Editorial

I can remember (just) that when I was about 7 or 8 years old it seemed very important to declare my age to the nearest ½ or even ¼ year. Well, that phase passes all too quickly but the instant in time when the Earth has made one complete orbit around the Sun and occupies the same relative position as it did at the starting point, t_0, has an importance which is deeply buried within our culture. And further, it seems that the time period of certain multiples of this unit have special significance for us. So when t_0 marks a birth then we can celebrate, this year for example, in honour of: Edmund Halley – a period of 350 years, Benjamin Franklin – 300 years, JJ Thomson and Nikola Tesla both 150 years, to mention just a few.

But there are constraints imposed upon these multiples and it would seem from common usage that the anniversary quantum is 25 years if the period is greater than say, 50 years.

So, we may happily add James Clerk Maxwell to our list as this year is the 175th since his birth in Edinburgh on November 13th, 1831. Incidentally, it was in that same year that Michael Faraday carried out his seminal work at the Royal Institution in London, investigating and illuminating the relationship between electricity and magnetism, and producing the first primitive transformer and dynamo thus laying the foundations of the electrical industry.

For JJ Thomson it is also 100 years, this year, since he was awarded the Nobel Prize for Physics, *"in recognition of the great merits of his theoretical and experimental investigations on the conduction of electricity by gases".* So, arbitrary it may be, but like blue plaques in spatial terms, it serves, quite rightly, to focus attention upon their achievements. And speaking of blue plaques, in 1997, the centenary of his discovery of the electron, a blue plaque was unveiled in Free School Lane, Cambridge. It reads:

"Here in 1897 at the old Cavendish Laboratory J.J. Thomson discovered the electron subsequently recognised as the first fundamental particle of physics and the basis of chemical bonding, electronics and computers".

So, *Happy anniversary!*

Malcolm Cooper

The University of Aberdeen Natural Philosophy Collection of Historical Scientific Instruments

by Dr John S. Reid

Curator and Senior Lecturer, Department of Physics, University of Aberdeen

18th century equatorial telescope for stellar mapping from the first semi-public observatory in Scotland erected in 1782 at Aberdeen. The telescope was originally made by Jonathan Sisson but the scales were re-divided by Jesse Ramsden for the observatory.

This is the curator's story of a hidden historical treasure in the heart of Aberdeen that's been more than two centuries in the making.

Until as recently as the mid 1980s, graduates in the old Scottish Universities would have obtained their degrees in 'Natural Philosophy' and not in 'Physics'. I did. What we have in our collection is apparatus used in University teaching and research over some 250 years, from the mid-eighteenth century until almost the present day.

What have we got? The outsider might imagine that academics in a university that's more than 500 years old have been carefully accumulating for centuries a historical archive of significant objects, the sacred relics of the learning trade. Not a bit of it! Frankly, it is only over the last 30 years that we have realised the value of what we have in a national and international context. The bulk of the collection is a result of North-East frugality, never throwing away what might be useful; of comparative penury, not being able to replace equipment at a whim; and a North-East eye for quality, making sure we bought the best that was affordable at the time so that it would last the longest. Only the modern items have been added to the collection in an organised and rational way. The rest is historical accident, survival of the good, the interesting and the lucky pieces. Not much different from any other museum collection then! That said, the realisation that we have a stunning collection of scientific equipment spanning two and a half centuries has come just in time. The combination of good fortune and our history in the UK of being close to centre-stage in the world of science has meant we have a collection of international value.

When I first looked at what we had in our stores and laboratories I found items made in the 1850s still in use, not because we were behind the times but because they still worked well. Lecturers weren't aware of the pedigree of some of what they used (me included) and were unaware that some items had acquired a considerable historical value. These working pieces are now part of the collection. As honorary curator of over 2000 instruments and devices, I have tried to put the items we have in their historical context, finding the story behind many pieces. I've also tried to conserve items from the late 20th century as they become obsolete, so that our collection represents not simply science past but science continuing into the present. It is highly desirable when filling a display case to link historical artefacts with those that the audience might recognise, to show the relevance of the earlier pieces and perhaps some of the evolutionary path to today's technology.

Frictionless wheels, or the next best thing prior to air bearings, from the top of an Atwood's machine made in the later 18th century by Patrick Copland.

I'm probably preaching to the converted here in saying that apparatus that demonstrated clearly the principles of mechanics, electrostatics or optics two hundred years ago still demonstrates clearly those principles today. The old equipment with its polished brass, varnished wood and slightly irregular glass may look old but it actually works as well as today's version in die-cast metal and plastic. In some respects the old equipment is better. It can be elegant, artistic and it never tries to do two things at once. 'Multifunctionality' is a 20th century development – useful at times but how many owners can work all the functions on their video recorder or even their graphics calculator?

Collections of scientific instruments are pretty rare – anywhere in the world. At Aberdeen we have one of the best collections in Britain. The equipment has been used by the famous and the worthy, and the not so famous researchers, teachers and students who have been through the university for the past two-and-a-half centuries. The scientific instrument trade has been an international one, more or less from the beginning. Our collection shows not just what science was being done in the North-East over the past two centuries but what science was being done in the world.

Professor Patrick Copland (1748 – 1822) of Marischal College, one of the founders of the art of teaching physics by lecture demonstrations. From a painting in possession of his descendant, Patrick A Copland.

The 'founder' of our collection was a remarkable man, Professor Patrick Copland of Marischal College. He was a figure of the Scottish Enlightenment, that loose movement of intellectuals in 18th century Scotland whose ideas, methods and philosophy were very influential in shaping science, technology and other subjects into their modern form.

Copland was a professor who was not only fully conversant with his subject but also a skilled mechanic in wood, glass and metal, the materials of his day, capable of making apparatus to the best professional standards in his own workshop. He believed passionately in the application of science for the betterment of mankind and being a man of action as well as ideas he gave very extensive courses to tradesmen as well as to university students, all profusely illustrated with demonstrations. This was well before the efforts of Young, Birkbeck and many others in the 19th century. In fact Copland was one of the pioneers of teaching Natural Philosophy by demonstration.

Copland built up his collection until, in the words of contemporary historian Robert Wilson, "*the collection is generally considered as superior to any in Britain, and some deem it superior to any in Europe*". He might have added '*the world*' because there was nothing better than in Europe anywhere else in the world. That was said in 1822 and we have an inventory of Copland's collection in that year with over 500 entries that backs up the claim. About 50 of Copland's pieces, or parts of them, survive.

Copland didn't make all his equipment himself. Some he bought and in the 1780s he obtained a grant that enabled Marischal College to employ a technician, John King, to make equipment. King may well have been the first university science technician in Britain. In Glasgow, James Watt had earlier been given premises within the College to operate his instrument-making shop but he was never a college employee. John King specialised in making models of industrial machinery and models relevant to clocks. Only a few of King's models survive but pride of place among King's work in our collection goes to an astronomical clock made by King and Copland in the late 1780s. It's a complex piece that was designed by the famous 18th century North-East born educator and inventor, James Ferguson, FRS. After leaving Marischal College, King earned his living as a clockmaker and examples of his clocks, signed 'JNO KING', can occasionally be seen in the North East.

James Clerk Maxwell's dynamical top, as produced by Harvey and Peake in the 1890s.

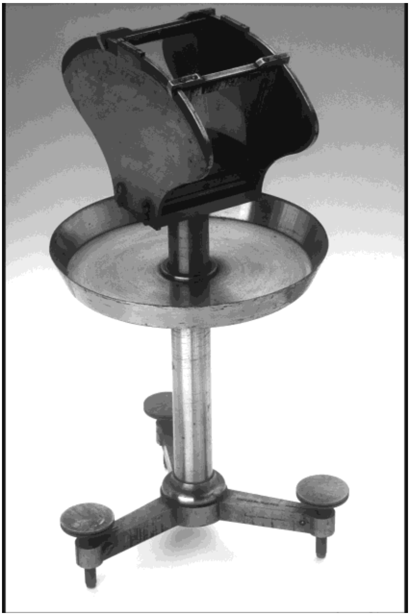
Copland and King's astronomical clock to a design by James Ferguson FRS made in the 1780s

James Clerk Maxwell was the last Professor of Natural Philosophy at Marischal College before the universities at Marischal and King's in Aberdeen amalgamated in 1860. This year marks the 150th anniversary of Maxwell's appointment.* He inherited such an extensive collection of equipment that he had little need to make any further routine pieces. He did, though, innovate two historically memorable demonstration pieces associated with his research.

The workshop of Smith and Ramage in Regent Quay made them for him. One was a model to illustrate stability in Saturn's rings, a subject he spent years investigating; the other was Maxwell's 'dynamical top' that illustrated advanced concepts connected with rotating bodies. Unfortunately for us he took both pieces with him when he left Aberdeen but we have a rare commercial production of Maxwell's dynamical top that is on permanent display in the Marischal Museum. It is even more finely made than the Smith and Ramage version, which can still be seen at the Cavendish Laboratory in Cambridge, where Maxwell ended up.

David Thomson, a very able teacher and administrator, said by one source to be a relative of Faraday, was the first Professor of Natural Philosophy in the new University of Aberdeen. His teaching covered a wide range of topics but he was particularly known as an authority on acoustics. He was the author of the long article on that subject in the famous 9th edition of the Encyclopaedia Britannica. Maxwell was one of the science editors of that edition, regarded as the most sophisticated edition in the entire history of this encyclopaedia. Thomson expanded the University's apparatus in other fields too.

From 1880 – 1922, Charles Niven, FRS presided over Natural Philosophy. I was intrigued to find that in 1899 his assistant was a distant cousin of mine. Aberdeen has a habit of springing such surprises. Acoustics must have been one of Niven's interests too for he was seconded during World War 1 to work on the location of submarines by underwater acoustics. Niven lived in exciting times, with the discovery of radio waves and X-rays, radioactivity and, later, the birth of nuclear physics. He witnessed the invention of the gramophone and telephone, radio broadcasts, moving pictures and the cinema, bicycles and cars. These developments and more besides are the foundations that our lives are built on and we are lucky to have many examples in our collection that show the science that started them.



Almost a sculpture in brass and glass. This 19th century prism of variable angle is filled with water or other liquid to illustrate the relationship between the bending of light passing through a prism and prism angle. It is typical of a large number of 19th century demonstration pieces in the collection.

Niven was succeeded by G.P. Thomson, son of J. J. Thomson who had won the Nobel Prize for Physics in 1906. G.P. Thomson's own work in Aberdeen in the late 1920s on electron diffraction won him the Nobel Prize too, making him one of the select few University staff to obtain this honour.

Thomson was succeeded in 1930 by John Carroll, later Sir John Carroll, whose work in solar spectroscopy would be very topical in astronomy today. Carroll was followed after World War 2 by Professor R V Jones, who's absorbing involvement in designing precision instrumentation was significantly ahead of its time. His twin interests in apparatus and teaching by demonstration mirrored those of Patrick Copland 150 years earlier. In one way, Copland and Jones were the alpha and the omega of teaching by demonstration, the beginning and the end. Nowadays, computer simulation has replaced much of this technically intensive but very effective educational technique.

Helmholtz double siren from the 19th century acoustic demonstration equipment of David Thomson.

I've given a brief outline of the professoriate who, through their teaching and research, built up the equipment that now forms our 'natural philosophy collection of historical instruments of physics'. It is a treasure-trove, covering an enormous range of subjects. Where can you see this 'hidden historical treasure'? We have a modest display of items adjacent to the foyer of the Fraser Noble Building in the University at Old Aberdeen. It's open to the public during normal working hours. A few items are displayed in Marischal Museum's *Encyclopaedia of the North-East*. An increasing number of items are accessible on the web through the Lemur initiative www.abdn.ac.uk/diss/historic/museums/. More and more will appear on the web in the coming years, so patience is needed.

Creating displays in cases is a costly business in terms of cash, space and personnel. I believe that the collection has an enormous amount to offer both the academic community and the public at large. The challenge is to realise its potential. The University is working on this challenge. We would like more of this hidden historical treasure to be visible. If you are in a position to offer help, contact me at j.s.reid@abdn.ac.uk.

A version of this article with colour illustrations was published in the November 2005 "Leopard", a magazine for the North-East of Scotland, under the title "The Curator's Tale" pp 23 - 25.

*A meeting to mark this event is being organised for 7th/9th September at the University of Aberdeen – see *Forthcoming events* (page ..) for further details.

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Abstract

Eur.J.Phys. 26 (2005), pp 225-242

John Roche,
Linacre College, Oxford OX13JA

Abstract

Efforts after Newton to reform the concept of mass have not been entirely successful. The unitary Newtonian concept has now been fragmented into various 'masses', including inertial mass, active gravitational mass and passive gravitational mass. This article attempts to clarify the concept of mass.
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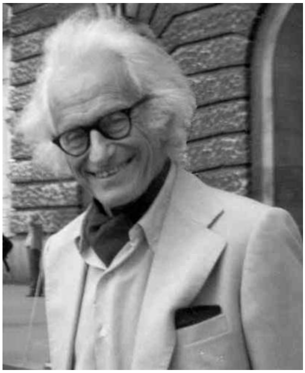
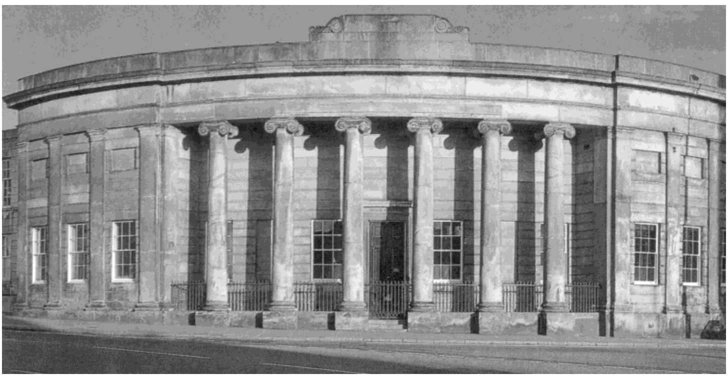
Fröhlich Centenary Symposium



Herbert Fröhlich FRS

It was wholly in accord with the spirit of the meeting that those gathered to honour Herbert Fröhlich FRS should do so in the fine and elegant surroundings of the Liverpool Medical Institution. The LMI is one of the oldest medical institutions in the world and is housed in this extraordinary Grade II* listed building which dates from May, 1837 – just one month before the accession of Queen Victoria.



As the delegates assembled, indications of the excellent organization were apparent with the inclusion of a copy of the collected papers of the symposium† in the registration pack.

The lecture theatre – Liverpool Medical Institution

After a warm welcome by the Pro Vice Chancellor, Prof. G Dockray the conference got underway with the first session which was the **Herbert Fröhlich Centenary Lecture** given by Dr. G.J. Hyland.

The LMI was not, however, restricted to grand interiors and fine architecture – it also provided excellent refreshments ranging from the essential morning coffee and afternoon tea (of which there is no doubt that Prof. Fröhlich would have heartily approved) to the four course symposium dinner.

Then came the traditional after dinner speeches - but what made these engagingly different was the fact that all the speakers had known Prof. Fröhlich personally and could paint a picture that could be done in no other away. It is hoped to publish these in a companion booklet to **'HERBERT FRÖHLICH FRS, *A physicist ahead of his time'***

MJ Cooper

† The book 'A physicist ahead of his time' is available price £15 including p&p. Details are on page 25

The above two photographs are reproduced by kind permission of the Liverpool Medical Institution

Abstracts

Herbert Fröhlich was a wonderfully creative scientist who made many contributions to diverse areas of physics. The contribution that had the greatest effect on my career was, of course, his famous paper that established the role of phonons in the phenomenon of superconductivity. This paper, which predicted the isotope effect, was focused on what we now call the self-energy of the electron. However, it was soon realized that the exchange of a phonon between two electrons would lead to an interaction between electrons that could in favorable circumstances overcome the coulomb repulsion.

Very soon after I started thinking about the problem of superconductivity, I focused my attention on the consequences of an attractive interaction between electrons in the highly degenerate system near the Fermi surface.

Fröhlich was one of the first to whom I showed my results when he visited the University of Illinois in 1956. And he was one of the first to understand their significance.

It is somewhat ironic that the interaction that is responsible for much of normal resistance can, under the right circumstances, lead to superconductivity. But this is the substance of Fröhlich's great insight.

I am honored to have known Herbert Fröhlich and am personally grateful for his remarkable work.

Nobel Laureate ***Leon Cooper***

Herbert Fröhlich, FRS: A physicist ahead of his time

GJ Hyland

University of Warwick UK/ International Institute of Biophysics, Neuss

Fröhlich was born in Rexingen (Württemberg) on 9th December 1905, and entered the Ludwig-Maximilian University of Munich as an undergraduate in 1927, obtaining his *D. Phil.*, under Sommerfeld's direction, 3 years later, without ever having taking an undergraduate examination. After a brief appointment in Freiburg, he worked in Russia for a while, before coming to England in 1935, to the university of Bristol, where he remained until he was appointed to the first Chair of Theoretical Physics in Liverpool in 1948. His distinguished career, which spanned some 60 years, was distinguished by the diversity of the fields in which he was active and to which he contributed so significantly, influencing subsequent developments, often revealing some hitherto unsuspected connection between seemingly quite unrelated areas of physics, and, later, even between physics and biology. The *decisive* influence he exerted - often as a 'man ahead of his time' - in fields as diverse as meson theory and biology stands as a strong indictment against fragmentation and over-specialization in theoretical physics - something that was quite alien to his holistic perception. Indeed, so much ahead of his time was he that he pioneered a number of topics long before some of them were rediscovered later by others, who now take the credit.

Most influential of all, however, was undoubtedly his introduction, in the early 1950's, of the methods of quantum field theory into solid state physics, which completely revolutionised the future development of the subject.

Fröhlich became a Fellow of the Physical Society of Great Britain in 1944, was elected a Fellow of the Royal Society in 1951, was awarded the Max Planck Medal of the German Physical Society in 1972, and received numerous Honorary Degrees worldwide. From 1979 to 1991, he was a Foreign Member of the Stuttgart Max Planck Institute for Solid-state Research.

He died in Liverpool on 23rd January 1991 at the age of 85.

Dielectrics in High Fields

JH Calderwood,

Trinity College, Dublin, and University of Bolton UK

It was established in the early 20th Century that dielectric materials did not obey Ohm's Law, and that the application of voltage to a specimen resulted in a current that was not proportional to the voltage, but which increased more steeply, particularly at high voltages. Different physical mechanisms were postulated to explain this behaviour, but these mechanisms could often be described by equations of similar form relating current to voltage. This means that quantitative results of experiment are often not sufficient to enable the relevant mechanism to be uniquely identified, so that other additional criteria have to be introduced. When dielectric breakdown is considered, a similar difficulty is encountered, but to a greater extent. Different theories of dielectric breakdown will be reviewed, and their applicability to materials of various structures, subjected to a range of ambient and experimental conditions, will be considered. Attention will be given to the work of those who have made significant contributions to our understanding of the breakdown mechanisms involved. Many of the advances rest on the foundation of the pioneering work of Herbert Fröhlich.

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On the Interplay between the Microphysics and Macrophysics in Statistical Mechanics

GL Sewell

Department of Physics, Queen Mary, University of London,

A key feature of Fröhlich's legacy to physics was his anti-reductionist attitude to the relationship between microphysics and macrophysics. Specifically, he considered that, in view of the unimaginable complexity of the microscopic dynamics of many-particle systems, the derivation of intelligible macroscopic laws from that dynamics was not feasible; consequently, he advocated an approach to the relationship between microphysics and macrophysics on the basis of treatments in which the role of the former was to provide the constraints on the latter, which are imposed by general structures, rather than by detailed solutions, of the underlying quantum dynamics. This approach was fruitful in Fröhlich's derivation of
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the form of classical hydrodynamics from some general features of many-particle quantum theory, and the extension of that work by his colleagues to superfluid hydrodynamics. In the present talk, I shall discuss subsequent works that have been carried out in a similar spirit. In particular, I shall discuss the derivation of superconductive electrodynamics from the assumptions of ‘off-diagonal long range order' and gauge covariance, as well as a rather general quantum macrostatistical approach to irreversible thermodynamics far from equilibrium. An interesting new result that has arisen from that approach is that correlations of hydrodynamical fluctuations in the nonequilibrium regime are generically of long range: by contrast, in equilibrium states they are of short range except at critical points.

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Fröhlich's Interpretation of Biology through Theoretical Physics

CW. Smith

Salford University – Retired

Fröhlich had already considered biological problems in relation to theoretical physics in the 1930's. War intervened and he could not develop these ideas until in 1967, at a conference in Versailles, where he considered long-range phase correlations in respect of biological order. He combined the ideas of high frequencies and collective or cooperative behaviour with ideas of long-range phase correlations and coherence, and applied them to biological systems. The subsequent development of his ideas and the work of his world-wide circle of collaborators are contained in the two ‘Green Books’ which he edited: *Coherent Excitations in Biological Systems* in 1983, and *Biological Coherence and Response to External Stimuli* in 1988.

Subsequent developments from his fundamental ideas are traced out in this contribution. Work on electromagnetic field and frequency effects has led to the concept of the living system as a macroscopic quantum system with a sensitivity to the magnetic vector potential (**A**-field). Coherence has been shown to be a fundamental property of water in the ground state, and this makes frequency a fractal quantity that is able to link the chemical, technical and biological frequency bands and act as a parameter for arithmetic and logic operations. The physics involved also relates to environmental and alternative medicine.
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H. Fröhlich and Particle Physics

Christopher Michael

Theoretical Physics Division, Dept. of Mathematical Sciences, University of Liverpool

Herbert Fröhlich was one of the pioneers in applying quantum field theory to nuclear forces. Shortly after Yukawa's proposal in 1935 of a meson exchange interpretation of nuclear forces, he (with Heitler) described how the virtual effects of mesons could explain the observed proton and neutron magnetic moments. He also addressed the issue of the modification to the spectrum of the hydrogen atom arising from such mesonic effects.

I also briefly describe some of his later involvements in trying to describe the particle spectrum and its underlying theory.

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Fröhlich's Spark – Bridging Biology and Physics Reflections of a Quantum Field Theorist

H-P Dürr

Max-Planck-Institut für Physik- Werner-Heisenberg-Institut, München

In classical physics the world is described as a matter-based reality, an arrangement of spatially separated particles, the paths of which in time are uniquely determined by certain dynamic laws. By contrast, modern quantum physics reveals that matter is not composed of matter, but reality is merely 'potentiality' - a complex relationship potent for energetic-material manifestations. Because of these more open features, quantum physics suggested, from the very beginning, a possible affinity to the phenomenon of life. But first attempts to demonstrate this failed.

However, the relativistic generalization of quantum physics to the more sophisticated quantum field theories with their many-"particle" character offered new opportunities. At first sight, the superposition of aggregates of a huge number of immaterial "haps", as in mesoscopic objects, led back to the well-known unique material appearance and deterministic behavior of classical physics, due to statistical averaging or the incoherence of the probability waves. This, however, is not the case for *coherent* superpositions, as demonstrated not only for configurations at temperatures close to absolute zero like in "superconductivity", but also for unstable, but
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dynamically stabilized, configurations far away from thermodynamic equilibrium, as in case of a LASER. These enable quantum structures to surface to the mesoscopic level, and to exhibit themselves in terms of features we associate more with the living.

It was Herbert Fröhlich who initiated and performed the pioneering work in elucidating the decisive role of quantum physics for a non-mechanistic understanding of the phenomenon of life, identifying the electric dipole moments of biomolecules as one of the ordering parameters of the corresponding macro-quantum system. This insight has important consequences for biology. In particular, it may suggest the existence of a "software" that is essential for the logistics of biological processes, and which functions as a hidden immaterial guide behind a 'firmware', apparent as a 'material hardware'. In the conventional approach, the latter is considered to be the only important factor directing the observed processes.

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Fröhlich's One-Dimensional Superconductor, or a Charge-Density Wave?

C.G.Kuper

Physics Department, Technion Israel Institute of Technology, Haifa

Following on his pioneering work in which the interaction between metallic electrons and lattice vibrations was formulated in the language of quantum field theory, Fröhlich showed that the emission and absorption of phonons leads to an effective attractive electron-electron interaction, which he correctly diagnosed as the mechanism responsible for (low-T_c) superconductivity. However, his attempts to explain superconductivity by perturbation theory were not successful. He therefore developed a more tractible one-dimensional model. When the problem of superconductivity was solved by Bardeen, Cooper and Schrieffer a few years later, it was evident that no perturbation-theoretic solution could ever have succeeded, owing to an essential singularity in the dependence of the energy gap on the strength of the interaction.

In this paper, I reconsider Fröhlich's 1-D model, and conclude that what he had actually constructed was not really a model for superconductivity, but rather a charge-density wave (incidentally anticipating Peierls' construction, published the following year).
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Coupling of Fröhlich-Modes as a Basis of Biological Regulation

F-A Popp[1], L. Beloussov[(1,2)], W. Klimek[(1)], and J. Swain[(1, 3)]

1) *International Institute of Biophysics (IIB), Landesstiftung Hombroich, Raketenstation, D-41472 Neuss*
2) *Moscow State University, Moscow, Russia*
3) *CERN (Geneva) and North–Eastern University, Boston (USA)*

Herbert Fröhlich's model of coherent radiation in biological systems provides valuable answers to hitherto inexplicable biological phenomena. But there arise also new open questions that are of fundamental importance for understanding biology from a more integrative point of view. One of these concerns the possible coupling of modes, since just this could solve the crucial problem of regulation and coordination of many synchronous different biological functions in the living state. Decisive parameters of coherent organization are not only the phase relations, but also the interplay of the frequencies of the interacting modes. Key to understanding these connections are (*a*) the chemical potential of the Fröhlich-modes and (*b*) the frequency condition of coherent fields according to R.Glauber.

Following Fröhlich, the Bose-condensation-like accumulation of a mode takes place as soon as the chemical potential, $\mu(\varepsilon)$, approaches the quantum energy, ε, of the mode under study. Glauber requires that the coupling of the modes of a coherent field ("standing waves") obey the condition that the sum of frequencies of absorbing modes is equal to the sum of frequencies of emitting ones. This is certainly the situation for a stabilized coherent field that approaches thermal equilibrium, where all μ are zero. On the other hand, for an ideal *open* system, Glauber´s condition is certainly satisfied for all $\mu_l = \varepsilon_l$. This is the case for all Fröhlich-modes. As a consequence, one may consider that Fröhlich-modes are establishing a branch of modes that works as a kind of 'hub' system for establishing and connecting, in a dynamical way, all different modes that fulfil the actual boundary conditions of the biological system under study.

It will be shown that there are experimental results in favour of this kind of mode coupling, and that fundamental properties of biological systems – such as, for instance, the multiplicative organizational principle of the Weber-Fechner-law - can be faithfully explained in terms of this model. At the same time, we show that the conversion of energy into different modes is not confined to the down-step dissipation from higher to lower mode energies (subharmonics), but can move also upwards (superharmonics).

Coherent Quantum Electrodynamics & Frohlich's Coherent Excitations in Living Matter

E Del Giudice,

National Institute of Nuclear Physics, Milano

It is shown that the interplay between the quantum fluctuations of matter components and the electromagnetic field gives rise, beyond a density threshold and below a temperature threshold, to a coherent configuration where the components oscillate in tune with the electromagnetic field within extended coherence domains. These configurations are shown to produce selective attractions among components that could explain the onset of an intelligent biochemistry in living matter, as predicted by Herbert Frohlich.

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Role of the Fröhlich Coherent States in Cancer Transformation of Cells

J. Pokorný

Institute of Radio Engineering and Electronics
Academy of Sciences of the Czech Republic

Fröhlich introduced the concept of coherence into biological systems and described mechanism of energy condensation in living matter. Microtubules in an eucaryotic cell skeleton form electrically polar structures that satisfy conditions for excitation of coherent states and the generation of electromagnetic fields with a dominant electric component in their vicinity. From the physical point of view, living cells are assumed to form a Fröhlich system.

Phosphorylation of proteins is a ubiquitous controlling mechanism in living cells, which is different in malignant cells from that in their healthy counterparts. Phosphorylation may cause a significant increase in the coupling of the Fröhlich coherent modes to the heat bath, resulting in a decrease of excitation, accompanied by a decrease in interaction forces between cells. As a consequence, cancer cells form less organized structures in tumours in comparison with surrounding healthy tissue. Interaction forces between cancer cells and healthy cells are greater than
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between cancer cells, and cancer cells are, therefore, pulled by healthy cells out from the tumour into the healthy tissue, a process that may act as a driving agent for local invasion. Further increase of the coupling to the heat bath results in strong decrease of interaction forces between cancer cells and their detachment – an initial condition for metastatic growth. Organ selective adhesion of a cancer cell may depend on the similarity of the frequency spectra of the Fröhlich vibrations in the cancer cell and in the cells of the organ.

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A sort of Biography - Lao Tzu's influence on Fröhlich

Fanchon Fröhlich

Liverpool

Herbert Fröhlich wanted to be remembered for his contributions to physics and biology, rather than for his life per se, which, he considered, to be, in some respects, not unlike an adventure film. When still a youth, he came across a German translation of the Tao Te Ching, authored by the Chinese philosopher, Lao Tzu, and was deeply struck by it, feeling that he had found in it a resonance with his own thought and an intensified expression of it. The Tao Te Ching perhaps also prefigured his later interest in biology - being concerned, as it is, with the organic processes of growth and life. Philosophically, he believed that that there is an impersonal, non--individualistic path - or Tao - embedded in the world and in the mind, and that at some deep level of insight they coalesce. It was his complete immersion in the quest for such a sympathetic understanding of Nature (Einfühlung) that constituted his special unending happiness.

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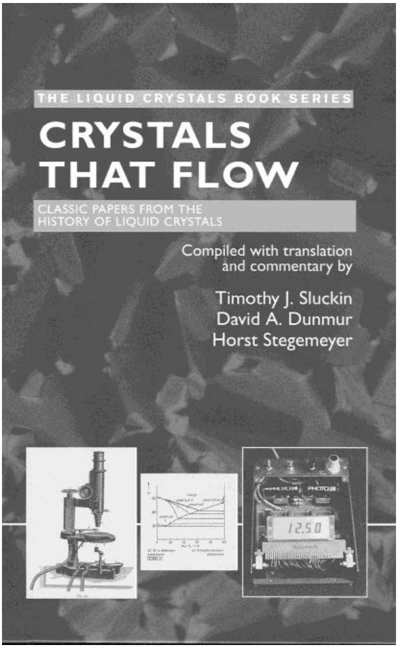
'A Physicist ahead of his time is available from:

John Hardie,
Physics Dept,
University of Liverpool,
Oliver Lodge Laboratory, jhardie@liverpool.ac.uk

Oxford St, Liverpool L69 7ZE, Tel:0151 7943440

Book Reviews



Crystals that Flow:
Classic Papers from the History of Liquid Crystals

Tim J. Sluckin, David A Dunmur and Horst Stegemeyer
Taylor & Francis June 2004
ISBN: 0415257891
Hardback £85

Reviewed by:
J. M. Seddon Professor of Physical Chemistry and Head, Interfacial and Analytical Science, Chemistry Department, Imperial College London

This volume provides a unique overview of the history of liquid crystals, that 'beautiful and mysterious' state of matter, which is now so familiar to us all in our flat computer and TV screens, and which has become a multi-billion dollar industry. The book is a labour of love by the authors, who have striven to make the early literature – much of it not written in English - accessible to the modern reader by translating from the original German or French.

It is divided into five sections, with the first three being essentially arranged chronologically: The Early Period, The Inter-War Period, and The Modern Physical Picture. The fourth section covers The Development of Display Device Technology, and the last section covers Lyotropic and Polymeric Liquid Crystals. The authors are well-known experts in the liquid crystals field, who have written extensive and erudite commentaries at the beginning of each of the sections.

Liquid crystals have been used by man since ancient times, when soap was first discovered. However, it was only in the second half of the 19th century that they began to be recognized as an independent state of matter, with fascinating and unique optical properties. The observation by the botanist Reinitzer in 1888 of 'double melting' in cholesteryl benzoate is conventionally regarded as the date of discovery of liquid crystals, although the biologist Rudolf Virchow had already in 1853 observed in nerve myelin features characteristic of the liquid-crystalline state, and by 1857 Mettenheimer had deduced that nerve myelin was both fluid and optically birefringent. Following his discovery, Reinitzer contacted the crystallographer Otto Lehmann, who was involved in developing the hot-stage polarising microscope, to study the optical properties of his cholesteryl esters; by the following year of 1889, Lehmann had already published his first paper in the field entitled '*Über fliessende Krystalle*' ('*On flowing crystals*'), and he later introduced the term 'liquid crystal'. From the earliest days, there was controversy over the nomenclature within the field, and even the very name 'liquid crystal' was violently opposed by a number of prominent scientists. The field was dominated until the early 1920s by the German school, joined after about 1910 by the French school. Lehmann himself continued to publish extensively in the field until his death in 1922. In that year, Friedel published his famous two-hundred page overview in the *Annales de Physique*, where he set out most of the basic classification of liquid crystals (although he himself preferred the term 'mesomorphic state') into types (nematic, smectic, cholesteric). In fact, with help from his classicist daughter Marie, he coined these names, the former two from the Greek words for 'thread' and 'soap'.

At the end of the 1920s PP Ewald organised and edited a series of papers and an extensive 'general discussion' on liquid crystals, which appeared in volume 79 of the *Zeitschrift für Kristallographie* in 1931. Two years later, in 1933, a Faraday Discussion Meeting on 'Liquid Crystals and Anisotropic Melts', organised by Sir William Henry Bragg and J. D. Bernal, was held in London, and brought together many of the main groups working on liquid crystals. After this meeting, basic research on liquid crystals went rather quiet for a number of years (although some important liquid crystals work was done in this period, for example on the coefficients of viscosity by Miesowicz, and on surface alignment by Chatelain). Another Faraday Discussion Meeting on 'Configurations and Interactions of Macromolecules and Liquid Crystals' was held in Leeds in 1958, and this, along with a seminal article in *Chemical Reviews* by Brown and Shaw in 1957, stimulated the third phase of development of liquid crystals, which continues until the present day. It is fascinating to learn that the famous molecular field theory of Maier and Saupe, published in 1958-1960 and presented at this 1958 Faraday Meeting is remarkably similar in some respects to a little known paper published already in 1917 by Grandjean!

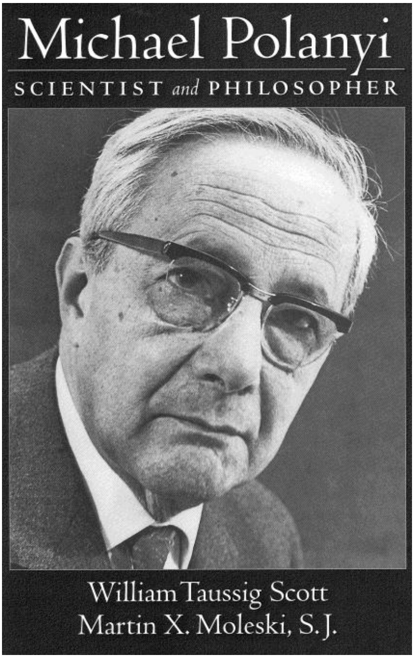
In 1936 a British patent was awarded to the Marconi Company for 'a liquid crystal light valve', but nothing further came of this until much later, in 1970, when Schadt and Helfrich (and independently Fergason) invented the twisted nematic display, which even today still forms the essential basis for most liquid crystal displays, although the switching speed is a little slow. A vital breakthrough came in 1973 with the invention by George Gray of the cyano biphenyls and cyano terphenyls, the first liquid crystal materials which were really suitable for the production of high quality and long-life twisted nematic displays. Later in the 1970s ferroelectric liquid crystals were first predicted, then discovered by Meyer and co-workers. This led to the development of the faster ferroelectric liquid crystal display by Clark and Lagerwall in 1980; only quite recently have such ferroelectric microdisplays become available, for applications in digital camera and mobile phone displays.

The authors have chosen to stop the volume at this point in time (1980), and the extensive developments which have occurred in the field during the last 25 years are deliberately not covered.

The book is full of fascinating insights and anecdotes about the personalities involved, and the heated and sometimes bitter arguments over priority, terminology, and even basic concepts. It is interesting to learn how many famous early physicists and crystallographers worked on aspects of liquid crystals, for example, Born, Ewald, Ornstein, Mauguin, Zsigmondy, Hückel, Bernal, and Landau, as well as the more familiar and more recent contributions of Onsager, Flory, Frank, Leslie, Ericksen and De Gennes.

Inevitably in a project of this sort, the balance of material chosen will not please everyone. A surprising omission is the paper reporting the discovery of discotic liquid crystals by Chandrasekhar in 1977. Furthermore, the emphasis is rather firmly on thermotropic systems, with relatively little on lyotropic or polymeric liquid crystals, although these latter fields are at least as extensive as thermotropics. I was however very pleased that they have chosen to include an early seminal paper by Vittorio Luzzati's group, who first deduced the structures of most of the lyotropic phases known today.

The book is generally very well produced, although I did note that the Permissions for the Section A articles are missing from the Acknowledgments. Another apparent oversight was the appearance in two places (p435 and p535) of the Biographical Sketch of Frank Leslie. These are however very minor criticisms, and the authors are to be congratulated for producing a book that both instructive to read, and which will provide an invaluable source of material about the historical development of the liquid crystals field for many years to come.



Michael Polanyi
Scientist and Philosopher

William Taussig Scott and
Martin X Moleski
Oxford University Press 2005
ISBN: 13 978-0-19-517433-5
364 pp Hardback £26.99

Reviewed by:
Emeritus Prof. Derry W. Jones
Chemical and Forensic Sciences, University of Bradford

Michael Polanyi (1891-1976) possessed a formidable intellect, achieving international distinction across a swathe of physical and social sciences. Qualifying initially in medicine in Budapest, he conducted influential research in physics and chemistry in Germany in the 1920s and then held Chairs at Manchester successively in Physical Chemistry (1933-1948) and Social Studies (1948-1958). Throughout his scientific career he thought, wrote and campaigned in the humanities from economics to theology but he felt that his greatest contribution to intellectual life was in his later years as a philosopher and in his advocacy of a renewed bridge between science and faith.

With such a range of activity, it is perhaps less surprising that this first full biography should have as authors a theoretical physicist and philosopher, the late W.T.Scott, and a Jesuit religious studies academic, M.X.Moleski. American authorship is consistent with the greater appreciation of Polanyi' s later philosophical studies in the USA (where there is even a Polanyi Society) than in Europe. The book is not the outcome of a true collaboration. Scott, who died in 1999, knew Polanyi well from 1959 and spent seventeen years researching his life and conducting 150 interviews with Polanyi's associates. During Scott's final illness, Moleski, a long-time student of Polanyi's writings on the philosophy of personal knowledge (the subject of Polanyi's major book in 1956), became co-author in 1997, substantially revising Scott's extensive manuscript. Both authors are clearly admirers and, by implication, do not dissent from Polanyi's decision to move wholly to the humanities from physical science at the age of 57. However, they incorporate critical views and recognize that, although Polanyi came close, he did not quite achieve crucial discoveries in, for example, cellulose structure, dislocations, quantum indeterminancy, and organic reactivity. Overall, the biography forms a coherent and, despite some American usages, readable entity.

Throughout his life Polanyi had the ability to think deeply - and generally creativelyin more than one field and to grasp a new field rapidly; twice he had to change countries to escape persecution. Accordingly, it seems natural that family events and political influences should be referred to within chapters dealing mainly with scientific and other intellectual developments. Eleven chapters cover phases of Polanyi's education and career successively in Hungary, Germany, Manchester and Oxford. About two-thirds of the book deals with times when Polanyi's paid activities were primarily scientific, rather than economic and philosophical.

While some great scientists focus on one field, Polanyi made significant contributions to several, as his FRS citation illustrates. He did not attain a Nobel Prize as did his son John Polanyi (share in Chemistry Prize, 1986), who has contributed a valuable chronological list of his father's books and papers.
Polanyi interacted with eminent physicists Born, Einstein, Nernst and

Pauli, and his co-authors included Calvin, Ewald and Wigner. His capacity for profound thinking and writing in diverse fields began early. His education at the same Minta Gymnasium as Neuman was predominantly classical, including Hungarian, German, Latin and Greek, but also maths and physics. Even then he was theorizing about heat capacities of gases. At Budapest University, 1908-1913, while reading medicine (chosen partly because of the quality of the science education), he began research in the Institute of Pathology (continued during a summer in Karlsruhe) on the pressure dependence of surface adsorption in colloid gels; this led to several papers in the German Physical Society, 1913-1916. In World War II, as a military medical officer, he coped with Austro-Hungarian casualties; succumbing himself to illnesses, he continued to correspond with Einstein!

The biographers describe well how Polanyi's seminal contributions to X-ray fibre and metal physics came in the 1920s and early 1930s. During 1920-1923 at the Berlin Institute of Fibre Chemistry, assistants included Ewald (plasticity), Mark (metal crystals), Schiebold (rotating crystal method) and Weinssenberg (worked metals). With no prior experience of X-ray diffraction, Polanyi had rapidly interpreted the fibre diagram of cellulose and been first to suggest consistency with a chain structure.

Throughout a decade at Haber's Institute for Physical Chemistry, Polanyi continued to publish on adsorption, cold-working, lattice distortion, and the solid state, but most of his research was in reaction kinetics in which the activation-energy concept was conceived. With Eyring, a post-doc in Berlin 1929-31, the idea of an intermediate aggregate in a reaction emerged. Subsequently, Eyring applied statistical mechanics to the activated complex, while Polanyi and M.G.Evans focussed on the thermodynamic consequences of the transition stale. In 1933, rising Nazism forced Polanyi to leave Berlin (which he loved intellectually) and accept a Chair in Manchester (preferred to the USA). Here he set up and directed several research groups in physical chemistry, some continuing the sodium-flame experiments, making fundamental contributions to the understanding of reaction kinetics. On Polanyi's approach to teaching, one recalls that, in his first-year lectures on diffraction and energy-partitioning in the 1940s, students were asked to listen and observe rather than scribble notes and - unusually for the time - summary sheets were available afterwards.

Most of the undergraduates would be unaware that, throughout Polanyi' s time in Physical Chemistry at Manchester, his intellectual endeavours, external lectures, and publications were largely devoted to economics and social rather than physical science. Thus, soon after lecturing in Berlin on low-temperature polymerization in late 1947, he was engaging in philosophical discussions with Arthur Koestler and borrowing his cottage in North Wales (Koestler's anti-communist book The Yogi and the Commisar was dedicated to Polanyi). Ironically, despite being anti-Nazi and anti-communist, Polanyi experienced a long delay in securing a U.S. visa in 1951-53 when offered a Chair in Social Philosophy at Chicago. Apparently there had been a brief association, 1946-7, with an Anglo-USSR cultural society that included novelists Greene, Maugham, Priestley and Wells. One of the first physicists to follow up Polanyi's early X-ray rotation technique was I.D. Bernal under W.H. Bragg at the Royal Institution. Fifteen years later Bernal's influential book The Social Function of Science, favouring central planning of science, received its most searching critique from Polanyi in 1939 with a major review and several addresses stressing the importance of basic research and freedom of scientists. Scott and Moleski also illuminate the freedom and domestic life of a distinguished Professor; soon after his arrival in Manchester in 1933, Polanyi took a six-bedroom, three-reception house for which four servants were recommended (they hired only three).

For the scientist there is intrinsic interest in this book over the evolution of theories and experimental methods on gas adsorption, X-ray analysis, crystal strength and solid-state physics. The totality of research on kinetics, began in Budapest and Karlsruhe and developed in Berlin and Manchester, embraces activation energy, the transition state, catalysis and steric hindrance. Advice from other scientists has ensured that the disciplines are covered well and in a fashion intelligible to the nonspecialist. However the description by the authors of the parallel life of economics, social analysis and philosophy emerging in the 1930s and 1940s is equally fascinating. After 1948, when he metamorphosed into a Professor of Social Studies and, even more so, in the 1960s, Polanyi became a scholar at large, spending lengthy periods in the USA. This biography illuminates Polanyi' s clarity of thought and reverence for the truth but allows him to retain some of the mystery about his faith. As an account of the life of one of the most distinguished philosopher-scientists of the twentieth century, it is recommended.

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Letters

A reader has written in with regard to John Lydon's piece 'A welcome to Leeds' querying the date given when Kathleen Lonsdale solved the structure of ice and hexamethylbenzene, suggesting that this must have been much earlier.

John Lydon replies:

Your reader is, of course, quite correct. I apologise for the error and I am glad that it has been pointed it out. A moment's thought would have told me that I was twenty years out. The structure determination of hexamethylbenzene was done in 1927, not 1947. I had made some effort to check all of the other facts listed in my introduction to Leeds - but without thinking, repeated a story that I had heard a number of times when I was an undergraduate and research student working on X-ray crystallography in the chemistry department at Leeds (1958-1964).

I have asked Prof. Durward Cruickshank for help, since he was at Leeds some years before me. He cited the Biographical Memoir of the Royal Society about Kathleen Lonsdale (written by Dorothy Hodgkin). She did her famous work in the Physics Department (courtesy of Prof. Whiddington) over the three year period 1927-1929.
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Prof Ingold of Organic Chemistry offered her the crystals of hexamethylbenzene. The way which the crystal structure was solved is described in her book "Crystals and X-rays" (Bell and Sons Ltd. London, 1948). It was remarkable piece of work for that early date and she appears to have been both fortunate in terms of the favourable crystallographic parameters involved and perceptive enough to have taken full advantage of them. The actual unit cell was triclinic but she recognised that the diffraction pattern indicated pseudo-hexagonal symmetry. This drastically restricted the possible structures and a trial and error checking of possible atomic positions by matching observed and calculated structure factors, gave a completely plausible model. I have not been able to find any confirmation of the story about sub-zero work being done on the roof of the building and although Kathleen Lonsdale may have studied ice crystals, I cannot track down any reference to it. (X-ray work on ice dates all the way back to Laue photographs taken by Ancel St John in 1918). It may all be urban myth. (Perhaps the date 1947 which I had heard, arose from a confusion between a hard winter and the hard winter (since 1947 was famously severe). In 1927, physics was housed in the old redbrick buildings in University Road. Although Bragg's laboratory was in a wooden building at ground level. I gather that there were some laboratories high up on the third or fourth floors in the Baines Wing, more or less under the eaves. As far as X-ray structure determination is concerned, the lower the temperature the better, since the effect of thermal motion is to smear out the observed electron density pattern. Bearing this in mind, perhaps Kathleen Lonsdale simply opened the windows and turned off the heating.

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The group’s website address has changed and is now (for the moment):

http://groups.iop.org/HP
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Forthcoming meetings

History of Physics Group:

August 15th Wadham College, Oxford

You are invited to participate in an informal visit to Wadham College, Oxford followed by a tour of some historic science sites in the city including the Museum of Science.

The date is Tuesday August 15th and the plan is to assemble at Wadham College for a light sandwich lunch, which starts at 12.30pm. Professor Allan Chapman, who is a Fellow of Wadham College, will be hosting the lunch and will then give a short talk, the title of which will be announced later.

At about 2pm we will depart from Wadham for the tour around the city.

The meeting is free of charge (including the lunch). Numbers are limited to a **Maximum of THIRTY PEOPLE.**

For further information and to reserve a place, contact the Secretary, Dr. Peter Ford. (Details on page..)

October 26th Annual General Meeting

The AGM and half day meeting will be held in the Bath Royal Literary and Scientific Institution, 16-18 Queen Sq, Bath, BA1 2HN Tel: 01225 312084; email: admin@brlsi.org; web: www.brlsi.org

The meeting will start at 2pm with AGM following at approx 5pm.

There is no set theme as yet for this meeting so if you have any ideas please forward them to our Secretary, Peter Ford.

Others:

European Society for the History of Science

Second International Conference
Cracow, Poland, 6th - 9th September, 2006

'The Global and the Local: History of Science and Cultural Integration of Europe'

An international conference organized jointly by the European Society for the History of Science, the Commission on the History of Science of the Polish Academy of Arts and Sciences, the Commission for European Matters of the Polish Academy of Arts and Sciences, the Jagiellonian University, and the Institute for the History of Science of the Polish Academy of Sciences, in co-operation with Czech, Hungarian and Slovak institutions.

The European Society for the History of Science will hold its second international conference in Cracow, a city located at the heart of Europe that has long been a traditional place for exchanges between various parts of the continent. Beginning on the evening of Wednesday 6 September 2006 (with the opening plenary lecture and a reception and get-together party) and ending, after three full days, on Saturday 9 September, the conference is planned as an important event within a series of initiatives aimed at creating a European community in the history of science. The first conference of the ESHS, held in Maastricht from 4 to 6 November 2004, set the tone, and we now look forward to building on the achievements of that conference in a gathering that will bring together scholars from all parts of Europe, from the West and East, North and South, and Centre of the continent.

Further details at: www.eshs.org/news/conference.html

UNIVERSITY OF ABERDEEN

Maxwell 150 years on

The impact of his science

A meeting to celebrate the 150^{th} anniversary of the appointment of James Clerk Maxwell to his first Professorial Chair and his only Scottish post

Sept 7^{th}/9^{th} 2006

Invited talks

- Speakers from the UK, Europe and the USA
- Emphasis on electromagnetic topics in research today

Poster session

- Wide remit of topics with Maxwell connections

Public talks

- Maxwell at Aberdeen
- Maxwell's achievements and impact

For further details and registration:
http://www.abdn.ac.uk/maxwell

CCLRC

Institute of Physics in Scotland

September 18-20th, Graz, Austria,

1st International Conference of the History of Physics Group of the European Physical Society

This is to be a joint meeting of the History of Physics groups of the EPS and the ÖPG (Austrian Physical Society) and will be held at Graz University of Technology. Short papers by various members of the EPS committee and members of the History Group of the ÖPG will be given on a variety of topics, as well. There will also be a meeting of the EPS committee and the 56th Annual Conference of the ÖPG will follow up to the 21st September.

More details at: http://oepg06.tugraz.at/

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October 20th, University of Liverpool

A conference on the life and work of Sir Joseph Rotblat, FRS, Nobel Peace Laureate will be held in the Liverpool Medical Institution.

Papers given will include his involvement with the development of the atom bomb, his subsequent working for peace especially with the Pugwash organization and his deep commitment to teaching physics particularly in the field of medicine.
Confirmed speakers (at time of going to press) are:
Mrs Diana Preston –*'Before the Fall-Out – Joseph Rotblat, James Chadwick and the Road to Los Alamos'*
Dr. John Curry **–** *'Sir Joseph before and After the Bomb'*
Dr. Philip Mayles – *'Radiation: Cause of Cancer or Cancer Cure*
Mr. Bruce Kent **–** *'Sir Joseph Rotblat: From Nuclear Disarmament to the Abolition of War'*
It is hoped to have various videos and photographs of Sir Joseph available at the conference and all participants will receive a hard-back copy of the (expanded) texts of papers given and also includes other contributions from some of those who knew and worked with him.
Further details from the University of Liverpool.
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The 17th Novembertagung, Edinburgh, 3rd - 5th November 2006.

Novembertagung is an annual meeting of young researchers in the history and philosophy of mathematics from around the world. It is seeking papers from PhD students or those who have recently completed their thesis in the History and/or Philosophy of Mathematics.

More details at: www.17th-novembertagung.net

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A message from our Web Pages Editor:

The History of Physics group website is still there!

Our web pages can be found as before by starting at URL

http://groups.iop.org/HP/index.html

- The latest news page, 'new.htm', records the finding of a 520 page document in Robert Hooke's handwriting describing meetings and debates he attended between 1661 and 1691.

- Did you know that the British Library has made available on the internet recordings of speeches by some Nobel prizewinners including Francis Crick, Albert Einstein and Ernest Rutherford?

- How many of you have seen the fine image of our chairman and a sculpture based on the 'Weaire-Phelan Structure' in Trinity College Dublin? It is easily accessed by clicking on the year 2005 underlined at the top of the current latest news page.
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The current committee page of the group has been updated with members for 2005-6. I update the 'Events' page as soon as I receive news of any meetings, but I can only add details if you send them to me.

I am still accumulating details about IoP 'blue plaques' I think I have dates of birth and death for all the people commemorated on the plaques and I am now looking for a few paragraphs describing their achievements and some useful web links to other sites who have already set up information. If you live near any of the plaques, please photograph them for me.

The layout of the 'links.htm' page has been improved to make it easier to find your way around it. New links are always welcome.

Those of you who have received your 'Physics World' for June 2006 will have also received a copy of 'Interactions' with a letter from the new webmaster explaining that an all new IOP site will go live on 1 June 2006 at www.iop.org

I urge you to try it for yourselves and let me know your experiences. *For example you might try looking for our latest news page via this new site.*

I have to admit that I could not find it and have asked the new webmaster how to find it. Perhaps by the time you read this it will be easier to find links between the old and new IOP websites.

Please send any comments or news items for the web site to me,

Kate Crennell

email: BCA@ISISE.RL.AC.UK

tel: 01235 834357

post: 'Fortran Friends', P.O.Box 64, Didcot, Oxon OX11 0TH

Although the following article has only very tenuous connections with the history of physics, it seemed that whilst on the theme of 'anniversaries' and since it is 250 years since the birth of Wolfgang Amadeus Mozart, it would be quite in order to include this fascinating account by the author of 'The Braggs and Astbury...' in issue 19. *-editor*

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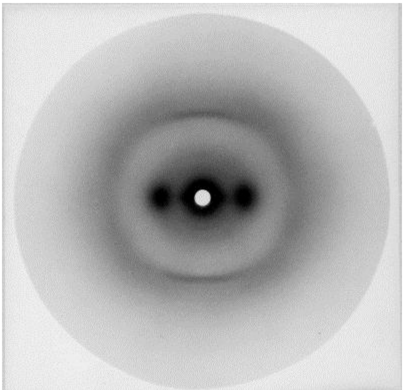
Mozart's hair and the Novello/Cowden Clark Collection

Anthony North, Leeds



X-ray diffraction pattern of hair

W.A. Mozart by Doris Stock, 1789

Among the various items kept in the then Astbury Department of Biophysics at the University of Leeds was a print of an X-ray fibre diagram taken from a lock of Mozart's hair, with a label signed 'W T Astbury'.

How the University of Leeds came to possess a lock of Mozart's hair is an interesting story, involving members of the Novello family, well-known in musical circles, particularly as music publishers.

Vincent Novello was born in London in 1781, the son of an Italian father, a pastry-cook who had settled in England, and an English mother. He became a well-known and influential church musician and, in addition to his many compositions, some of which remain in the present repertoire, he was responsible for introducing to England the Masses of Haydn and Mozart and works by Palestrina, all
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hitherto unknown to British audiences. He founded the Novello music publishing company in order to publish his own compositions and it was put on to a firm footing by his son Alfred. Of Vincent's other ten children, the eldest (Mary Victoria) and the seventh (Clara), who became a celebrated soprano singer, will be referred to later.
In 1829, Vincent and his wife Mary embarked on a journey through Europe with a three-fold purpose: to present Mozart's aged sister Nannerl with a modest sum of money to which Novello and his colleagues had subscribed; to collect material for a projected 'life of Mozart'; and to make arrangements for their daughter's musical education. Both Vincent and his wife kept diaries of their journey.

In the latter part of 1944, after the battle of Florence, a British army officer, Major Edward Croft Murray, found himself quartered in the Villa Novello in Genoa. The house had been bought by Alfred Novello; it later became the last home of Alfred's eldest sister Mary and her husband, Charles Cowden Clarke and, after their deaths, of other Novello family members. Although it had been sold some years previously, Murray found in it a book written by Mary which referred to Vincent Novello's diaries; these were eventually tracked down to an old house, the Palazzo Gigliucci, in Fermo, a little hill town on the Adriatic. It was to this house that Clara Novello had been taken as a bride by her Italian husband Count Giovanni Battista Gigliucci and which became their family home. Clara had been advised by Rossini to accept an appointment as a singer in Fermo, where she had met Gigliucci.

After their re-discovery, the diaries describing the Novellos' journey were subsequently edited and transcribed by Clara's grand-daughter Donna Nerina Medici (née Gigliucci) with a commentary, and were published by Novello's in 1955 in a translation by Rosemary Hughes, entitled *'A Mozart Pilgrimage'.*

The diaries include a description of Vincent and Mary's visits to Mozart's widow Constanze in Salzburg. On the first visit, Constanze showed them a lock of what she said was Mozart's hair, but would not give them any as little was left. On a second visit, however, she relented and gave them a lock, which we presume was later kept with the diaries in Fermo.

Mary Victoria Novello and her husband Charles Cowden Clarke left no children. They, with the Vincent Novellos, had been well acquainted with the literary leaders of the day, the Shelleys, Keats, the Lambs, Leigh Hunt, etc. They were bibliophiles and built up a large collection of correspondence, books and manuscripts, which were transferred to the Palazzo Gigliucci in Fermo when the Villa Novello in Genoa was sold, although the material found by Major Murray had presumably been left behind accidentally.

In the 1950's the University of Leeds library was presented with what has become known as the Novello/Cowden Clarke collection (NCC) by Nerina Medici and her sister Contessa Bona Gigliucci; the collection was augmented in subsequent years by further items, some contributed by a third great grand-daughter of Vincent and Mary Novello, the cousin of Nerina and Bona. The collection includes the travel diaries, numerous manuscripts and other papers – and the lock of hair. A second lock of hair is also included in the collection, preserved in a folded paper inscribed "Cheveu de mon Fils Wolfgang Mozart ano 1829". This was presumably written by Mozart's widow, Wolfgang Jr's mother, at the time of the Novellos' 1829 visit to her. Constanze and Wolfgang's youngest child, Franz Xavier Wolfgang, who was born shortly before the composer's death, was generally known as Wolfgang.

It is not clear what connection there was between those responsible for the artefacts belonging to the Novello family and the University of Leeds, but the gift probably came through the agency of a man called Roger H Ellis, who was a distinguished member of the staff of the Public Record Office (PRO). It is likely that the Novello descendents, looking for a permanent UK home for their collection, directly or indirectly consulted Ellis at the PRO, and he suggested Leeds. It was certainly apparent at that time that Leeds was the most serious, active institutional collector of 19th century rare books and manuscripts in the UK outside the copyright libraries, our activity being supported by the unique Brotherton endowment. The NCC printed books formed the most substantial part of the original gift and it may be that Ellis rightly recognised that fewer of them would be near-duplicates of books already here than would have been the case with copyright libraries.

Julian Rushton (Emeritus Professor of Music in Leeds) has commented “One doesn't like to question the integrity of a lady long dead, but I suppose it's possible it was someone else's hair (but whose? and why offer it, if it wasn't real?) Constanze may also have recalled her husband's affectionate memory of his childhood year and a bit in England: he once called himself a ‘regular Englishman’ and was certainly interested in coming back to London – he had a number of offers. So she may have liked the idea of a bit of hair going to England, not realising it would end up 200 miles away from anywhere he had been.”

The University collection also has a sample of hair said to be Beethoven's. This too came from the Novello family. It is attached to an engraved portrait of Beethoven bearing the manuscript inscription "J.A. Stumpff Wien 1824". Stumpff, a maker of musical instruments based in London, was a personal friend both of Beethoven and of Vincent Novello. He was a major subscriber to the cash collection for Nannerl Mozart which Vincent was to take to her in 1829. We are not aware of any documentary account of how this item came into Novello's possession, but a route from Beethoven himself through Stumpff seems perfectly feasible. As Google will tell you under “Beethoven hair”, a good deal of scientific study of alleged Beethoven hair has been undertaken elsewhere, but our sample has never been studied in such a way to our knowledge.
William Astbury, who was responsible for the X-ray photograph of the Mozart lock, was himself a keen amateur musician. Alas, the photograph reveals that Mozart’s hair was no different from that of any lesser mortal.

With thanks to Chris Sheppard and Oliver Pickering of the Special Collection section of the Brotherton Library in helping to compile these notes.

ACTN

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