•Dr. David Brackett

•Research Fellow
  •Additive Manufacturing & 3D Printing Research Group

- Design for Additive Manufacturing (AM)

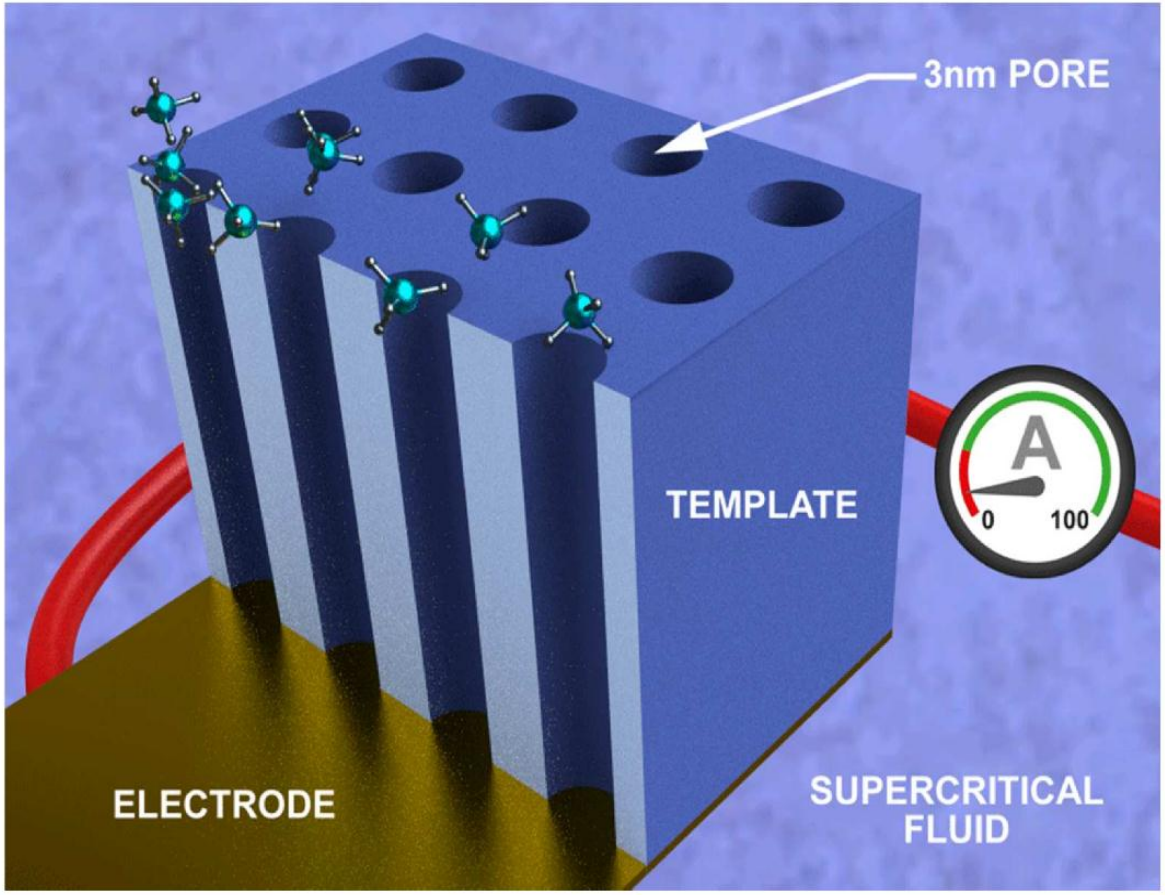
- How can we exploit the manufacturing •ability of AM through design?

- Increased design freedom:
  - Geometric complexity
  - Material complexity

- Design philosophies:
  - Topology optimisation
  - Cellular / lattice structure design
  - Design for multifunctional 3D printing

SuperCritical Fluid ElectroDeposition

Dr. Xue Han School of Chemistry



EPSRC Engineering and Physical Sciences Research Council

UNIVERSITY OF Southampton

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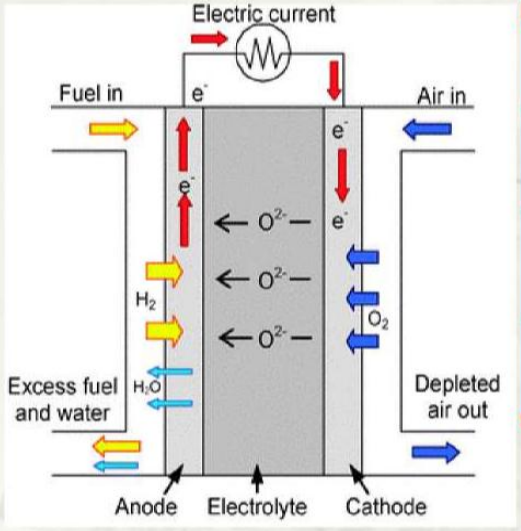
THE UNIVERSITY OF WARWICK

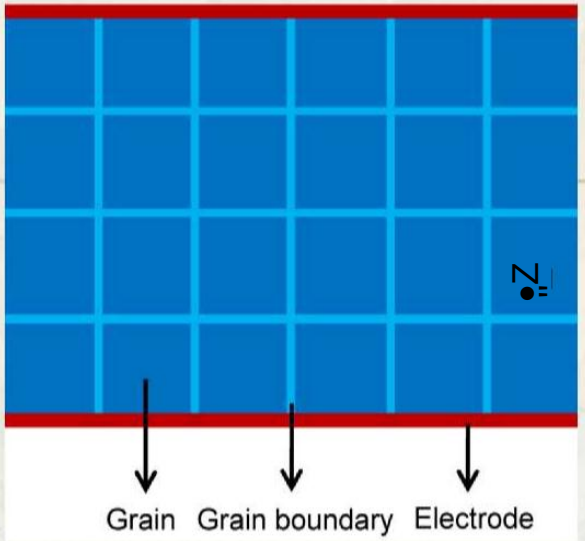
•Electrical characterisation using Impedance Spectroscopy

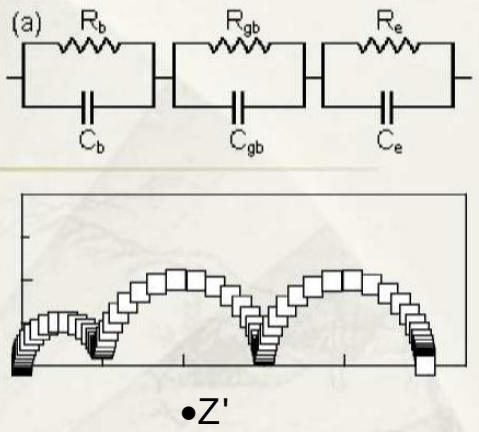
• Dr Ming Li (ming.li@nottingham.ac.uk)

• Department of Mechanical, Materials and Manufacturing Engineering, Faculty of Engineering

•**Impedance Spectroscopy** measures the response of a system to a small ac-perturbation over a range of frequencies. It is commonly used for characterisation of electrical properties for a wide range of materials and devices (fuel cells, batteries, solar cells, etc.), particularly for **separation of different processes and mechanisms in an electrically inhomogeneous system**.







•Examples: separating contributions from anode, electrolyte and cathode in a fuel cell (left); from grain, grain boundary and electrode in a polycrystalline sample (middle); typical equivalent circuit and complex plane impedance plot (right).

•**We can perform impedance measurements over a wide range of temperature (RT-1000 ^{o}C), atmosphere (pO_2: 10^{-30} - 10^{5} Pa) and frequency (10^{-3} - 10^{7} Hz).**

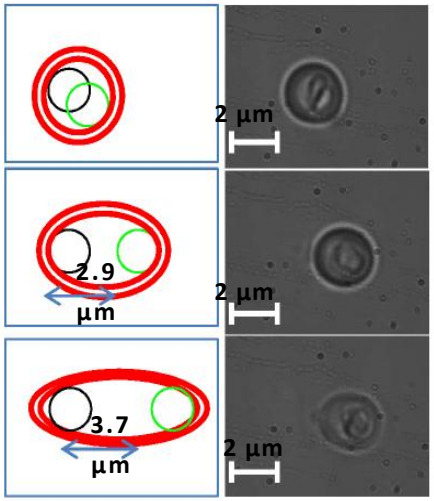
Amanda Wright – IBIOS, Electrical Systems and Optics Division (amanda.wright@nottingham.ac.uk)

The University of Nottingham

Optics, microscopy, optical trapping, aberration correction, non-linear microscopy, bio-photonics ....

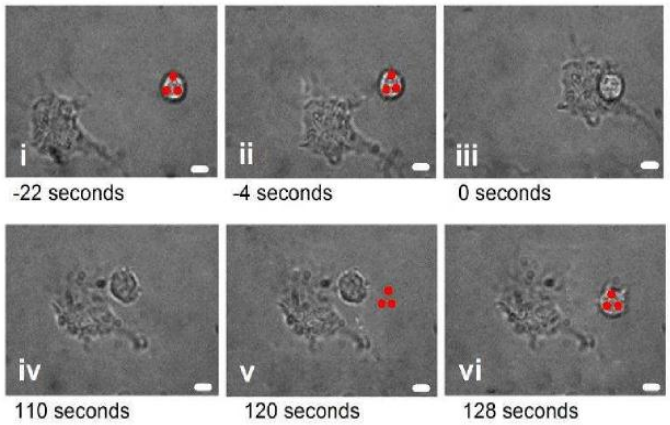
Mechanobiology

- Force-deformation relationships
- Micro-rheology



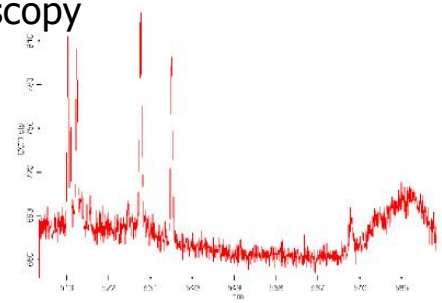
Force transducers

- Cellular interaction forces



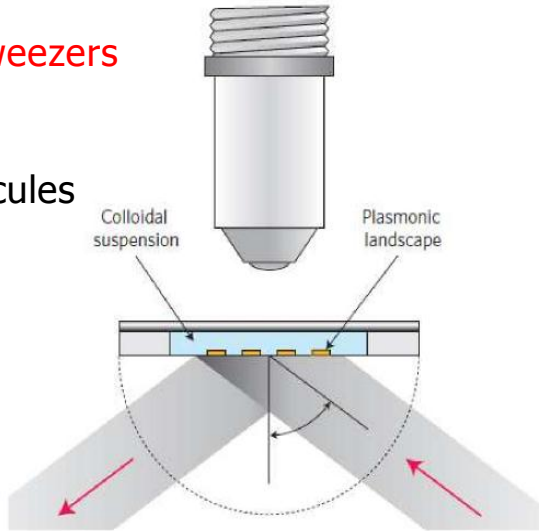
Raman tweezers

- Single cell/molecule spectroscopy



Nano-optical tweezers

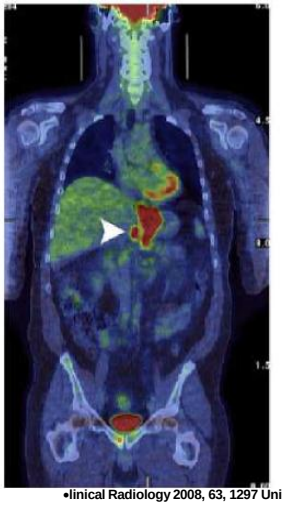
- Plasmonic enhancement
- Single molecules



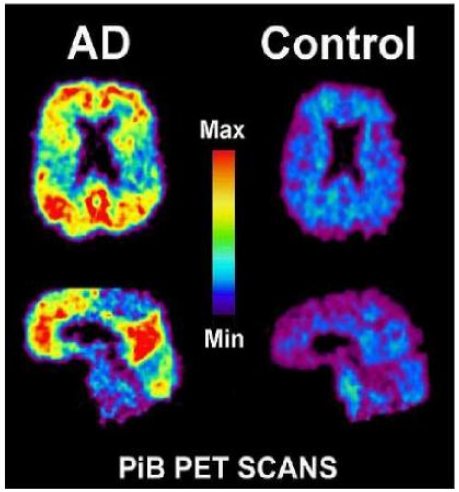
•New Radiolabelled Probes for Positron Emission Tomography

•helen.betts~nottingham.ac.uk
•Nottingham University Hospitals NHS Trust & School of Medicine

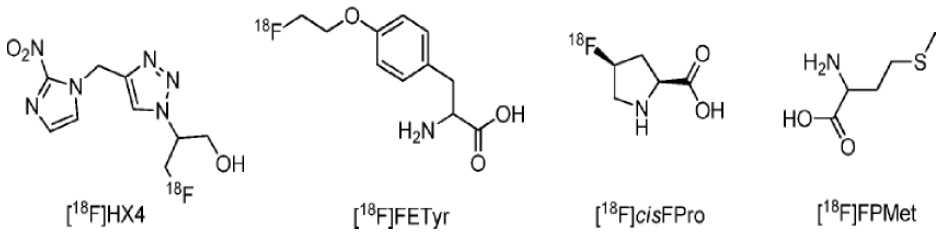
•**Anus:**
-diagnosis
-treatment selectio n
& monitoring



•linical Radiology 2008, 63, 1297 University of Pittsburg



•**Targets:**
-hypoxia
-protein synthesis -
receptors



•**Fluorine-18t_{112} = 110 min**

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Nottingham University Hospitals NHS
NHS Trust

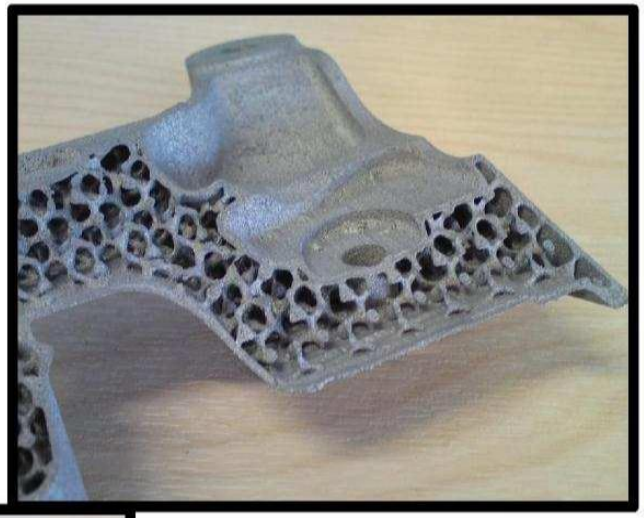
•Selective laser melting

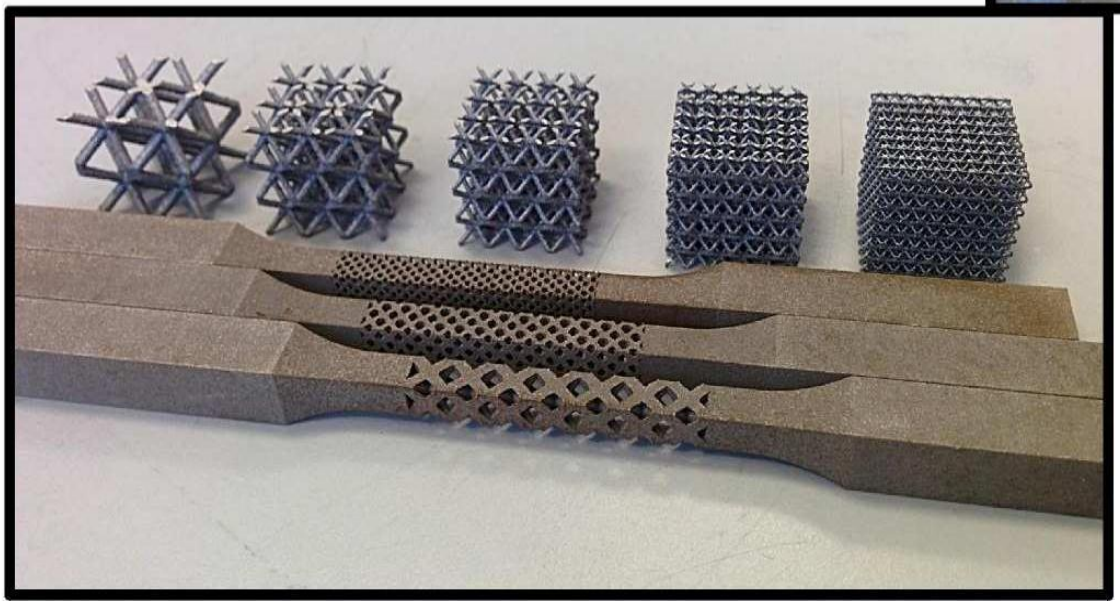
EPSRC Centre for Innovative Manufacturing in Additive Manufacturing

•**Ian Maskery**

- Design and manufacturing freedom.
- Multi-material (Al, Ti, steel, ...).
- Novel lightweight structures.

ALSAM
ALUMINUM LATTICE STRUCTURES VIA ADDITIVE MANUFACTURING





•**Projects:**

- Design and make
- New materials
- New functionality

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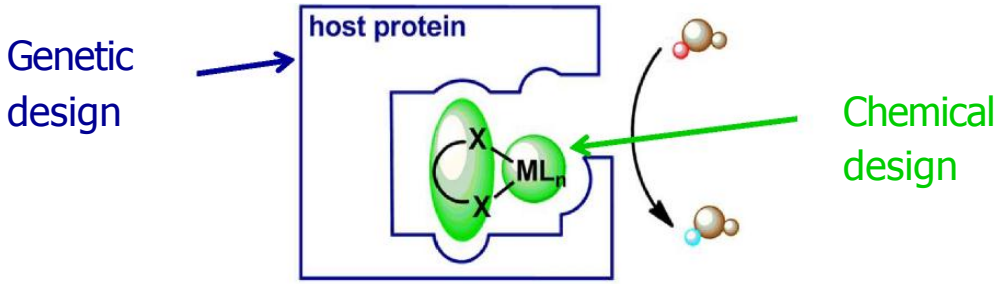


Examples:

Metal replacement in alcohol Cofactor replacement in heme-dehydrogenases based enzymes (P450BM3)

Help needed:

- Measurement of protein-metal (complex) interaction
- New protein scaffolds? (strong protein-ligand affinity)
- Metal replacement techniques (not dialysis)

Anca Pordea, anca.pordea@nottingham.ac.uk

Biorenewables and Bioprocessing Group, Faculty of Engineering

Global Top 100 University

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

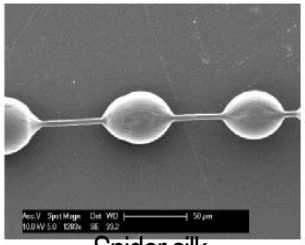
Testing materials

Nicola's research is concerned with understanding the relationships between structure and physical properties by testing small bits of things!

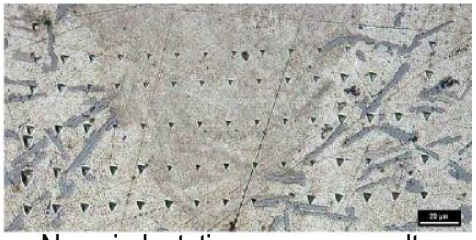
She works on a range of materials which have previously spanned from spider silk and lily anthers to HAZ on welds and selective laser melted (3D printed) aluminium alloys.

Dr Nicola Everitt
Nicola.everitt@nottingham.ac.uk
Coates Bldg, room A32a

Images from past UG projects



Spider silk



Nano-indentations across a melt pool

Bacterial cellulose film

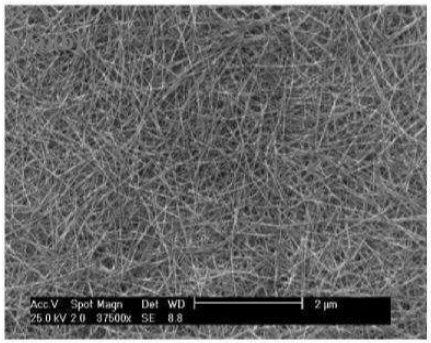
Single fibre testing

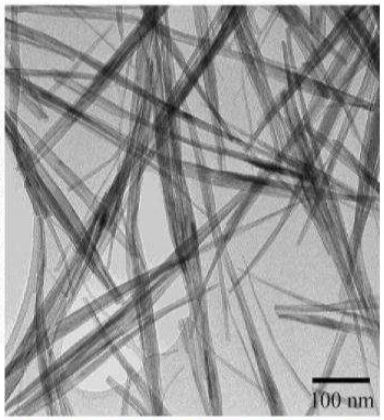
Possible Project areas:

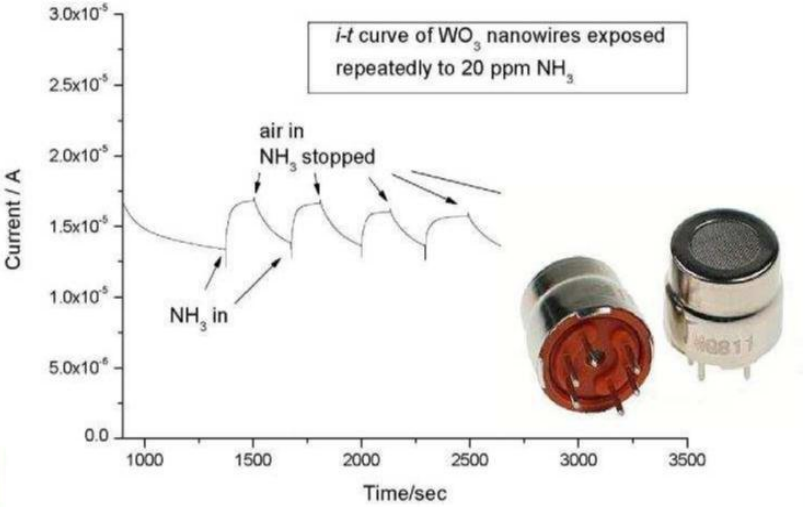
1. Using nanoindentation to probe the microstructure properties metallic alloys.
2. Understanding modes of rice leaf bending.
3. Characterising very porous biomaterial scaffolds.
4. Measuring strains on growing plants using digital image correlation technology.

•Ultra-fine $W_{18}O_{49}$ nanowires

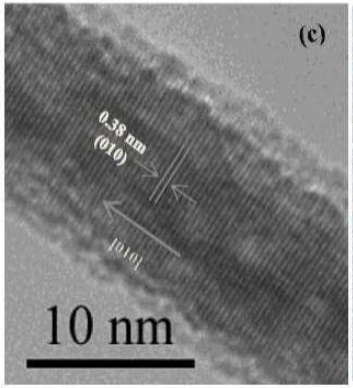
•---Future gas sensors/electro-chromic devices

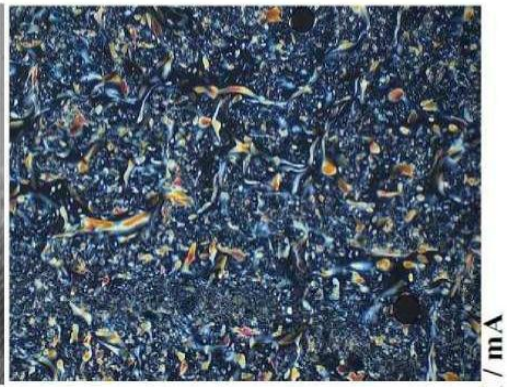






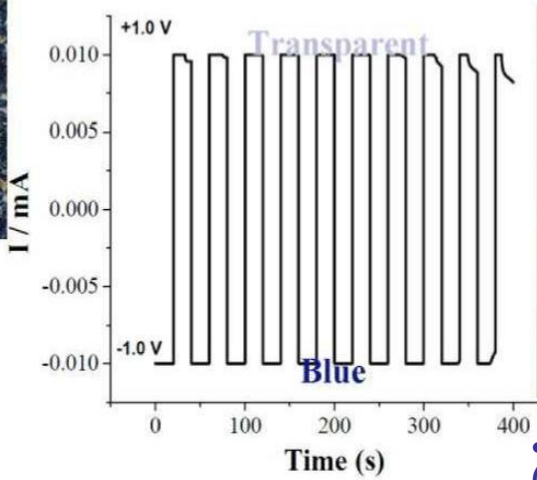
• Capable of ppb level detection (10 ppb)! NH_3,CO,NO,H_2S etc.





• Liquid Crystallinity

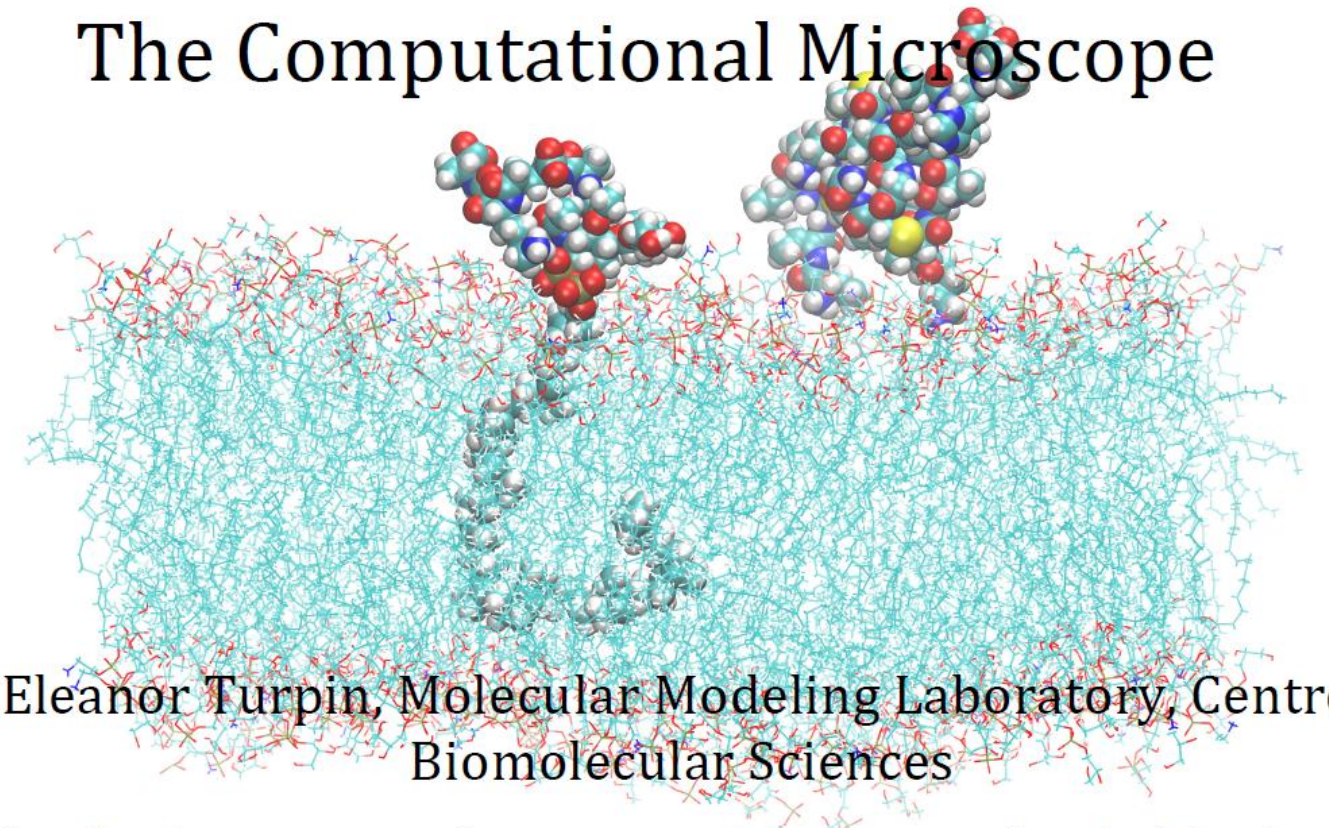
• WO_x nanostructures	• Specific surface area (m^2/g)
• Best reported (WO_x thin film)	• 143
• Our results (ultra-thin $W_{18}O_{49}$ nanowire)	• 275



• Dimming window (Boeing 787)

•Fang XU

The Computational Microscope



Dr Eleanor Turpin, Molecular Modeling Laboratory, Centre for Biomolecular Sciences

- Molecular dynamics simulations provides atomistic detail of the dynamics and interactions of a system of particles through time.
- Computational chemistry software: CHARMM, NAMD, VMD, Q-Chem, AutoDock, Gaussian, OpenEye Docking suite, CPMD, GROMACS, AMBER
- High Performance Computing; Force field parameter development; *Ab initio* molecular dynamics and QM-MM simulations

Collaborator needed

Who: someone with expertise in business, organisations, management, economics

What for: to develop a proposal and bid to research organisations and individuals working non-professionally with dying people and their families

Glenys Caswell: glenys.caswell@nottingham.ac.uk

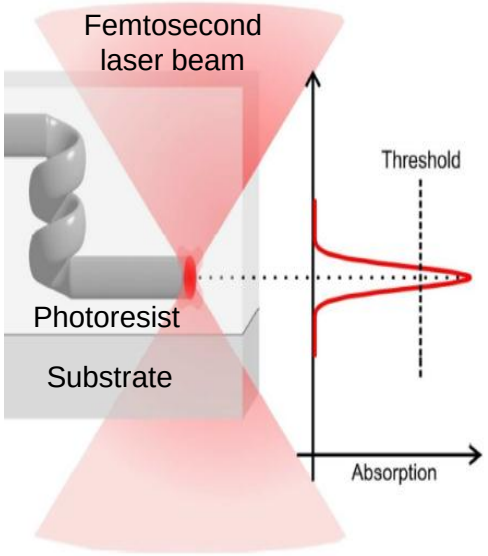
School of Health Sciences

Evaluating the PINCER trial roll-out

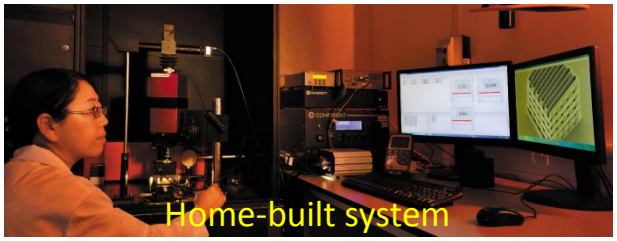
- The PINCER trial demonstrated effectiveness and cost-effectiveness of an IT-based pharmacist-led intervention to reduce prescribing errors in general practices (results published in *The Lancet*)
- Now have AHSN support for widespread rollout in East Midlands and Greater Manchester
- Plan to do stepped-wedge design study
- Key challenge is linkage between primary and secondary care data to determine whether the intervention reduces the incidence of serious drug-related morbidity

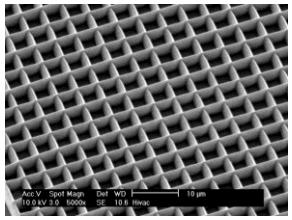
3D micro/nano fabrication by multi-photon lithography

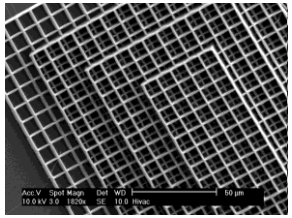
Dr Qin Hu (qin.hu@nottingham.ac.uk)
3D Printing and Additive Manufacturing Research Group, Faculty of Engineering, University of Nottingham

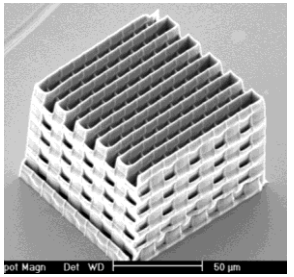


- Fabricate arbitrary 3D structures without a mask
- Feature size: ≤ 0.2 μm (lateral), ≤ 1.5 μm (vertical)
- Overall dimensions: up to 100 x 100 mm^2
- Fabrication speed: up to 10 mm/s
- Materials: polymers, ceramics, metals & hybrid

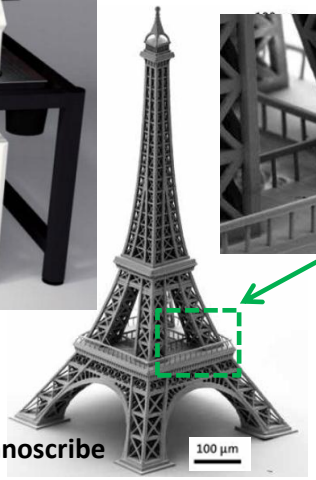


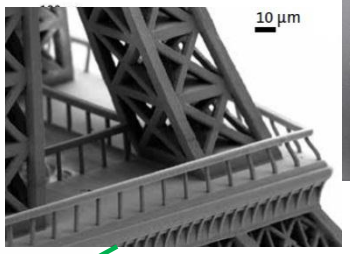


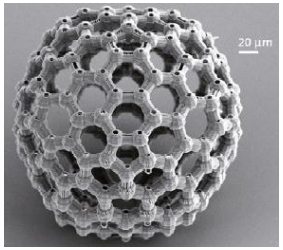


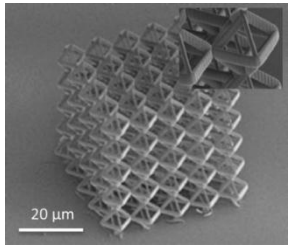


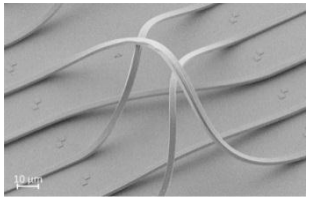
Commercial system

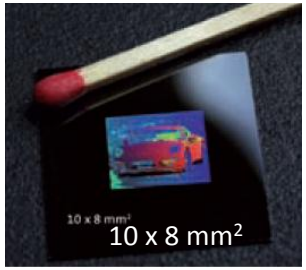








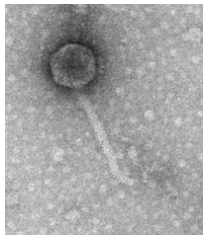




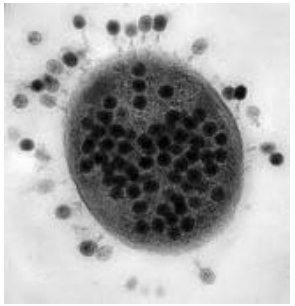
Images courtesy of Nanoscribe

Rapid detection of Mycobacteria

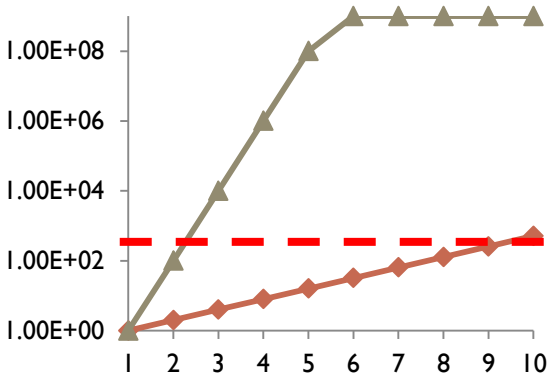
Ben Swift



- Bacteriophage are viruses that specifically infect bacteria
- Mycobacteria grow **very slowly** (months to form colonies)
  - Phage replicate faster than bacteria
    - Bacteriophage replicate within the doubling time of the host
    - Produce >50 phage particle



- Phage only replicate within **viable host**



- **Using phage amplification assay** viable slow growing mycobacteria can be detected within 5 h

PBD BIOTECH

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

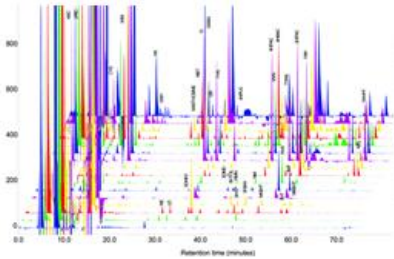
Centre for Analytical Bioscience, Pharmacy

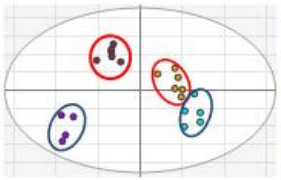
Dave Barrett, Dong-Hyun Kim, Catharine Ortori

- **Mass spectrometry** applied to pharmaceutical, life and biomedical sciences research
- Focus on **small biomolecules** (MWt 50-2000)

• Biomarker discovery

('global profiling', metabolomics, lipidomics)

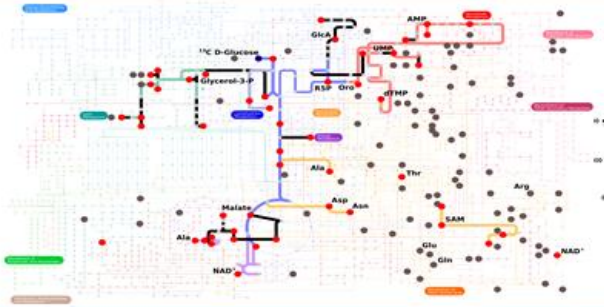


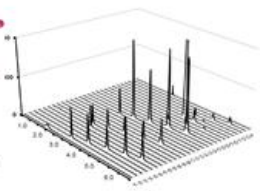


Charge	Exact m/z	Biomarker Database Search	
+	650.236	Tri-N-acetylchitotriose	"tri acetyl-hexosamine"
+	572.258	Quinagolide glucuronide	
+	276.144	Anabasamine	sn-glycero-3-Phosphocholine
+	684.221	Streptomycin 6-phosphate Na	
+	405.202	Glu Glu Lys	Glu Lys Glu

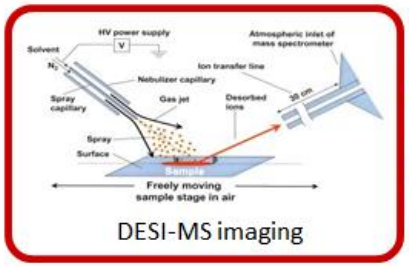
• Metabolic pathway profiling

(targeted analysis of metabolites, stable isotope assisted analysis)

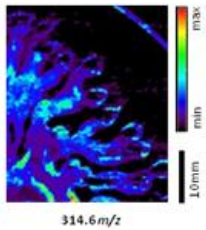




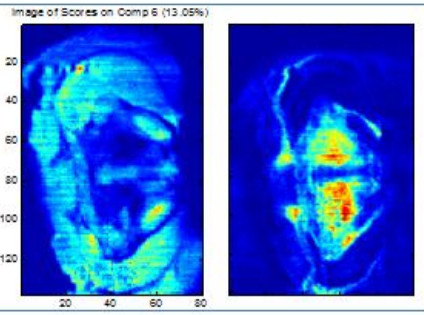
• Ambient imaging of biological tissues by mass spectrometry



DESI-MS imaging



314.6 m/z



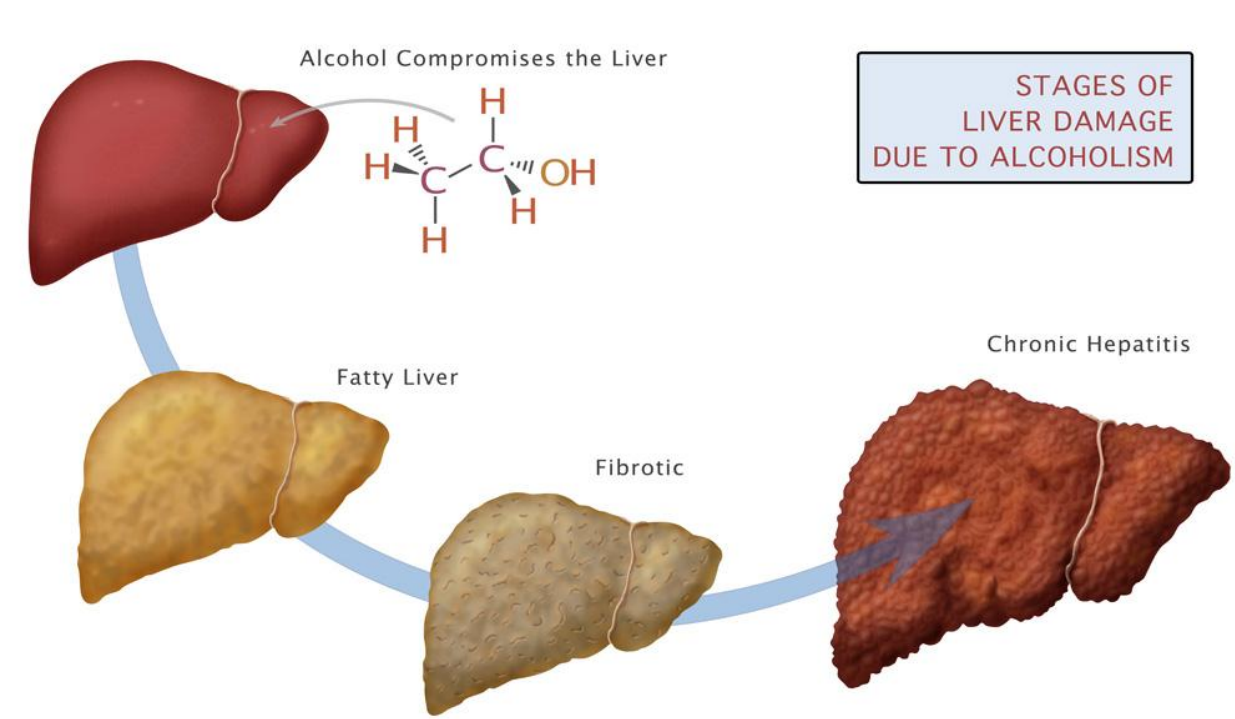
david.barrett@notingham.ac.uk, dong-hyun.kim@nottingham.ac.uk, catherine.ortori@nottingham.ac.uk

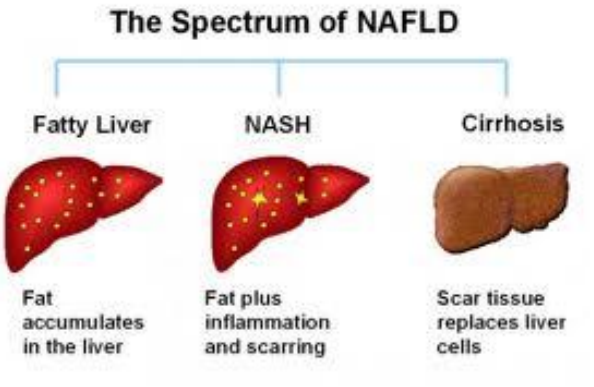
Built Environment – Benjamin Jones

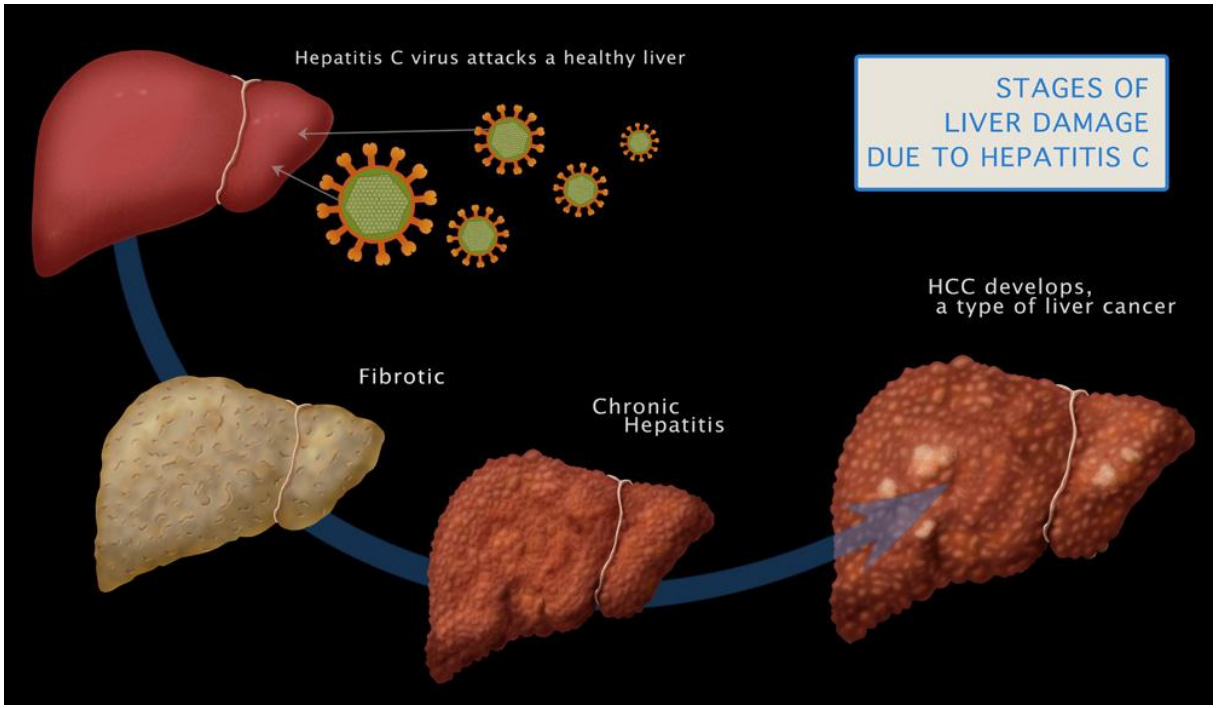
The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

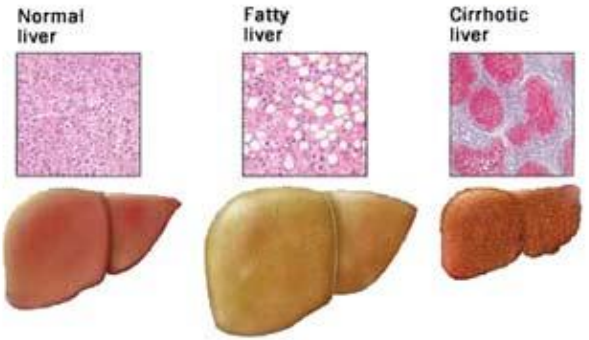
1. Home energy efficiency interventions could lead to the increase in mean pollutant concentrations
   - PM2.5, radon, mold, dust mites
   - Life table approach
2. The identification of overheating buildings and the point at which occupants experience thermal stress
   - Houses, schools, hospitals, offices

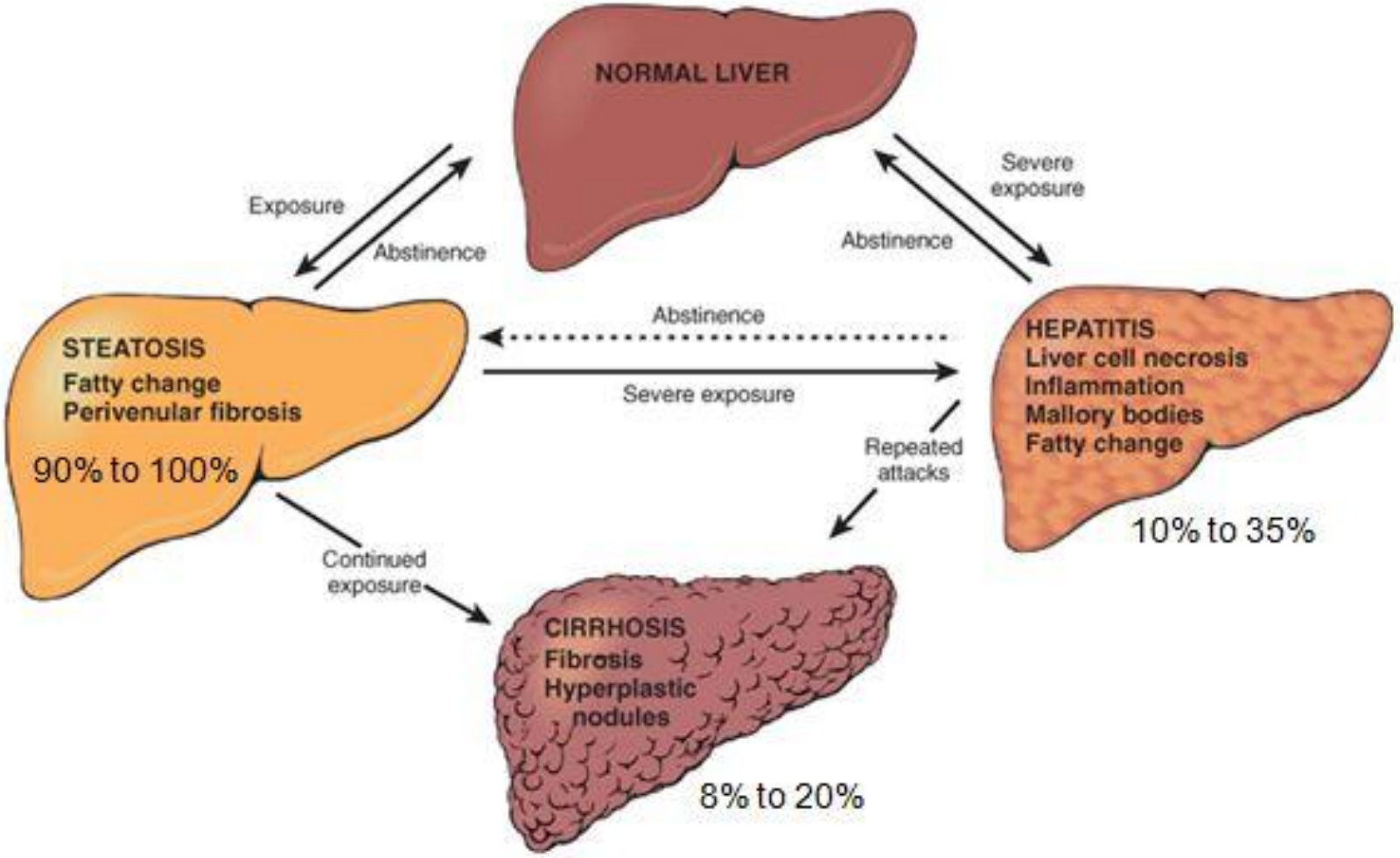
Dr Wayne Grant Carter
School of Medicine
Royal Derby Hospital











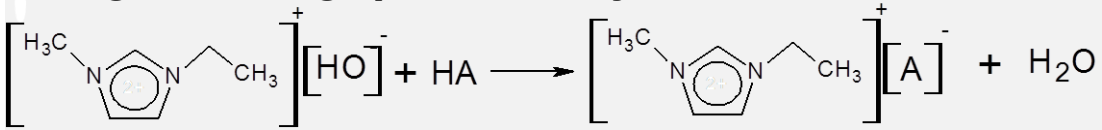
New biomarkers of liver injury/damage and response to therapy are required

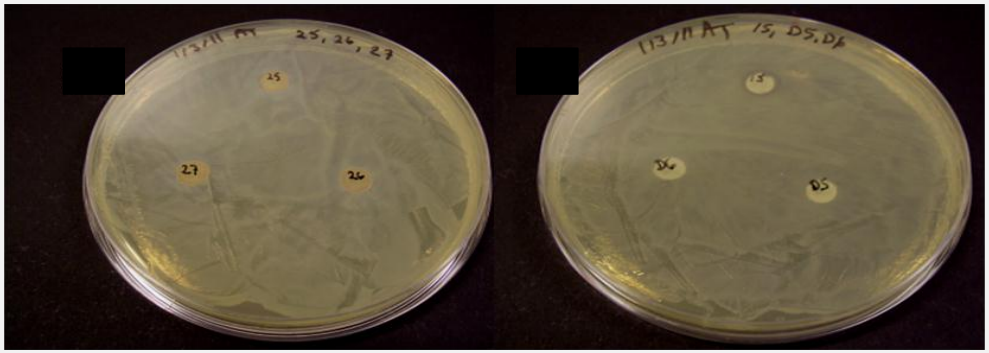
Dr. Angela L. Tether
Biorenewables and Bioprocessing Research Group

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

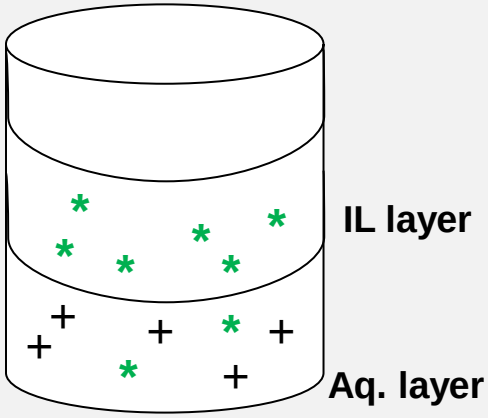
Use of Ionic Liquids as solvents

Background – Synthesis and High-Throughput Toxicity Studies

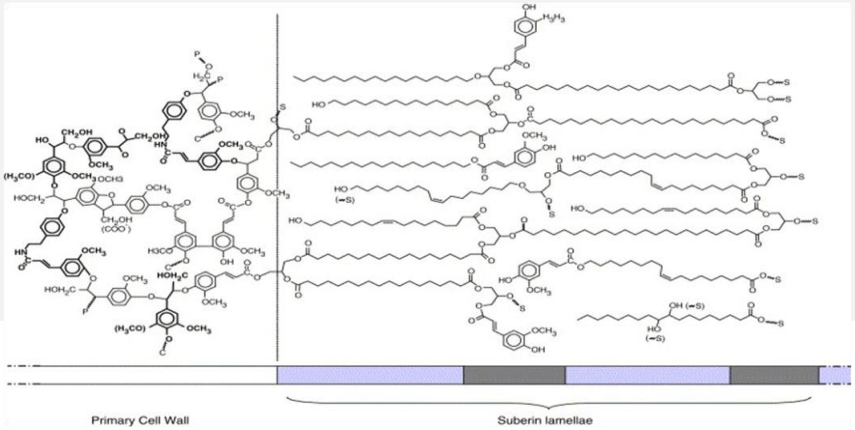




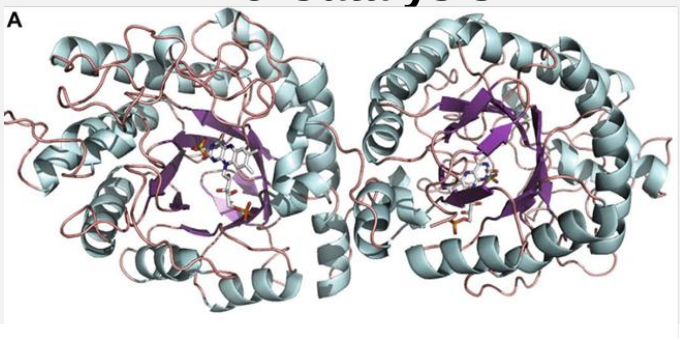
Separation/Extraction Technologies



Biomass Dissolution



Bio-Catalysis



Enzyme stability & Increase in activity

Microwave extraction of high value chemicals from plants

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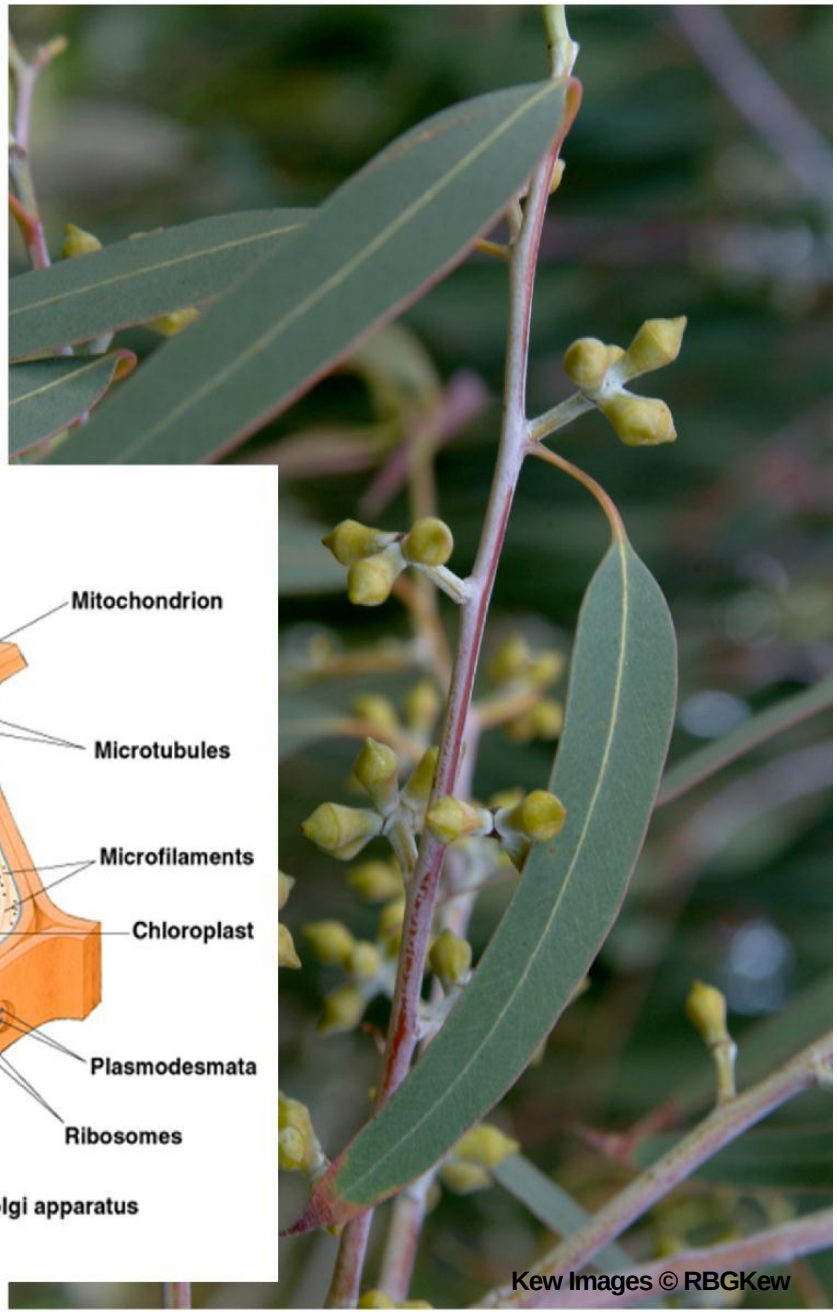
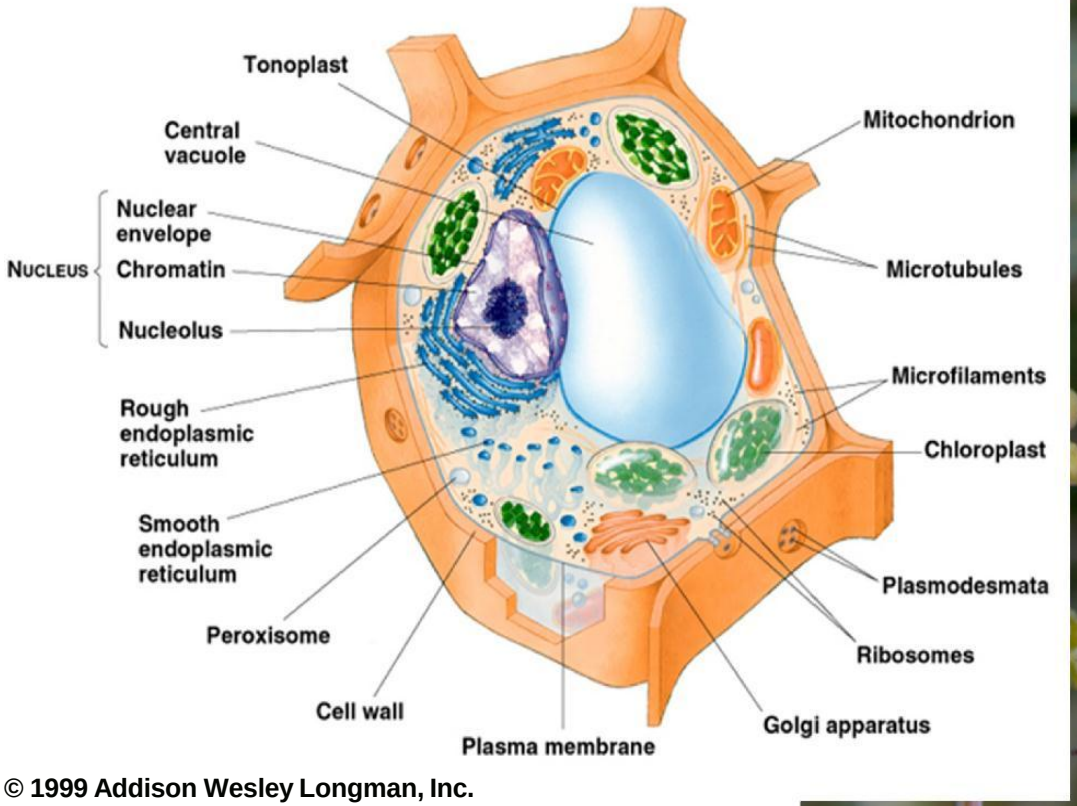


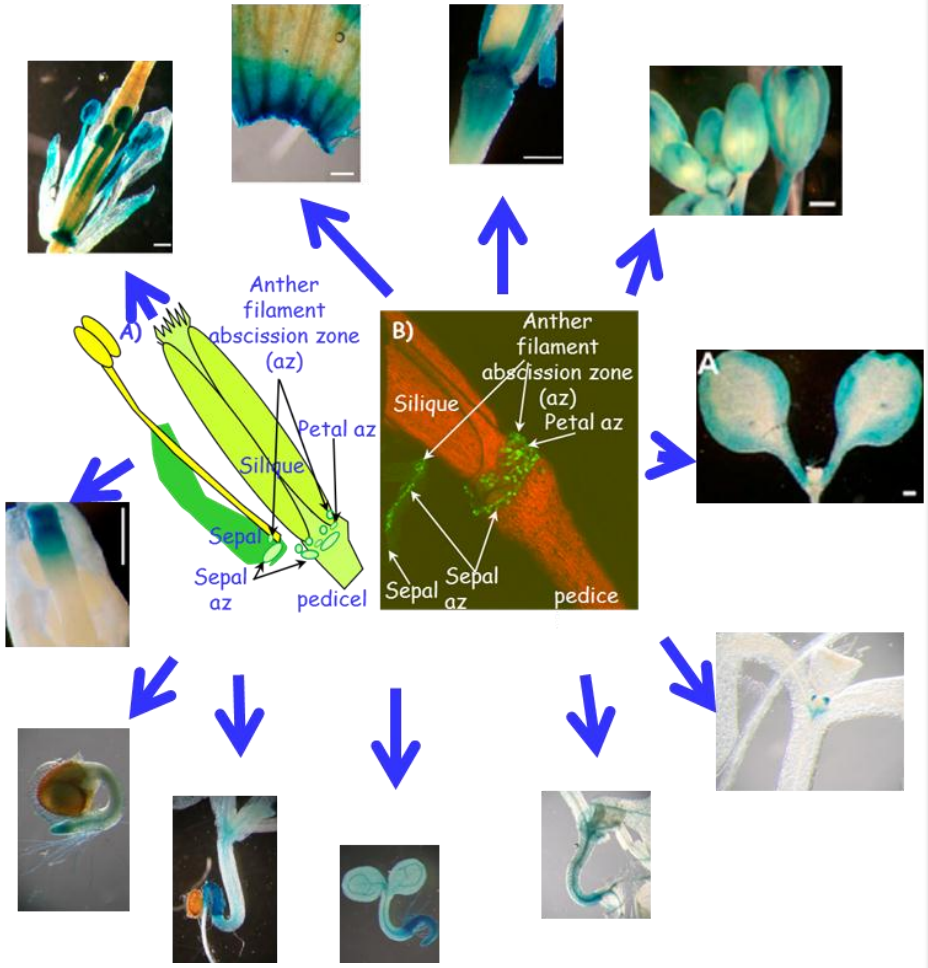


Dr. Zinnia Gonzalez

Abscission, cell separation and the role of the *HAWAIIAN SKIRT* F-box gene during plant development

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

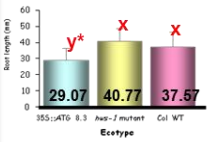
Dissecting the abscission and other cell separation processes.



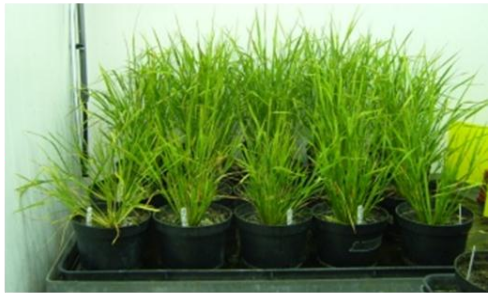
Elucidating the role of the F-box protein *HAWAIIAN SKIRT* in microRNA regulation during plant development

- Y2H screens
- Pull down assays
- 2-D gels
- Generation of *HWS* tagged constructs
- EMS mutagenesis
- Mapping of mutants
- Genetic crosses

Seeds, roots and plants are bigger in the *hws-1* mutant



Translating findings from Arabidopsis to Rice.



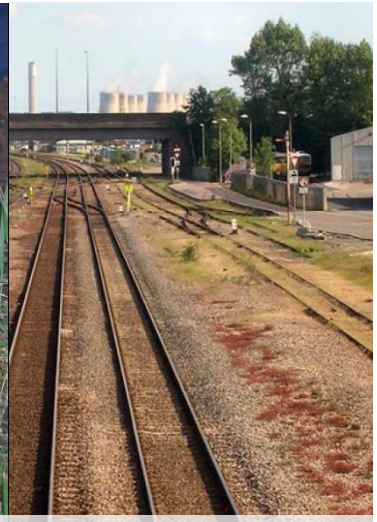
***HWS* is involved in the microRNA pathway, suggesting a link between the ubiquitination and microRNA pathways during plant development.**

CENTRE FOR ENVIRONMENTAL GEOCHEMISTRY

Dr Michael Watts (mwatts@bgs.ac.uk)
Head of Inorganic Geochemistry
British Geological Survey

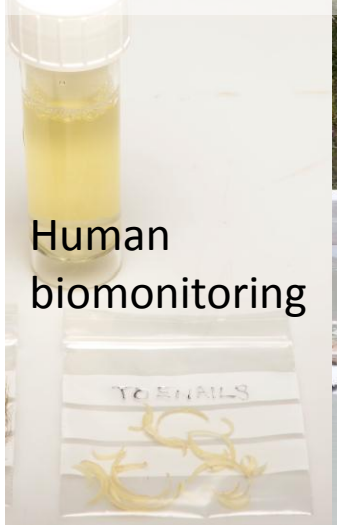
Analytical R&D challenges

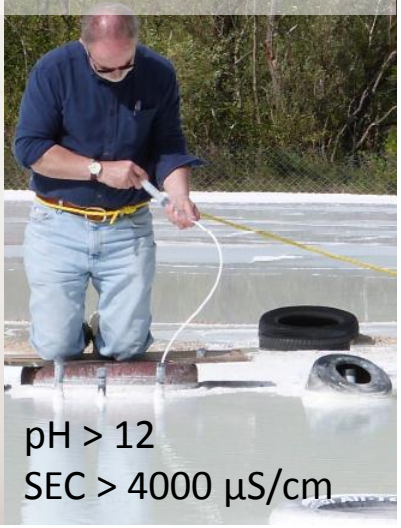
Geochemical analyses: Lab or remote locations



Isotopes as natural tracers

Complex and variable matrices





Food security e.g. micronutrient deficiencies soil-crop transfer

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