Institution: Aston University

Unit of assessment: 15: General Engineering

a. Overview

The research in this Unit forms part of the School of Engineering and Applied Science (EAS) and includes topics such as chemistry and chemical engineering, mechanical engineering and design, and mathematical techniques and modelling. Research themes address major societal and economic challenges particularly **Bioenergy & Sustainability** and **Healthcare Technologies.** Researchers work together and with others in the University, particularly in the Business School and School of Life and Health Sciences, and elsewhere across disciplines and strategic themes.

b. Research strategy

Overall position compared with RAE2008

In RAE 2008 the groups in this Unit formed part of a single submission from the whole of the School of Engineering and Applied Science (EAS) to the General Engineering panel. The headcount of academic staff in areas included in the Unit is now (with approximate comparison with 2008) 39 (+8), including 6 professors (0), 4 (+2) readers, 9 (+2) senior lecturers, 20 (+4) lecturers, and one Marie Curie Incoming International Fellow. The staff includes 11 early career researchers (ECR) and is supplemented by 21 postdoctoral researchers and 77 PhD students. Since 2008, research grant funding awarded in the areas in this Unit has increased markedly. Offices and labs are all located in Aston's Main Building and the adjacent new bioenergy facility. The overall vision is to build existing strengths and extend newer areas, to address some of the critical engineering challenges in society such as ensuring sustainable energy, providing clean water, and enhancing the quality of life for an aging population. Each area in the Unit is led by experienced researchers who set research directions with their extended teams, with colleagues at Aston and with partners / collaborators elsewhere. Since 2008, major parts of this Unit have benefitted from significant investments in research staff, support staff, laboratories, equipment and facilities and the plans for the next 5 years or so are to demonstrate value from these. As in 2008, the research is strongly aligned with industry needs: most staff actively engage in projects such as Knowledge Transfer Partnerships and directly-funded commercial contracts. The research is also global, with over half the submitted staff engaged in funded international projects.

The **strategy overall** is integrated by the School Research Strategy Committee, chaired by the Associate Dean for Research, and constituted by representatives of the institutes and groups, and includes research students. Regular quarterly meetings, workshops and away-days are used to review and revise research directions, share ideas and technical developments. The committee has recently established a research development fund (£30k) to initiate short exploratory projects or build collaborations. Eight such projects were awarded in the Unit in the last year, enabling travel, purchase of materials, design and construction of small items of equipment etc. Industry Advisory Groups, involving representatives from appropriate businesses and other organisations, with interests in the work of the Unit, also contribute to shaping strategies, using their knowledge of markets and environments external to academia.

Since 2008, research in **Bioenergy & Sustainability** has increased significantly, with the formation of the European Bioenergy Research Institute (EBRI) as was planned. Activities in **Healthcare Technologies** have been refocused slightly following changes of staff, with successes in polymer materials and their applications in biomimetic contact lenses, aging-resistant hip and knee implants, and by research into medical devices and micro-sensors using advanced control methods.

The **achievements and plans** for the Unit will now be summarised by group:

The **European Bioenergy Research Institute,** led by Prof Hornung, undertakes research in all aspects of bioenergy, from fundamentals through development, to deployment of innovative technologies, in collaboration with industry. This was newly formed in 2008, incorporating and expanding from the longstanding Bioenergy Research Group led by Prof **Bridgwater.** A purpose designed and built facility for EBRI was completed on campus at the end of 2012, with £6M grant from Royal Society-Wolfson Lab Refurbishment Fund, £8M investment from European Regional Development Fund, and the University (total investment of over £16M). Key recent *achievements* of the Institute include:

- Leadership of the EPSRC SUPERGEN bioenergy consortium through 2 consecutive phases
- SUPERGEN Bioenergy challenge awards to both Prof **Bridgwater** and Prof **Hornung**
- Design and patent of new intermediate pyrolysis equipment (Pyroformer™), enabling efficient and effective conversion of biomass to fuels. This has been demonstrated in the UK and also in India for decentralised power generation.

The core capability of the institute is in thermochemical processing based on pyrolysis and gasification. This has been extended to analytical chemistry for characterisation of biomass feedstocks and of plant oils; testing of engines with 1st and 2nd generation biofuels; technoeconomics and supply chains; environmental life cycle assessments; resource assessments using geographical information systems; catalytic upgrade of biomass; biorefinery design and derivation of fertilisers and soil amenders as by-products.

EBRI *plans* to extend its research, particularly with the recruitment of Prof Karen **Wilson**, and to extend further its many industrial and international collaborations through, for example, the EU network established under the BioenNWInterreg and the Bioenergy Support Centre in the West Midlands. Key goals are to develop practical means of processing high volumes of representative domestic and industrial wastes, into fuels and power, and extend this to generate very high value specialty chemicals and materials for use in manufacturing.

The focus of the **Polymers and Advanced Materials Research Group,** led by Prof Sahar **Al-Malaika**, is the link between materials properties and molecular structure, together with the application of this understanding to the synthesis of novel materials for high value applications. These include organic electronics, ophthalmic biomaterials (**Tighe**), polymers for orthopaedics and nanomaterials for biomass processing. Specific *achievements* since 2008 include:

- Design and synthesis of an injectable intervertebral disc repair system, novel wound dressings and biomimetic contact lenses based on analogues of naturally occurring proteoglycans.
- Taking a leading role in a large EU consortium (11 partners, €4M) working on the next generation of organic photovoltaics using their novel polymeric material.
- A new highly efficient, non-migratory safe antioxidant system for crosslinked polymers targeted for use in potable water pipes has been recently patented.

Building upon internationally-recognised expertise in polymers, biomaterials and advanced materials, the group *plans* to continue to diversify its multinational cross-disciplinary collaboration to provide practical and new innovative solutions for development of marketable polymer products and devices with direct benefit to industry, business, society and the environment. This will be facilitated by the strong interactions that are in place with relevant chemical industries, their suppliers and consumers.

The **Biomedical Engineering Research Group,** now led by Dr Xianghong **Ma**, aims to develop medical devices, tools and techniques for the benefit of patients and health care clinicians. Major *achievements* include:

- The first microscale vibrational biosensor for successful differentiation of diseased cells during surgery – an outcome of strategic efforts in smart actuation and sensing as planned in RAE2008.
- A novel endovascular catheter integrating state-of-the-art tactile sensing and actuation techniques for use in coronary, cerebral and peripheral vasculature, in collaboration with St George's hospital.
- Design and construction of ophthalmic instruments and eye measurement devices for diagnostics and condition monitoring, in collaboration with optometrists from Aston's School of Life and Health Sciences.

The group develops and applies advanced analytical and computational tools in control systems and non-linear mechanics to achieve innovations in the area of micro-sensors. It also develops ophthalmic instruments, artificial ocular lenses, and bone fixation devices. It works with selected national and international collaborators to realise and evaluate its innovations. For example, collaboration with the US Centre for Integrated Nanotechnologies is enabling the fabrication of resonating beams and plates for use as biosensors.

The group *plans* to leverage its collaborations to broaden the application and evaluation of these

innovations; for example, the design and test of orthopaedic devise such as fracture fixation screws and plates in collaboration with surgeons at City Hospital and Royal Orthopaedic Hospital. The outcomes will feedback into the underpinning modelling, design and prototyping activities expected to yield new generations of medical devices.

The **Sustainable Environment Research Group,** led by **Davies**, aims to develop sustainable solutions for vital services in the areas of energy, water, food and transport. Much of the research has a strong international focus. Key *achievements* include:

- Leadership of UK-India Science Bridge project with Aston Business School and with IIT Delhi, the outcomes of which have included a rural trigeneration system and new solutions for desalination of brackish groundwater using solar thermal energy.
- Setting up and monitoring of 3 sites in India for water treatment and cultivation of biomass.
- Electric vehicle usage trial in the West Midlands to understand driver behaviour.

Research in the area of solar energy focuses on decentralised applications including: hybrid solar-biomass power; solar-powered desalination of brackish groundwater; and solar-powered cooling of greenhouses for crop production in hot countries. In the area of green transport, detailed studies of electric vehicle energy management in relation to lifestyles have been carried out, while research on alternative fuels links to the activates of EBRI.

Strategically, this group *plans* to develop further its international engagement through EU projects that focus on the water-energy nexus, and through collaboration with arid countries needing desalination and refrigeration. It also plans to strengthen activities in sustainable design, materials, and life cycle assessment through the involvement of a broader range of academic staff and appointment of a new professor.

Modelling of Complex Systems, led by **Generalis,** is a new research group which aims to provide modelling tools, based on mathematical insights, to predict the behaviour of complex systems ranging from the scale of macromolecular solutions, biological cells and tissues, human societies, through to fluid systems at the scales of the oceans or atmosphere. Key *achievements* include:

- Mathematical modelling of double glazing leading to 10−20% reduction in energy usage
- Collaboration through a UK-Japan research exchange programme with Kansai and Tottori Universities; a rigid structure, known as the Hairpin Vortex was shown to exist within the centre of turbulence, confirming a theory put forward over 50 years ago.
- Development of an interdisciplinary national knowledge base in mathematical economics and mathematical biology.

The group develops novel mathematical techniques based on statistical mechanics and non-linear dynamics. Frequently these are implemented in the development of advanced computational methods and parallel numerical architectures to solve fundamental as well as applied problems in, for example, drug designing, immunology, medical imaging and energy conservation. The group *plans* to extend its research capacity to model complex systems at meso- and micro-scopic scales including: atomistic representations of proteins, models of heat and mass transfer in the natural environment, and turbulence modelling for weather prediction. To enable this, links are being expanded with research groups and user communities that benefit from such mathematical techniques. The group also works closely with computing groups at Aston (submitted to UOA11) and shares advanced computational facilities with them.

c. People, including:

i. Staffing strategy and staff development

This Unit takes a strategic approach to the recruitment of academic staff by appointing staff with appropriate levels of experience and research track records that complement and supplement existing areas of strength, particularly considering issues of succession for people in key positions. Vacancies are advertised and notified to personal networks to maximise the potential of recruiting high quality candidates. For posts difficult to fill, “head hunters” have been assisting. Applicants short-listed are interviewed by a small panel against specific criteria to ensure equality of opportunity. All new academic staff are initially on a 5 year contract with the expectation that these will normally be renewed without end date. Since 2008, 14 new staff have been recruited:

In **EBRI:** (i) Prof **Wilson**, an expert in sustainable catalytic processes, (starting 1st September

2013) brings a £2.5M portfolio of RCUK and EU funded projects that will commence in Aston. This appointment extends research in the areas of chemical synthesis from waste biomass and catalyst development for biofuel production especially in the context of biorefineries. Wilson also holds a Royal Society Industry Fellowship seconding her 50% to Johnson Matthey. (ii) **Makkawi**, whose expertise in modelling of complex chemical reactions and particle reactors is aligned to research on pyrolysis and gasification.

In **Polymers and Advanced Materials:** (iii) **Leaper** whose expertise also covers particle technology. (iv) **Topham**, a polymer scientist, who was appointed to create an advanced materials branch under the Bioenergy & Sustainability theme. (v) **Martin**, whose expertise in bioactive glasses and dental polymers contributes to several areas across the Healthcare Technologies theme. (vi) **Swadener**, whose micro-scale mechanics and materials modelling expertise connects with biomedical engineering and health research across the University (vii) **Evans**, whose track record in NMR contributes to and complements research in the Polymer and Advanced Materials Group and in EBRI. (viii) **van Koningsbruggen**, whose expertise in functional materials with tuneable magnetic, electronic or optical properties also contributes to research in advanced materials. (ix) **Yuan**, whose broad expertise in chemical engineering (with relevance to energy, nanofluids and separation science) contributes to both the Polymers and Advanced Materials Research Group and to EBRI.

In the area of **Sustainability:** (x) **Matopolous** whose expertise in supply chains and life cycle assessment contributes strongly to the Bioenergy & Sustainability theme.

In **Modelling:** (xi) **Nerukh**, whose strong track record in molecular modelling supports several areas of research in healthcare across Aston University. (xii) **Stich** whose strong expertise in mathematical modelling of biological systems will contribute to the Healthcare Technologies theme. (xiii) **Johansson** whose expertise in differential/integral equations will add strength to the Modelling of Complex Systems Research Group. (xiv) **Akinaga**, a Marie Curie Incoming Fellow who brings from Japan world-class excellence in modelling of turbulent shear flows.

The Unit has been highly successful in recruiting high-calibre postdoctoral fellows; 17 in total since 2008, including 4 Marie Curie fellows (50% success rate).

Career development for all academic staff The University Performance Development Scheme is used by all academic staff, PDRAs and Fellows. This includes an annual review by managers that includes achievements, plans for outputs and impact, training and development, as appropriate to each individual. Opportunities to gain appropriate wider experience are also considered. Staff can access a variety of courses through the University's "ResearcherPlus" facility. All staff have the option of mentoring independent of their manager. Staff are encouraged and supported to achieve promotion; the University criteria reflecting achievements in research alongside generating impact and teaching. The Research Development Manager assists in planning 5 year funding strategies with individuals and groups; current focus is considering alignment with EU Horizon 2020. **Early career researchers** (ECRs) receive specific additional support: they are assigned a mentor, an experienced researcher who advises them for about 3 years. The manager assists in setting up a "Training Needs Analysis" to align development with the themes in the Researcher Development Framework. Early career researchers maintain their career development plan which is reviewed typically 3 or 4 times a year by their manager. All newly appointed academics have £10k start-up fund and a PhD student to support their research programme. ECRs have a lower teaching commitment in their first two years of appointment.

Career development support for researchers is guided by the Framework for Career Development of Researchers. As a result of the development of the action plan implementing the Concordat, Aston was among the first UK institutions to receive the Human Resources Excellence in Research Excellence Award in 2010 and renewed in 2012. These plans included: (i) documentation in the Reference Guide for Managers on recruitment and support methods for researchers; (ii) specific webpages and a range of activities dedicated to researcher development; using feedback from surveys such as PIRLS, CROS and PRES to guide future approaches.

In addition to formal aspects of career development, researchers at all levels are encouraged and supported in building their experience through working in collaboration with other groups and Schools in the University, and with other institutions in the UK and internationally. Engagement

with relevant activities through, for example, professional institutions, national research institutes, and companies are routine for most staff. Secondments and exchanges are supported, where appropriate; teaching commitments may be adjusted to facilitate such activities.

In support of **international collaborations**, the Unit benefits from the Aston Visiting Scholars' fund, from which it has gained £22,000 to support 10 visiting scholars from 9 countries over the last 5 years. A number of visits and exchanges have also been supported by the Royal Academy of Engineering, the Royal Society, the Japanese Society for the Promotion of Science, and EC Marie Curie Industry-Academia Partnerships and Pathways (IAPP), and the Leverhulme Trust. Success rate with the Royal Academy of Engineering Distinguished Visiting Fellowship Scheme is high with 4 awards to this Unit during the period of assessment. A Distinguished Visiting Fellowship Award by the Leverhulme Trust is enabling us to host world-renowned fluid dynamicist Prof Friedrich Busse for 20% of his time over two years.

The University has a well-established **equality and diversity policy** that is adopted by staff and students. Aston was awarded Athena Swan Bronze Award in 2010 and the School that includes the Unit is applying for Silver in November 2013. The Equality Action Plan is reported on and published annually. At Unit level, for example, meetings and events are organised considering personal needs, such as access to venues, and timings especially for those who are part-time workers. Returners after longer absence or secondment are updated appropriately. On the REF census date, 2 full-time profs were female (2 FTE), while 4 part-time profs were male (1.83 FTE).

ii. Research students

Recruitment: Studentships are advertised widely, mainly through electronic fora used by potential applicants and personal networking. The EAS recruitment team first check the essential qualifications of each applicant including speculative applicants, before academic judgements are made through interview by the potential supervisor and a second academic staff member. Students are assessed to ensure that they have both the academic potential and personal qualities to success as PhD students. The Unit recruits high-quality students funded by diverse sources - about 20 research students per year - and currently has 77 students working towards PhDs, of whom 50 are from EU/UK and 27 from elsewhere. About 40% have been funded by EPSRC and the central training account, 35% by School studentships (including those to newly apppinted staff) and the rest wholly or in part (through TSB, KTP, CASE awards) by industry, EU programmes or private funds. The Unit (and the School) is building a cohort approach to PhD recruitment and training by engaging all students together, regardless of funding and scheme. As part of this, the Unit already participates in one Marie Curie Initial Training Network, and is establishing joint PhD programmes with overseas partners including Blaise Pascal University (France), University of Da Nang (Vietnam), Queensland University (Australia) and Hong Kong Polytechnic University.

Training and support mechanisms: Since 2010, PhD training, monitoring and assessment are coordinated through the "Graduate School" which provides a coherent structure for training in accordance with the QAA UK Quality Code for Higher Education and the Researcher Development Framework. The Graduate School has produced a comprehensive "handbook" for all research students that covers both formal University requirements as well as practical help for students new to Aston and Birmingham. PhD students have the option of a peer mentor to help in their first few months. Students attend induction in the Graduate School and EAS, where they are introduced to Senior University staff, academic and support staff responsible for the PhD programme and to other students in their cohort. The University offers a range of courses of relevance to PhD students, varying from 2 hours to 3 days, on topics including research techniques, thesis and viva preparation, writing for publication, interview techniques, career planning, and also languages. Students are required to complete at least 90 hours training, which must include some transferable skills, before submission of the PhD thesis. EAS requires all research students to pass a three-day intensive Research Skills module in their first year and prior to the student being registered as a full PhD student. This includes This includes basics such as literature review, academic writing and teamwork.

The research programme commences with refinement of the project topic by supervisor and student. At least one associate supervisor is appointed. All PhD supervisors are (re)trained at 3-

yearly intervals. Students complete a training needs analysis to identify relevant courses and experience required, then draw up a learning agreement with their supervisor that expands the project topic and defines mutual responsibilities and ownership of outputs.

Wider experience may be gained through **seminars** in topics closer or further from their own research topics; these being fully participative with students presenting and gaining feedback from staff and peers. For example, a recent workshop on 'Applications of mathematical models in science and engineering' convened students and staff with theoretical and experimental perspectives on fluid mechanics and chemical engineering, thus promoting interdisciplinary collaboration and exchange of knowledge. In addition, the Research Student Development Fund supports each student to attend at least one conference during their studies. Many PhD students contribute to **laboratory teaching** (after training), to enhance their career prospects and improve communication skills. PhD students are encouraged to support and participate in local events, eg those organised by professional institutions, especially "**outreach**" to schools and the community. **Progress monitoring** for PhD students follows University regulations and policies. Formal reviews are held annually with supervisors; these are 2-way, providing students and supervisors with the opportunity to provide feedback, highlight issues and plan the next phase of their research. More than 93% progress of students progress to a PhD after the first year Qualifying Report (approx. 6-10k words) and viva. The Graduate School has introduced a new progression monitoring policy requiring all second year students to prepare either an article for submission to a peer-reviewed journal or to give a conference paper to members of their academic subject group. Informally, students meet with supervisors at least weekly, and formally have a recorded meeting at least quarterly. Students meet routinely with other researchers and peers in their area, learning and gaining knowledge in their own field and wider areas of interest. In the few cases where problems arise, these are investigated by the Associate Dean for Research and the Director of Research Degrees.

d. Income, infrastructure and facilities

In the last 5 years, the Unit has benefited from a diverse portfolio of funding, with increasing income from EU sources and companies, as well as very significant University investment. Completion of the **EBRI** building funded by the European Regional Development Fund (ERDF) and University (as planned in RAE 2008), is notable. This bioenergy facility contains research and pilot-scale demonstration equipment, as well as offices for staff and students, and meeting facilities. 1900m^2 of floor space is available for experimentation with a range of biomass feedstocks for thermochemical and biological energy conversion processes, including a thermochemical Unit for research and demonstration based on Aston patented Pyroformer^{TM} technology. The self-sufficient facility includes a combined heat and power engine with total output of 1.2 MW. For biological conversion, there is a BioFence demonstration facility provided by Varicon Aqua allowing algal biomass growth at capacities up to 400 litres. A further £2.2M is being invested in EBRI, including further reactors and analytical equipment, to support research in catalytic processes and biorefinery technologies.

The **Polymers and Advanced Materials** Group moved to new chemical and analytical laboratories costing £6M at the end of 2011. A comprehensive range of equipment is available in the laboratories, including not only standard analytical techniques but an extensive range of novel techniques for investigating the complex behaviour and interaction of materials with the biological environment. This is the result of continued investment including about £500k over the last few years. Equipment includes FTIR spectrometers, differential scanning calorimetry, gel permeation chromatography, density columns, high performance liquid chromatography, mini and micro Langmuir Blodgett film troughs, microscopes, mass spectrometers, ion chromatography, tissue culture facilities etc.

Investment in computer equipment for the Modelling of **Complex Systems Group**, is included in the next phase of investment , in conjunction with other parts of the School (submitted to UOA11). For **Healthcare Technologies** and sustainable engineering activities, a wide range of design and fabrication techniques are employed, using existing in-house design and mechanical engineering facilities, as well as those available through collaborators and partners in the University School of Life and Health Sciences and elsewhere. .

The Unit encourages staff to engage in **consultancy and professional** services at both the

individual and institutional level. Staff are normally allowed to dedicate up to 50 days of time to individual consultancy activities per year because this is beneficial to strengthening our knowledge base and industrial networks. Expereinced staff, particularly Tighe and Bridgwater, both provide advice to major international companies and SMEs, as consultants.

More broadly, professional support is offered through the EU-funded BioenNWInterreg IVB project. This project aims to establish innovative bioenergy power plants across North West Europe, fuelled by waste on a local scale. Aston is one of five support centres that offers information, training, and support for developers, manufacturers and regulators, a feedstock testing service and a decision support tool to assess regional bioenergy potential. BioenNW is an approved strategic initiative by the European Union.

e. Collaboration and contribution to the discipline or research base

Supporting and facilitating collaborations

This Unit collaborates, both nationally and internationally, with partners from industry, academia and the third sector. Industrial partnerships are facilitated through the University Business Partnership Unit, which helps build links with business to promote awareness of the capabilities of this Unit. To bring together researchers and industry representatives, the Business Partnership Unit hosts 2 awareness events per year, showcasing the achievements of existing projects and outlining the opportunities and mechanisms to support new projects. These include commercially-funded projects, innovation vouchers, KTPs, CASE awards, TSB calls and ERDF proposals.

Examples of international and interdisciplinary collaborations

Research collaborations typically address the challenges posed by our two strategic themes. Under **Bioenergy & Sustainability**, for example, Hornung of EBRI has recently taken up a directorship of the Fraunhofer Centre for Energy Storage in Sulzbach-Rosenberg, thus combining the Aston capability in thermochemical energy conversion of biomass with Fraunhofer's capability in chemical/thermal storage.

The £2M UK-India Science Bridge in collaboration with IIT Delhi project led by Davies is another example of an international collaboration supporting this theme. In this interdisciplinary project, Aston worked with partners from agricultural universities in India to show the potential for wastewater re-use for growing energy crops and deriving useful energy services from them. Demonstration plantations were installed at 4 sites in India. Samples of wood with wastewater contamination were analysed to provide understanding of their suitability for energy conversion via pyrolysis, and community power systems have been developed for rural areas.

Topham and Sutherland are partners in the ESTABLIS Initial Training Network which has €4M of funding under EU FP7 to work on future generation solar cell technology. This consortium comprises eight academic/research institutions and three industrial partners from across Europe. The team are fabricating advanced materials to produce thin-film, flexible, lightweight, inexpensive organic solar cells with higher efficiencies and longer lifetimes and stabilities. This interdisciplinary project encompasses molecular design and synthesis, material degradation studies, device manufacture and theoretical modelling.

In the strategic theme of **Healthcare Technologies,** staff in the Unit work extensively with Aston colleagues in Life and Health Sciences, to provide a complementary mix of physical science and bioscience expertise, through to clinical applications. **Al-Malaika** received £194k funding from Biomet Orthopaedics Corporation (a major US manufacturing company) to carry out research into the role and fate of vitamin E antioxidant in a new generation of prosthetic implants for knee and hip joints. Such industrial collaboration supports on-going research into natural antioxidants for enhancing the longevity of biomedical polymers, improving the quality of life for patients, and providing savings for health services by reducing the need for corrective surgery.

Another very successful, and also long term, collaboration is that under Salt Healthcare Ltd – a manufacturer of stoma- and wound-care products. The work of **Tighe** and his team has increased the understanding of interactions between devices and the human body. They have developed models of biological fluids to enable in vitro testing of a hydrocolloids typically consisting of natural polymers, such as gelatine or pectin, in a matrix of polyisobutylene. The collaboration has been developed through 3 KTP and 2 CASE awards, and led to licensing of Aston intellectual property.

In another project relevant to healthcare, **Ma** has collaborated with Scottish Microelectronics Centre at Edinburgh and Chinese Academy of Science on developing microscale biosensors. The outcome is a new BioMEMS device for characterising in real time a range of physical properties and behaviour of biological cells, which is currently being protected and commercialised with the help of Aston's Business Partnership Unit.

Examples of leadership

Staff lead and advise several important *industrial and academic advisory panels*. **Bridgwater** is a member of the Energy Technologies Institute Strategic Advisory Group and he represents the UK at European bodies including the European Energy Research Alliance and the Biofuels Technology Platform. He is also Secretary of the IChemE's Energy Conversion Technology Group. **Davies** represents Aston University in the European Innovation Platform Water Action Group on Renewable Energy-Desalination. In the area of polymers, **Al-Malaika** participates in the International Advisory Committee of the Modification Degradation Stabilisation Society, of which she is also President.

Staff also influence industrial engagement in research through their *participation in professional and learned societies* e.g. **Ma** is a board member of the Engineering in Medicine and Health Division of the Institution of Mechanical Engineers, leading the micro and nanotechnology activities for the Institution. Consequently she organised seminar events on Nanotechnology in Medicine and Biotechnology, in 2008 and 2010. **Tighe** has been Vice-President of the International Society for Contact Lens Research since 2001.

Staff have also taken *leading roles in conferences* e.g. **Bridgwater** initiated and organised Bioten - Biomass, Bioenergy, Biofuels, Biorefineries (Birmingham, 2010). **Topham** chaired sessions at the UK MACROGROUP conference in Sheffield 2009 and at the Warwick World Polymer Conference (2012). **Davies** chaired two sessions at Heat Powered Cycles, Alkmaar (2012). **Matopoulos** chaired two sessions at the Annual Logistics Research Network Conference (2013), and was invited to join the Advisory Board of the 1st International Conference on Humanitarian Logistics (ICHL 2013) at the Indian Institute of Management Raipur. **Makkawi** chaired a session at the Bioenergy VI conference, Brindisi (2013).

Staff have also delivered numerous *keynote and invited lectures* to interdisciplinary and specialist audiences. **Al-Malaika** has delivered 17 invited lectures at conferences including: 28th PDDG Conference, Sestri Levante, Italy (2009); Swedish Chemical Society Conference on Green and Sustainable Materials, Stockholm, Sweden (2013); 28th US-Polymer Processing Society conference, Thailand (2012), at the 5th European Weathering Symposium, Lisbon, Portugal, (2011); the19th International Conference on Composites and Nano Engineering, Shanghai, China (2011). **Davies** gave an invited lecture about Solar-Powered Desalination at a meeting of the Sharing Knowledge Foundation, Tunis (2012). **Generalis** was invited to talk at the Streaks in Shear Flow Workshop at Imperial College (2012) and **Topham** at the Warwick World Polymer Conference (2012). **Sutherland** gave an invited lecture at the Zing Conference on Asymmetric Synthesis in Antigua (2009).

Staff are active in the *editorial boards* of several prestigious journals e.g. **Bridgwater** in Biomass and Bioenergy; **Wilson** in Journal of Biobased Materials and Bioenergy; **Al-Malaika** in Polymer Degradation and Stability; **Topham** in Polymer International. Wilson has also been Guest Editor for Catalysis Today. **Matopolous** received the Emerald Outstanding Reviewer Award (2012) for his work for the Journal of Humanitarian Logistics and Supply Chain Management.

Tighe's research has attracted several *prestigious awards* for its work on ocular materials, including the European Federation of Contact & Intraocular Lens Manufacturers Technology Award (2008) which is rarely awarded to an academic scientist. He was the first UK scientist to receive the Ruben Research Medal (2009) International Society of Contact Lens Research; and his contributions to the development of a biomimetic spine repair system attracted the Best Spine Technologies of the Year Award (2009) Orthopaedics this Week (US). **Bridgwater's** bioenergy research was recognised most notably in the Don Klass Award at Thermochemical Biomass Conversion conference, Chicago (2009), and the Johannes Linneborn Prize at 15th European Bioenergy Conference (2007).