



University of Salford
A Greater Manchester University

Faculty of Science, Engineering & Environment

**30 June
2010**

**11.00am – 2.30pm
Lady Hale
Building**

Celebration of Research

Poster Abstracts

Contents

School of Environment & Life Sciences

Centre for Parasitology & Disease Research

Occurrence of Helminth and Protozoan Parasites in UK Populations of the European Eel (*Anguilla Anguilla*). Rosilah, Ab Aziz¹, Michael Godard², Alan Walker², Chris Williams³, Miran Aprahamian³ and Darren Brooks¹

Antigen Recognition Patterns in Humans with Different Cyst Classifications in Cystic Echinococcosis. Tony Bodell, Russell Richardson, Philip Craig, Eberhard Zehyle and Mike Rogan

Studies on the Life Cycle and Transmission of the Trematode *Plagiorchis muris* at Malham Tarn, Yorkshire. Kellyanne Boyce, Helen Bradshaw, Mike Rogan, Geoff Hide, Adrian Pickles, Philip Craig

Endoparasites of Pipistrelle Bats.
Jennifer Lord, Nicole Dodd, Geoff Hide and Darren Brooks

An Investigation into the Prevalence of *Toxoplasma gondii* Infection in British Bats.
Nicole Dodd

Antimicrobial Properties of Ag/TiO₂ and CuO/TiO₂ Films Deposited by Chemical Vapour Deposition.
H A Foster, S Varghese, P Evans, P Sheel, D W Sheel, N Rutschke and H M Yates

Evidence for High Levels of Vertical Transmission in *Toxoplasma gondii*.
Geoff Hide, Emma K Morley, Jacqueline M Hughes, Omar Gerwash, Mohamed S Elmahaishi*, Khalid H Elmahaishi*, Denise Thomasson, Elizabeth A Wright, Huw Williams, Gai Murphy and Judith E Smith

Detection of *Echinococcus granulosus* in Farm Dogs in South Powys, Wales using coproELISA.
Wai-San Li

Mosquito Monitoring in the UK.
Dr Gai Murphy

Imaging Mass Spectrometry: Optimising Tissue Specific Methodology for Cancer Biomarker Investigation. Dr Niroshini Nirmalan

Development and Validation of a Quantitative in vitro Model System to Investigate Host Erythrocyte Remodelling in Severe Malaria.
Dr Niroshini Nirmalan

Inflammatory Bowel Disease and *Trichiuris muris* Infection.
Ekta Bhardwaj, Kathryn J Else, Geoff Warhurst and M T Rogan

Hydatid Cysts: Every Picture Tells a Story.
Michael T Rogan, Wang Yun Hai, Russell Richardson Eberhard Zeyhle & Philip S Craig

Role of Fibroblasts in Chronic Obstructive Pulmonary Disease.
Stephanie Buxton, Dave Singh*, Jeremy T Allen, Lucy Smyth

Biocidal Surfaces: Activity Testing and Growth using APCVD .

S Varghese, P Fitton, S Haq, D W Sheel, P Youngson, P Sheel, F J (Eric) Bolton and H A Foster

Inhibition of Murine Skeletal Muscle Differentiation by Transforming Growth Factor β_1 (TGF- β_1) is Attenuated by the Omega-3 Polyunsaturated Fatty Acid Eicosapentaenoic Acid (EPA).

J K Whittingham-Dowd and J T Allen

Centre for Biochemistry, Drug Design & Cancer Research

An in vitro Study of the Cytotoxic and Cellular Biochemical Effects of L-glutamine Moderation in Pediatric Sarcomas.

Jodie Allsup

Electrochemical Monitoring of Tumour Cell Responsiveness to Anti-cancer Drugs.

Jon A Deakin and Alan T McGown

Novel Heparin Mimics: Design, Synthesis & Biological Evaluation.

R Lagoutte and J A Wilkinson

Investigating the Biological Role of human NEIL3.

Thomas Roedl and Rhoderick H Elder

Photoactivation of Trans-combretastatins as Anticancer Drugs.

Kathrin Scherer, Roger Bisby, John Hadfield, Nicholas Hirst and Alan McGown

Asymmetric Alkylation of Diarylmethane Derivatives.

James Wilkinson, Steve Rossington, Eun-Ang Raiber, John Leonard, Nigel Hussain

Centre for Environmental Systems & Wildlife Research

Fuel Moisture Content Estimation based on Hyperspectral Data for Fire Risk Assessment.

T A Almoustafa, R P Armitage, F M Danson

Genetic Response of the Common Toad (Bufo bufo) to Environmental Change.

Robert Coles, Chris Reading* and Robert Jehle

The Salford Advanced Laser Canopy Analyser (SALCA): A Multispectral Full Waveform LiDAR for Improved Vegetation Characterisation.

R Gaulton, F M Danson, G Pearson, P E Lewis and M Disney

Do Great Crested Newts (Triturus cristatus) find their Breeding Ponds by Following Acoustic Cues from Frogs and Toads?

Neil Madden & Robert Jehle

The Historical Ecology of the Large Mammal Fauna of Ngorongoro Crater, Tanzania.

Louise Oates and Dr Paul Rees

Delineating Margins of Debris-covered Himalayan Glaciers from Remotely-sensed Images.

R Wilson, D N Collins & R P Armitage

Research Centre for Urban Change

Green Fix: Valuing Manchester's Nature.

Luke Blazejewski

Pond Landscapes in an Urban Context.

David G Gledhill and Philip James

The Urban Environment: Quantifying Ecosystem Services at the Neighbourhood Scale.

Kathleen G Radford

Drivers of Change – Regenerating Saltmarsh using Conservation Grazing Cattle in an Industrialised

Area. Damian Smith and Philip James

The Resilience of Urban Green Infrastructure: A Case Study of Runcorn, UK.

N J Wallbank and P James

School of Computing, Science & Engineering

Materials & Physics Research Centre

Bulk Ordering Phenomena in the Li-N-H Hydrogen Storage System.

G Baldissin & D J Bull

Experimental and Theoretical Investigation of the Li-N-H System for Hydrogen Storage.

D J Bull, D J Riley, D Moser, G Baldissin, W A Oates, I Morrison and D K Ross

A High-Pressure Hydrogen Energy Research Facility in the Faculty of Science, Engineering and the Environment.

D J Bull, D Moser, J S Cowpe, R D Pilkington and D K Ross

Snell's Law for Nonlinear Beams.

J M Christian, G S McDonald, J Sánchez-Curto and P Chamorro-Posada

Laser-induced Breakdown Spectroscopy of Organic and Biomedical Materials.

J S Cowpe, R D Pilkington, R D Moorehead, S H Kilcoyne, G Crofts, C Ucer

Spectroscopic Study of Transient Laser-induced Plasmas.

J S Cowpe, J S Astin, D Moser, D K Ross, J J Smith and R D Pilkington

Hydrogen Storage on Pyrolysed Carbon.

Gilbert Dwek, Dan Bull, Simon Keens, David Moser, Tom Patterson and Keith Ross

Transmission Electron Microscopy with in situ Ion Irradiation at the University of Salford.

J A Hinks, J A van den Berg and S E Donnelly

A Single Step PDMS Deposition Process for Stoichiometric CuInSe₂ Solar Cell.

Sreejith Karthikeyan, Arthur E Hill and Richard D Pilkington

Paschen Curve Analysis to Optimise Pulsed dc Sputtering Plasmas.

Sreejith Karthikeyan, Arthur E Hill, John S Cowpe and Richard D Pilkington

Scientific Analysis of Archaeological Artefacts.

K Gannon, S H Kilcoyne, R D Pilkington, J Cowpe, G Parr, L M Simmons

Relativistic Effects in Non-Relativistic Systems.

G S McDonald, J M Christian and T F Hodgkinson

SANS Study of Pore Structure of Activated Carbon: The Use of Contrast Matching and Partial Pressure Variation.

Z A Mileeva and D K Ross

Spatial and Temporal Solitons in Magneto-optic Metamaterials .

R C Mitchell-Thomas and A D Boardman

Optimising Processing Routes in Fluorapatite – Fluorophlogopite Glass Ceramics.

R D Moorehead , S H Kilcoyne, N L Bubb, D J Wood , P M Bentley

Transition Metal Doped Magnesium-based Hydrogen and Energy Storage Materials.

David Moser, Gael Baldissin, Dan Bull, John Cowpe, Ian Morrison, Alan Oates, Dag Noréus, Richard Pilkington, Duncan Riley and Keith Ross

The Pressure-Temperature Phase Diagram of MgH_2 and MgD_2 .

David Moser, Gael Baldissin, Dan Bull, John Cowpe, Ian Morrison, Alan Oates, Dag Noréus, Duncan Riley and Keith Ross

Planned in-situ TEM Study of Silicon Carbide under Irradiation.

C J Pawley, S E Donnelly, M-F Beaufort, J A Hinks and E Oliviero

Optical Emission Spectroscopy for Remote Materials Analysis in Hazardous Environments.

R D Pilkington¹, J S Cowpe¹, D Moser¹, A I Whitehouse²

The UKLIBS Network.

J S Cowpe and R D Pilkington

Geo-archaeological Applications of LIBS.

R D Pilkington, J S Cowpe, S H Kilcoyne and K Gannon

Fabrication and Characterisation of Iron-Gallium (FeGa) Thin Films and Nanostructures.

C J Quinn, N Mellors and P J Grundy

First Principles Study of Hydrogen Storage in Metal-Organic Frameworks.

Duncan Riley, Ian Morrison, Dan Bull and David Moser

Application of Poly-CINS Modelling to Defect Dynamics in Natural and Irradiated Graphites.

Daniel L Roach and D Keith Ross

White Light Lasers .

C S Rose, G S McDonald and J M Christian

Nanostructured Hybrid Hydrogen Storage Materials.

D K Ross, I L Shabalin, T M Paterson, S G Keens & Z A Mileeva

Thermal Shock Resistance of Hetero-Modulus Ceramics based on Transition-Metal Carbides.

I L Shabalin

Hybrid 3D-Nano/Microstructures Obtaining on the Basis of Pretreated Carbon Fibers.

Z A Mileeva, V A Bogolepov, D V Schur, S Y Zaginaichenko, V A Begenev, I L Shabalin and D K Ross

Investigation of Common Industrial Wastes for the Production of Hetero-Modulus Hybrid Materials with Reduced Embodied Energy.

I L Shabalin, J Cloughley and H Naji

Nano-Structured Hybrid Hydrogen Storage Materials .

D K Ross, I L Shabalin, T M Paterson, S G Keens, Z A Mileeva

Energy-Saving Hybrid Materials based on Polymer-Ceramic Chemically Bonded & Fibre Reinforced Microstructures.

I L Shabalin and J Cloughley

Soft X-Ray Magnetic Imaging of Focused Ion Beam Lithographically Patterned Fe Thin Films.
P J Cook, [T H Shen](#), P J Grundy, G A Jones, S A Morton, P J Fischer, M Y Im and A L D Kilcoyne

Observation of the Effect of Spin-resolved Density of States in Optically Excited Polarised Electron Injection at Schottky Barriers.
N Wang, [T H Shen](#), G A Jones, P J Grundy and W Y Liang

Monocrystalline Hexagonal Close-packed and Polycrystalline Face-centered Cubic Co Nanowire Arrays Fabricated by Pulse dc Electrodeposition.
J Zhang, G A Jones, [T H Shen](#), P J Grundy, S E Donnelly and G Li

Investigation into the Recrystallisation of Amorphous CoFeB Alloys.
[L M Simmons](#), S H Kilcoyne, D Greig and M J Walker

Three Dimensional Mapping of Texture in Dental Enamel.
[L M Simmons](#), S H Kilcoyne, M Al-Jawad, K Abboud and D J Wood

The Nanomaterials Research Group – Sample Preparation and Characterisation Techniques.
S H Kilcoyne, N J Mellors, R D Moorehead, [L M Simmons](#), C J Quinn, P Busby and S Atkinson

Diffusion of Hydrogen in Palladium Nano Particles.
David Wilkinson

Engineering 2050 Research Centre

Evaluating the Performance of Motorway Weaving Sections using Micro-simulation.
[Hamid Al-Jameel](#)

Modelling Ramp Metering at Motorway Merges.
[Jalal Al-Obaedi](#) & Saad Yousif

Residential Trip Generation Characteristics in City Centre Developments.
[Firas H A Asad](#) and Ralph Henson

Manufacture and Characterisation of Metal-Alloy Nanowires.
[P Busby](#) & N J Mellors

Estimation of the Wheel-Rail Contact Condition for Traction & Braking Control.
[Imtiaz Hussain](#), T X Mei

Enhanced Safety and Reliability through Fault Tolerant Control.
James Thomas

Acoustics Research Centre

Structure Borne Sound from a Small Wind Turbine: Characterisation by Measurement in-situ.
[Andy Elliott](#) and Andy Moorhouse

Subjective Perception of Room Mode Control Methods based on Multiple Sources and Signal Processing. [Lucy Elmer](#)

Sonic Crystal Noise Barriers made of Resonant Elements.
[A Krynkin](#) and O Umnova

Acoustics Research in Modelling and Simulation, with Implications for VR and Future Media.

Y W Lam

A Microstructure-based Approach for Modelling Acoustical Properties of Multi-scale Porous Materials. Rodolfo Venegas and Olga Umnova

The Development of a Transponder Based Technique for the Acoustic Calibration of SODARs (acoustic wind profilers).

B Piper and S von Hünenbein

Validation of Sodar Real-Time Sensing and Visualisation of Wake Vortices.

S G Bradley, S v Hünenbein and K Underwood

Data Mining & Pattern Recognition Research Centre

A Rules Based System for Named Entity Recognition in Modern Standard Arabic .

Ali Elsebai

An Empirical Comparison of Cost-Sensitive Decision Tree Induction Algorithms.

Susan Lomax and Sunil Vadera

A Survey of Cost-Sensitive Decision Tree Induction Algorithms.

Susan Lomax and Sunil Vadera

UML QoS Profile Exploration for the Specifications of a Generic QoS Metamodel for Designing and Developing Good Quality Web Services.

Wan Nurhayati Wan Ab. Rahman

Computer Networking & Telecommunications Research

Improvements in Data-Transport Security in Wireless Sensor Networks.

E Ekonomou & K Booth

A New Framework for Context Representation, Maintenance and Discovery in Mobile and Ad Hoc Networks.

Qi Liu and Nigel Linge

Virtual Environments & Future Media Research Centre

Upgrading Emergency Planning Tabletop Exercises.

J S Mooney, L S Griffiths, L Wallis, W P Smith & P A Driscoll

Major Incident Tabletop Exercises: A High Tech, Low Cost Evolution.

J S Mooney, P A Driscoll & L S Griffiths

12/12 School Kids enjoy Emergency Planning Gaming.

J S Mooney, P A Driscoll & L S Griffiths

School of Health, Sport & Rehabilitation Sciences

Centre for Health, Sport and Rehabilitation Sciences Research,

Relationships between Amputee Independent Prosthesis Properties and Gait Performance.
Matthew J Major

The Role of Visual Attention in Learning to use Myoelectric Prosthesis – A Pilot Study.
M Sobuh, L Kenney, S B Thies, A Galpin, P Kyberd and M Twiste

Salford Analytical Services

Identification and Quantification of API in Counterfeit Medicines by Nuclear Magnetic Resonance (NMR) Spectroscopy. Kirit Amin

Occurrence of Helminth and Protozoan Parasites in UK Populations of the European Eel (*Anguilla anguilla*)

Rosilah, Ab Aziz¹, Michael Godard², Alan Walker², Chris Williams³, Miran Aprahamian³ and Darren Brooks¹

¹*Centre for Parasitology & Disease Research,
School of Environment and Life Sciences, University of Salford*

²*CEFAS, Lowestoft, UK*

³*Environment Agency, UK*

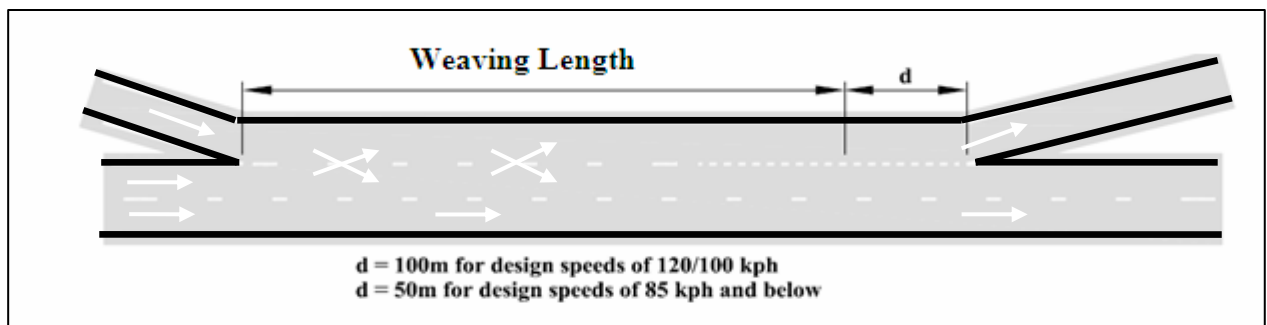
Populations of the European eel *Anguilla anguilla* are under threat and one contributory factor is believed to be the effect of infection with parasites. One parasite has attracted more attention than others, the swim-bladder nematode *Anguillicoloides crassus*, due to its relatively recent and rapid invasion of European waters and the subsequent debilitating pathology that occurs within *A. anguilla*. The natural host, the Pacific eel *A. japonica*, is not harmed by *A. crassus* infection. In an attempt to update our knowledge of *A. crassus* in UK habitats, we have obtained eels from widely distributed sites. Data highlighting the prevalence and intensity of *A. crassus* infection in UK eel populations will be presented at the meeting. In addition, eels are host to a variety of other helminth and also protozoan parasites. As part of an overall strategy to analyse parasite community structures within UK eel populations, molecular-based techniques are being developed to assist rapid identification of these eel parasites. Preliminary effort has focussed upon *Trypanosoma granulosum* given that a number of reports suggest that the effects of this protozoan may have been underestimated and that the parasite may indeed be pathogenic to the European eel. As such, data on the development of a PCR-based screening approach for identification of *T. granulosum* in eel samples derived from sites across the UK will also be presented at the meeting.

Evaluating the Performance of Motorway Weaving Sections using Micro-simulation

Hamid Al-Jameel (PhD Student – Supervisor: Dr Saad Yousif)

*Engineering 2050 Research Centre,
School of Computing, Science & Engineering, University of Salford*

Motorway weaving sections are characterised by generally higher number of lane changes which normally results in turbulence and consequently, causes bottlenecks leading to congestion and queues. Thus, and in order to alleviate the effects of congestion in these sections, measures to improve motorway capacity needs to be considered. Such measures include geometric design features as well as using traffic control devices, such as Intelligent Transport Systems (ITS) to influence drivers' behaviour. Micro-simulation models have proved to be more effective in replicating such complex situations rather than relying on mathematical models to predict and evaluate traffic performance when certain measures were implemented aiming to increase weaving capacity. The figure below shows a typical weaving section.



Weaving section

The methodology of this research is to determine the factors/affecting weaving capacity based on previous literature to help in the building and developing the micro-simulation model using Visual Compact Fortran. This model consists mainly of two sub-models: car-following and lane changing models. This car-following model can represent different traffic situations from free flowing to congested (stop-and-go) conditions. A hybrid lane changing model has been developed to represent normal and weaving sections with different configurations up to a total number of lanes of five.

The model has been calibrated with field data which have been collected from different sections (i.e. normal and weaving) within Greater Manchester. The data will be used in both the calibrating and validating processes of the model. The model will then be used to test different scenarios on how best capacity may be improved for weaving sections such as selecting the optimum location of warning signs and applying variable speed limits upstream of the motorway to regulate traffic.

An in vitro Study of the Cytotoxic and Cellular Biochemical Effects of L-glutamine Moderation in Pediatric Sarcomas.

Jodie Allsup

*Centre for Biochemistry, Drug Design & Cancer Research, Room 310 Cockcroft Building,
School of Environment & Life Sciences, University of Salford*

Background

L-glutamine (gln) has many cellular roles including energy generation and protein biosynthesis making it vital to cells. Gln deprivation is being explored as a clinically relevant means of chemosensitizing cancer cells to chemotherapeutic agents

Aims

To investigate the cytotoxic and cellular biochemical effects of gln and L-asparagine (asn) deprivation in vitro to explore the potential of using gln deprivation clinically and to investigate synergism between gln and asn deprivation combined with clinically used anti cancer agents.

Methods and results

Ewing's Sarcoma (ES) TC32, Osteosarcoma (OS) HOS and Rhabdomyosarcoma (RMS) A204 cell lines were deprived of gln and asn for periods of up to 72 hours. Decreased viability of cells with increasing time of gln deprivation was observed in all cell lines, but no effect was observed for asn deprivation. However, a greater effect on viability was found with simultaneous gln and asn deprivation. For gln deprivation, flow cytometry revealed noticeable accumulation of cells in G1 phase of the cell cycle in ES and RMS cells. However, Annexin-V FITC staining showed dramatic increase in apoptosis in all cell lines. Cytotoxicity assays with cisplatin, doxorubicin, temozolomide, topotecan, methotrexate and vincristine have given sensitive IC50 results. Synergistic studies combining these agents with gln, asn and combined gln/asn deprivation are being performed.

Conclusions

Loss of cell viability during gln and asn deprivation is caused by dramatic induction of apoptosis here. Current cytotoxicity studies show these cell lines to be very sensitive to the listed chemotherapeutic agents. Preliminary synergy studies are revealing encouraging results.

Fuel Moisture Content Estimation based on Hyperspectral Data for Fire Risk Assessment

T A Almoustafa, R P Armitage, F M Danson

*Centre for Environmental Systems & Wildlife Research,
School of Environment and Life Sciences, University of Salford*
T.A.Almoustafa@pgr.salford.ac.uk

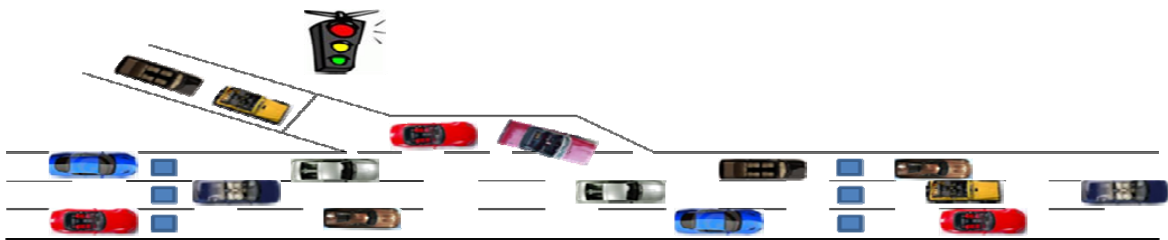
This study aims to investigate whether the relationships between fuel moisture content (FMC) and vegetation spectral reflectance identified in previous studies, can be used to improve fire risk assessment for fire-prone upland vegetation in the UK. Two hyperspectral images from the AISA Eagle and Hawk sensors were collected over a UK test site in 2008 by the Natural Environment Research Council (NERC) Airborne Remote Sensing Facility (ARSF). In-situ field spectra were collected concurrently with the flight using an Analytical Spectral Devices (ASD) field spectroradiometer. Ground data on live FMC and other relevant variables were collected. Spectral reflectance values were extracted from the two airborne images for the sites at which coincident ground-based measurements were made. The results show that FMC varies temporally and with vegetation type. Reflectance variability with FMC is expressed most strongly in the SWIR and NIR. The sensitivity of SWIR and NIR reflectance to FMC variations is much greater when considering each vegetation type individually. The results also compare first derivative and broad band vegetation indices to estimate vegetation FMC.

Modelling Ramp Metering at Motorway Merges

Jalal Al-Obaedi & Saad Yousif

*Engineering 2050 Research Centre,
School of Computing, Science & Engineering, University of Salford*

Traffic congestion has increased rapidly in the past decades mainly due to a sharp increase in vehicles using the road networks. Recently, and to deal with motorway congestion, traffic signal devices (ramp metering) installed on motorway entrances were increasingly being applied on a part-time basis to regulate the entering traffic aiming at reducing congestion. However, there are still some questions which this research project is trying to address for justifying the use of ramp metering systems.



Questions to be addressed

- the effectiveness of ramp metering in reducing spill-backs on motorway and slip-road sections in congested conditions;
- the optimum positioning of traffic signals and motorway detectors;
- the effect of slip-road (ramp) length;
- the optimum algorithm for traffic signals timings; and finally
- the limits of the parameters used in triggering the ramp metering signals, such as occupancy, flow and speeds.

Methodology

In order to answer the above questions, it is obvious that conducting on-site trials will need extensive time and funding resources. Therefore, the use of micro-simulation models would be more appropriate as a tool in this research to evaluate the effects on delay and reduced road capacity for different conditions. A micro-simulation model has been developed for this purpose here at Salford. The model deals with general as well as more specific drivers' behavioural tasks such as their cooperative nature when they allow others to merge either by decelerating or shifting to other lanes. The developed model has been calibrated and validated using different sets of available electronic and videos data recordings. At this stage, the results from the process of applying the model to answer the above questions are under consideration.

Identification and Quantification of API in Counterfeit Medicines by Nuclear Magnetic Resonance (NMR) Spectroscopy

Kirit Amin

Salford Analytical Services, Office 02, Cockcroft Building, University of Salford

The Problem/Issue:

The problem of counterfeit drugs is a significant issue as administering a counterfeit medicine can have serious health consequences. The counterfeit drug market is a multibillion pound business. The problem compounded by the growing number of medicine suppliers which includes internet vendors.

The Challenge:

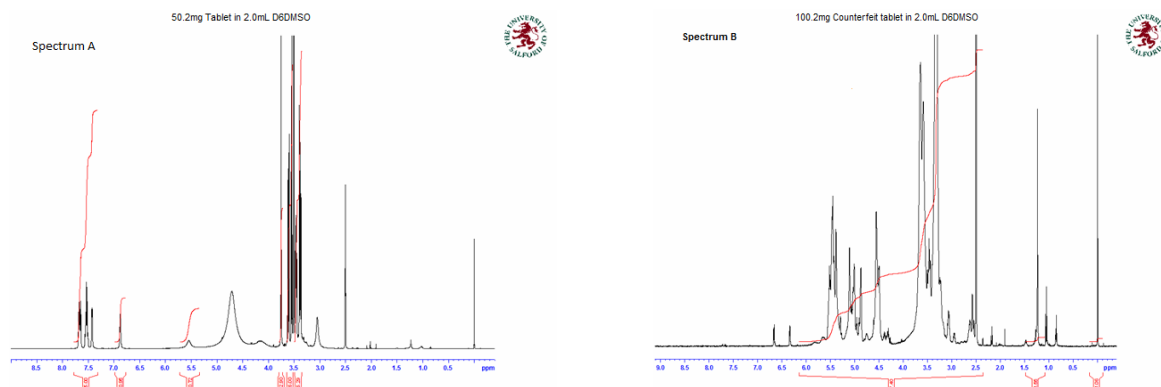
Identification and quantification of the (Active Pharmaceutical ingredients (API's)) is of paramount importance. The formulated medicines in addition to API's contain considerable amounts of excipients. The API needs to be extracted for identification and quantification.

Method:

In order to extract all the API the medicine tablet is grounded into powder and appropriate solvent is added to it. This results in to a suspension as all of the excipients are not soluble. For efficient extraction the suspension is sonicated for ~30min and then centrifuged to separate the insoluble excipients. The supernatant liquor containing the API is analysed by ¹H NMR to confirm the identity. Once the identity is confirmed quantification by ¹H NMR is carried out using an internal standard of known purity in duplicates. The purity determination is carried out by weight the medicine tablet powder and the standard in the same vial, solvent is added to this, then sonicated and centrifuged prior to analysis, as carried out for identification. The ¹H spectra are obtained under quantitative conditions and purity of API is calculated from the NMR data as a weight % and this in turn converted to actual amount in the tablet (mg/tablet).

Case Study

A suspected counterfeit tablet was analysed, spectrum B and compared with a control tablet, spectrum A.



Residential Trip Generation Characteristics in City Centre Developments

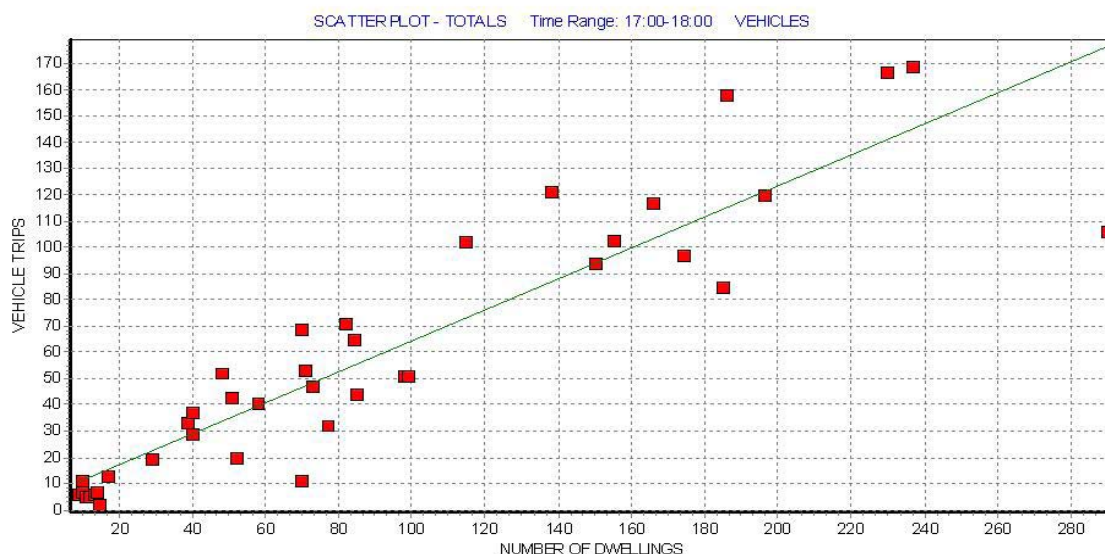
Firas H A Asad (PhD student) and Ralph Henson

*Engineering 2050 Research Centre,
School of Computing, Science & Engineering, University of Salford*

Trip generation is a vital stage in the orthodox travel demand forecasting process embedded in urban transportation planning. In this stage, the number of trips generated from or attracted to a specific development is determined and then modelled. Recently, it has become clear that regeneration of city centre areas is taking into account a renewed desire for some people to locate their homes in central areas. This change in land-use has an important impact on travel demand and on the need to design sustainable transport systems.

The general purpose of the research is to enrich the trip making behaviour literature while the particular one is to investigate the characteristics of home-based trips in urban development areas and hence to identify the traffic impact of any land use changes on transport indicators. Eventually, practical and adequate suggestions may be presented concerning the required transportation improvements.

Residential trip modelling is supported by national data resources including the UK Trip Rate Information Computer System (Trics), UK National Travel Survey (NTS), UK Census and UK Trip End Model Presentation Program (TEMPRO) and the work will review current methodologies such as the Category Analysis and Regression Analysis techniques. The Figure illustrates this, at its simplest level. More advanced statistical techniques are used to examine the significance of the developed models.



Bulk Ordering Phenomena in the Li-N-H Hydrogen Storage System

G Baldissin & D J Bull

*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

Lithium nitride is a potential candidate a high gravimetric hydrogen storage compound. It was initially thought that the hydrogenation reaction occurs via a two stage process:



The disordered phases, $Li_{2+x}NH$ [1] and $Li_{2-x}NH_{1-x}$, [2], have since been reported. Modelling these phases would be of great benefit, enabling their incorporation in a general phase diagram, but constitutes a significant research challenge.

From a fundamental point of view, equilibrium properties of a multi-element system as a function of concentration, x_i , and temperature, T , are described by the Gibbs Free Energy $G(x_i, T)$. However, the determination of this function is not an easy task: a many-body problem has to be managed and approximations have to be made and tested carefully with respect to their validity. First-principles calculations based on Density Functional Theory (DFT) have been very useful in understanding the stability of ordered compounds. Modelling disordered systems adds significant complexity to the problem, due to the vast number of configurations the systems can adopt. The best way approach the problem is to combine quantum mechanics with statistical physics. In this approach, so-called, cluster expansion potentials are parameterised by DFT calculations and used in Monte Carlo simulations to study, quantitatively, the finite-temperature properties. The phases are being modelled in terms of two ionic interacting sublattices [3] in the mixed-phase CE ansatz [4].

- [1] E Weidner, D J Bull et al. Chem Phys Lett. **444** (2007) 76-79.
- [2] W I F David et al. J Am Chem Soc. **129** (2007) 1594-1601.
- [3] P D Tapesch et al. Phys Rev Lett. **74** (1995) 2272.
- [4] D B Laks et al 1992 Phys Rev B **46** 12587.

Green Fix: Valuing Manchester's Nature

Luke Blazejewski

*Research Centre for Urban Change,
School of Environment & Life Sciences, University of Salford*

There is a problem with the 21st Century, people in urban environments are becoming so detached from the natural world (Goode 2005) that their only experience of nature is coming from manufactured imagery (Kaiser 2007). Reintroducing people with nature is becoming an incredibly important part of conserving our natural world. This is recognised by leading organisations through their nature-engagement schemes (Natural England 2009), however very little region-specific (or even city-specific) research has been conducted in this area. This study was an ambitious collaborative project between Manchester City Council, Groundwork Manchester and the University of Salford and aimed to understand exactly how Manchester's population feel about their natural environment. The research emphasis was on synthesizing quantitative (surveying) and qualitative (film and photographic) methods into one cohesive research project, which aimed to engage people with their local wildlife in a refreshing way. The findings were transformed into a people-friendly 38 page booklet, which will be used to support future conservation efforts and biodiversity action plans.

Antigen Recognition Patterns in Humans with Different Cyst Classifications in Cystic Echinococcosis

Tony Bodell¹, Russell Richardson¹, Philip Craig¹, Eberhard Zehyle² and Mike Rogan¹

¹*Centre for Parasitology & Disease Research,
School of Environment and Life Sciences, University of Salford*

²*AMREF, PO Box 30125, Nairobi, Kenya.*

A recent WHO ultrasound classification of hydatid cysts in human cystic echinococcosis (CE) has been developed to aid in the clinical management of this infection. The classification may also represent a natural history of cystic development from a mature fertile and viable cyst to a lesion which is degenerate non-viable. However accurate assessment of viability based on ultrasound is not possible. To try and use immunological markers as potential indicators of viability, sera from hydatid patients from Turkana, Kenya, with different cyst morphologies were tested for antibodies to a range of different *Echinococcus* antigens by ELISA and immunoblotting. The antigens used were, crude hydatid cyst fluid; Laminar layer homogenate; a protoscolex homogenate and protoscolex E/S antigens. Results from the pilot study using native antigens of the cyst indicated that when the mean OD values for each cyst type were calculated, HCF antigen was the most reactive and this was most evident for CE2 cysts where reactivity was much greater than that for the LL antigen. For CE1 cysts however there was very little difference between HCF and LL antigen reactivity. PSC and ES antigens were the least reactive only being recognised by the CE2 type cyst. Initial results clearly show that there is different antigen recognition profiles associated with different types of cyst.

Improvements in Data-Transport Security in Wireless Sensor Networks

E Ekonomou & K Booth

*Computer Networking & Telecommunications Research Centre,
School of Computing, Science & Engineering, University of Salford*

Wireless Sensor Networks constitute a promising technological advance that poses contradicting research challenges. The networks are limited, miniaturised computers that aim to sense and wirelessly report information about their environment. Typical networks are expected to be self-organising and able to operate with little or no human interaction.

Many of the potential application scenarios for wireless sensor networks are either too critical [1] or too valuable [2] to be run without an acceptable level of security. Therefore provision of security widens the possible application of sensor networks. However, the limited nature of the devices is an important obstacle in providing adequate security [3], sufficient to enable application in most environments [4]. Traditional security mechanisms cannot operate in sensor networks as they are too demanding in resources [5]. A new security solution has to be developed to provide an acceptable level of security with as minimal impact as possible to the longevity of the sensor network.

We therefore introduce SecRose, an efficient and easy to use data-transport layer security mechanism for WSNs. SecRose is based on improvements in existing proposals plus a set of distinctive novel characteristics. Major Features include encrypted and authenticated communications, integrated key management and categorisation of communication types. SecRose is secure, scalable and extremely lightweight and, in its present form, meets security requirements without significant energy cost.

References:

1. Wartena, F., J. Muskens, and L. Schmitt. Continua: The Impact of a Personal Telehealth Ecosystem. in International Conference on eHealth, Telemedicine, and Social Medicine, 2009. eTELEMED '09. 2009.
2. BP. Condition Monitoring. 2009 5/2009; Available from: http://www.xbow.com/General_info/Info_pdf_files/BP_Intel_Sensor_Networks.wmv.
3. Walters, J.P., et al., Wireless sensor network security: A survey., in Security in Distributed, Grid, Mobile, and Pervasive Computing. 2006, Auerbach Publications, CRC Press. Available from: <http://www.cs.wayne.edu/~weisong/papers/walters05-wsn-security-survey.pdf>.
4. Karlof, C., N. Sastry, and D. Wagner. TinySec: A Link Layer Security Architecture for Wireless Sensor Networks. in Second ACM Conference on Embedded Networked Sensor Systems (SensSys 2004). 2004.
5. Perrig, A., et al., SPINS: security protocols for sensor networks. Wireless Networks, 2002. 8(5): p. 521 - 534.

Studies on the Life Cycle and Transmission of the Trematode *Plagiorchis muris* at Malham Tarn, Yorkshire.

Kellyanne Boyce¹, Helen Bradshaw¹, Mike Rogan¹, Geoff Hide¹, Adrian Pickles², Philip Craig¹

¹*Centre for Parasitology and Disease Research,
School of Environment & Life Sciences, University of Salford*
²*Malham Tarn FSC Field Study Centre, Settle, North Yorkshire, UK.*

Plagiorchis muris is an intestinal trematode found in wild rodents from several countries. Recently, the first recorded occurrence in the UK was reported in the wood mouse *Apodemus sylvaticus* at Malham Tarn, North Yorkshire (Rogan *et al.*, 2007). The trematode has been recorded each September for a 13 year period as part of an undergraduate field course, with a mean prevalence of 18.4%. The lifecycle of this trematode is not well understood and reasons for its occurrence in this location within the UK remain unclear. Aquatic snails act as the first intermediate host for *P. muris* and as many as 25 species of freshwater snail have been recorded within the Malham area (Norris, 2000). Aquatic insect larvae are the second intermediate host and infected dragonflies, mosquitoes and naiads have been most frequently reported (Hong *et al.*, 1998). To define the lifecycle of *P. muris* and establish prevalence rates at Malham Tarn, species-specific molecular primers able to detect adult and larval stage parasites are currently being designed. Primers will be used to identify primary and secondary intermediate hosts, sampled from the Tarn, surrounding streams and temporary surface water by PCR amplification of the mitochondrial cytochrome oxidase C gene and ribosomal ITS regions of *P. muris*. Additionally, *A. sylvaticus* and the bank vole *Myodes glareolus* will be sampled seasonally from three distinct locations within the area to determine prevalence and intensity rates of *P. muris* in the rodent definitive host.

Endoparasites of Pipistrelle Bats

Jennifer Lord, Nicole Dodd, Geoff Hide and Darren Brooks

*Centre for Parasitology and Disease Research,
School of Environment and Life Sciences, University of Salford*

Bats (Chiroptera) are one of the most successful and diverse of mammalian orders, with an estimated 1100 species worldwide. Due to protected species legislation, studies that focus upon bat endoparasites are limited. As such, many fundamental questions concerning bat-parasite relationships remain unanswered, including evolutionary aspects of such associations, host-parasite interactions and factors that may influence the composition of bat parasite communities. To further knowledge of bat parasitology, one hundred bats, that had either died of natural causes, or had been euthanized due to severity of injury, were acquired across Greater Manchester and Lancashire (England), between September 2005 and September 2008. Ninety three specimens were confirmed to be *Pipistrellus pipistrellus*, six to be *Pipistrellus pygmaeus* and one to be *Myotis mystacinus*. Development of PCR-based methodologies, coupled when possible with morphological analyses, confirmed the presence of the following microparasites (prevalence data in parenthesis); *Babesia vesperuginis* (23%), *Trypanosoma* spp (36%), *Bartonella* sp. (2%) and *Eimeria* sp. (20%), and the following macroparasites; *Lecithodendrium linstowi* (80%), *Lecithodendrium spathulatum* (20%), *Prosthodendrium* sp. (35%), *Plagiorchis koreanus* (29%) and *Pycnoporos heteroporus* (10%). Potential factors affecting the parasite community composition, including host sex and age, season, year, geographic location and parasite co-infection will be discussed. Bat genotyping analyses are currently underway, and this data is expected to provide further insight into the relationship between bats and their parasites.



The digenean trematode *Lecithodendrium linstowi*, found in the GI tract of ~40% of bats sampled in Greater Manchester.

Experimental and Theoretical Investigation of the Li-N-H System for Hydrogen Storage

D J Bull, D J Riley, D Moser, G Baldissin, W A Oates, I Morrison and D K Ross

*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

The Li-N-H system has attracted a great deal of research interest from the hydrogen storage community since it was demonstrated that Li_3N can reversibly absorb large amounts of hydrogen; in excess of 10 wt%. Initially, it was suggested that the hydrogenation reaction occurs via a two stage process, according to:



Subsequent neutron diffraction measurements by the authors have revealed that the underlying structural transitions are significantly more complicated than first proposed. In particular, the suppression of LiH in the initial part of the reaction, coupled with the presence of the compound Li_4NH and a novel cubic phase with a compositionally-dependent lattice parameter, have been observed [1].

The authors have embarked on a coordinated experimental and theoretical program in an attempt to elucidate the reaction mechanisms and their implication for hydrogen storage. Further detailed neutron diffraction measurements have determined the phase fractions as a function of hydrogen content [2] in addition to understanding the nature of the novel cubic phase, which we believe to be a non-stoichiometric (disordered) phase, formed from a solid-state interaction between Li_4NH and Li_2NH . A related non-stoichiometric phase, intermediate between Li_2NH and LiNH_2 has also been reported [3]. The stabilities of the stoichiometric phases have been modelled by density functional theory, enabling a phase diagram to be established. Modelling of the non-stoichiometric phases poses a significant challenge, and is the subject of ongoing research.

- [1] E Weidner, D J Bull et al. Chem Phys Lett. **444** (2007) 76-79.
- [2] D J Bull et al. Phys. Chem. Chem. Phys. **12** (2009) 2089-2097.
- [3] W I F David et al. J. Am. Chem. Soc. **129** (2007) 1594-1601.

A High-Pressure Hydrogen Energy Research Facility in the Faculty of Science, Engineering and the Environment

D J Bull, D Moser, J S Cowpe, R D Pilkington and D K Ross

*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

Hydrogen could play a significant role in future low-carbon energy strategies, predominantly in off-grid energy storage systems and the automotive sector. It is an attractive fuel, with a specific energy density three times greater than petrol and the by-product from its consumption in both combustion and electrochemical reactions is pure water. However, there remain many technical challenges hindering the large scale adoption of hydrogen energy, in particular its production (from water or hydrocarbons), its distribution and storage; for the automotive industry, the latter of these arguably remains the largest challenge. Recent attention has focused on exploring synergies between conventional high pressure gaseous storage and solid storage materials.

The high pressure hydrogen energy laboratory at Salford represents a major investment toward the University's energy research strategy. An existing hydrogenation laboratory has been re-fitted with a 200 bar external hydrogen supply, and a hydrogen detection and automated shut-off safety system. Currently, the facility has been equipped with two state-of-the-art volumetric apparatus, capable quantifying the up-take and release of hydrogen under carefully controlled conditions of pressure (up to 200 bars) and temperature (-196 to 500°C). Planned future developments include the housing of a hydrogen permeation test rig, designed for evaluating the effectiveness of permeation-barrier coatings for hydrogen supply pipes, and the development of a multi-stage metal hydride compressor, operating at 350 bars coupled with apparatus for quantifying hydrogen up-take at these pressures, which corresponds to the current BS rated tanks used in the automotive sector. The high pressure hydrogen energy laboratory will provide a unique facility with a focused research strategy, providing a strong platform on which to build collaborative research with SMEs and industrial partners.

Manufacture and Characterisation of Metal-Alloy Nanowires

P Busby & N J Mellors

*Engineering 2050 Research Centre
School of Computing, Science & Engineering, University of Salford*

Research into the field of nanowires and nanotubes is becoming increasingly popular, driven by the promise of being able to further miniaturise and improve a wide range of electronic equipment ranging from magnetic data storage devices to pressure sensors, micro actuators and pumps.

Techniques based on electrodeposition are now being developed which enable nanowires to be manufactured from an increasing range of metals using a porous aluminium oxide template, although the production of magnetostrictive metal-alloys such as GaFe/NiFe and others alloys based on transition metals such as Tb, Dy and Ho are still in their early stages of development. Magnetostriction is the change in dimensions of a material in the presence of a magnetic field.

Once a technique for producing nanowires in a chosen material has been perfected, in addition to measuring their magnetic properties it is also important to be able to characterise the nanowires physical properties in terms of their tensile strength and modulus of elasticity.

A large part of this challenge is dependent on being able to see, manipulate and accurately measure these miniature structures, which typically have a diameter of 20nm and a length of 60µm. The practical aspects of this research will require the use of a range of microscopy techniques such as; Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM) and Atomic Force Microscopy (AFM), plus the development of miniature piezo-driven stages capable of accurately controlling applied load and strain rates. Combining real time microscopy with new methods to measure these physical properties will help support our understanding of materials at sub-micron level.

Snell's Law for Nonlinear Beams

J M Christian¹, G S McDonald¹, J Sánchez-Curto² and P Chamorro-Posada²

¹ *Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

² *ETSI Telecomunicación, Universidad de Valladolid, Spain*

Genetic Response of the Common Toad (*Bufo bufo*) to Environmental Change

Robert Coles, Chris Reading* and Robert Jehle

*Centre for Environmental Systems and Wildlife Research,
School of Environment and Life Sciences, University of Salford*

** NERC Centre for Ecology and Hydrology, Oxford, UK.*

The Millennium Ecosystem Assessment (2005) regards current climate change, involving the rise in temperature associated with alterations in precipitation and atmospheric CO₂ concentrations, as a main contributor for adverse effects on environments. It has been estimated that global biodiversity has declined by more than 25% over the last 35 years. Amphibians are the most severely affected vertebrate group, with 32% of the currently known species being threatened with extinction. The common toad (*Bufo bufo*) is the most populous amphibian found in the UK, and often occurs in human-altered environments. A 22-year study in Southern England (led by Dr. Chris Reading, NERC Centre for Ecology and Hydrology, Oxford) indicates that increasing mean winter temperatures can be linked to the decline of individual body condition (body mass-body weight ratio) of individuals, and also alters the timing of breeding. The current study aims to identify a relationship between life history traits (such as size, weight, reproductive timing and success) of the common toad with information derived from DNA via genetic fingerprinting using microsatellites. The value of the genetic data should be twofold. Firstly, it should reveal interactions between genotypes and phenotypes: are individuals that are most severely affected by the adverse effects of climate change carriers of specific genetic variants, or are they particularly poor in overall genetic variation? Secondly, the genetic data should enable to construct individual-based pedigrees across the toad population, to reveal whether the amount of changes in body condition are inherited across generations (signifying evolutionary adaptation), or whether they are a general response to changing condition regardless of genealogical relationships (signifying phenotypic plasticity).

Laser-induced Breakdown Spectroscopy of Organic and Biomedical Materials

J S Cowpe¹, R D Pilkington¹, R D Moorehead¹, S H Kilcoyne¹, G Crofts², C Ucer³

¹*Materials & Physics Research Centre,*

School of Computing, Science & Engineering, University of Salford

²*School of Health, Sport and Rehabilitation Sciences, University of Salford*

³*Oaklands Dental Clinic, Salford, M6 8AQ.*

The quality, density of bone and the three dimensional structure of a proposed dental implant site are influential factors in the long term success of dental implants. Traditionally, implantologists have relied on radiographs to obtain information regarding the nature of the bone density and underlying pathology of the implant site. In the 1980s Computerised Tomography (CT) was introduced, allowing the production of localised images of implant sites to be taken without the superposition of other structures, which can be used to ascertain bone density. There are, however, several disadvantages associated with CT technology, namely the cost and the fact that several reports have highlighted a problem associated with higher absorbed radiation doses when compared to conventional radiography. Even using modern equipment, and the planned next generation of lower radiation dosage Cone-Beam Computerised Tomography scanners, there are still safety issues associated with using any such equipment. The aim of this discipline hopping research is to evaluate the performance of Laser-Induced Breakdown Spectroscopy (LIBS) as a replacement for current bone analysis technologies, prior to tooth implant surgery.

Spectroscopic Study of Transient Laser-induced Plasmas

J S Cowpe, J S Astin, D Moser, D K Ross, J J Smith and R D Pilkington

*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

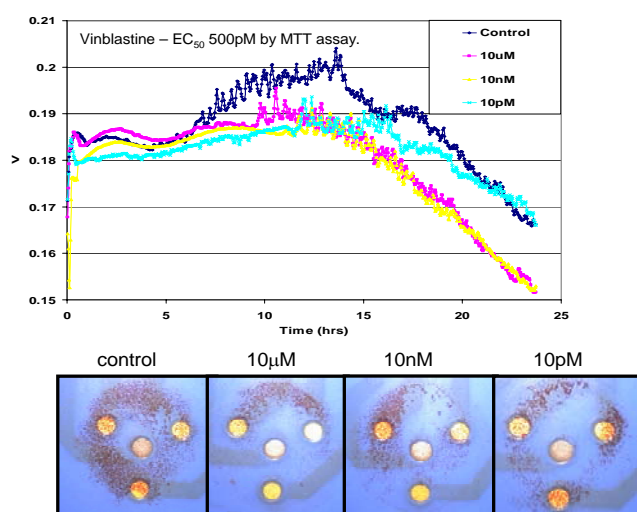
Optical Emission Spectroscopy (OES) of laser-induced silicon plasmas was performed under typical Pulsed Laser Deposition (PLD) ambient conditions to assess the application of OES as a real-time PLD process monitoring tool. The validity of the assumption of Local Thermal Equilibrium (LTE) conditions as applied to the plasmas studied herein, and those generated during typical Laser-Induced Breakdown Spectroscopy (LIBS) experiments, is considered. The second harmonic of a ns pulsed Nd:YAG laser was used to induce plasmas on the surface of a silicon target through a range of ambient pressures, from atmospheric to 1×10^{-4} mbar. Fast gated capture of the dispersed emission spectra enabled temporal resolution of the resultant plasma plumes. Under the assumption of LTE, plasma excitation temperatures were calculated using the emission line-to-continuum ratio method, and were found in the range 9100 – 20140 K. Si (II) ionic species temperatures were determined using the Saha-Eggert equation, and were found in the range 13650 – 22560 K. Plasma electron number densities were determined from the Stark broadening of the Si (I) 288.16nm emission line profile in the range $2.79 \times 10^{16} - 5.59 \times 10^{19} \text{ cm}^{-3}$. Comparison of temperature measurements casts doubt on the validity of exclusively considering the McWhirter criterion when assuming LTE plasma conditions.

Electrochemical Monitoring of Tumour Cell Responsiveness to Anti-cancer Drugs

Jon A Deakin and Alan T McGown

*Kidscan Centre for Biochemistry, Drug Design and Cancer Research,
School of Environment and Life Sciences, Cockcroft Building, University of Salford.*

We are currently testing a novel electrochemical device (Oncoprobe Ltd) to measure real-time micro-electrical changes produced by cancer cells in response to clinically-used chemotherapy drugs. The device passively “listens in” to the cells by means of detection of minute changes in electrical potential (the open-circuit potential, OCP) generated at the interface between their basolateral membranes and a series of gold electrodes, to which the cells adhere. Using cultured cells, we have been able to demonstrate marked changes in OCP profiles in drug-treated cells relative to controls, and have shown these to be supported by independent toxicity assays as well as by staining and microscopy. Below is one example, in which the ovarian cancer cell line A2780 has been treated with the anti-cancer drug Vinblastine. It was demonstrated that, relative to controls (dark blue), those cells treated with a high dose of Vinblastine (pink) generate a significantly different OCP profile. This is mirrored by dramatic cell death (first two pictures). Sub-lethal drug doses attain the same end-point (light blue) as controls, with little evidence of any extensive cytotoxicity (photo 4). Interestingly, the device was able to detect OCP changes at intermediate doses before they were evident microscopically, and as a prelude to cell death (yellow, panel 3). In the very near future, in collaboration with Hope and Christie hospitals, it is hoped that we can reproduce similar results in clinically-derived tumour samples, with a view to predicting the response of colon and oesophageal cancer patients to current chemotherapy, and thereby identifying any unnecessary toxic treatments and delays in subsequent surgery that they would otherwise undergo. This will be highly beneficial to both the patient and the hospital.



An Investigation into the Prevalence of *Toxoplasma gondii* Infection in British Bats

Nicole Dodd

*Centre for Parasitology & Disease Research,
School of Environment & Life Sciences, University of Salford*

The causative agent of toxoplasmosis, *Toxoplasma gondii*, is an obligate intracellular parasite of medical and veterinary importance. Moreover, infections are prevalent in humans and animals world-wide. Three modes of transmission are recognised: the cat sheds infective oocysts in faeces, ingestion tissue cysts from raw meat and materno-foetal transmission. All British bats are insectivorous and therefore are only exposed to the oocyst stage of *T. gondii* in the environment or transplacental transmission. Little is known about the prevalence of *T. gondii* infection in bats or its importance in their wildlife cycles. Although *Toxoplasma* has been reported in bat tissue, the only prevalence study (2009), to our knowledge, showed no infection in a cohort of vampire bats. To investigate the infection prevalence of *T. gondii* in British bats, a collection of *Pipistrellus pipistrellus* were obtained and DNA was extracted from bat tissue. The prevalence of infection was determined as 13.4 % by PCR amplification of SAG1 genes. Using microsatellite genotyping, we have determined the population structure of the sample of bats. We will report the relationship between parasite infection and population structure. Data such as these are valuable in epidemiological models which can be used to study the host parasite ecology of toxoplasmosis in wildlife species. Furthermore, knowledge of the prevalence and host population structure may provide insight into the modes of transmission of *Toxoplasma* in bats.

Hydrogen Storage on Pyrolysed Carbon

Gilbert Dwek, Dan Bull, Simon Keens, David Moser, Tom Patterson and Keith Ross

*Materials & Physics Research Centre,
School of Computing, Science & Engineering, Maxwell 109, University of Salford*

In this project, the properties of two levels of activated carbon based on the structure of phenol resorcinol formaldehyde resins at various different concentrations were investigated. From resins synthesised in the lab, samples were pyrolysed leaving the porous carbon structure. The carbon structures were then CO₂ etched for the second level of activation.

Sorption tests have been carried out in the intelligent gravimetric analyser (IGA) for both the pyrolysed and the CO₂ etched carbon structures. The density of the samples was determined using inert helium gas; the surface area was calculated following the BET model on nitrogen gas adsorption. Hydrogen uptake was measured at liquid nitrogen temperature (77 K).

The second level of activation, CO₂ etching, improved both the surface area and the hydrogen uptake. It was found that the best performing samples had a surface area of the order of 700 m²/g and a hydrogen uptake of 2 wt% at 15 bar at 77 K.

Further test would likely involve higher concentrations of resorcinol to determine if the bonding structure of the resorcinol can further improve the porosity and surface area of the sample. Depositing lithium nitride on the surface of the carbon would allow us to investigate how a combination of adsorption and absorption affects the total uptake as well as the desorption process of the structure.

Structure Borne Sound from a Small Wind Turbine: Characterisation by Measurement in-situ

Andy Elliott* and Andy Moorhouse

**Acoustics Research Centre,
School of Computing, Science & Engineering, University of Salford*

The UK is known to have a good wind resource which could potentially be used to generate power for homes cleanly, at the point of use. Unfortunately however, during field trials in the UK, building mounted micro wind turbines (BMWTs) have been found to produce significant structure borne noise. At the current time this is preventing BMWTs from being allowed the permitted development rights (UK) which have been granted to other green technologies such as photovoltaics (PV). Consequently, there is a need to understand better the nature of BMWTs as sources of structure borne sound, and mounting systems and buildings as transmission paths.

A particular difficulty with characterising BMWTs as vibration sources is that they can only be operated properly when installed and this means that existing methods for measuring key vibration characteristics are impossible to implement. Recently however a method has been developed at Salford University which allows vibration sources to be characterised by measurements in-situ, this is a major advantage for vibration sources such as BMWTs. Furthermore, it seems that not only are the required measurements considerably easier when using this approach, the predictions they allow are also superior to those obtained from other methods. The Acoustics research centre has recently been awarded an EPSRC grant to research the method further using real case studies including motor vehicles and BMWTs. In addition to this funding has also been awarded from DEFRA to apply the new “in-situ blocked force” method to BMWTs and to make predictions of structure borne noise.

Subjective Perception of Room Mode Control Methods based on Multiple Sources and Signal Processing

Lucy Elmer

*Acoustics Research Centre,
School of Computing, Science & Engineering, University of Salford*

Room modes are known to cause problems in rooms used for live and reproduced music. They alter the perceived sound, often producing a less than ideal listening experience. A number of accepted techniques are used to try and reduce the effects of the problematic modes. These include the use of multiple subwoofers and their relative position to the modal waveform. Simple signal processing, such as altering the gain and phase of the subwoofers, is sometimes used to attempt to minimise and remove any unwanted model effects and interaction between the subwoofer and the room. Although many of these techniques have been objectively researched and shown to improve a room response at low frequency, little is known about the subjective effect on the listener. Therefore, this project aims to produce a formal test to measure the subjective effect of a number of different control methods, focusing on multiple sources and signal processing.

The project will specifically include the setting up and testing of multiple control methods that have been extensively researched and are known to improve the response of a room. Rigorous listening tests have been devised to extract the relative preference between each method. Extra data is also extracted in terms being defined for the description of low frequency reproduction quality. Based on these results, it will be possible to subjectively compare and assess the individual systems. Testing is currently being carried out; therefore, results are currently unavailable.

This research is important within the field of acoustics, as little is known about the subjective perception of room mode control methods.

A Rules Based System for Named Entity Recognition in Modern Standard Arabic

Ali Elsebai

*Data Mining & Pattern Recognition Research Centre,
School of Computing, Science and Engineering, University of Salford*

The amount of textual information available electronically has made it difficult for many users to find and access the right information within acceptable time. Research communities in the natural language processing (NLP) field are developing tools and techniques to alleviate these problems and help users in exploiting these vast resources. These techniques include Information Retrieval (IR) and Information Extraction (IE). The work described in this thesis concerns IE and more specifically, named entity extraction in Arabic. The Arabic language is of significant interest to the NLP community mainly due to its political and economic significance, but also due to its interesting characteristics.

Text usually contains all kinds of names such as person names, company names, city and country names, sports teams, chemicals and lots of other names from specific domains. These names are called Named Entities (NE) and Named Entity Recognition (NER), one of the main tasks of IE systems, seeks to locate and classify automatically these names into predefined categories. NER systems are developed for different applications and can be beneficial to other information management technologies as it can be built over an IR system or can be used as the base module of a Data Mining application. In this thesis we propose an efficient and effective framework for extracting Arabic NEs from text using a rule based approach. Our approach makes use of Arabic contextual and morphological information to extract named entities. The context is represented by means of words that are used as clues for each named entity type. Morphological information is used to detect the part of speech of each word given to the morphological analyzer. Subsequently we developed and implemented our rules in order to recognise each position of the named entity. Finally, our system implementation, evaluation metrics and experimental results are presented.

Antimicrobial Properties of Ag/TiO₂ and CuO/TiO₂ Films Deposited by Chemical Vapour Deposition

H A Foster^{1*}, S Varghese¹, P Evans³, P Sheel³, D W Sheel^{1,3}, N Rutschke¹ and H M Yates²

¹*Centre for Parasitology and Disease Research,
School of Environment & Life Sciences, University of Salford*

²*Materials & Physics Research Centre, School of Computing, Science & Engineering
University of Salford*

³*CVD Technologies Ltd, Salford, UK*

Biocidal surfaces employing photocatalytic activation of thin films of TiO₂ have been explored over some years. We have combined the activity of TiO₂ with the well characterised antimicrobial activities of Ag and Cu (or more correctly CuO) using a combination of atmospheric pressure thermal and flame-assisted Chemical Vapour Deposition (CVD). The resulting composite films were highly durable and the Ag-TiO₂ films retained a high photocatalytic activity but the activity of the CuO films was very low. Antibacterial activity in the dark was highest for the Ag-TiO₂ films. These films showed a high antibacterial activity when irradiated with UVA with a >5log kill within 24 h for most organisms tested. MRSA was less sensitive but a >95% kill was recorded after 24 h. Although the copper films were less active in the dark the activity was greatly enhanced by UVA and enhanced activity was also seen in fluorescent light albeit at a reduced level. The implications for their use for reduction of surface contamination by microorganisms as part of control measures for healthcare associated infections will be discussed.

The Salford Advanced Laser Canopy Analyser (SALCA): A Multispectral Full Waveform LiDAR for Improved Vegetation Characterisation

R Gaulton^a, F M Danson^a, G Pearson^b, P E Lewis^c and M Disney^c

^a*Centre for Environmental Systems Research, School of Environment and Life Sciences,
University of Salford. email: R.Gaulton@salford.ac.uk*

^b*Halo Photonics Ltd, Unit 2, Bank Farm, Brockamin, Leigh, Worcestershire, WR6 5LA*

^c*Department of Geography, University College London, Gower Street, London, WC1E 6BT*

Vegetation canopy structure influences key physiological and ecological processes, such as photosynthesis and net primary production. Accurate measurement of canopy parameters such as leaf area index and canopy cover via direct methods is time-consuming. Indirect methods, based on light interception, are limited by an inability to distinguish woody material and foliage, assumptions relating to canopy leaf angle distribution and clumping and, with the exception of hemispherical photography, the lack of a permanent record of canopy structure.

Terrestrial laser scanning can provide a permanent, three-dimensional record and allow the extraction of more detailed and accurate information on the distribution of canopy components. Most laser scanners apply commercially sensitive echo detection algorithms to detect ranges to a limited number of targets, and as this may include returns triggered by objects only partially occupying the laser beam, errors can result in estimating gap fraction. The Salford Advanced Laser Canopy Analyser (SALCA) is the first multispectral full waveform terrestrial laser scanner for characterising forest canopies. The instrument records the full waveform of backscattered energy at two wavelengths in the near- and middle-infrared (1040 and 1550nm), designed to allow the separation of foliage and woody material. The first results are presented from laboratory-based trials of the instrument to examine the return from a range of targets.

Pond Landscapes in an Urban Context

David G Gledhill and Philip James

*Research Centre for Urban Change,
School of Environmental and Life Sciences, University of Salford*

Blue / green spaces within urban areas offer a variety of services to human populations as well as habitats for other species. Of these habitats urban ponds are among the least well studied, despite being designated as nationally important habitats in the UK. Urban planning policy in the UK is moving towards increasing urban density rather than urban expansion. While, compact cities offer benefits in terms of resource utilisation and transportation, they also place increased pressure on blue/green spaces. Ponds offer an ideal microcosm for exploring issues of urban ecology within differing urban settings. Ecological, landscape and socio-economic data were collected for thirty seven ponds in the urban area of Halton, northwest England over a three year period (2005 – 2007). This represents 10% of the total number of ponds within the borough. These data were compared to data from fifty one ponds in the adjacent rural landscape of Cheshire. This allowed exploration of variations in pond ecology along an urbanisation gradient. The most significant impact on pond species numbers was the density of ponds within the surrounding landscape. There was significant variation between the community structure of urban and rural ponds. Further, there was significant variation between the structure of communities in traditional urban centres and the designated New Town development. Certain elements of the socio-economic environment surrounding each pond were also shown to significantly impact species numbers. This work offers insights into the impact of urban development on pond ecology and suggests the potential impact of future developments, and how this may be ameliorated.

Evidence for High Levels of Vertical Transmission in *Toxoplasma gondii*

Geoff Hide, Emma K Morley, Jacqueline M Hughes, Omar Gerwash, Mohamed S Elmahaishi*, Khalid H Elmahaishi*, Denise Thomasson, Elizabeth A Wright, Huw Williams, Gai Murphy and Judith E Smith

*Centre for Parasitology and Disease Research,
School of Environment and Life Sciences, University of Salford*

**Misurata Central Hospital, PO Box 65 Misurata, Libya.*

Toxoplasma gondii is a highly ubiquitous and prevalent parasite. Despite the cat being the only definitive host, it is found in almost all geographical areas and warm blooded animals. Three routes of transmission are recognised: ingestion of oocysts shed by the cat, carnivory and congenital transmission. In natural populations, it is difficult to establish the relative importance of these routes. This poster reviews recent work in our laboratory which suggests that congenital transmission may be much more important than previously thought. Using PCR detection of the parasite, studies in sheep show that congenital transmission may occur in as many as 66% of pregnancies. Furthermore, in families of sheep on the same farm, exposed to the same sources of oocysts, significant divergent prevalences of *Toxoplasma* infection and abortion are found between different families. The data suggest that breeding from infected ewes increases the risk of subsequent abortion and infection in lambs. Congenital transmission rates in a natural population of mice were found to be 75%. Interestingly, congenital transmission rates in humans were measured at 19.8%. The results presented in these studies differ from those of other published studies and suggest that vertical transmission may be much more important than previously thought.

Transmission Electron Microscopy with in situ Ion Irradiation at the University of Salford

J A Hinks, J A van den Berg and S E Donnelly

*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

An understanding of the behaviour of materials under irradiation is vital when developing technologies for deployment in irradiating environments and for manufacturing processes which employ radiation modification of materials. In the nuclear industry it is of particular importance for extending the lifetime of the UK's current reactor fleet, developing the next generation of fission reactors and working towards the first electricity-generating fusion reactors.

A new facility has been established at the University of Salford to allow materials to be examined using transmission electron microscopy (TEM) whilst being ion irradiated. TEM allows the internal microstructure of samples to be imaged at a resolution not offered by any other experimental technique and by combining this with in situ ion irradiation it is possible to explore the dynamic effects caused. This has major advantages over ex situ studies in that the processes can be monitored as they occur – rather the simple observation of end-states. Furthermore, experimental variables such as temperature can be controlled throughout the experiment. In this way, a fundamental understanding of the underlying atomistics and mechanisms at work can be gained.

The system is capable of delivering both low-energy light-ions to explore the introduction of, for example, helium on materials and of using heavier high-energy ions to create large numbers of atomic displacements. This combined capability to produce ions from 1 keV to 100 keV and from H to Xe with high fluences (6 keV He fluences of 10^{17} ions.cm⁻² can be obtained in around an hour) makes this facility ideal for investigations into materials for use in nuclear environments.

Estimation of the Wheel-Rail Contact Condition for Traction & Braking Control

Imtiaz Hussain, T X Mei

*Engineering 2050 Research Centre,
School of Computing, Science & Engineering, University of Salford*
I.hussain@pgr.salford.ac.uk, T.X.Mei@salford.ac.uk

Condition changes at the rail surface due to the existence of fallen tree leaves and contaminations by snow etc cause the low adhesion level which presents a serious challenge for the traction/braking control systems to avoid the problem of wheel slip/slide. This research presents the development of a multiple model-based approach for the identification of the adhesion limit to overcome the problem of the wheel slip/slide in poor contact conditions. The proposed scheme is an indirect method that exploits the dynamic properties of the conventional solid axle wheelset in response to changes in contact condition at the wheel-rail interface avoiding difficult and expensive measurement requirements. A nonlinear model of lateral and yaw dynamics of a conventional solid axle wheelset is used for the study. The non-linearity and changes in the interaction with the rail are modelled by using a set of non-linear creep/slip curves. The scheme consists of a bank of Kalman filters based on the linearized wheelset models. Each Kalman filter in the filter bank is optimally tuned to operate in a specific contact condition. Normalized root mean square values from the residual of each filter calculated using time moving windows are assessed to identify the operating condition of the wheelset. This poster mainly covers: (1) the modelling of wheelset dynamics and non-linear contact laws and that of condition changes at the wheel-rail interface; (2) the design detail of the Kalman filters; (3) Fuzzy logic based Identification of wheel-rail contact conditions and; (4) simulation results to demonstrate potential effectiveness of the proposed scheme.

A Single Step PDMS Deposition Process for Stoichiometric CuInSe₂ Solar Cell

Sreejith Karthikeyan, Arthur E Hill and Richard D Pilkington

*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

CuInSe₂ (CIS) based thin solar cells are an important source of renewable energy. CuInSe₂ thin films may be used as the absorbing layer in solar cells. The complexity of this material makes it difficult to design a single step process to deposit the nearly stoichiometric p-type layer required for an efficient cell. Researchers have previously worked on CIS layers using flash evaporation, co-evaporation, sputtering, molecular beam epitaxy, spray pyrolysis etc. These films were either made by a multi-step process or had a non-stoichiometric ratio of their component elements. This work describes the use of pulsed d.c magnetron sputtering (PDMS) - a unique single step technique that produces stoichiometric CuInSe₂ films. The p-type CIS films which were produced from PDMS were found to have low resistivity, were pinhole free and adhered well to the glass substrate. The films deposited from polycrystalline powders of different starting stoichiometric ratios at room temperature were all found to be nearly stoichiometric, almost irrespective of the starting composition of the powder material. The physical and structural properties of these films were analysed using XRD, SEM and AFM. Conductivity measurements were carried out using the four point probe and hot probe methods. The single step deposition process can cut down the cost of the complex multi step processes involved in the traditional vacuum based deposition techniques.

Paschen Curve Analysis to Optimise Pulsed dc Sputtering Plasmas

Sreejith Karthikeyan, Arthur E Hill, John S Cowpe and Richard D Pilkington

*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

The behaviour of the breakdown voltage of a pulsed d.c. magnetron sputtering system under various operating conditions has been studied with reference to Paschen's Law. This can help to understand the conditions necessary for a stable breakdown at low voltage and hence improve sputtering performance and target life. The breakdown voltage decreases with increasing pressure in constant current mode, and at a certain pressure it reaches a minimum value and then increases thereafter. The behaviour of breakdown voltage *versus* pressure does not follow previous models based on Paschen's curve, but instead follows an exponential linear functional form. The breakdown voltage decreases and the graph minima move towards the lower pressure region when the frequency is increased. It is possible that the combined effect of metastable atoms or ions that remain from the previous pulse-on time and the high mean free path at lower pressures results in this effect. The pressure at which the minimum value of breakdown voltage occurred was calculated by applying an exponential linear function for different electrode separations. From this analysis, it is clear that the pressure at which the minimum breakdown occurs is independent of the electrode separation. The breakdown voltage minima shift towards higher pressures when the operating current is increased. The behaviour of the breakdown voltage with pulsing frequency at different pressures and constant pulse-off time was recorded and revealed that the breakdown voltage decreased consistently as the frequency increased up to 70 kHz. Above this frequency, perturbation in the breakdown voltage was noted, possibly due to the rise in pre-breakdown current during the few microseconds of pulse-on time. The breakdown voltage was seen to decrease when the pulse-off time was increased while keeping the total period of the pulse constant.

Scientific Analysis of Archaeological Artefacts

K Gannon, S H Kilcoyne, R D Pilkington, J Cowpe, G Parr, L M Simmons

*Materials & Physics Research Centre,
School of Computing, Science and Engineering, University of Salford*

The area around Blackden in Cheshire has been occupied for over 10 thousand years. It is reported to have been a winter camp at the start of the Mesolithic, c.8000 BC and possibly into Upper Palaeolithic. Each of prehistory's conventional ages - Neolithic, Bronze Age and Iron Age - is represented by artefacts from the site, whilst materials such as glass, metallurgical waste and pottery show people living or working in the area before the present Toad Hall was built around the end of the Middle Ages. However, there has been no conclusive evidence of iron smelting on the site, although many pieces of clinker, which could be furnace slag, have been recovered. The aim of this project was to determine if the samples discovered at Blackden could be by-products of an iron smelting process such as that occurring in bloomery and blast furnaces.

We will show how a range of scientific techniques (x-ray diffraction, scanning electron microscopy (SEM), energy dispersive x-ray analysis, Laser induced breakdown spectroscopy (LIBS) and Mossbauer spectroscopy) can be used to determine the structural and compositional characteristics of archaeological materials. We will then present the results from two samples. The first sample does not exhibit the characteristics of either bloomery or blast furnace slag and is most likely some kind of fuel ash with a possible glassy phase. It could possibly have been formed due to a non-metallurgical process through the burning of silicate containing items. The second sample, however, could be a by-product of a bloomery process, due to the high levels of wuestite (FeO) and the presence of a fayalite phase. The lack of a flux in the sample, along with the relatively high presence of calcium, aluminium and quartz (SiO₂) also supports this argument.

Sonic Crystal Noise Barriers made of Resonant Elements

A Krynkin and O Umnova

*Acoustics Research Centre,
School of Computing, Science & Engineering, University of Salford*

A Y B Chong, S Taherzadeh and K Attenborough

*Department of Design Development Environment and Materials, The Open University,
Milton Keynes, UK*

The main spectral property of a Sonic Crystal structure is a notable sound attenuation related to the Bragg band gaps. This effect is observed in air and makes Sonic Crystals effective noise barriers in a particular frequency range. This performance can be extended to a wider range of frequencies by introducing scatterers supporting multiple resonances of various types. In this paper the sonic crystals composed of infinitely long multi-resonant composite scatterers are studied. First the concentric elastic shell and outer 4-slit rigid cylinder composite is considered. Theoretical and experimental results show the existence of the axisymmetric resonance of the elastic shell followed by the annular cavity resonance. The second type of scatterers considered is a U-shaped resonator composed of thin elastic plates. The plates form an open cavity so that resonances are defined by their bending motion as well as by the geometry of the scatterer. Theoretical analysis of the elastic-acoustic coupling in a single scatterer is based on the Kirchhoff-Love asymptotic theory. Numerical results on the overall performance of the proposed structures are obtained with the multiple scattering technique and finite element method. The predictions are compared with the experimental results.

Keywords: Periodic structures, Scattering, Structural vibration, Noise barriers.

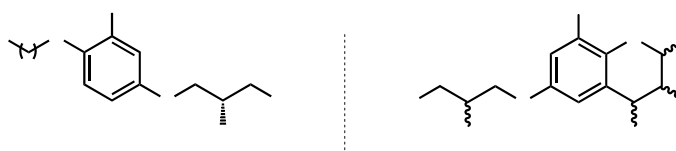
Novel Heparin Mimics: Design, Synthesis & Biological Evaluation

R Lagoutte and J A Wilkinson

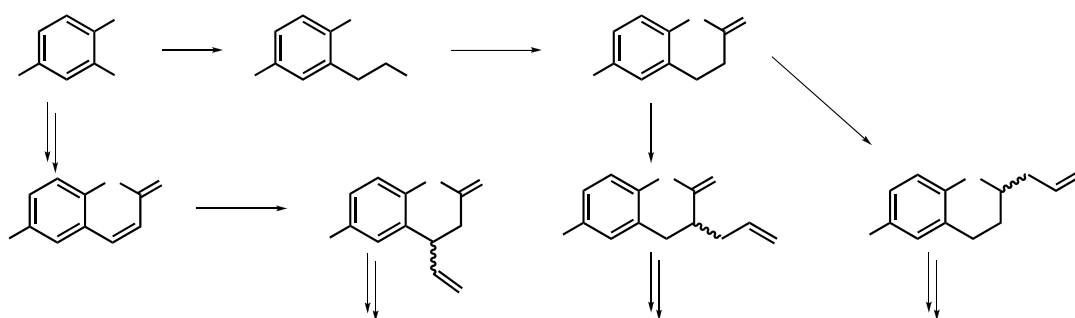
*Centre for Biochemistry, Drug Design and Cancer Research,
School of Environment & Life Sciences, University of Salford*

Dysregulation of HGF/SF-induced activation of the tyrosine kinase Met is involved in many types of cancer. Inhibiting Met therefore has potential in cancer treatment.¹ Based on heparin interactions with HGF/SF, small aromatic mimics were designed, synthesised, and tested for their bioactivity.

Thus, 14 compounds were synthesised. After screening, compound (1) was one of the compounds that exhibited inhibitory activity.² Docking experiments suggested that conformational restriction may improve the activity: the 2nd generation of compounds was envisaged as chromans of general form (2).



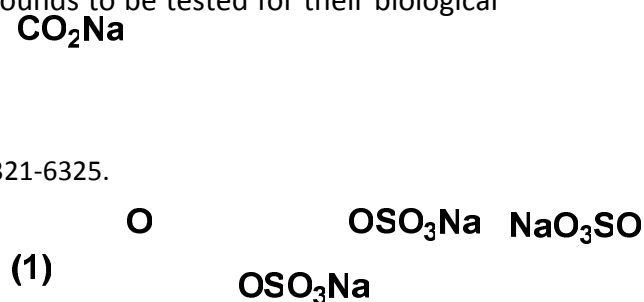
Formation of the chroman ring is achieved through conjugate addition and cyclisation towards chroman-2-one (4), which has been used for the formation of precursors to (2a) and (2b). Compounds of type (2c) will be formed by a slightly different approach, with formation of the ring before conjugate addition of a vinyl moiety.



Functionalisation of these precursors *via ortho*-lithiation, attachment of a chiral diol precursor and sulfation will lead to a total of 60 compounds to be tested for their biological activity against the activation of Met.

1. O Holmes *et al.*, *J. Mol. Biol.*, 2007, 367, 395–408.

2. E-A Raiber *et al.*, *Bioorg. & Med. Chem. Lett.*, 2007, 17, 6321–6325.



Acoustics Research in Modelling and Simulation, with Implications for VR and Future Media

Y W Lam

*Acoustics Research Centre,
School of Computing, Science & Engineering, University of Salford*

The Acoustics Research Centre has a long track record of research into modelling and simulation techniques. These are seen as fundamental technologies that underpins modern research in audio and acoustics. The first piece of modelling work started in the early 90's for room acoustics simulation. We worked with international partners to establish and develop works on surface scattering that led the world at the time. Since then we have diversified into many other wave based modelling methods. Currently we are pioneering work on the implementation of source functions and frequency dependent boundary conditions in finite difference time domain methods. Apart from supporting many of the research projects we have in acoustics, these techniques also establish a platform for integrating high quality acoustics into both real built and virtual environments. We were a partner in the University's world leading Platform Grant research into nD Modelling. At present we are working with the Centre for Virtual Environment to integrate a high grade wavefield synthesis system into the OCTAVE virtual reality system. Such a high grade acoustic system is essential for accurate and immersive virtual environments that will enable the development of future paradigms for work collaboration, social interaction, and future media realisation. This poster will provide an overview of these past and present activities, and some ideas on potential priority growth areas for the future.

Detection of *Echinococcus granulosus* in Farm Dogs in South Powys, Wales using coproELISA

Wai-San Li

*Cestode Zoonoses Research Group, Centre for Parasitology and Disease Research,
School of Environment and Life Sciences, University of Salford*

Echinococcus granulosus is a dog tapeworm that causes the zoonotic disease, cystic echinococcosis. Canine echinococcosis appears to have re-emerged in Powys, Wales following a control programme in the 1980s (Buishi *et al.*, 2005). The Office of the Chief Veterinary Officer and the Department for Public Health and Health Professions in the Welsh Assembly Government jointly funded a pilot dog worming campaign as a preventative public health measure. To evaluate the impact and efficiency of a short-term supervised dog dosing scheme, collection of faecal samples on farm visits and worming of dogs with praziquantel commenced in South Powys in May 2008. In Year 1, approximately 1500 canid faecal samples were collected from registered farms and delivered to the University of Salford to be tested. In total 1351 faecal samples were tested by coproELISA, of these 609 samples were collected at baseline and were found to have a coproantigen prevalence of 10.8%. A total of 742 samples tested after 3 treatments gave a coproantigen prevalence of 0.7%. The study will continue to compare the coproantigen prevalence over one year after cessation of dosing.

A New Framework for Context Representation, Maintenance and Discovery in Mobile and Ad Hoc Networks

Qi Liu and Nigel Linge

*Computer Networking & Telecommunications Research Centre,
School of Computing, Science & Engineering, University of Salford*

In this paper, a framework has been developed for applying context representation, discovery and sharing within mobile ad hoc networks. This leads to the creation of a Context information Base (CiB) which is used by each device within a mobile ad hoc network to maintain context parameters. In addition to the CiB, a communication protocol, Context information Communication protocol (CiComm) is also developed and integrated into the network to enable nodes to discover and share context information.

The framework has been simulated using NS-2. This enabled a detailed set of simulations to be carried out in order to assess the operation and performance of the overall system. The simulated results confirm the correct operation of the CiB and CiComm protocols; it also shows that context information can be effectively exchanged within mobile ad-hoc networks but depends on network density and bandwidth, and devices' movement in the network. Furthermore, the system has been tested and shown its robustness under specific conditions such as information loops, device failure and rejoining, all of which arise because of random node movement.

Compared to SLPManet, a widely agreed and used SDP protocol, the framework shows better performance in a rapid changing environment. The overall context discovery success of the CiComm protocol is over 97%. The protocol consumes on average 80% less bandwidth and 50% less time exchanging context information than SLPManet. However, the performance of the framework is affected by the network density. For example, in the March scenario, where each device has over 45 neighbours, it takes on average 2.2 seconds to retrieve context using CiComm, whereas SLPManet takes about 0.1 second.

Overall, the framework presented in this paper provides a new and more efficient method for managing context within mobile ad hoc networks.

An Empirical Comparison of Cost-Sensitive Decision Tree Induction Algorithms

Susan Lomax, Sunil Vadera

*Data Mining & Pattern Recognition Research Centre,
School of Computing, Science and Engineering, University of Salford*

Decision tree induction is a widely used technique for learning from data which first emerged in the 1980s. In recent years, several authors have noted that in practice, accuracy alone is not adequate, and it has become increasingly important to take into consideration the cost of misclassifying the data.

Several authors have developed techniques to induce cost-sensitive decision trees. There are many studies that include pair-wise comparisons of algorithms, but the comparison including many methods has not been conducted in earlier work.

This paper aims to remedy this situation by investigating different cost-sensitive decision tree induction algorithms. A survey has identified 30 cost-sensitive decision tree algorithms, which can be organized into ten categories. A representative sample of these algorithms has been implemented and an empirical evaluation has been carried. In addition, an accuracy based look-ahead algorithm has been extended to a new cost-sensitive look-ahead algorithm and also evaluated.

The main outcome of the evaluation is that an algorithm based on genetic algorithms, known as ICET, performed better over all the range of experiments thus showing that to make a decision tree cost-sensitive, it is better to include all the different types of costs i.e., cost of obtaining the data and misclassification costs, in the induction of the decision tree.

Keywords: cost-sensitive learning, decision trees, data mining.

A Survey of Cost-Sensitive Decision Tree Induction Algorithms

Susan Lomax and Sunil Vadera

*Data Mining & Pattern Recognition Research Centre,
School of Computing, Science and Engineering, University of Salford*

Decision tree learning is one of the main methods of learning from data that has been applied to a wide range of problems including medical diagnosis, drug design and credit scoring. Traditionally, decision tree learning algorithms have focused on accuracy, though practical requirements dictate that one should take account of the cost of misclassification. So, for example, the cost of misclassifying a process plant as safe is likely to be much higher than the cost of misclassifying a safe plant as unsafe.

The past decade has seen a significant interest in this problem, known as cost-sensitive induction, with the development of a number of independent algorithms though there is no synthesis of the field. This meta-study develops the first taxonomy of the various cost-sensitive algorithms, showing the characteristic features and analysing their capabilities for a range of applications. The study covers over 50 algorithms and is the most comprehensive study of its kind.

Keywords: survey, cost-sensitive learning, decision tree, data mining.

Do Great Crested Newts (*Triturus cristatus*) find their Breeding Ponds by Following Acoustic Cues from Frogs and Toads?

Neil Madden & Robert Jehle

*Centre for Environmental Systems and Wildlife Research,
School of Environment and Life Sciences, University of Salford*

Amphibians are an endangered group of vertebrates; they are notoriously difficult to study on land, and relatively little is known about how they orientate themselves during seasonal migration between aquatic and terrestrial habitats. In the UK, the legal protection status of the great crested newt (*Triturus cristatus*) requires the (often laborious and expensive) translocation of populations away from licensed construction sites. However, the efficacy of such measures is still under debate, and understanding more about the species' migration and orientation behaviour would help to improve current practices. The present study tests the hypothesis that crested newts use the calls of frogs and toads that share the same aquatic habitats for finding their ponds for reproduction.

Newts were caught during their aquatic and terrestrial phases, and were placed into the centre of an acoustic arena. Calls from two native species (common toad *Bufo bufo* and common frog *Rana temporaria*), an alien species (bullfrog *R. catesbeiana*), as well as a heterochthonous sound ("Champagne Supernova" by Oasis) were broadcast as successive acoustic stimuli (in random order and from random directions). Aquatic newts orientated significantly towards the *B. bufo* stimuli, but moved randomly when exposed to *R. temporaria* and *R. catesbeiana* stimuli. Terrestrial newts significantly orientated towards all amphibian species, and significantly orientated away from the heterochthonous stimulus.

For the first time in a British amphibian, this study demonstrates the ability of orientation based on acoustic cues emitted by other species, a finding with important consequences for successful management and translocation measures. Moreover, the discovery of an unnatural acoustic stimulus that causes crested newts to migrate away from an area suggests that construction-related noise could disrupt their natural migratory behaviour.

The poster presents data from the first results chapter of an ongoing PhD by Neil Madden.

Keywords: heterospecific attraction hypothesis; *Triturus cristatus*; orientation; homing; playback experiment; great crested newt.

Relationships between Amputee Independent Prosthesis Properties and Gait Performance

Matthew J Major, PhD candidate

*Centre for Health, Sport and Rehabilitation Sciences Research,
PO30 Brian Blatchford Building, University of Salford*

Achieving improved gait performance of below-knee amputees and associated prosthetic function is dependent on the a) the interface between amputee and prosthesis, and b) the mechanical properties of the prosthesis independent of the amputee. The vast majority of previous research have observed the effects of various prosthetic components on amputee gait performance, but do not characterise the Amputee Independent Prosthesis Properties (AIPP). Without proper characterisation, comparison can only be made on relative performance, but cannot explain why a particular prosthesis performs better than the next and, hence, cannot directly inform prosthetic design. Therefore, the aim of this study was to conduct a controlled investigation of the relationships between AIPP and the amputee gait performance. A purpose-built prosthetic foot was designed for independent modulation of forefoot (FF) and rearfoot (RF) stiffness properties. Gait kinematics, temporal parameters, and oxygen consumption of five amputee subjects were measured. These parameters were observed while the subject walked with four combinations of high and low prosthetic RF and FF stiffness and under the following gait conditions: self-selected and fast walking speeds on a level surface, self-selected speed on 5% grade incline, and self-selected speed on 5% grade decline. As expected, greater range of prosthetic ankle-joint motion was found with lower values of RF and FF stiffness. Low FF stiffness was associated with an increase in sound leg knee flexion, reduced variability in temporal gait parameters (indicating greater stability), and lower values of metabolic energy expenditure. This paper discusses the relationships between the amputee independent prosthesis properties and amputee gait performance using a novel experimental method which is decoupled from the constraints imposed by the use of commercial products. A combination of experiments such as this and amputee gait simulation can be used to identify specific AIPP that optimize particular measures of amputee performance in order to develop improved prosthetic designs.

Relativistic Effects in Non-Relativistic Systems

G S McDonald, J M Christian and T F Hodgkinson

*Materials & Physics Research Centre, School of Computing, Science & Engineering,
University of Salford*

SANS Study of Pore Structure of Activated Carbon: The Use of Contrast Matching and Partial Pressure Variation

Z A Mileeva and D K Ross

*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

Porous activated carbons with their large surface area and microporosity are one of the most promising systems for hydrogen storage for use with fuel cells. There are numbers of techniques applied for activated carbons characterization, but all of them have their uncertainties and limitations. SANS provides direct and accurate way of assessing pore geometry.

One of the advantages of contrast matching method is that the contrast between a sample (carbon) and its environment (pores) can be readily varied by isotopic substitution of hydrogen with deuterium to estimate the density of the carbon and the distribution of closed pores. The internal structure of the open pores can then be introduced in steps by reducing the partial pressure of the adsorbate. The contrast matching technique, together with partial pressure variation, thus gives a direct measure of the pore filling process (Fig. 1).

In the current research we present a previously unreported analysis of pore structure in the studied porous carbon and how this structure is filled with increasing partial pressure.

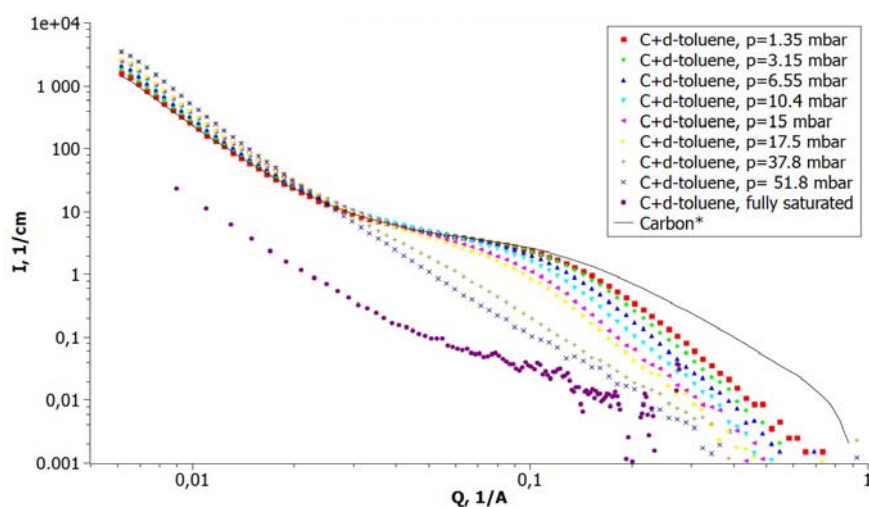


Fig. 1. Small-angle neutron scattering from carbon at various partial pressures of d-toluene using contrast matching technique.

Spatial and Temporal Solitons in Magneto-optic Metamaterials

R C Mitchell-Thomas and A D Boardman

*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

The advent of metamaterials has opened up a new range of possibilities for the technological advance of optical devices. Therefore, wave propagation in metamaterial structures is an important topic to investigate. In this presentation, it will be, more specifically, soliton propagation that is of interest. Although the soliton family is very large, here, the focus will be upon just two types; the spatial and the temporal soliton. A nonlinear Schrödinger equation can be derived to model each of these soliton types, and both will be stated explicitly.

Narrow spatial solitons will be examined, and the influence of the higher-order effect called nonlinear diffraction is illustrated. It will be shown that this is especially necessary addition when a metamaterial based diffraction-managed waveguide is considered.

Temporal soliton propagation in double negative metamaterials is discussed with an emphasis upon short pulses that exhibit self-steepening controlled by the frequency dependence of the relative permittivity and permeability. Other higher order effects such as Raman scattering will also be included, and the interesting outcome of pulse shift compensation will be discussed

In addition, an exciting dimension can be added through the inclusion of magneto-optical properties. It will be shown that a Voigt configuration of an externally applied magnetic field can be used to create significant magneto-optic control over, both, spatial and temporal soliton propagation in asymmetric waveguides. An emphasis will be placed on the use of solitons in optical chip applications, for example switches, bit-patterns and logic gates.

Upgrading Emergency Planning Tabletop Exercises

J S Mooney^{*,+}, L S Griffiths⁺, L Wallis[#], W P Smith[#] & P A Driscoll^{*}

^{*} *Emergency Department, Salford Royal Hospital Foundation Trust, UK*

⁺ *Virtual Environments & Future Media Research Centre,*

School of Computing, Science & Engineering, University of Salford

[#] *World Cup Medical Team, Emergency Medicine, Republic of South Africa*

Contact: janemooney78@googlemail.com

Introduction:

Paper-based tabletop exercises are a globally accepted mainstay of Emergency Planning teaching and simulation. We describe the use of an electronic alternative that can enhance functionality within teaching and planning scenarios locally and internationally.

Methods:

We developed a low-cost, software package to facilitate Emergency Planning tabletop exercises. This allowed work to be recorded and was easily adapted to create bespoke training scenarios, with purpose-built functionality, located in specific environments within premises that are presently under construction. A locally used example being a model built for the new Emergency Department at Salford Royal Hospital NHS Foundation Trust. This was compiled to examine patient flow from both clinical and managerial perspectives. An international example is a collaborative project that has produced a preliminary model for the Green Point stadium in Cape Town to be used by the medical team covering the football World Cup events within this venue. Acceptance and usability of this software is being assessed via data collected observationally and through retrospective questionnaire completion.

Results:

This remains a work in progress with data collection ongoing from these projects. However, initial acceptance and usability testing has seen positive results. The level of adaptability this technology offers across the expanding spectrum of Emergency Planning training needs (e.g. tailoring exercises to real locations) has been met with resoundingly positive feedback.

Discussion:

By developing new bespoke Emergency Planning tabletop software from an Emergency Medicine perspective we have been able to produce unique products permitting the functionality that allows people to safely train within their own work environment. This approach has generated a number of research opportunities that are being pursued and developed with the data generated through software assessment. Future work with this innovative technology will include updating tabletop exercises used nationally and internationally in Major Incident education.

Major Incident Tabletop Exercises: A High Tech, Low Cost Evolution

J S Mooney^{*,+}, P A Driscoll^{*} & L S Griffiths⁺

^{}Emergency Department, Salford Royal Hospital Foundation Trust*

*⁺ Virtual Environments & Future Media Research Centre,
School of Computing, Science & Engineering, University of Salford*

Contact: janemooney78@gmail.com

Traditional tabletop exercises, that facilitate Major Incident (MI) planning and education, use paper plans and models. We describe a low-cost, electronic whiteboard that explores how interactive software can advance this educational scenario. The authors intend to demonstrate this technology.

The infra-red tracking device within the Nintendo Wii handset is the key to this setup's functionality. When connected to a computer and projector it provides an ad-hoc interactive whiteboard, operated with infra-red pens, comparable to proprietary wall-mounted solutions yet easily transportable. Capturing a team's work, by enabling print-outs at principal stages of exercises, is additionally advantageous.

Utilising this technology we ran an exercise to determine our new Paediatric Emergency Department Unit's MI Plan. The software was purpose-built so the incident played out on the departmental floor plan, allowing scrutiny of patient flow within our own physical environment. Questionnaires employing 1-5 Likert scales (where 1 and 5 indicated strong disagreement and agreement, respectively), were retrospectively completed by participants. Median values and interquartile ranges (IQR) were calculated.

Although from a small sample size (n=10), the results from this 'mini-trial' were very encouraging. The response rate was 100%. A high level of positive concordance was maintained across the feedback received. The main outcome was whether the setup facilitated MI Plan development. The median response found unilateral strong agreement for this and none of the users found the setup distracting. Additionally, novice contributors found the equipment easy to use (median=4; IQR=4.0-4.75).

By combining new, affordable technology and bespoke software, this novel set up demonstrates a new approach to updating the current tabletop exercises used in MI training and practise. We were able to positively apply the feedback generated to develop the new Paediatric Unit's MI Plan. Future work with this innovation will include adapting our MI Plan for a new Emergency Department currently under-construction.

12/12 School Kids enjoy Emergency Planning Gaming

J S Mooney^{*,+}, P A Driscoll^{*} & L S Griffiths⁺

** Emergency Department, Salford Royal Hospital Foundation Trust*

*⁺ Virtual Environments & Future Media Research Centre,
School of Computing, Science & Engineering, University of Salford*

Contact: janemooney78@gmail.com

In producing bespoke Emergency Planning software we have enhanced Major Incident tabletop exercises, moving from physical models to an interactive computer-based system incorporating a serious games philosophy. We put our serious gaming software into the hands of serious gamers – a group of students from Woodhey High School, Bury, to see how they would apply their skills in an unfamiliar context.

As part of a School Report made by the school and filmed by the BBC, the students used pilot software developed, by the authors, to assist the Emergency Medical Planning Team for the 2010 World Cup in South Africa [1].

Of the 12 students participating in this exercise, 4 performed the role of Silver Command and 8 triaged casualties resulting from a hypothetical Major Incident. The students worked in separate rooms communicating via radios to orchestrate and manage the incident. Observational and audit data were collated regarding software usability and understanding gained by the students of the tasks undertaken.

All of the students, who play computer games on a weekly, or more frequent, basis, found the user interface: fit for purpose; clear and easy to navigate. All of the Silver Commanders strongly agreed that they understood and felt confident in their roles. In the Triaging team, while all of the students responded positively, fewer strongly affirmed their understanding and confidence. When asked what they had learned, the students commented on: triage use; task management; how stressful a 'real life' exercise would be and their perceived beneficial use of gaming in Major Incident preparation.

In conclusion, we took a bespoke medical training application and asked medically-naïve 'professional gamers' to trial it's software credentials. The students' reported positively on usability and successfully utilised the software to complete their allotted tasks. Feedback from this exercise will be applied in future Emergency Planning modelling.

References:

1. BBC News School Report, broadcast on Northwest Tonight 10/03/2010. "Can a computer game save lives?" <http://news.bbc.co.uk/1/hi/8558244.stm>.

Optimising Processing Routes in Fluorapatite – Fluorophlogopite Glass Ceramics

R D Moorehead^a, S H Kilcoyne^a, N L Bubb^b, D J Wood^b, P M Bentley^{c*}

^a*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

^b*Leeds Dental Institute*

^c*Hahn-Meitner-Institut*

Apatite based glass-ceramics are some of the most bioactive materials found to date. They do not require fibrous encapsulation and bond to bone directly through an apatite layer. Apatite based glass-ceramics exhibit relatively poor biaxial flexural strength, hence limiting their applications to non-load bearing implants (e.g. maxillary sinus implants). It has been shownⁱ that the addition of mica results in a material that is highly machinable, and provided that a suitable interlocking microstructure can be produced, the strength will be increased.

In this poster we present the results of a study of glass ceramics formed by heat-treating a glassy precursor. The details of this heat treatment (hold temperatures, times etc) are shown to be as important as the initial feedstock chemicals in determining the final microstructure which, in turn, determines the final mechanical properties. Results of real time kinetic neutron diffraction experiments carried out on the D20 diffractometer at the Institut Laue-Langevin for three compositions with increasing amounts of fluorapatite forming feedstock (4%, 8% and 12%) will be shown, together with the final crystalline composition, lattice parameters and crystallisation temperatures.

* Current address: Bragg Institute, ANSTO, Australia.

ⁱ Hölland W, Wange P, Naumann K Vogel J, Carl G, Jana C and Gotz W, *Journal of non-crystalline Solids* **129** (1991), 152-162.

Transition Metal Doped Magnesium-based Hydrogen and Energy Storage Materials

David Moser^a, Gael Baldissin^a, Dan Bull^a, John Cowpe^a, Ian Morrison^a, Alan Oates^a, Dag Noréus^b, Richard Pilkington^a, Duncan Riley^a, and Keith Ross^a

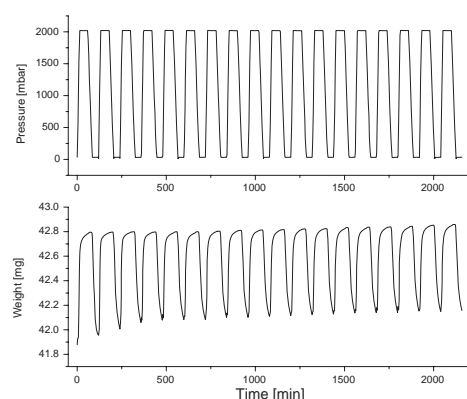
^a*Materials & Physics Research Centre, School of Computing, Science & Engineering, Maxwell 109, University of Salford*

^b*Department of Materials and Environmental Chemistry, Arrhenius Laboratory, 2010, Stockholm, Sweden*

Magnesium hydride (MgH₂) has long been considered as a promising candidates for a low cost hydrogen storage material. However, this compound requires temperatures of above 300°C to release the stored hydrogen at 1 bar.

By modifying the stable tetragonal rutile structure of MgH₂, it could be possible to make the hydride less stable thermodynamically and hence reduce the temperature required to retrieve the stored hydrogen. Recently, transition metals (TM) addition at high hydrostatic pressure (order of GPa) [1] or via co-deposition on thin films have led to novel

cubic modifications [2]; the new phases present lower temperature of release and greatly enhanced kinetics [3]. This family of materials (Mg-TM-H) has attracted an increasing interest in both hydrogen and energy storage fields with reversible uptake of hydrogen of the order of 6 wt% and reversible capacity of 1750 mAh/g.



References

- [1] Kyoji D. et al, *J. of Alloys and Compounds*, **372** (1-2):213-217 2004.
- [2] Kalisvaart W.P. et al, *J. of Materials Research*, **22** (6):1640-1649 2007.
- [3] Moser D. et al, *J. of Materials Chemistry*, **19** (43):8150-8161 2009.

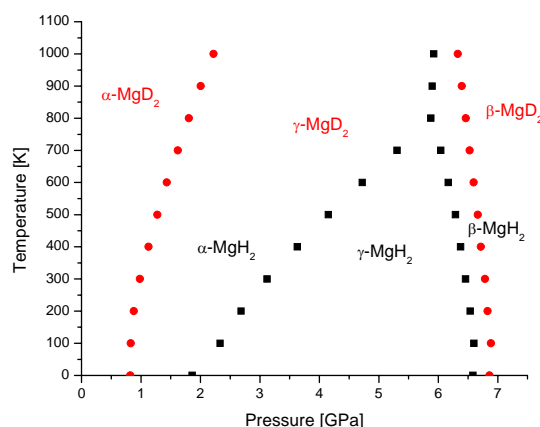
The Pressure-Temperature Phase Diagram of MgH_2 and MgD_2

David Moser^a, Gael Baldissin^a, Dan Bull^a, John Cowpe^a, Ian Morrison^a, Alan Oates^a,
Dag Noréus^b, Duncan Riley^a, and Keith Ross^a

^a*Materials & Physics Research Centre, School of Computing, Science & Engineering,
Maxwell 109, University of Salford*

^b*Department of Materials and Environmental Chemistry, Arrhenius Laboratory, 2010,
Stockholm, Sweden*

Computational thermodynamics using density functional theory ab-initio code such as CASTEP [1] is a powerful tool to evaluate phase diagrams. The method is usually applied at the standard pressure of $p=1$ bar where the Gibbs energy is assumed to be equal to the Helmholtz energy. In this work, we have calculated the Gibbs energy in order to study the release temperature and phase modifications of MgH_2 at high pressure up to 10 GPa (100 kbar). The isotope exchange substituting hydrogen with deuterium shows surprisingly strong effects on the phase diagram. These considerations are of extreme importance for the synthesis of novel magnesium based hydrides and deuterides at high pressure. The results are compared with experimental data obtained with an in-situ neutron diffraction measurement.



References

- [1] S Clark, M Segall, C Pickard, P Hasnip, M Probert, K Refson and M Payne, *Zetschrift für Kristallographie*, **220** (5-6):567-570, 2005.

Mosquito Monitoring in the UK

Dr Gai Murphy

*Centre for Parasitology and Disease Research,
School of Environment and Life Sciences, University of Salford*

The invasion and establishment of exotic mosquito species in Britain could pose a significant threat to human (and animal) health. Recent invasions/colonisations (*Aedes albopictus*, *Ochlerotatus atropalpus*, *Ochlerotatus japonicus*, *Aedes aegypti*) in mainland Europe have highlighted this potential threat. Fifteen countries across Europe have now reported invasion of *Aedes albopictus* and in Italy this species has recently become involved in the transmission of significant diseases such as chikungunya to humans (>200 cases in 2007). *Aedes albopictus* in particular has drought resistant eggs and the adults and larvae show considerable cold tolerance. This has enabled its spread and establishment in temperate climates, including many European countries, and would permit its survival in the UK. Previous mapping has confirmed that London, the South coast and north-west of England could provide a suitable environment for *A. albopictus* (Medlock et al., 2006).

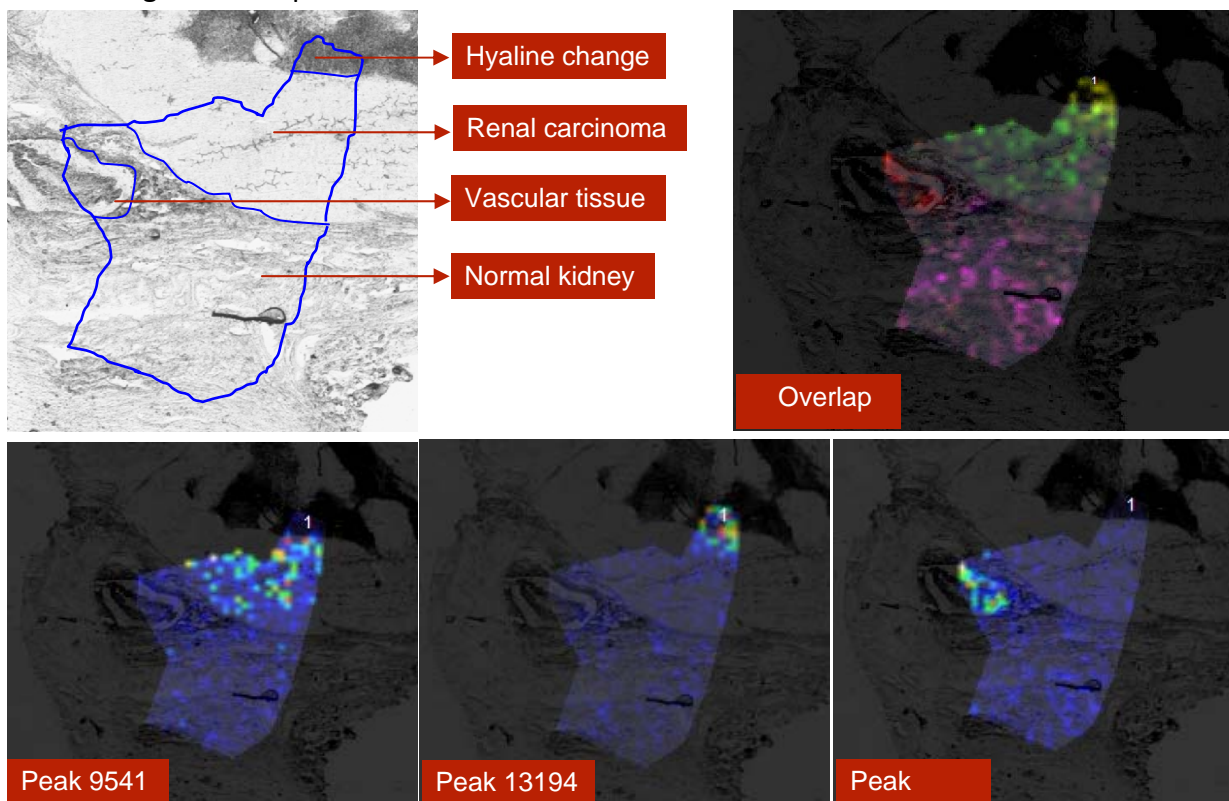
The International Health Regulations (2005) state that parties must establish programmes to control vectors that may transport an infectious agent that constitutes a public health risk to a minimum distance of 400 metres from those areas of point of entry facilities. The minimum distance must be extended if vectors with a greater dispersal range are present. In collaboration with the Health Protection Agency, work has been ongoing with UK port health authorities to establish the environments that would support mosquito colonies in and around port areas and to establish the species currently present.. Survey and sampling last year confirmed the presence of 4 UK mosquitoes species. Further sampling is continuing this year and a protocol for a rigorous and effective surveillance and monitoring system for use by all UK Ports is being developed based on this work.

Imaging Mass Spectrometry: Optimising Tissue Specific Methodology for Cancer Biomarker Investigation

Dr Nirosini Nirmalan, Senior Lecturer in Biomedical Sciences

*Centre for Parasitology & Disease Research,
School of Environment & Life Sciences, University of Salford*

Imaging mass spectrometry (IMS) represents a powerful new tool to investigate the molecular histology of tissue samples. The new technological platform enables the combination of the high throughput detection capability of mass spectrometry with the spatial localisation of constituent analytes (proteins, peptides, lipids and drugs) in frozen tissue sections. Although still in its infancy and requiring significant methodological and technological refinement, several studies have already illustrated its ability to provide insights into crucial aspects of clinical disease, highlighting its significant potential as a clinical diagnostic endpoint.



The acquisition of high quality spectral data however, is also heavily reliant on optimisation of tissue specific processing methodology prior to laser desorption. Our preliminary work with renal tissue samples (tumor/normal) has successfully explored several aspects of the processing methodology for the application of IMS in biomarker discovery in renal carcinoma (Fig). We aim to widen the process to hepatic, pancreatic and colorectal tissue samples collected in collaboration with clinicians based at the Manchester Royal Infirmary and North Manchester General hospitals. The method would initially be applied to identify diagnostic markers of pre-malignant lesions in predisposed individuals.

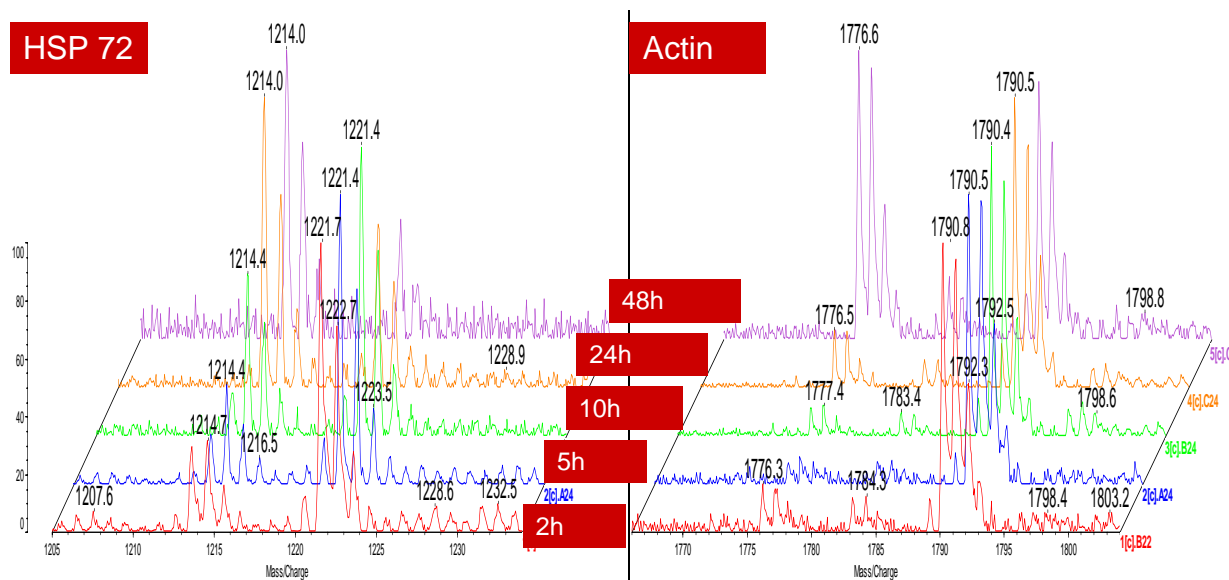
Development and Validation of a Quantitative in vitro Model System to Investigate Host Erythrocyte Remodelling in Severe Malaria

Dr Nirosini Nirmalan, Senior Lecturer in Biomedical Sciences

*Centre for Parasitology & Disease Research,
School of Environment & Life Sciences, University of Salford*

Key aspects of the pathology of severe malaria are mediated through a cohort of parasite synthesised proteins that are exported for insertion into host red cell membranes. This selective trafficking of parasite proteins results in remodelling of infected erythrocytes, predisposing them to sequestration in major organs. While some of the proteins involved in remodelling have been extensively studied individually, the global expression behaviour of the exportome is yet to be investigated. The completion of the malarial genome project allows for the harnessing of the consequent technological developments in proteomics and mass spectrometry to achieve this objective.

A novel isoleucine-based stable isotope labelling methodology developed by us (Nirmalan et al. 2004, 2007) enables robust quantitation of the malarial proteome. This study proposes to use the strategy to selectively quantify parasite expressed surface proteins on host erythrocytes, as background host proteins will not be labelled due to the metabolic inertness of enucleate mature red cells.



The Historical Ecology of the Large Mammal Fauna of Ngorongoro Crater, Tanzania

Louise Oates and Dr Paul Rees

*Centre for Environmental Systems and Wildlife Research,
School of Environment and Life Sciences, University of Salford*

Ngorongoro crater is one of the most spectacular landscapes in the world. It is a World Heritage Site and Biosphere Reserve and is home to approximately 20,000 to 30,000 large mammals. Despite the ecological importance of Ngorongoro crater, a comprehensive detailed historical record of the large mammalian fauna does not exist and records are fragmentary. This poster is a review of available data on the crater's large mammal community, including species composition, population fluctuations and factors which can potentially affect each species. In addition, a review of the quantity of primary research completed on each species is presented. A thorough literature review was conducted to gather all accounts of large mammal presence or absence in the crater, along with figures for population sizes. Several sources and various forms of literature were consulted and some information was gathered from unpublished census data collected by staff and students from the University of Salford, Manchester Metropolitan University and College of African Wildlife Management. Findings suggest that significant changes in the numbers of some species have occurred. Most grazers have declined except buffalo, which have replaced wildebeest as the dominant animal in terms of biomass. The primary causes for this decline are vegetation change and in the case of rhino, poaching. Predator numbers have also changed dramatically with the primary cause being disease. The species composition within the crater has changed: while no resident large mammal species have disappeared from the crater, wart hog and buffalo have relatively recently populated the crater. Other species, such as wild dog and cheetah have been recorded periodically. Much research has been carried out on both rhino and lion, while many other species have been largely ignored. The results show that the populations within the crater are vulnerable to change and this is further complicated by the evidence that each species is affected by varying and interacting factors.

Planned in-situ TEM Study of Silicon Carbide under Irradiation

C J Pawley¹, S E Donnelly¹, M-F Beaufort², J A Hinks¹ and E Oliviero³

¹*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

²*Laboratoire PHYMAT, Université de Poitiers, SP2MI, BP 30179 86962,
Futuroscope Cedex – France*

³*CSNSM, Bâtiment 108, 91405, Orsay Campus, France*

An ongoing collaboration between the University of Salford, CNRS at the Université de Poitiers and the JANNuS facility at Orsay in Paris unites two world-leading facilities for in-situ irradiation in transmission electron microscopes (TEM) together with experts in the field of ion damage in silicon carbide (SiC). The aim of the collaboration is to utilise the resources of both in-situ systems in order to simulate the material behaviour under neutron irradiation. We utilise the ability to perform the irradiation at a variety of temperatures, energies, and to use a variety of ions in order to investigate a wide range of behaviours in this material – which will provide key information for future applications of SiC, specifically within the nuclear industry.

Optical Emission Spectroscopy for Remote Materials Analysis in Hazardous Environments

R D Pilkington¹, J S Cowpe¹, D Moser¹, A I Whitehouse²

¹*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

²*Applied Photonics Ltd., Skipton, North Yorkshire, BD23 2DE.*

Optical Emission Spectroscopy (OES) offers several unique benefits as a materials analysis technique. One particularly advantageous feature of OES is its ability to perform non-contact, remote materials characterisation; this is of particular importance in extreme environments, or for the analysis of hazardous substances. OES has been applied to the remote compositional analysis of radioactive materials and spent fuel residues, and to the in-situ analysis of nuclear power station steam generator tubes. Here we will describe several methods of deployment for remote OES analysis; lens-coupled systems, fibre-optically coupled systems and telescopic systems for long range stand-off measurements.

The UKLIBS Network

J S Cowpe and R D Pilkington

*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

The *UKLIBS Network* is a major new consortium of 40 academic, industrial, public sector and central research facility partners spearheaded by the University of Salford. Together, we are advancing fundamental research and technology development in Laser-Induced Breakdown Spectroscopy (LIBS). The *UKLIBS Network* is generating fresh multi-disciplinary LIBS collaborations, and bridging the gap between academia and industry. Our extensive public engagement program, developed in conjunction with Manchester's *Museum Of Science and Industry*, and the *National Co-ordinating Centre for Public Engagement*, has been integrated with the *Institute Of Physics* UK Plasma Vision initiative, helping to elevate the research profile of the University of Salford.

LIBS is an extraordinarily versatile, important analytical technique, employed in a great many diverse fields worldwide: environmental monitoring, archaeology, medical research, pharmaceuticals, industrial processes, forensics, materials characterisation and many more. The range of tasks to which LIBS is applied has expanded year by year. The University of Salford Laser Facility is currently supported by several inter-disciplinary research grants, and is investigating medical, geological, archaeological, fundamental physics, solar energy and hydrogen storage aspects of LIBS.

At present, the UK is vastly under-represented in the developing LIBS technique, which is keenly backed worldwide by prestigious academic institutions and large industrial concerns alike. International LIBS conferences have been held every year since 2000; these conferences are regularly attended by over one hundred academic and industrial participants from across the globe. Our research presentations at these conferences have been the only UK representation in this field by an academic establishment. Our LIBS research has been published in peer-reviewed journals and cited by other respected LIBS practitioners. As the UK's leading academic LIBS research group, the University of Salford Laser Facility is ideally qualified to act as the co-ordination hub of the *UK LIBS* network.

Geo-archaeological Applications of LIBS

R D Pilkington, J S Cowpe, S H Kilcoyne and K Gannon

*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

Geo-Archaeology has developed into a mature subject, enriched by cross-disciplinary input. Scientific innovations exploited in geo-archaeology have advanced knowledge and understanding, helping to unlock the secrets of artefacts and sites that previously were not completely understood. Over recent years developments in geophysical prospecting have provided effective analysis of buried archaeological remains without the need for excavation; this is especially important as an archaeological survey is now mandatory before site development. Geophysics has given archaeologists the tools to 'see' beneath the soil and delve into the past, but these prospecting techniques are not without their limitations.

Laser-Induced Breakdown Spectroscopy (LIBS) is a versatile analytical technique that offers many attractive features to the field of geo-archaeology. LIBS is applied across a diverse range of disciplines: forensics, environmental studies, medicine, space exploration, industrial process control and many more. LIBS can provide trace element fingerprinting of materials, accurately mapping the 3-dimensional composition of a given sample. The LIBS apparatus is relatively inexpensive, easily deployed, and portable. LIBS is unique as it requires no sample preparation; it is precise, accurate, and sensitive, offering trace detection limits of parts per million. It is perceived that LIBS prospecting analysis would not be corrupted by the underlying geology, water content or magnetic anomalies. It is also envisaged that, further to geo-archaeological prospecting and site characterisation, LIBS displays the potential for rapid analysis of artefacts either in the laboratory or *in-situ* at a dig site; and being a relatively non-destructive technique retains the integrity of fragile specimens. LIBS artefact analysis could yield extra information to help interpret archaeological context, and to track ancient patterns of resource acquisition and trade.

Fabrication and Characterisation of Iron-Gallium (FeGa) Thin Films and Nanostructures

C J Quinn, N Mellors and P J Grundy

*Materials & Physics Research Centre, School of Computing, Science & Engineering,
University of Salford*

The iron-gallium (FeGa) alloy displays the highest magnetostrictivity of all the ferrous materials (excluding those containing rare earth metals such as Terbium-Dysprosium - TbDy). This particular alloy has several advantages over the other magnetostrictive alloys and displays a magnetostriction of up to 300ppm. The material is machinable meaning that it is a favoured choice in the development of MEMS and NEMS (Micro and Nano Electrical Mechanical Systems.) The different atomic compositions and the variation between thin film and nanostructures show subtle differences in the magnetic and structural properties of this material; predominantly in the magnetic moment but also in the porosity of the samples. The formed films and structures are polycrystalline by nature, although melt-spun ribbons display an amorphous morphology, although heat-treatment can augment the ribbons into a polycrystalline structure.

The films and structures are produced in-house by using a vacuum chamber utilising a DC Magnetron sputtering system; the bulk alloy is bombarded by ions formed in plasma using the inert noble gas Argon. The thin films are grown perpendicular to the sputtering target whereas the nanostructures use a technique known as Glancing Angle Deposition (GLAD)¹ which employs an atomic 'shadowing effect' in order for these columns to be grown; the substrate (predominantly Silicon) can also be rotated at varying rates in order to change the shape and pitch of the columns.

The various physical and magnetic properties of both the thin films and structures are characterised using several methods including Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Vibrating Scanning Magnetometry (VSM) and Magnetic Force Microscopy (MFM).

¹ Robbie, Kevin J., Brett, Michael J. 2001. ***Glancing angle deposition of thin films,***

United States. The Governors of the University of Alberta (Edmonton, CA), Alberta Microelectronic Corporation (Edmonton, CA) Patent No. 6206065.

The Urban Environment: Quantifying Ecosystem Services at the Neighbourhood Scale

Kathleen G Radford

*Research Centre for Urban Change,
School of Environment and Life Sciences, University of Salford*

The degradation and loss of vital ecosystem functions and services are an uncontested result of urbanisation. This has led to the need to quantify ecosystem services at a variety of temporal and spatial scales to aid in the conservation and enhancement of these services to increase quality of life and to aim for a sustainable future. Attempts to measure and value ecosystem services have been made, the most common of these methods being 'willingness-to-pay' which attributes economic gain to an environmental attribute, but such methods are subject to much debate which has led to a lack of consensus between academics and practitioners. Furthermore, there is a lack of knowledge surrounding the quantification of many cultural services such as aesthetic and spiritual values, resulting in them receiving less attention. Current methods for ecosystem service quantification focus largely on the landscape and global scales; failing to appreciate services provided at the neighbourhood scale and at different levels of urbanisation. This paper critically examines a variety of extant methods for measuring ecosystem services at different temporal and spatial scales. The paper describes a new tool, based on a selection of previously used methods such as the Green Flag Award and Residential Environment Assessment Tool, for quantifying a selection of ecosystem services at the neighbourhood scale. The Tool has been applied to the Greater Manchester conurbation to assess how ecosystem services are provided at different levels of urbanisation. The results of a pilot study are then presented and discussed. The uses of this method in planning for sustainable communities in an increasingly urbanised world are then discussed.

First Principles Study of Hydrogen Storage in Metal-Organic Frameworks

Duncan Riley, Ian Morrison, Dan Bull and David Moser

*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford.*
d.j.riley@salford.ac.uk i.morrison@salford.ac.uk

We present a study hydrogen adsorption in the Metal-Organic Framework MOF5 by first principles calculations. The binding sites and adsorption energies of H₂ have been identified through density functional theory (DFT) using Castep [1], this found binding energies up to 43 meV. Further quantum states, including both the ground and excited states of the H₂ quantum rotor, have been evaluated following a full three-dimensional mapping of the adiabatic surface of each site. These states have then been used to interpret features of the measured INS spectra [2] attributing the large peak at ~ 12 meV to a first rotational transition of the hydrogen molecule in the 'Cup' site of the Zinc-oxide cluster.

Also presented is the study of the binding of atomic hydrogen to the organic linkers in a range of metal-organic frameworks using dftb+ [3]. Calculations of the ground-state total energies show a more favourable binding of atomic hydrogen to the carbon linkers of the MOFs than in H-H bonding (H₂ gas). At finite temperatures, the thermodynamic stability of the system can be predicted from the free energy, which is calculated from phonon frequencies. Comparing the free energies of the 'full' storage material with the 'empty' MOF + H₂ gas over a range of temperatures has predicted release of the gas between 425 and 550K for MOFs with benzene/graphene type linkers.

References

- [1] S J Clark, M D Segall, C J Pickard, P J Hasnip, M J Probert, K Refson, and M C Payne, Zeitschrift Fur Kristallographie 220 (2005) 567.
- [2] N L Rosi, J Eckert, M Eddaoudi, D T Vodak, J Kim, M O'Keeffe, and O M Yaghi, Science 300 (2003) 1127.
- [3] B Aradi, B Hourahine and T Frauenheim, J Phys Chem 111 (2007) 5678.

Application of Poly-CINS Modelling to Defect Dynamics in Natural and Irradiated Graphites

Daniel L Roach and D Keith Ross

*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

Currently the only available methods of investigating the dynamics of nanomaterials are more or less limited to IR and Raman and density of states measurements using incoherent inelastic scattering. We are currently developing the use of coherent inelastic scattering from polycrystals, which in principle contains information about the spatial separation of atoms taking part in a particular mode of vibration. However, because the model has to be averaged over all possible orientations of the crystalline structure, the data obtained is difficult to interpret directly and hence requires the development of a model to compare with the data. We have so far published a brief account of the technique combined with model simulations of poly-CINS scattering from graphite[1,2].

Natural graphites are distinguished by the fact that they show evidence for the presence of a proportion of rhombohedral graphite (RG) [3]. This allotrope of carbon is never found on its own, only in combination with well crystallised hexagonal graphite following deformation under geological conditions or following mechanical deformation such as ball milling. A recent poly-CINS experimental study conducted on the IN5 spectrometer at the ILL, Grenoble, by the authors has provided evidence of new, low energy transfer ($Q < 2.0$ Angstroms⁻¹), low frequency (around 1meV) vibrational modes due to the partial stacking fault structure of RG, and analysis is underway on using the 'scatter' subroutine in GULP to model the poly-CINS spectrum of this system. Recent work on the diffraction analysis of the rhombohedral content of a range of natural and laboratory-annealed expanded graphites [4] has provided additional information necessary to properly identify peaks in the authors' own diffraction patterns which identify the presence of RG within the samples used for the poly-CINS experiment.

Currently planned experimental work at ISIS will continue this investigation by applying the poly-CINS method to a range of neutron irradiated graphites, including those exposed to both low dose and temperature (below 150C) BEPO graphite and higher temperature and irradiation dose Magnox (PGA) and AGR (Gilsocarbon) graphite respectively. These graphites are important as the irradiation changes to the mechanical properties of these may be life limiting for the respective reactor designs. Moreover, failures have been observed that are apparently inconsistent with the accepted model of radiation damage build up in these graphites[5,6].

- [1] D.L.Roach, J.D.Gale and D.K.Ross "Scatter: A new inelastic neutron scattering simulator for GULP", Neutron News 18 (2007) 21.
- [2] D.L.Roach, J.D.Gale and D.K.Ross "The application of coherent inelastic neutron scattering to the study of polycrystalline materials" submitted to Phys Rev B.
- [3] G. Parthasarathy, B Sreedhar and T.R.K.Chetty, "Spectroscopic and X-ray diffraction studies on fluid-deposited rhombohedral graphite from the Eastern Ghats Mobaile Belt, India" Current Science 90 (2006) 995
- [4] H.A.Wilhelm, B.Croset and G. Medjadi, "Proportion and dispersion of rhombohedral sequences in the hexagonal structure of graphite powders" Carbon 45 (2007) 2356-2364.
- [5] Reed, J., *An Overview of Graphite Core Assessment Methodology.*, in *securing the safe performance of graphite reactor cores*, b.c. group, editor. 2008: East Midlands Conference Centre, University Park, Nottingham.
- [6] Thrower, P.A., *The Study of Defects in Graphite by Transmission Electron Microscopy*, in *Chemistry and Physics of Carbon* P.L. Walker, Editor. 1969, DEKKER: New York.

Investigating the Biological Role of human NEIL3.

Thomas Roedl and Rhoderick H Elder

*Centre for Biochemistry, Drug Design & Cancer Research,
School of Environment & Life Sciences, Cockcroft Building, University of Salford*

To combat the detrimental effects of DNA damage, cells have evolved a number of DNA repair systems. Chemically altered bases in DNA are removed by a number of DNA glycosylases in the first step of base excision repair. Among these, mammalian cells contain three proteins, NEIL1, NEIL2 and NEIL3, with homology to the *Escherichia coli* Fpg and Nei proteins. However, while the function of NEIL1 and NEIL2 as DNA glycosylases/AP lyases is well documented, no substantial DNA glycosylase activity on double-stranded DNA substrates has been detected for NEIL3. NEIL3 is the largest member of the family with an extended C-terminal domain and is unique to higher eukaryotes, showing a restricted gene expression pattern, mainly in cells of the immune system. To investigate the biological role of human NEIL3 (hNEIL3) a yeast two-hybrid assay (y2-h), a system that allows the examination of protein-protein interactions will be carried out. In y-2h, the chosen 'bait' protein (hNEIL3) is expressed in yeast fused to the DNA-binding domain of a bipartite transcription factor (LexA), while the second protein (the prey) is expressed from a cDNA library, bound to the activation domain (B42) which, in combination with LexA activates transcription. Neither LexA nor B42 alone are able to activate the transcription; only if they are in close proximity due to interaction of the bait protein with a prey protein, will transcription of a downstream reporter gene occur. In this project the LexA-operator is responsible for the expression of two genes; LEU2, which is involved in leucine biosynthesis and LacZ. The use of two reporter systems allows a double selection, which decreases the number of false negatives. To date, the project has focused on the molecular cloning of the hNEIL3 cDNA into two bait vectors, pEG202 and pEG202-NLS. Although a relatively straightforward procedure, single base-pair changes (mutations) resulting from amplification of the hNEIL3 sequence have so far impeded progress. Results from these initial experiments will be presented.

Inflammatory Bowel Disease and *Trichiuris muris* Infection

Ekta Bhardwaj¹, Kathryn J Else², Geoff Warhurst³ and M T Rogan¹

¹*Centre for Parasitology & Disease Research,
School of Environment and Life Sciences, University of Salford*

²*Faculty of Life Sciences, University of Manchester, M13 9PT*

³*Gut Barrier Research Group, Clinical Sciences, Hope Hospital, Salford M6 8HD*

Prevalence of inflammatory bowel disease (IBD) is far more common in developed countries as compared to the developing world, where infection with intestinal parasites is common. The hygiene hypothesis suggests lack of infection predisposes to the development of IBD in genetically susceptible people. However, little is known immunologically about how gut parasites alter IBD progression. P-glycoprotein (PGP) present in the apical membrane of gut epithelial cells is encoded by the *mdr1a* gene. This protein inhibits absorption of many drugs and acts like a transport protein. Mice which lack the *mdr1a* gene (*mdr1a*^{-/-}) develop spontaneous colitis in the presence of enteric bacteria. We have used *mdr1a*^{-/-} mice on an FVB background to investigate any change in progression of colitis in mice infected with *Trichuris muris*. Our results reveal that the *mdr1a*^{-/-} mice were unable to expel *T. muris* and had a higher worm burden at day 19 after infection compared to controls. This was associated with increased Th1 and Th2 cytokines, particularly IFN-gamma in the draining lymph nodes. Interestingly, there was also evidence that *T. muris* infection may accelerate the development of gut inflammation in the *mdr1a*^{-/-} mice as judged by increased mucosal infiltration by CD4⁺, CD8⁺ and F4/80⁺ cells and other histological changes. This study shows that infection with *Trichuris* may worsen colitis in the precolitic *mdr1a*^{-/-} model which could be a complex interaction between the translocated bacterial products (due to absence of P-glycoprotein molecule) and immunomodulatory molecules of worm.

Hydatid Cysts: Every Picture Tells a Story

Michael T Rogan¹, Wang Yun Hai², Russell Richardson¹ Eberhard Zeyhle³ & Philip S Craig¹

¹*Centre for Parasitology & Disease Research,
School of Environment and Life Sciences, University of Salford*

²*Xinjiang Medical University, Urumqi, P.R. China*

³*Nomadic Health Unit, AMREF, PO Box 30125, Nairobi, Kenya*

For more than 30 years, ultrasound screening has been an effective aid to the detection of abdominal cystic hydatid disease, caused by *Echinococcus granulosus*, in humans. In recent years, however, the images produced have provided more information than just a diagnosis. Different cyst morphologies have been classified into types, and such classifications may be considered as representing a natural history of cyst development. However, the developmental events seen in ultrasound need to be more closely matched to immunological and cellular events to have a fuller appreciation of disease progression and regression. Understanding how cyst structures alter with time is crucial to evaluating the effectiveness of different treatment regimes and monitoring the natural degeneration of cysts which may occur in some patients. Studying the relative proportions of different cyst morphologies at a community level may also provide epidemiological information on disease transmission.

White Light Lasers

C S Rose, G S McDonald and J M Christian

*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

Nanostructured Hybrid Hydrogen Storage Materials

D K Ross (PI), I L Shabalin (CI), T M Paterson, S G Keens (RA) & Z A Mileeva (PhD-S).

*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

Hydrogen/fuel cell cars are being developed by most of the major car manufacturers for commercial launch in around 2015. These cars are designed to work with either high pressure hydrogen gas or (BMW) using liquid hydrogen. We are researching into improved ways of storing this hydrogen on a vehicle. In this project, we are developing high surface area carbons which adsorb molecular hydrogen by *physisorption* with other elements deposited on the surface to enhance the properties of the surface. The objective is to reach a position where a tank filled with carbon will adsorb as much hydrogen as an empty tank at the same operating pressure. This would have a considerable safety advantage over high pressure hydrogen on its own. The measurements of hydrogen adsorption are made using the IGA - an intelligent gravimetric analyser that was originally developed in our group or alternatively using an automated volumetric equipment.

One way of enhancing the absorption of hydrogen is to load the surface with Li_3N as this will combine reversibly with hydrogen to produce Li imide and Li amide. In order to investigate these materials we have developed an air free pyrolysis unit for preparing the sample under nitrogen gas at elevated pressures. The design allows us to move the materials produced to the IGA without exposing to air.

Photoactivation of Trans-combretastatins as Anticancer Drugs

Kathrin Scherer, Roger Bisby, John Hadfield, Nicholas Hirst and Alan McGown

*Centre for Biochemistry, Drug Design and Cancer Research,
School of Environment and Life Sciences, University of Salford*

Combretastatins are powerful anticancer drugs that are presently being evaluated in clinical trials. They are substituted stilbenes that are active in the *Z*- (*cis*-) configuration. Since stilbenes are readily photoisomerised from the *E*- (*trans*-) to *Z*- (*cis*-) forms, this has suggested that *E*-combretastatin may be regarded as a pro-drug and could be activated in the body by localised exposure to light at the tumour site. *E*-Combretastatin A4 has an absorption maximum at 320 nm, a wavelength at which there is effectively no light penetration into tissues. To overcome this problem it is proposed to use two-photon excitation at ca 640 nm using the very high instantaneous powers within femtosecond pulses generated by a Ti-sapphire-OPO laser system.

At this early stage in the project, suitable compounds are being synthesized and their photochemistry and photophysics evaluated. *E*-Combretastatin A4 has a fluorescence spectrum that may be useful in fluorescence lifetime imaging of intracellular drug distribution. Fluorescence quantum yields have been determined to be in the range 0.08 to 0.15 depending on solvent polarity and are consistent with anticipated sub-nanosecond fluorescence lifetimes that will be measured using the Ti:Sapphire laser. Further studies to determine the quantum yield for photoisomerisation are now underway prior to an initial visit to the Central Laser Facility (Rutherford Appleton Laboratory) for exploratory two-photon experiments.

Acknowledgements

This work is supported by Science and Technologies Facilities Council (STFC) through the BioMed network. We are grateful for the collaborative assistance of Professor Tony Parker and Dr Stan Botchway at the STFC Central Laser Facility.

Thermal Shock Resistance of Hetero-Modulus Ceramics based on Transition-Metal Carbides

I L Shabalin

*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

The group 4 transition-metal carbides are real champions among the variety of materials as far as their melting points (up to 3950 °C for HfC) and hardness (up to HV 40 GPa for TiC) are concerned. Because of these properties they are candidate materials for many modern engineering applications. A key problem that would have to be avoided before they could be used as engineering materials is connected with their dramatically brittle properties. The generally imperfect impact tolerance and low thermal-shock resistance, which are inherent to the transition-metal carbides, can be improved noticeably by the addition of a low-modulus phase such as graphite, and this effect can be achieved without significant restrictions to their applications at ultra-high temperatures, because the eutectic points in the TiC – C, ZrC – C and HfC - C systems are positioned close to 3000 °C.

Highly densified TiC-, ZrC- and HfC-based ultra-high temperature hetero-modulus ceramics (HMC), containing 10-50 vol. % of low-modulus phase in the form of particulate graphite, were prepared by hot pressing at 2700 °C and 12 MPa in argon atmosphere. The microstructure and physico-mechanical characteristics were investigated and compared with those available in earlier works to provide a clear understanding of the composition-property correlations and anisotropy of this type of composites. Different thermal shock resistant parameters for the hetero-modulus ceramics were calculated on the basis of the experimental data obtained. A new principle of optimum materials design for the compositions in the refractory carbide – graphite systems is exemplified by the TiC – C hetero-modulus materials.

Hybrid 3D-Nano/Microstructures Obtaining on the Basis of Pretreated Carbon Fibers

Z A Mileeva¹, V A Bogolepov², D V Schur², S Y Zaginaichenko²,
V A Begenev², I L Shabalin¹ and D K Ross¹

¹*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

²*Institute for Problems of Materials Science, National Academy of Sciences,
Krzhyzhanovski St. 3, Kyiv 03142, Ukraine*

One of the most important problems of materials science is the development of optimal carbonaceous structures for the production of new multi-functional hybrids and construction composites. Synthesis of carbon nanotubes was carried out on the surface of carbon filaments (cross-sectional dimensions – 4-10 μm) preliminary impregnated with non-metal catalysts in the temperature range from 350°C to 800°C. A gas mixture of acetylene and helium was used as a precursor. Morphology and structure of derived samples were studied by SEM/EDX methods using Philips XL 30 SFE. Under the optimum conditions of treatment, deposited from gas phase nanostructures have a good adhesion to the substrate forming whole clusters on the filament surface. The distribution of such nano-conglomerates in the volume of carbon fiber bundles is varied depending on the synthesis conditions. These nanostructures were of various shapes: from plane needle-shaped (jagged) to 3D-smooth pseudo-triangular in cross-section with negative curvature. Carbon fibers with nano-structured clusters are characterized by extended specific surface area. This will render to apply them in adsorption processes as an active carbonaceous medium. The developed manufacturing method can be used for the fabrication of hybrid carbon 3D-nano/microstructures by the treatment of fibers with different characteristics.

Investigation of Common Industrial Wastes for the Production of Hetero-Modulus Hybrid Materials with Reduced Embodied Energy

I L Shabalin¹, J Cloughley² and H Naji³

¹*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

²*e4 Structures Ltd, Unit 2B, Greenvale Business Park, Todmorden Rd, Littleborough,
Lancashire, OL15 9EG, UK*

³*Envirolink Northwest, Spencer House, 91 Dewhurst Road, Birchwood, Warrington,
WA3 7PG, UK*

The design of cost-efficient and high-performance materials is extremely important to the Energy Economy, which is necessary for the sustainable development of our society. Sustainability is also connected with recycling and utilisation of various wastes. New hybrid ceramic-polymer (inorganic-organic) materials can provide new engineering solutions capable of optimizing the application of current energy storage and technologies, minimizing their negative side effects and reducing their production costs. Moreover, new materials design & technology development usually achieves considerable economic advantage, thanks to their vast application breadth. Each year, the UK generates several million tons of various wastes, including about 3 million tons of plastics. All these wastes can be measured in terms of energy resources as well as ecological impacts. Plenty of technological wastes, such as various types of fly ash, ground/powdered glass (currently, in the UK, only 33% of manufactured glass is recycled), debris from the tableware and sanitary-ware industries and some others, can be used for the preparation of the inorganic chemically bonded matrix for the hybrids. Various fibrous and needle-like-particulate types of wastes, organic and inorganic originally, such as pulp and paper mill residue, textile and fibreglass production scrap, wooden shavings and milled oriented strand board, could be applied as efficient reinforcement constituents for strengthening this matrix.

Nano-Structured Hybrid Hydrogen Storage Materials

D K Ross, I L Shabalin, T M Paterson, S G Keens, Z A Mileeva

¹*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

Hydrogen is a significant and progressive energy carrier, as energy release can be achieved without producing polluting and harmful by-products, as would be emitted by the combustion of fossil fuels. There are two principal mechanisms of hydrogen storage in solids connected with intermolecular forces, which do not cause any change in the electronic patterns (adsorption or physisorption), and interatomic electron exchange, which leads to formation of different hydrogen containing chemical compounds (absorption or chemisorption). A recently declared approach is shifting research focus toward the hybrid systems, which could combine capacity of chemisorbing materials with kinetics of physisorption systems. One of the alternatives of such system could be a dispersion of the nanoparticles of metal or metal compound, which chemically interact with hydrogen to form hydrides (or amides, imides), inside of nanoporous media with high specific surface area, which is provided by the precise porosity. The potential pathways for preparation of such hybrid store can be selected from a number of methods, e.g. infiltration of activated carbons. There are many cost-effective activated carbons produced in industrial scale. Most of them are available for infiltration by the different solvents containing the precursors of hydrogen chemical absorbents. Although the simplicity of this process is obvious, it is necessary to recognize its lower potential for the introduction of considerable amounts of metal or metal compounds into a nanoporous matrix, which is inherent to this preparative method.

Energy-Saving Hybrid Materials based on Polymer-Ceramic Chemically Bonded & Fibre Reinforced Microstructures

I L Shabalin¹ and J Cloughley²

¹*Materials & Physics Research Centre,*

School of Computing, Science & Engineering, University of Salford

²*e4 Structures Ltd, Unit 2B, Greenvale Business Park, Todmorden Rd, Littleborough, Lancashire, OL15 9EG, UK*

Hybridization and structural control of ceramic and polymer materials have been in the limelight during the past two decades because of their ability to enhance properties and enlarge application areas in the conjunction with fundamental understanding of Physics, Chemistry, Materials and related disciplines. A new approach to the production technology of energy-saving materials is connected with design of polymer-ceramic hybrid microstructures and, in particular, based on the application of advanced microstructural combinations of chemically bonded phosphate/phosphate-aluminosilicate ceramics, i.e. inorganic polymers, with plastics, i.e. organic polymers. A unique feature of the approach is in the special focus on the formation of interface between organic and inorganic constituents in the material. The materials design concept results in the next generation of building-construction materials: energy-saving, low embodied energy and eco-friendly polymer-ceramic hybrids with excellent thermal (sound) insulation properties. Additionally, the newly developed hybrid materials possess higher levels of durability, toughness, chemical, wear and surface-scratch resistance, grade of recycling, but also - zero emissions (class 0 fire-rating), low toxicity, good aesthetics, ability to be painted in various colours and other advantages.

Soft X-Ray Magnetic Imaging of Focused Ion Beam Lithographically Patterned Fe Thin Films

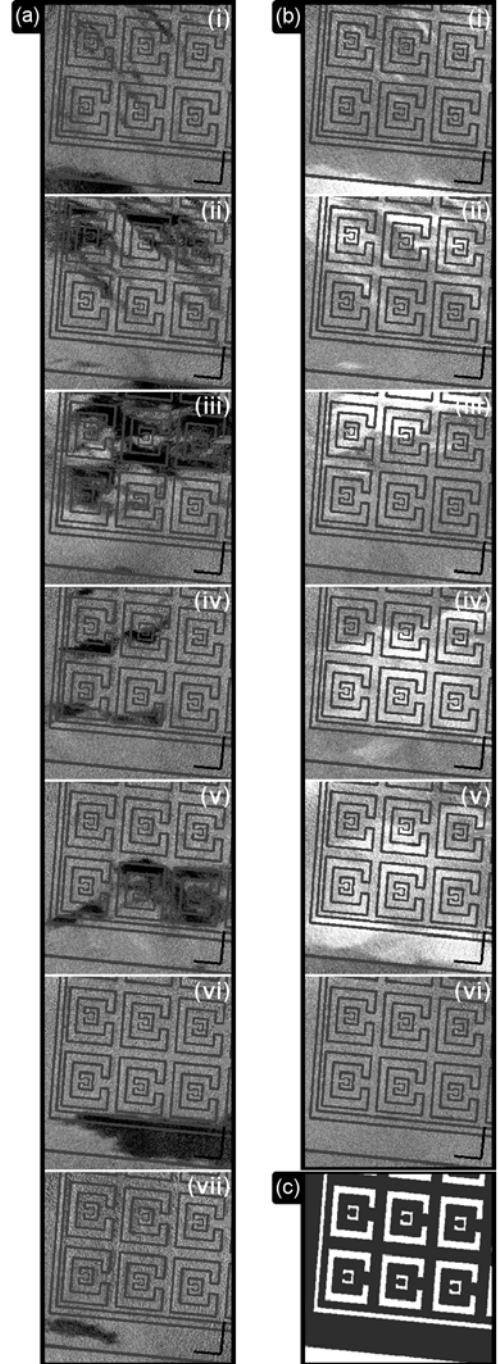
P J Cook¹, T H Shen¹, P J Grundy¹, G A Jones¹, S A Morton², P J Fischer², M Y Im²
and A L D Kilcoyne²

¹*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

²*Lawrence Berkeley National Laboratory, Berkeley, USA.*

We demonstrated the potential to modify the magnetic behaviour and structural properties of ferromagnetic thin films using focused ion beam “direct-write” lithography. Patterns inspired by the split-ring resonators often used as components in meta-materials were defined upon 12 nm thick Fe films using a 30 keV Ga⁺ focused ion beam at a dose of 2×10^{16} ions cm⁻². Structural, chemical and magnetic changes to the Fe were studied using transmission X-ray microscopy at the ALS, Berkeley. These observations showed a 23% reduction in the thickness of the film in the irradiated areas, but no chemical change was evident. Images of the magnetic reversal process show domain wall pinning around the implanted areas, resulting in an overall increase in the coercivity of the film. Using transmission electron microscopy, the grains within the implanted areas were seen to be more than double the size of those within the as-grown Fe. A detailed magneto optical investigation of the dose-dependent magnetization characteristics will also be presented.

Figure 1. Magnetization reversal cycle of a section of patterned Fe, with the applied field in the horizontal direction. The images show the change in domain structure between successive field steps, with an overlay of the pattern design as a guide. An in-plane field of +913 Oe was first applied to saturate the film, then swept from zero field to -884 Oe (a), and then zero field to +913 Oe (b). The pattern design is shown in (c), with the shaded areas representing the Ga implantation.



Observation of the Effect of Spin-resolved Density of States in Optically Excited Polarised Electron Injection at Schottky Barriers

N Wang¹, T H Shen¹, G A Jones¹ and P J Grundy¹ and W Y Liang²

¹*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*
²*Cavendish Laboratory, University of Cambridge, England.*

Previous research has reported on optically excited spin-injection. In these studies, circularly polarized light, usually at normal incidence, was used as a tool to generate a chirality-dependent photocurrent. While the circular polarisation states of the electroluminescence may provide a direct measure of the spin polarisation states after the injection, the chirality dependence of the photocurrents nevertheless provides a convenient way of determining the magnetic asymmetry of the spin-injection process. In our earlier work [1] we reported an experimental study of the chirality dependence of the photocurrent with photon energies both above and below the GaAs band gap in the case of a Fe/GaAs Schottky barrier structure, thereby examining the contribution of the interband transition in the semiconductor to the overall effect. Our experiments were conducted at an angle off normal incidence, a configuration which allowed us to probe the in-plane magnetization of the magnetic films. In the present work, we examine the spin-dependent photocurrent in the case of Ni/GaAs. Ni is known to have a negative spin polarisation at the Fermi energy. Using a different experimental approach, the photon energy-dependent measurements have enabled us to demonstrate the change of sign in the magnetic asymmetry of the photocurrent, Fig. 1, as a result of the change in spin-polarisation when the electrons at different energies below the Fermi level are probed.

Reference

[1] Y Liu, T H Shen, W Li and W Y Liang, J. Appl. Phys. 97, 10J118 (2005).

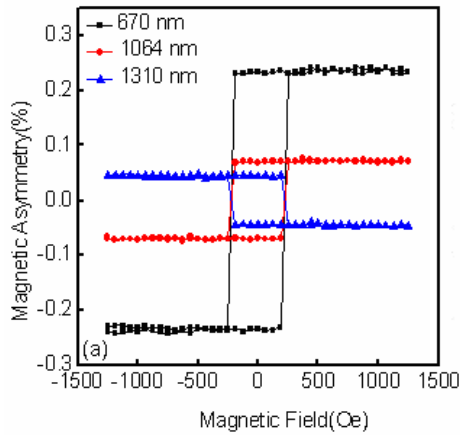


Fig. 1 Spin dependent magnetic asymmetry for a Ni (8.1nm)/GaAs sample, measured with lasers of different wavelength and showing the reversal of spin polarisation close to the Fermi level.

Monocrystalline Hexagonal Close-packed and Polycrystalline Face-centered Cubic Co Nanowire Arrays Fabricated by Pulse dc Electrodeposition

J Zhang¹, G A Jones¹, T H Shen¹, P J Grundy¹, S E Donnelly¹ and G Li²

¹*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

²*Key Laboratory of Materials Physics, Institute of Solid State Physics, CAS, China*

Cobalt nanowire arrays have been grown onto anodic aluminum oxide templates by using a pulse dc electrodeposition technique. We demonstrate that the crystal structure, grain size and related magnetic properties can be controlled by applying different pulse frequencies. For a pulse frequency of 25 Hz, monocrystalline hexagonal close-packed (hcp) Co nanowires are formed with a well defined $[10\bar{1}0]$ growth axis along the wire length. At a higher pulse frequency of 1000 Hz, face-centered cubic (fcc) Co nanowires are deposited with a small grain size and a preferred $[111]$ texture directed along the length of the wire. Possible mechanisms for the observed growth characterization are discussed. An investigation of the corresponding magnetic properties indicates that the fcc Co nanowire arrays have the larger coercivity and squareness values: reasons for this behaviour are explored.

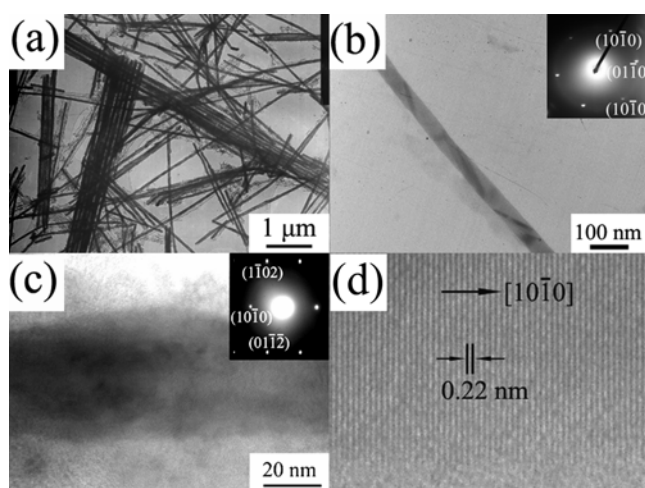


Fig. 1 TEM images of hcp Co nanowires: (a) hcp Co nanowire bundles; (b) a single nanowire and its corresponding SAED pattern; (c) bright-field image of an hcp Co nanowire and its corresponding SAED pattern; (d) lattice image of (c).

Investigation into the Recrystallisation of Amorphous CoFeB Alloys

L M Simmons¹, S H Kilcoyne¹, D Greig² and M J Walker²

¹*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

²*Department of Physics and Astronomy, University of Leeds*

MgO-based magnetic tunnel junctions (MTJs) exhibit high levels of tunnelling magnetoresistance [1], a desirable quality for magnetoresistive devices such as magnetic random access memory, magnetic read heads and magnetic sensors [2]. A high tunnelling magnetoresistance effect (TMR) has been realised in MTJ's with a highly orientated MgO (001) texture sandwiched between recrystallised CoFeB electrode layers. Because tunnel junction crystallinity has a profound impact on the value of the TMR ratio [3], studies of MTJ crystal structure have implications for the development of high performance MTJ's.

Current research suggests that crystalline electrode components can only be achieved by annealing amorphous CoFeB in order to induce lattice matching with the MgO insulating layer. However although there has been well documented research into the overall crystalline structure of the MTJs there have been no studies of the crystallisation of CoFeB itself.

The effects of heating regime and alloy composition on the recrystallisation of amorphous CoFeB have been investigated using synchrotron x-ray diffraction. We have studied the crystallisation of melt spun $\text{Co}_x\text{Fe}_{(80-x)}\text{B}_{20}$ where $x = 40$ and 60 , on the XMaS beamline at the ESRF, Grenoble, France.

In both alloy compositions a CoFe solid solution is the primary crystal phase formed. Furthermore we have modelled the kinetic parameters such as grain growth and activation energies for this phase using the Johnson-Mehl-Avrami-Kolmogorov (JMAK) equations of isothermal heating conditions, the Avrami exponent, n , suggests a 2D or rod-like crystallite growth, and is independent of heat treatment.

1. Lee Y.M H.J, Ikeda S, Matsukura F, Ohno H.. Applied Physics Letters, 2006. 89.
2. Parkin S.S.P, et al.. Nature Materials, 2004. 3(12): p. 862-867.
3. Butler WH. Et al,. Physical Review B, 2001. 63(5).

Three Dimensional Mapping of Texture in Dental Enamel

L M Simmons¹, S H Kilcoyne¹, M Al-Jawad², K Abboud and D J Wood³

¹*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

²*Queen Mary University London*

³*Leeds Dental Institute*

Dental enamel – predominately comprising of Hydroxyapatite (HA) is the most mineralised and hardest biological tissue. During enamel formation HA crystals are laid down in the form of nanorods, which cluster together in groups of prisms. Understanding the orientation and crystal growth of the HA prism provides an insight into the natural growth and formation of dental enamel and ultimately will aid in the development in synthetic dental materials.

In this study we have used synchrotron x-ray diffraction to compare the crystal orientation in human dental enamel as a function of position within intact tooth sections of a maxillary premolar and incisor.

Keeping tooth sections intact has allowed us to construct 2D and 3D spatial distribution maps of the magnitude and orientation of texture in dental enamel. We have found that the enamel crystallites are most highly aligned at the expected occlusal points in both maxillary first premolar and incisor. We show further to this that in the maxillary premolar that the texture direction varies spatially in a three dimensional curling arrangement. Our results provide a model for texture in enamel which can aid researchers in developing dental composite materials for fillings and crowns with optimal characteristics for longevity, and will guide clinicians to the best method for drilling into enamel, in order to minimize weakening of remaining tooth structure, during dental restoration procedures.

The Nanomaterials Research Group – Sample Preparation and Characterisation Techniques

S H Kilcoyne, N J Mellors, R D Moorehead, L M Simmons, C J Quinn, P Busby and S Atkinson

*¹Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

Both careful sample preparation and comprehensive sample characterisation are fundamental in Condensed Matter research. This area of research generally follows a cradle-to-grave approach with researchers preparing their own materials, carrying out experiments, analysing the results and publishing the papers. Researchers in the Nanomaterials Research Group (NRG) take this approach in their studies of the electronic, magnetic or structural properties of nanoscale materials, amorphous materials, when investigating phase diagrams and in the design of replacement biological materials.

Our samples take many forms: metallic alloys can be fabricated as ribbons, ingots and powders, or by using a modified sputterer to create thin films and nano-structures. Ceramic biomimetic materials are processed using the large range of ovens and furnaces. More recently we have begun preparing materials via electrodeposition. Our materials are then characterised using a variety of techniques including vibrating sample magnetometry, ⁵⁷Fe Mossbauer spectrometry, Differential Scanning Calorimetry & Thermo-Gravimetric Analysis rig, and nanoindentation.

In addition to the work carried out in-house NRG researchers have the opportunity to work at international science facilities, such as ISIS and Diamond in Oxfordshire and the Institut Laue Langevin and European Synchrotron Radiation Facility in Grenoble, France to carry out neutron, muon and synchrotron experiments exploring the magnetic and structural properties of materials in greater detail.

This poster describes some of the techniques we use in our research and describes some of the science we carry out.

Drivers of Change – Regenerating Saltmarsh using Conservation Grazing Cattle in an Industrialised Area

Damian Smith and Philip James

*Research Centre for Urban Change,
School of Environment and Life Sciences, Peel Building, University of Salford*

Key Words: saltmarsh, ecosystem services, local communities, conservation cattle.

Introduction: Saltmarshes are an integral part of coastal ecosystems, from which more ecosystem services are delivered to coastal populations than any other habitat. Recent ecosystem based management research has sought to recognise drivers of change in ecosystem services and quantify such changes in terms of their negative or positive effects. Examples of saltmarsh ecosystem services include habitat provision for birds, provision of food through livestock grazing and a regulating service through carbon sequestration in the sediment. Less well known, but obvious, is the cultural value in delivering a natural environment to which local communities have access and the resultant state of well-being which many derive from contact with nature. Drivers of change in the ecosystem are quantifiable using traditional methods of scientific research coupled with new models being developed for habitat suitability e.g. for birds. Once quantified, the effects of changes can be passed on to policy and decision makers using the ecosystem service concept.

Aims: The current study seeks to recognise and unpick ecosystem services provided by the saltmarsh and to quantify changes in these as a result of changes in management practice.

Approach: This study is aiming to quantify the changes in ecosystem services attributable to re-introducing grazing on an abandoned saltmarsh on the Upper Mersey Estuary. The saltmarsh lies at the center of Runcorn and Widnes, an urban environment with a long history of chemical industry. Grazers on saltmarsh have been shown to have various effects on the ecosystem relating to type of grazer and the intensity thereof. Therefore, drivers of change include grazing cattle, a provisioning service, with the resultant effects on vegetation, including changes in floral diversity and structure and the use of this by breeding, over wintering and passage avifauna. This research will also evaluate the cultural value of the saltmarsh by quantifying changes in local resident and working communities.

Role of Fibroblasts in Chronic Obstructive Pulmonary Disease

Stephanie Buxton, Dave Singh*, Jeremy T Allen, Lucy Smyth

*Airway Immunology Group, Centre for Parasitology and Disease,
School of Environment and Life Science, University of Salford*

**University of Manchester, NIHR Translation Research Facility, University Hospital of South
Manchester Foundation Trust, Southmoor Road, Manchester, UK, M23 9LT*

COPD is a condition of progressive and poorly reversible lung function decline and is mostly caused by cigarette smoking. The only current treatments are poorly effective steroids and oxygen therapy, resulting in high patient morbidity. In latter disease stages patients face lung transplantation and a lifetime (<5 years expectancy) of taking immunosuppressant drugs as their only option. A key pathology is airway wall thickening, mediated by fibroblast proliferation in response to mediators released from airway epithelial cells. The initial cause of fibrosis is often undetermined. A second COPD pathology is alveolar wall destruction resulting in large defective airspaces, (emphysema), sometimes requiring lung reduction surgery due to excessive lung expansion and stretch. The combination of emphysema and fibrosis is an under studied area and the relationship between lung expansion and fibrosis requires attention.

Our research programme objectives are to examine the effects of stretch forces and cigarette smoke on *primary* human fibroblast properties to observe their influence on: 1) inflammatory mediator (eg IL-6, TGF β) release, 2) proliferation 3) resistance to apoptosis. Patients undergoing lung resection surgery as part of their clinical care are recruited and the study has received full ethical approval from the local Manchester and Salford ethical committees. Following *in vitro* exposure to stretch forces +/- cigarette smoke, fibroblast properties are analysed using ELISA (mediator release), and flow cytometric analysis (proliferation and apoptosis events). Findings from ongoing investigations will improve our understanding of COPD fibroblast pathogenesis and may identify new therapeutic targets to provide better treatment and improve prognosis of COPD patients.

The Role of Visual Attention in Learning to use Myoelectric Prosthesis – A Pilot Study

M Sobuh, L Kenney, S B Thies, A Galpin, P Kyberd and M Twiste

*Centre for Health, Sport and Rehabilitation Sciences Research,
School of Health, Sport & Rehabilitation Sciences,
Brian Blatchford Building, University of Salford*

Myoelectric prostheses are controlled via the electromyographic (EMG) signal generated during a muscle contraction and it is believed that users rely heavily on visual feedback for their control. This study is believed to be the first to report on the characteristics of visual attention while learning to use a myoelectric prosthesis.

A healthy subject was recruited to the study. Within each test session the subject was instructed to complete a manual task (pouring water from a carton) from a sitting position. During the performance of the task an eye-tracking system was used to monitor gaze. The task was repeated 10 times on 5 separate sessions (S1-S2, phase 1; S3-S5, phase 2).

In phase 1 the subject completed the task using her anatomical hand; in phase 2 she completed the task with a myoelectric prosthesis, fitted over her anatomical limb. The SHAP functionality test was also performed following sessions S3-S5.

Both task completion time and SHAP scores deteriorated dramatically at the start of phase 2, and both showed significant improvements over the course of phase 2, indicating skill acquisition.

For analysis of gaze, the task was segmented into reaching and manipulation.

Reaching was associated with lengthy fixation durations at the hand or grasping area which appeared insensitive to training. Fixation at the grasping area was also observed during manipulation, but this was reduced by training. The results of the study are consistent with the hypothesis that myoelectric prosthesis users rely heavily on visual feedback for their control and merit further investigation.

Enhanced Safety and Reliability through Fault Tolerant Control

James Thomas

j.thomas@pgr.salford.ac.uk

*Engineering 2050 Research Centre,
School of Computing, Science & Engineering, University of Salford*

This research aims to develop fault tolerant control algorithms for use in active controllers in railway vehicles, which can be used to enhance the safety and reliability of trains. The current stage of the project involves the modelling and simulation of vehicle dynamics, focusing on linear models of wheel-rail contact, train vehicle-bogie-wheel suspension and dynamics.

Such active control systems for railway vehicles have been shown to provide better performance and efficiency than standard, passive, systems. The problem of introducing additional systems to already well defined mechanical systems used in the rail industry is one that will be addressed with the research. The fault tolerant algorithms and architectures will be developed in such a way that reduces the level of redundancy usually associated with such systems, reducing any costs associated with the system, and promoting uptake.

The poster will present an overview of the project including the current state of active control within the rail industry and where and how fault tolerant control can be used to improve system performance and safety.

Keywords : Fault Tolerant Control, Active Control, Control Systems, Railways

Biocidal Surfaces: Activity Testing and Growth using APCVD

S Varghese^{*1}, P Fitton¹, S Haq¹, D W Sheel^{2,3}, P Youngson², P Sheel³,
F J (Eric) Bolton⁴ and H A Foster¹

¹*Centre for Parasitology and Disease Research, School of Environment & Life Sciences*

²*Materials & Physics Research Centre, School of Computing, Science & Engineering,
University of Salford,*

³*CVD Technologies Ltd, Salford*

⁴*Health Protection Agency, Manchester*

Recent years have seen a growing interest in the area of improving disinfection and sterilization technologies as an additional mechanism of control of transmission of disease along with conventional disinfection methods. Production of self sterilizing and self cleaning surfaces can be highly useful in medical, food processing, ventilating, and air conditioning industries where cross-contamination with bacteria and viruses occurring between hands and inanimate surfaces is a major problem. The use of silver as an antimicrobial agent is well known but silver coatings on surfaces can be soft and easily scratched allowing microorganisms to survive on the surfaces. Novel antimicrobial surfaces are being developed and tested in a unique cooperation between Materials Scientists, Microbiologists and Health Protection specialists. These coatings produced by Chemical Vapour Deposition (CVD) method contain both metal and silica. The resulting coating is a hard glass like structure which retains the antimicrobial property of silver.

The antimicrobial activity of these coatings against various hospital related pathogens has been tested. In an attempt to standardise the methods to evaluate the performance of these coating in hospital setting, biocidal activity testing methods have been developed which allow both laboratory testing against known organisms and *in situ* testing against clinical pathogens in a hospital setting. A comparative study on the performance of antimicrobial samples produced by CVD Technologies Ltd and a commercially available cladding sample was also carried out using the method developed.

The results show that the surfaces have high antimicrobial activity. The ability to coat different surfaces will provide self-disinfecting coatings which have the promise to help to limit transmission of infections in various public, commercial and residential facilities. For example, antibacterial tiles and door handles made of these coatings may be used in hospitals and health care facilities to reduce the spread of hospital acquired infections.

A Microstructure-based Approach for Modelling Acoustical Properties of Multi-scale Porous Materials

Rodolfo Venegas and Olga Umnova

*Acoustics Research Centre,
School of Computing, Science & Engineering, University of Salford*

Porous materials have been conventionally used for acoustic treatment due to its sound absorptive and sound insulating characteristics. A new emerging field is the study of acoustical properties of multi-scale porous materials. An example of this kind of materials is a double-porosity granular material, in which the grains are porous themselves. In this work a methodology for modelling this type of materials is presented. It consists of solving the governing equations at different levels in reconstructed geometries. The information for the geometric reconstruction is extracted from the images of the material. Sound absorption coefficient measurements on perlite have been conducted to validate the approach. This is shown in Figure 1. Perlite has been modelled as a monodisperse ensemble of spherical particles at the mesoscopic level whilst as a monodisperse semi-closed Kelvin cell at the microscopic level. It is proven that a double-porosity granular material provides higher low-frequency sound absorption and is considerable lighter than its single-porosity counterpart.

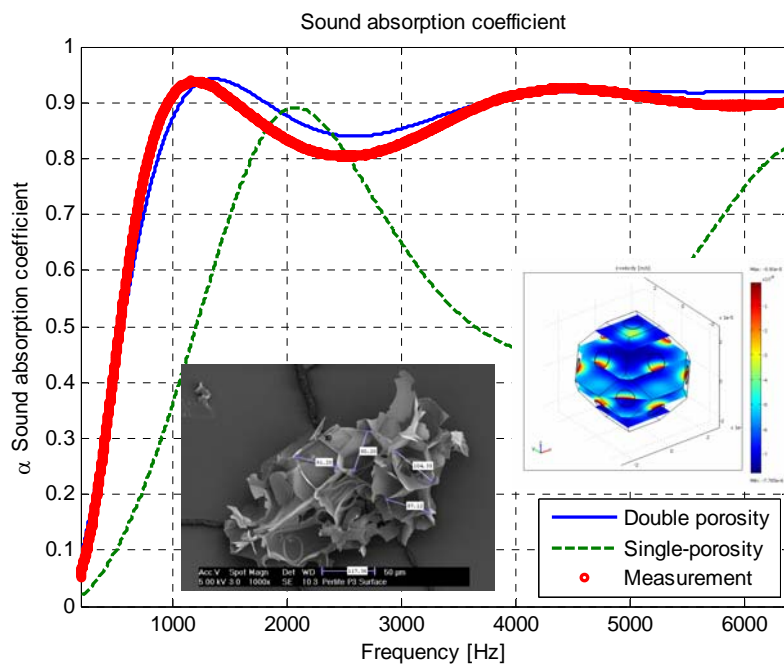


Figure 1 Sound absorption coefficient for a 3-cm rigidly-backed layer of perlite. Predictions using single-porosity model (green dashed line), double-porosity model (blue continuous line) and measurement (red circles). The inset plots are a SEM image and the principal component of the static fluid velocity field.

The Development of a Transponder Based Technique for the Acoustic Calibration of SODARs (acoustic wind profilers)

B Piper and S von Hünenbein

*Acoustics Research Centre,
School of Computing, Science & Engineering, University of Salford*

SODARs are useful tools for examining meteorological trends but their accuracy is not known with different SODARs giving slightly different results in the same location. SODAR measurements are often compared to those from anemometers to examine their accuracy. This method can only give a partial calibration and the differences between a point measurement and a volume measurement are likely to cause errors. And independent traceable technique is required. A method of auditing the performance of SODARs based on Acoustic Pulse Transponder (APT) system is shown in Baxter. Using this approach as a starting point a transponder system that is designed to provide a complete calibration is being developed. This poster examines two methods of return echo generation which have been tested in the development of this system.

Validation of Sodar Real-Time Sensing and Visualisation of Wake Vortices

S G Bradley, S v Hünnerbein and K Underwood

*Acoustics Research Centre,
School of Computing, Science & Engineering, University of Salford*

The strong downwash from wingtip vortices is a hazard to following aircraft, and determines the safe spacing between aircraft landing and taking off. Interaction between vortices and the atmosphere makes their duration, strength, and location difficult to predict. Considerable effort has been expended to provide real-time remote sensing measurement tools such as LIDAR, RADAR, and passive acoustic sensing.

The Resilience of Urban Green Infrastructure: A Case Study of Runcorn, UK

N J Wallbank and P James

*Research Centre for Urban Change,
School of Environment and Life Sciences, University of Salford*

Vegetation incorporated into urban environments has an ecological and a social value which helps sustain public health and well being. What is not known is how resilient urban vegetation is. If urban vegetation is likely to change over time then this raises questions about the effects on the ecosystem services it provides. Local authorities must now consider implementing adaptation strategies to minimize the effects threatened by climate change. In Runcorn, a town in northwest England large scale landscaping and tree planting that built on the existing topography and vegetation was an integral part of the town's spatial planning strategy. This planting took place during the 1960s to 1980s. As a result, there is, within Runcorn, a comprehensive vegetative framework comprising playing fields, parks, woodlands and greenways. The trees within these vegetated areas have reached maturity and questions are being asked about their future. In this poster the authors discuss the current flora composition of Runcorn's green infrastructure and consider the influence of predicted climate change. Species lists and abundance reading have been combined with the UK climate projections 2009 to produce climate change scenarios to *circa* 2080.

UML QoS Profile Exploration for the Specifications of a Generic QoS Metamodel for Designing and Developing Good Quality Web Services

Wan Nurhayati Wan Ab. Rahman

*Data Mining & Pattern Recognition Research Centre,
School of Computing, Science and Engineering, University of Salford*

The work developed and reported in this paper aims at contributing to research related to the Quality of Service (QoS) for web services field. More specifically, this work investigates the possibility of using the Unified Modelling Language as a specification language for QoS requirements. This research provided a comprehensive review and description of the QoS specifications that comprise some already existing factors contributing to the QoS and some newly proposed ones. Furthermore, the research has proposed a QoS metamodel as a lightweight extension to the Web Service Description Language (WSDL) to incorporate the selected QoS specifications into web services' functionalities. The main question this research is trying to answer is, "What makes a web service better than other web services providing the same functionality?" Hence, the aim of this research is twofold, first it helps designers and developers to provide better web services and second, it helps web services users to select the best web service for their applications.

The QoS metamodel illustrates what functionalities and how they can be extended with the proposed QoS specifications as they are vital as an augmentation to the existing WSDL specification to assure high quality web services development and implementation. The metamodel could be used to incorporate the selected QoS specifications into the WSDL. Both the QoS specifications and metamodel can be used as a reference model for service providers, developers and users on how to provide, use and select good quality web services. The metamodel is not restricted to specific service providers or the use of a certain technique, language or implementation approach.

We have illustrated a possible use of the QoS specifications and implementation of the model by using a case study. We have conducted controlled experiments that involved novice and experienced users as the validation method to give a practical experience to users in designing high quality web services.

Inhibition of Murine Skeletal Muscle Differentiation by Transforming Growth Factor β_1 (TGF- β_1) is Attenuated by the Omega-3 Polyunsaturated Fatty Acid Eicosapentaenoic Acid (EPA)

J K Whittingham-Dowd and J T Allen

*Centre for Parasitology and Disease Research,
School of Environment & Life Sciences, University of Salford*

Transforming Growth Factor β_1 (TGF- β_1) is an important fibrogenic growth factor for skeletal muscle where it has been associated with a failure to repair damage and has been identified as an inhibitor of myogenesis [1]. Eicosapentaenoic acid (EPA) is an omega-3 polyunsaturated fatty acid with anti-inflammatory properties which has previously been reported to protect against the damaging effects of TNF- α during skeletal muscle differentiation [2]. Additionally EPA was shown to prevent endothelin-1 induced cardiomyocyte hypertrophy via TGF- β_1 suppression [3]. We hypothesised that EPA may be able to suppress TGF- β_1 in skeletal muscle and therefore attenuate fibrosis.

C2C12 myoblasts were differentiated by culture in growth medium containing 2% horse serum (DM). Cells were treated with EPA (50 μ M) and TGF- β_1 (1ng/ml) either independently, as a co-treatment or with EPA as a pre-treatment in DM for up to 168 hours. Myogenesis was evaluated morphologically by a myogenic index, by myotube metrics and by myosin heavy chain (MyHC) expression at 24 hour intervals.

TGF- β_1 delayed the appearance of multinucleated myotubes by approximately 72 hours compared to control, which confirms impediment of differentiation. The length and diameter of myotubes were significantly decreased in cells treated with TGF- β_1 at all time points ($p < 0.05$) compared to control. EPA, as a co treatment or pre treatment, significantly increased the width and length of myotubes ($p < 0.05$) at all time points, however the myogenic index was only significantly increased ($p < 0.05$) in cells pre-treated with EPA at 48 and 96 hours.

In summary, EPA treatment protects against TGF- β_1 -associated reductions in myotube size. Further research will be required to determine whether EPA can also protect against the TGF- β_1 -associated delayed onset of differentiation. Additional investigations will also aid in the elucidation of the mechanisms involved in this process.

References

- [1] Magee, P., Pearson, S., Allen, J. (2008). The omega-3 fatty acid, Eicosapentaenoic acid (EPA), prevents the damaging effects of Tumour Necrosis Factor (TNF)-alpha during murine skeletal muscle cell differentiation. *Lipids in Health and Disease* **7**: 24-35.
- [2] Murakami, M., Ohkuma, M., Nakamura, M. (2008). Molecular mechanism of transforming growth factor-beta-mediated inhibition of growth arrest and differentiation in a myoblast cell line. *Development, Growth and Differentiation*. **50**: 121-130.
- [3] Shimojo, N., Jesmin, S., Zaedi, S., Maeda, S., Soma, M., Aonuma, K., Yamaguchi, I., Miyauchi, T. (2006) Eicosapentaenoic acid prevents endothelin-1 induced cardiomyocyte hypertrophy in vitro through the suppression of TGF- β_1 and phosphorylated JNK. *American Journal of Physiology of Heart Circulation Physiology*. **291**: 835–845.

Diffusion of Hydrogen in Palladium Nano Particles

David Wilkinson

*Materials & Physics Research Centre,
School of Computing, Science & Engineering, University of Salford*

It is of interest to return to the theory behind hydrogen diffusion in metals, specifically the concentration dependence of the two often quoted diffusion coefficients. These coefficients are the tracer coefficient(D_t) which is based on the random walk of *single* gas atoms and the chemical diffusion coefficient (D_c) based on the random walk of *many* particles. The latter is better known as Fickian diffusion and corresponds to the idea of a chemical potential being the motive force, setting up a *net flow of uncorrelated moves* in a self maintained potential. The former theory being visualised as tracing a single atom in a collection of hydrogen atoms which is subject to specific correlation effects that ultimately influence the diffusion.

Both descriptions are based on the solution of similar partial differential equations. From previous work, it is apparent that D_t and D_{chem} are described by the same quantity at low concentrations but differ at high concentrations and this work aims to augment theory at the high concentration limit.

This may be achieved by neutron scattering techniques, noting that the self correlation function $G_s(r,t)$ ¹ (derived from probability distribution) relates directly to D_t via the *incoherent* summing of scattered waves . Likewise the *coherent* contribution is the Fourier transform of the pairwise correlation factor $G(r,t)$ ² and will enable calculation of D_{chem} .

Established mathematical models predict that at finite concentrations D_{chem} remains constant as a function of c , whereas D_t reduces as $(1-c)$.Thus by separating the quasi elastic scattering into a fixed coherent part and varying incoherent contribution (as a function of concentration) our efforts, along with gravimetric kinetic results, set out to elaborate on the original simple model.

Ongoing work to piece additional H-H interactions information into the model is achieved by Monte Carlo simulation together with information relating to barrier height obtained from Ab-initio calculations.

1 $G_s(r,t)$ is the probability that if an atom is at $r=0$ at $t=0$ then the same atom is found at r and t respectively.
2 $G(r,t)$ is the probability of finding *any* atom at radius r after a time t assuming that there was an atom at $r=0$ at $t=0$.

Asymmetric Alkylation of Diarylmethane Derivatives

James Wilkinson¹, Steve Rossington¹, Eun-Ang Raiber¹, John Leonard², Nigel Hussain³

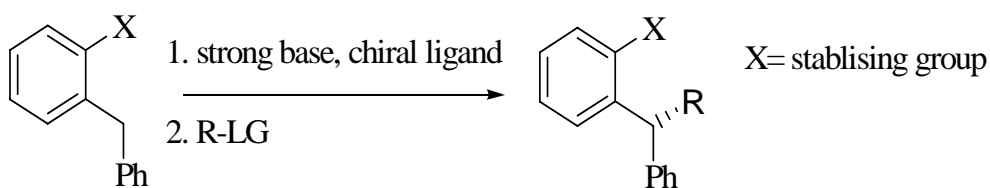
¹*Centre for Biochemistry, Drug Design & Cancer Research,
School of Environment & Life Sciences, University of Salford*

²*AstraZeneca Process R&D, Macclesfield, Cheshire*

³*GlaxoSmithKline Chemical Development, Tonbridge, Kent*

E-mail : j.a.wilkinson@salford.ac.uk, Ext 54046

The diarylmethane motif appears in a vast range of natural products and man-made biologically active molecules. The aim of this research was to develop an efficient and reliable method for conversion of a prochiral diarylmethane to a wide range of substituted derivatives in high yield and enantiomeric excess.



A method has been developed, along with a novel stabilising group, which allows high yields and enantioselectivities in the reactions of prochiral diarylmethanes via a dynamic resolution.

Delineating Margins of Debris-covered Himalayan Glaciers from Remotely-sensed Images

R Wilson, D N Collins & R P Armitage

*Centre for Environmental Systems & Wildlife Research,
School of Environment & Life Sciences, University of Salford*

The Himalayan region delivers an estimated $8.6 \times 10^6 \text{ m}^3$ of water to ten of the largest rivers in Asia. Runoff at high elevation is augmented by significant quantities of glacier melt water, which during dry seasons in particular, provide an important downstream water resource. The areal extent of many Himalayan glaciers has reduced in response to climatic warming. Should glaciers continue to retreat, melt water runoff may eventually diminish as declining glacial extent reduces the surface area of ice exposed to melt. As such, mapping changes in glacierised area within the Himalayas has become very important. Although remotely-sensed images can provide an invaluable mapping resource, manual delineation of glacier boundaries over large areas is time consuming and problematic. Automated techniques can vastly improve processing time. However, automated mapping of glaciers is hindered by debris-covered ice as its spectral characteristics are very similar to those of the surrounding terrain, which results in misclassifications. A multisource automated approach is presented here to resolve the problems of mapping debris covered glaciers. Glacier margins were delineated using supervised classification techniques combined with slope angle and thermal thresholds using a knowledge based approach. The proposed approach utilises Landsat ETM+ and ASTER data for the Gangotri basin, Uttarakhand, India. An accuracy assessment has been conducted on the glacier-cover maps produced which is encouraging (90.6%). Problems arise in regions where debris cover is substantial and at high elevations where slope gradients exceed the thresholds set. Glacial ablation zone delineation however, was particularly promising and may associate well with glacier melt models. The accuracy of mapping glacier change can further be improved, by better correction of the satellite imagery (for effects such as terrain) and with some minor editing, and offers a viable alternative to manual delineation of debris covered glaciers.

Keywords: Himalayas; Glacier meltwater; Glacier area change; Debris covered glaciers; Automated mapping; Remotely-sensed images; Gangotri glacier.