Professor David Fowler CBE, FRS, FRSE

Centre for Ecology and Hydrology

David Fowler is a former Science Director of CEH with responsibility for Biogeochemistry and is currently a band 1 IMP based at CEH Edinburgh.

Research interests

Land-atmosphere exchange of trace gases and aerosols

Short lived pollutants: Deposition of reactive trace gases (SO_2, NO_2, O_3, HNO_3, NH_3) to the surface regulates the lifetimes and transport distances in the atmospheric boundary layer: each gas is controlled by different processes at the surface. Fowler work includes the measurement of fluxes in the field by micrometeorological methods and the development and application of models to quantify long-term inputs to terrestrial ecosystems.

Greenhouse gases: Research focussed on the atmospheric trace gases, N_2O and CH_4, includes the measurement of emission fluxes at the field scale by micrometeorological methods and the up-scaling to landscape and regional scales using aircraft sampling in the atmospheric boundary layer.

Aerosols: The deposition of aerosols by dry deposition to terrestrial surfaces is a significant removal process for large aerosols, and is strongly influenced by aerosol size and the aerodynamic roughness of terrestrial surfaces. His work includes the measurement of aerosol deposition fluxes by micrometeorological methods and by the application of ^{210}Pb tracer methods, the latter providing long term (~ 20year) average deposition fluxes and has been applied to quantify the effect of urban trees on removal of aerosols from urban air.

Ground level ozone

Ground level ozone represents a threat to human health, the productivity of vegetation and tropospheric ozone is a greenhouse gas, third in importance to CO_2 and CH_4. Work on ground level ozone has been focussed on the surface removal process, as above and on synthesis of the ground level ozone problems at the UK and global scales. Ground level ozone has become a global scale issue, rather than the local or regional pollutant it was considered to be in the late 20th century.

UNEP Black carbon and ozone assessment: A recent Assessment of the role of black carbon and tropospheric ozone in air quality and climate and the potential benefits of a range of control measures for each of these pollutants.

The long range transport of pollutants in Europe has been a substantial and long-term environmental issue, dominated in the 1970s by the effects of acid rain on

ecosystems and more recently by ground level ozone, oxidized and reduced nitrogen compounds and particulate matter. The synthesis of this research may be found in the review reports National Expert Group on Transboundary Air Pollution (NEGTAP) 2001) and ACCENT review papers: a full publication list may be found at: David Fowler CEH

Recent projects include ACCENT-Plus (Atmospheric Composition Change: The European Network of Excellence); PEGASOS (Pan-European Gas-AeroSOls-climate interaction Study); Heavy Metals Deposition Mapping; Acid Deposition Processes; OP3 - Oxidant and Particle Photochemical Processes above a Southeast Asian Tropical Rainforest; Black Carbon and Tropospheric Ozone; and UNEP Integrated Assessment of Black Carbon and Tropospheric Ozone.

Professor Mary Fowler
MA PhD FRAS FGS

Geophysics, Master of Darwin College

Biography

Professor Mary Fowler, a geophysicist, has been Master of Darwin College, Cambridge since October 2012. Her BA was in Mathematics (Girton College, Cambridge, 1972) and her PhD in Geophysics (Darwin College, Cambridge, 1976). After a Fellowship at the ETH Zurich, Switzerland she held positions at the University of Saskatchewan, Canada, before joining Royal Holloway, University of London in 1992 where she served as Head of the Department of Earth Sciences and Dean of the Science Faculty.

Professionally, in addition to editorial and advisory roles, she has served on various Research Council, Royal Society, Leverhume, RAE and REF panels, on the Councils of the Geological Society and the Royal Astronomical Society, as Chair of the Committee of Heads of UK Geoscience Departments and Vice-President of the Royal Astronomical Society. Personally she had a decade-long 'career-break' and worked part-time for another decade while her family was growing up.

Research Summary

Her research publications have contributed in a number of important areas including the first use of synthetic seismogram techniques to model oceanic crustal structure from marine seismic experiments; studies on the mechanisms of formation of sedimentary basins; the study of magma chamber processes on the Mid-Atlantic Ridge and her work on the biogeography of deep-sea hydrothermal vent fauna.

She is best known around the world for her book, ***The Solid Earth: An Introduction to Global Geophysics",*** for which she was awarded the Prestwich Medal by the Geological Society in 1996. Reviewers said of the first edition *"This fine new geophysics textbook will now be added to the top of my list of recommendations, as it promises to be excellent both for teachers and for those seeking a review of these processes from a geophysical point of view*." (Nature); and of the 2nd edition "*The book provides an exciting review of a decade of advances and improved comprehension of the interior working of the Earth. It is truly a wonderful text and a source of reference for many facts in the field of Geoscience*." (Environmental Geology).

Professor Tejinder S Virdee FRS

Professor of Physics, Imperial College

Tejinder Singh Virdee joined Imperial College London in 1982 and is famous for originating the concept and leading the construction of Compact Muon Solenoid (CMS) experiment, at CERN's Large Hadron Collider (LHC). CMS involves more than 3000 scientists and engineers from over 40 countries. So far, the highlight of CMS, and its sister experiment ATLAS, has been the discovery of the Higgs boson in July 2012.

Research career

After completing a PhD in 1979, Tejinder joined the Experimental Physics Division at CERN. His early career (1979-1984) involved experimentally verifying the notion that 'quarks' carry fractional electric charge, by scattering real photons off the quarks that are tightly bound inside the nucleon.

In 1984, he joined the UA1 experiment at the CERN proton-antiproton collider (SPS), where he invented a novel technique of collecting light in plastic scintillator-based calorimeters.

In 1990, Tejinder and a few colleagues planned an experiment to identify the missing elements of the Standard Model (SM) and to probe the physics of the TeV scale. This became the Compact Muon Solenoid (CMS) experiment at the Large Hadron Collider. Tejinder played a key role in all phases of CMS, including its conceptual design, intensive R&D, prototyping, construction, installation, commissioning, data-taking and finally physics exploitation. The possibility detecting the SM Higgs boson was crucial in the conceptual design of CMS and served as a benchmark to test the performance of the experiment, none more so than the low mass region, via its decay into two photons. Tejinder advocated the use of lead tungstate scintillating crystals ($PbWO_4$) for the electromagnetic calorimeter of CMS, and led the team that validated this technique, which has played a crucial role in the discovery of the Higgs boson in 2012. CMS is now one of the two largest experiments in particle physics. Tejinder was deputy leader (1993-2006) and leader (2007-2010) of the collaboration and oversaw the final stages of construction, installation and data taking with the first collisions at the LHC. He has been active in the measurement of the properties of the Higgs boson.

He has been a major voice in arguing for the long-term future of the LHC accelerator and its two experiments, CMS and ATLAS. A factor of five higher proton-proton interaction rate, and a factor of ten times larger data set are envisaged. H is now leading a project to replace CMS' endcap calorimeters for this programme.

Professor Angela Hatton

Director of Research, SAMS

I'm a microbial ecologist, focussed on marine biogeochemistry. My interests lie in understanding the role microorganisms play in the production and removal of environmentally significant trace gases, including the climate feedback gas, dimethylsulphide (DMS) and the greenhouse gas, methane. I use a multidisciplinary approach including using analytical chemistry, culturing, molecular biology and process studies to investigate pathways and rates of gas production in the marine environment.

Main interests involve

- Anaerobic microsites and methanogenesis
- Role of dimethylsulphoxide in the sulphur cycle
- Algal-bacterial interactions and their influence on biogenic sulphur production
- Dimethylsulphiopropionate production by different algae

Other current interests include

- Photochemistry
- Feeding behaviour and chemical cues
- Trimethylamine-N-oxide and its role in the marine nitrogen cycle

Career / education

From 2017	Director of Science and Technology, NOC
2014-2016	Director of Research, SAMS
2013-2016	UHI Professor, SAMS
2006-2012	Senior Lecturer, SAMS
2003-2006	Lecturer, SAMS
1997-2003	NERC Research Fellow, SAMS
1995-1997	Senior Research Associate, University of East Anglia
1991-1995	PhD student, University of East Anglia

Professor Graham J C Underwood

Executive Dean, Faculty of Science and Health, University of Essex

Research career to date:

I am a marine and freshwater biologist, particularly interested in the interactions between microbes (algae and bacteria), nutrient and element cycling, and how these 'bottom up' process feed through into ecosystem functioning. I have broader interests in the biology of invertebrates, habitat use and fragmentation on the coast, coastal geomorphology and sea level rise. My research is based in the UK, but I have also carried out research in the Baltic, Mediterranean and South African environments, tropical systems in the Indo-pacific and the Bahamas, and more recently studying Antarctic and Arctic sea ice communities.

Current research:

Recent projects funded by UK Natural Environment Research Council (NERC) have investigated photosynthesis, exopolymer production (extracellular polymeric substances, polysaccharides, carbohydrates) in estuarine benthic diatom biofilms, Arctic lakes and in sea ice environments in the Arctic and Antarctic. My group also has interests in the rhythms in photosynthesis, spatial and temporal heterogeneity and the contributions of different algal taxa to biofilm productivity. Diatoms have complex behavioural and physiological response enabling them to cope with high light stress, UVB and photo-oxidative damage: one reason for their abundance and high levels of primary production in aquatic systems.

My other research interests include:

- Salt marsh and estuarine ecology, looking at marsh fragmentation, food resources and habitat use by juvenile fish. The importance of water quality and environmental factors in the ecology of oysters (Ostrea edulis and Crassostrea gigas), and management measures to enhance biodiversity and ecosystem functioning in coastal habitats.
- Ecology of microalgal biofilms in tropical (corals sands, seagrass beds, beaches) habitats
- Sediment stabilisation by microalgal biofilms
- Managed realignment, saltmarsh restoration and rising sea levels
- Taxonomy and diversity of marine benthic diatoms

Professor Eric Wolff FRS

Royal Society Research Professor in the Department of Earth Sciences at Cambridge University

After graduating as a chemist, he has studied ice cores from the Antarctic and Greenland for the past 30 years, using them to understand changing climate, as well as changing levels of pollution in remote areas. He also carries out research into the chemistry of the lower parts of the Antarctic atmosphere. Until June 2013, he had worked at the British Antarctic Survey, leading their programme: "Chemistry and Past Climate". Before leaving BAS, he had reached IMP level 2. He chaired the science committee of the European Project for Ice Coring in Antarctica (EPICA), which produced 800,000 year records of climate from the Dome C (Antarctica) ice core and co-chairs the international initiative (IPICS) to coordinate future ice core research.

Main research interests: Long-term paleoclimate and atmospheric chemistry (including greenhouse gases) from ice cores; Quaternary climate; millennial-scale and rapid climate change; heavy metals in ice and snow; polar tropospheric chemistry; air-snow transfer; electrical properties of ice and relationship to chemistry; microstructure of ice

Major scientific contributions include:

- First good measurements of changes in heavy metals in Antarctic snow over the 20th century
- First direct demonstration that some impurities in polar ice sit at triple junctions and grain boundaries
- Significant role in developing the connection between electrical properties and chemical content of polar ice
- Major influence in the study of atmospheric chemistry over saline sea ice surfaces including proposal that sea salt in ice cores can be used as an indicator of past sea ice extent
- Lead author on EPICA paper presenting 740 ka climate records (shared with many Co-Is); led production/publication of 800 ka long chemistry records from EPICA ice core, and developed biogeochemical interpretations related to such chemistry
- Recent contributions on the nature of interglacials and glacial terminations
- Led the Royal Society team in a joint initiative with the National Academy of Sciences on explaining climate science "Climate change: evidence and causes" in 2013.

Professor Matt Griffin
Head of the School of Physics and Astronomy, Cardiff University

Matt Griffin is an experimental and observational astronomer. He graduated from University College Dublin as an electronics engineer in 1976, after which he worked in industry for several years, and also studied part-time for an MSc in Astrophysics at Queen Mary, University of London. Subsequently he did his PhD at Queen Mary, graduating in 1985 having worked on the development of a submillimetre photometer instrument for the United Kingdom Infrared Telescope in Hawaii, and its use for astronomical observations, particularly investigation of the at atmospheres of the giant planets. The instrument subsequently formed the prototype for a facility instrument on the James Clerk Maxwell Telescope.

Subsequently, as a postdoc and academic at Queen Mary, he worked on the design and construction of instrumentation for the JCMT, including the SCUBA camera. He also participated in balloon-borne Earth observations to investigate stratospheric ozone chemistry, and developed and implemented the detector system for the Long Wavelength Spectrometer instrument on board the European Space Agency's Infrared Space Observatory. He led the Solar System group in the LWS Science Team. In the early 1990s he acted as the UK spokesperson for ESA's *Herschel Space Observatory* and *Planck Surveyor* missions in the early stages of their development, and later became the Principal Investigator for SPIRE, a far-infrared camera and spectrometer for *Herschel*, built by a consortium of 18 institutes in eight countries.

He moved to Cardiff University in 2001, continuing to work on SPIRE and to lead the international consortium. *Herschel* was launched in 2009, operating until 2013, and has proved to be extremely successful scientifically, with over 200 refereed papers to date, approximately 60% of which use SPIRE observations. At Queen Mary and Cardiff, he also carried out observational studies in star formation and extragalactic astronomy using data from ISO, *Herschel* and other observatories. Between 2013 and 2016, he was the Principal Investigator for the European Union SPACEKIDS project, which developed and demonstrated the feasibility of superconducting Kinetic Inductance Detectors for space applications in astronomy and Earth observation. Currently, he is the UK spokesperson for SPICA, the next generation far infrared observatory, proposed as a joint European/Japanese mission, and is a UK Co-PI for ARIEL, a proposed exoplanet spectroscopy satellite.

He has served on numerous national and international committees, including the UKIRT and JCMT Boards, the ESA Science Programme Committee, STFC's Science Board (as chair), and the European Space Science Advisory Committee, the EU FP-7 Science Advisory Group, and the COSPAR International Working Group on The Future of Space Astronomy

Awards for his work on *Herschel* include the Royal Astronomical Society Jackson-GWILT medal, the PAS Group Achievement Award, and the Arthur C Clarke individual and group research achievement awards. He was also a member of the SCUBA team which received the RAS Group Achievement award. He is a Fellow of the Institute of Physics and of the Learned Society of Wales.