Kew Gardens. They hope to make use of venues and exhibitions around the country including Chelsea Flower Show, Eden, Kew Gardens and the Royal Show. The exhibition will focus on plant DNA, drawing on much of the research BBSRC funds but also on people's experiences of gardening.

The British Association for the Advancement for Science has plans for an event at The Eagle pub in Cambridge where Watson and Crick discussed their work. GlaxoSmithKline has commissioned a Giant Cell. It is an inflatable, interactive exhibit that will tour the country and which will be will be kite-marked as part of the DNA Anniversary celebrations during 2003.

To find out what is going on in your area consult the MRC website at **www.DNA50.org.uk**

ASE AREA CONFERENCES

Berks, Oxon and Bucks: 29 March
Edgehill College, Ormskirk : 27 – 28 June
University of Surrey: 4 July
Homerton College, Cambridge: 11 October
All organised by Alan Rhodes, tel: 01442 – 401924.

Reviews

Scientists Who Made History Series

"Rosalind Franklin"
by Cath Senker. Hodder Wayland 2002, 48 pages. £11.99. ISBN 0750240059.

"Dian Fossey"
by Liz Gogerly. Hodder Wayland 2002, 48 pages. £11.99. ISBN 0750240075.
Both reviewed by Peter Ellis

Both these books are part of Hodder Wayland's series "Scientists who made history." They are intended for the top end of Key Stage 2 and Key Stage 3. However the content, design and language make them suitable for Key Stage 4 pupils as well.

The series has adopted a double page spread style. Each spread covers a stage or incident in the subject's life. The books are highly illustrated with photos and diagrams. Most of the pictures contribute to the story or its background and are not simply there to make the page look pretty. As well as the main text there are boxes which add an explanatory note about the science. There are also boxes called "In their own words". These are short pieces from interviews with the main character or people who knew them or quotations from biographies or other publications. They make the books useful as a primary source and not just as a watered down biography.

The main text has digressions which provide background to the times in which the subject lives. For example, one spread in the Franklin book describes the life of women in the 1920s, when she was a child. The books do not end with the death of their subject. In both cases there is a final spread looking at the legacy of the subject's work. In addition there is a useful timeline, a glossary and index.

The two books reviewed do the valuable job of bringing women scientists into school lessons. At present there are twelve books in the series but Marie Curie is the only other woman covered.

Rosalind Franklin makes a good effort to overcome the poor image Franklin had from Watson's The Double Helix and the years of neglect from her colleagues. She is presented as a hard working, intelligent and serious scientist, but nevertheless someone who, given the chance, loved a good discussion, enjoyed parties and relished travel. She is not the dull plodder Watson represented her as. The publicity Franklin has received in recent years and in particular with the publication of Brenda Maddox's new biography will have dispelled the old incorrect impressions. Franklin is at last given her rightful position as a notable scientist who unfortunately died before she was able to receive the accolades due to her. This book more than redresses the balance by painting Crick and Watson as a dastardly duo who took data without permission, carried on working on DNA when told not to and ignored Franklin's contribution in their paper. Wilkins is presented as a shy, disgruntled nonentity meekly supplying Crick and Watson with data.

Cath Senker does try to provide reasons for the poor relationships that Franklin had at King's (and earlier with Roland Norrish at Cambridge). She also suggests that Franklin had no idea that she was in a race to discover the structure of DNA despite noting that she had seen Crick and Watson's first, incorrect, model. Her earlier experiences and her later work are also discussed and the story is well strung together.

Dian Fossey tells the story of a women less well known (to me at least) although of course her story has been made into a film ("Gorillas in the Mist"). Fossey comes over as less well qualified as a scientist than Franklin but as someone who had to battle against bureaucracy and the poachers who preyed on her gorillas. The same poachers who probably killed her. Her work with the mountain gorillas in Rwanda is told well – the long period of time taken to gain the trust of the gorillas, the joy of making contact with them, the sorrow when they died, and the anger when they were dragged off by poachers. Her techniques were completely different to that of earlier zoologists who captured animals for study in captivity. Fossey treated her gorillas as a group of primitive humans. While her work revealed a great deal about the lives of these gentle giants one wonders whether her role as an active observer influenced the animals. She certainly brought their plight to public view and while she may not have succeeded in ensuring their survival at least gave them a chance.

Both books, and others in the series, are exceptionally well written, and while perhaps being a little uncritical of their subject do provide considerable background to the lives. I would be delighted to see pupils of any age reading these books or using them for research. They should be on every school's library shelves and pupils should be directed to them. However I wonder how much use teachers do make of books like this. I would be very disappointed if they were just left to gather dust on those shelves. These books and others in the series deserve to be read and re-read.

"Charles Darwin"
by Cath Senker. Hodder Wayland 2002, 48 pages. £11.99. ISBN 0750238909.
Reviewed by John Cartwright

This book is one of a series written for young readers called "Scientists Who Made History". If the rest are as good, teachers should order the lot. This one is fairly short at 48 pages, but profusely illustrated and pleasingly laid out. The book does not specify the target age group, but I guess it would be suitable for 14-16 yr old pupils, making it a candidate to add interest to the science curriculum and address the "ideas and evidence" strand of GCSE.

I opened the book fearing that I would encounter some of the simplifications and context-bare treatments of the history of science found in some science textbooks. I was, however, very pleasantly surprised. The book opens with a vivid account of Darwin's encounter with the Galapagos Islands. The writing is fresh and immediately captures the reader's interest. The next chapter steps back to look at the social, economic and political world in which Darwin grew up. The following chapters trace Darwin's own life voyage: family life, his struggle to explain the formation of new species, the reaction of the public, and the support of his friends. The context of evolutionary theory is captured well with interesting discussions on such topics as the rise of Chartism, the high levels of infant mortality in

Georgian and Victorian Britain, and the colonization of less developed countries by emerging industrial nations such as Britain.

There are some nice detailed touches such as the well-known but ever poignant account of the Darwin's loss of their child Annie at the age of 10. This subject has now been made the subject of a book, Annie's Box by Randal Keynes (Fourth Estate) and the basis of a (to my mind rather disappointing) TV programme broadcast on 28th Dec 2002. The amusing cost benefit analysis that Darwin conducted in his notebooks over the subject of whether or not to marry is also given. Throughout the book, sharply focussed incidents like these do a lot to capture and sustain the attention of the reader.

I would criticise the book on just a few counts. Sexual selection is only given a brief treatment in the form of a box insert (p. 38) and not linked to the reference to Darwin's The Descent of Man – the full title of which reveals that half of the book is actually about the other pillar of Darwin's paradigm: "selection in relation to sex". The author also suggests (p. 27) that Darwin did not agree with Lamarck's theory of inheritance of acquired characteristics. Actually Darwin did. His singular contribution was to add to this the mechanism of natural selection and present a compelling case for its operation. Since Lamarckism has been discredited it has been one of the myths of science that Darwin rejected it totally. In fact, he seemed to warm to it in later editions of The Origin of Species, so much so that Wallace criticised him for this drift. At a less significant level the author suggest that it was Spencer in the 1860s who introduced the phrase "survival of the fittest". It was Spencer, but in 1852 not the 1860s.

The biggest disappointment to me was the final chapter on "Darwinism in Question". Here would have been an excellent opportunity to discuss some of the current controversial issues surrounding Darwinism and its application to human affairs. What the author does is to give a sketch of Social Darwinism. As far as I know there are few Social Darwinists these days and the rise of Social Darwinism has more historical than contemporary interest. I would have preferred a brief treatment of either Creationism in the USA (and Gateshead, UK), or an account of Evolutionary Psychology and its challenge to the social sciences. After all, an evolutionary understanding human behaviour was something that Darwin always hoped would be developed.

The review should not end on a negative note however. Overall, the book is smartly presented. The black and white and colour illustrations are superb and more often than not missing from texts aimed at an older readership. The writing is interesting and suitably pitched. The book is to be highly recommended

"Knowledge is Power: How magic, the government and an apocalyptic vision inspired Francis Bacon to create modern science." by John Henry. Published by Icon Books 2002. 177pages including glossary, further reading and notes. £9.99. ISBN1-84046-356-2.
Reviewed by Martin Monk

This is another title in the Icon Books Revolutions in Science series that includes:
- Latitude and the Magnetic Earth;
- Harvey's Heart;

- Moving Heaven and Earth: Copernicus and the Solar system;
- Turing and the Universal Machine;
- Eureka the Birth of Science;
- An Entertainment for Angels: electricity in the enlightenment;
- Poincaré and the Discovery of Chaos;

John Henry's book gives a brief account of Bacon's position on the way to create new knowledge. It also takes us through various features of Bacon's life that would have had a bearing on why he thought as he did. Henry picks out three key features of Bacon's daily round. There is Bacon's principal employment as a civil servant, working in the government of Jacobean England and Scotland. Then there is the religious turmoil of post reformation Europe and the attention that was paid to the Bible as a text. For the third feature of Bacon's life Henry turns to magic. However, Bacon's magic is a pre-enlightenment magic of the great chain of being, correspondences and interest in making things work.

Of Bacon's method James I, Bacon's employer, is reported by Henry as having joked, "Bacon's Philosophy is like the peace of God 'which passes all understanding' ". John Aubrey, the diarist is reported by Henry as writing that Bacon 'writes philosophy like a Lord Chancellor'. What is being commented on by James I and Aubrey is Bacon's penchant for institutionalising scientific method. In fact Henry comments that Bacon's method is better thought of as a description of a research institute than a method of science as we would now understand that. In *Salomon's House* Bacon describes a division of labour between different officers all working to the common end of producing new scientific (trustworthy and practical) knowledge.

In Henry's account we do learn of Bacon the man: Bacon the inquisitive and Bacon the acquisitive. Henry relates how at one time Bacon was found guilty of taking bribes and was sentenced to imprisonment in the Tower of London, a fine of £40,000 (a huge sum at that time) and forbidden to hold state office or sit as a Member of Parliament. But Bacon had friends in high places, most notably the King himself, and he made a social recovery from this ignominy.

I can not immediately see how I could use the text in my teaching of physics. Perhaps it is more useful in helping me to understand how what is put about as the Baconian method is in fact a grossly distorted version of what Bacon wrote and might have actually thought. I have learnt from Henry's account to be wary of the way that Bacon is popularly touted as the arch inductivist and the way that so called inductivism is attacked as being philosophically indefensible. I think I need a bit more than Henry gives me in his text to move from being wary to being clearer as to what a good defense of inductivism might look like.

The Icon books in this series are pocket sized and so small enough to carry about and read in odd moments of travel or leisure. I don't think you come away from the text thinking you know all about Francis Bacon and his philosophy. But you are given a sufficiently detailed account to think you know better and wanting to know more. That seems to me like a modest success.

Rosalind Franklin: the dark lady of DNA
by Brenda Madox. Published by Harper Collins 2002. 379 pages hardback. £20.
ISBN 0-00-257149-8.
Reviewed by Martin Monk

I had a vested interest in buying this book. I work in the Franklin-Wilkins building at the Waterloo campus of King's College London. Across the river Thames, at the north end of Waterloo Bridge, is the Strand campus and the buildings where Rosalind Franklin produced photo 51. Of all the hundreds of X-ray diffraction photographs she took in her professional work, it was photo 51 in the series she made with Raymond Gosling (her "slave boy"!) that was to make Rosalind Franklin famous and the subject of this biography.

Photo 51 could have been an alternative title for Brenda Madox's book. I would have preferred it. I think Brenda's choice of the sub-title as **the dark lady of DNA** perpetuates the very thing she is trying to dispel. Rosalind Franklin was not the dark lady that appears in James Watson's book, "The double helix: a personal account of the discovery of the structure of DNA". Yes, I grant that Maurice Wilkins did write to Francis Crick the words, "I think you will be interested to know that our dark lady leaves us next week...". The *dark lady* has resonances of dark-rooms, invisible X-rays, raven hair, femme fatale, wicked ways, invisible personality in history etc. But is this what Brenda set out to achieve: mere resonances. The answer given in the text of her book is definitely no. So why allow the title to get in the way? Photo 51 was the X-ray diffraction photograph that Maurice Wilkins showed to his Cambridge chum James Watson. It was photo 51 that Watson looked at with stunned realisation –the penny dropping. It was photo 51 that showed the structure of DNA was helical.

Brenda Maddox's book goes through Rosalind Franklin's life in chronological order. We read about her parentage, her jewish background is set against the 1930s; her early life in a grand house in Pembridge Place with a nanny; her schooling at St. Paul's School for Girls, in west London; her university studies at Cambridge; her work on coal at Kingston-on-Thames; her work in Paris after the War; her two years at King's College London; her move to Birkbeck into a unit headed by J.D. ("sage") Bernal; her overian cancer and her death in the afternoon of April the 16th 1958 at the age of 37. As this account of Rosalind's life unfolds before us on the page, Brenda Maddox adds commentaries that point up the issues of being Jewish; wealthy; well connected; clever; well dressed rather than pretty; a woman in a man's world; luckless in falling in love with a womaniser; able to command respect, loyalty and devotion; able to sacrifice oneself for the benefit of others; cautious professionally and personally. There are so many threads in anyone's life that to pluck at any one of them and say, "Here is the cause of what was to follow" is very difficult.

In her text, Brenda does not give us the equivalent of five reasons for the Franco-Prussian war. However, as one reads on, there are places where on thinks, "Ah yes". Of course one can always do the *verstehen* understanding with hindsight that is impossible in living life in real time. Here is a key example,

> "The examiners report, combined with Rosalind's own, suggests that science was taught to girls *at St. Paul's School for Girls* in a different way than to boys: an intellectual

endeavour calling for neatness, thoroughness, repetition rather than excitement and daring." (page 33. My italics added.)

Ah ha. So we see why there was photo 51, in a longer series, that had already been preceded by other X-ray diffraction photographs taken by Gosling and Wilkins. The school experience must have contributed to Rosalind seeking firm evidence rather than indulging in the speculative model building undertaken by Crick and Watson. It has to have contributed to her dithering over the differences between the hydrated and dry DNA photographs. Why else was she slow to go into print until she was sure of her facts. Perhaps this also provided some contribution to her not fitting into the de-mobbed crowd that crowded King's labs and tea rooms, etc. But school was just one of the features of Rosalind's life. It is perhaps a tribute to the writing skills of Brenda Maddox that one does not come away from the biography with a simple list of five factors for why Rosland Franklin did not get the Nobel prize.

The question of the Nobel Prize is dealt with in a very matter of fact way on page 323.

"'Rosy' never won the Nobel prize because, when Watson Crick and Wilkins got theirs in 1962, she was dead. The prize is never awarded posthumously."

Brenda deals with the alternative question of "what if.... she had lived" by curtly posing the question, "What if Kennedy had not gone to Dallas?"

This seems to me admirable. It is also fitting. Importantly it is fitting because history is about what happened. It is not speculation on what did not happen. Frivolously it is fitting because the French have a saying that translates to, 'with an "if" one can put Paris into a bottle'. This is frivolously fitting because Paris was Rosalind's 'natural' home. She was happy there in a way that she would never be happy again. She was doing excellent work, had enviable technical skills, had developed a professional reputation, enjoyed her colleagues company, loved the city as being bright and gay in contrast to grey drab post war London.... and fell in love.

Should you read this book ? Will it tell you more than you already know? Will it help you understand how scientists make new knowledge? Will it tell you about the nature of scientific collaboration and competition? Will it explain why it was Wilkins and Franklin, Wason and Crick that unravelled the structure of DNA rather than Pauling or Randall, Bragg and Bernall? Will it tell you more about Rosalind Franklin? Yes.

How can one use this in one's teaching? If I were a biology teacher I would buy this and read it twice over. I would read it once for the story of Rosalind's life and once for the way the evidence pointed to different models for the structure of DNA at different stages of the history. How do we know that DNA is a double helix? What is the evidence? How was that evidence pieced together? Who contributed which bits of evidence? Who were these people and how come they were working on this problem? Then I would go about teaching in my usual way but armed with a deeper insight and richer fund of stories to show how in one instance scientific knowledge unfolded

Resources

People in Science Series
"Elements and Atom", by Peter Ellis with additional material by Alastair Sandiforth,
Published by Pearson Education and Immersive Education, 2002.
64 pages of spiral bound text plus CD-rom. £76-38. ISBN. 0-582-77306-7.
Reviewed by Julian Swain

This is one of a series of six CD-ROMS designed to help teachers deliver the Ideas and Evidence strand of Sc1 in an interesting and motivating manner. They are also designed to develop students thinking and literacy skills. There is a companion website for the series at **www.peopleinscience.co.uk** where there is a user manual, weblinks and places for teachers to submit and share ideas.

Loading up my copy of the CD-ROM on a Macintosh proved difficult (I ignored the technical support telephone line!) and so I changed to a PC and after some minutes I was up and running. As with all new software there is tendency on the part of users to click, click and click to see what happens and I was no exception. Democratis stood before me in Greek philosopher robes; I moved to the audio button and heard him speak in a Greek accent and he told me where he was born and who taught him his ideas. It is possible to hear 26 scientists on their ideas on atoms and elements. Many of the usual scientists are included, such as Bohr, Boyle, Cannizzaro and Thompson, but a useful feature is the introduction of less well known ones to us in the West; the Arab alchemists, Hayyan and Rhazes of animal, vegetable and mineral fame. The characters available do not stop here and there are fictional ones from everyday life, such as, Dr Sandra Banning (a radiochemist), Bill Parsons (a patient), Melanie Proctor (representative from an organisation that warns about radioactivity), and Marcia and Azir (teenage characters). These are used to create story lines or to discuss controversial issues such as the benefits or hazards of radioactive substances. This can be done using text in thought and speech bubbles attached to the characters.

There are some excellent graphics in terms of Props, Layers and Backgrounds. Many hours must have gone into their design and collection. The Props provide access to items such as, an alchemistís distillation flask, a furnace or a cathode ray tube. The Layers can change the colour of the items. The many Backgrounds provided prove to be the most visually interesting and the user can choose Arabic courtyards, modern buildings, laboratories of the 18th, 19th and 20th century as well as the Seaborg cyclotron.

This software cannot fail to capture the interest of both teacher and student when loading this software on an individual basis. For class use, careful planning by the teacher will be needed if the software is to achieve its objectives. Some help for this is available in the accompanying guide and a number of activities are mapped out such as, Ideas about burning and Inside the atom. However, the main problems for the teacher come when 20 students are all clicking the mouse and playing the audio clips and changing the props and backgrounds rather than developing their scientific reasoning and literacy skills. The temptation for the less able will be to do just that but for the more able there are challenges here to last for many lessons. Which path is chosen depends of course on the teacher but it

does seem that the teacher will require some sound experience in both science and ICT to do this package justice otherwise like the new toy at Christmas it could be put aside by New Year.

New Zealand is Different: chemical milestones in New Zealand history.
Edited by Denis Hogan and Bryce Williamson, 1999. Clerestory Press for the New Zealand Institute of Chemistry. p. 308. NZ$65 (app. UK£ 20). ISBN 0-9583706-7-2.
Reviewed by Martin Monk

This is not a book – even though it is in book form – it is a resource. My best stab at a comparison, with which UK teachers might be familiar, is the ASE's Science and Technology in Society (SATIS) materials. Where SATIS was devised for KS3/4 and then extended down to KS2, **New Zealand is Different** is more suitable for A'level and undergraduate students. There are next to no chemical equations but quite a few molecular structures. So a good KS4 group could probably benefit from working on selected topics. A'level and KS4 teachers would need to photocopy and past from the text to produce classroom activities for learners.

Dr. Glynn Strange, a promoter of the book has written, "This substantial book is a history book outlining the contribution made to New Zealand's development by its chemists and chemical engineers. The editors wanted a book for scientists as well as historians, so the science of the historical development is there for all to see. The reactions, process and equipment of numerous agricultural and industrial applications of chemistry are contained in information boxes that can be photocopied and used in the classroom. Although it all relates to New Zealand the science is international and we believe that British science teachers will find it as useful as their NZ counterparts have." I think he is right.

In total there are some twenty five chapter/applications of chemistry that are introduced and discussed. Each chapter/application has the biography of the author(s) at the front with a photograph. There are lots of photographs, some in colour, many diagrams and illustrative material. What is really nice is that this is chemistry at work. The applications described are patently applied chemistry. This is in contrast to some of the SATIS topics where authors struggled to show applications of textbook science. There is textbook science in New Zealand is Different, but it is not the driving force of the chapter/application. What drove the research described were problems in agriculture and industry and mining. This is refreshing and should be seized upon by science teachers trying to make the chemistry they teach grounded in the everyday world.

Of the thirty or so authors only two are women: Joan Mattingly – who writes about her work on fish liver oils; and Linda Parker – who with two colleagues writes about synthetic fuel from Maui gas. Up until now chemistry in NZ has been pretty much a male affair. However, the applications/research projects described are by no means the preserve of males. Young female chemistry students may be more motivated in their future study of chemistry by working applications than by the standard textbook fare.

Copies are obtainable through contacting Glyn Strange: **young.writers@xtra.co.nz**

The Cambridge Dictionary of SCIENTISTS (second edition)
by David, Ian, John and Margaret Millar. Published by Cambridge University Press 2002. 428 pages with index. £14.95 pbk. ISBN 0 521 00062 9.
£40 hdbk. ISBN 0 521 80602 X.

"The Cambridge Dictionary of Scientists is a one-stop reference book for anyone wanting a brief and accurate account of the life and work of those who created science from its beginnings to the present day. This alphabetically organised, illustrated biographical dictionary has been thoroughly revised and updated, covering over 1500 scientists (157 more than in the previous addition) from 40 countries. Areas represented include physics, chemistry, biology, geology, astronomy, mathematics, medicine, meteorology and technology, with special attention paid to pioneer women whose achievements and example opened the way to scientific careers for others. As well as recent Nobel prize winers, this new edition includes winners of the Fields medal, the mathematicians equivalent of the Nobel prize. Illustrated with around 150 portraits, diagrams, maps and table, and with special panel features, this book is a clear and accessible guide to the world's prominent scientific personalties."