When the Blue Stuff Hits The Fan

“This image shows the flow structure evolving downstream of a tidal stream turbine, generating renewable energy from the sea. Computational Fluid Dynamics Modelling is used to predict the flow features around rotating blades, and stream surfaces are implemented to highlight the movement of flow within swirling regions downstream.”

Photograph by: Rami Malki, Marine Renewable Research Group.

This is one of the winning images from the 2012 Research as Art competition.
“We stand at a critical point in our development as we move towards our centenary in 2020.”

“Decades of applied research have enriched our economy and society.”

“Research informs all academic and student-based activities across the University.”
In the latest (2008) Research Assessment Exercise (RAE) Swansea achieved the highest growth in world-leading and international-quality research activity of any university in the UK, effectively confirming our position as a truly research-intensive university. The subsequent doubling of our research income is evidence that this upward trajectory is being maintained.

Now we stand at a critical point in our development as we move towards our centenary in 2020. Swansea’s new Science and Innovation Campus is among the most exciting and ambitious projects in the UK higher education sector for decades. Alongside the associated redevelopment of the Singleton Park Campus, this project reinforces Swansea’s growing reputation as one of the most rapidly progressing universities in the UK.

The University has been hailed by the European Commission as an exemplar of how higher education can support innovation and knowledge economy growth within a region, and our proactive engagement with economic, social, and political challenges is true to the vision of our founders.

Capitalising on the advantages of a campus environment and a new medical school, we have committed ourselves to a multidisciplinary approach to research, vastly increasing our success in winning major research grants and strengthening our joint ventures with industry and other organisations in the public and private sectors.

Breakthrough provides an overview of the scale and impact of research being undertaken at Swansea, and captures the vitality of the research environment now firmly established at the University.

“These are exciting times for Swansea University, as we continue to progress towards our aspiration of being one of the top 200 universities in the world and our immediate goal of becoming a top-30 research-led university in the UK by 2017.”

Professor Richard B. Davies
Vice-Chancellor
Swansea University has achieved recognition as a truly research-intensive institution through a successful policy of targeted intervention and investment. The University produces internationally excellent and world-leading research across all disciplines and displays strength across Science, Technology, Engineering and Mathematics (the STEM subjects), Medicine and Life Science, Social Sciences, and the Arts and Humanities.

The results of the latest (2008) RAE speak volumes: the largest increase in internationally excellent and world-leading research in the whole of the UK, with more than 90% of our academic staff classed as research active. Swansea University is currently ranked 29th in the UK in terms of research income as a proportion of turnover, and our College of Engineering is performing on a par with universities in the Russell Group. Moreover, for every £1 million of Higher Education Funding Council for Wales (HEFCW) research grant awarded, we now secure more than £2.5 million of competitive research funding, from a wide variety of sources.

Swansea’s approach to research builds on the aspirations of our founders, who in 1920 set out to respond to the requirements of industry. Their first five Chair appointments were in engineering, metallurgy, physics, mathematics, and chemistry – fields which remain prominent in the form of today’s STEM subjects and which underpin many of Swansea’s most notable advances.

Recent progress has been impressive but our challenge now is to accelerate that momentum. We have pledged to continue our policy of strategic appointments; to sustain the growth of research grant income through improvements in bid quality; to engage more researchers in grant-winning activities, and to build effective national and international collaborations.

Each of Swansea’s six Colleges houses research clusters that bring together research institutes, private companies, the public and the third sector, and which build our capacity to lead in new and emerging areas. Moreover, our campus-based setting, and researchers who have invested in interdisciplinary work, have enabled a programme of cross-College collaboration that is a distinctive and energising aspect of the University’s dynamic research environment.

Decades of applied research have enriched our economy and society. The UK Government’s growing emphasis upon impact reflects a guiding principle that informs our campus development programme, a vital catalyst for a development that provides a European hub for STEM research and industry collaboration. A further commitment to multidisciplinary research ensures that we combine strengths in STEM with research in the social sciences, arts and humanities, and business, economics and law, to address many of the world’s most complex and pressing challenges.

The Science and Innovation Campus development heralds a new era for the University and its research. This significant investment will enable us to harness research strengths to a broad range of local and transnational business enterprises, and to promote the growth of high-technology clusters.

Research informs all academic and student-based activities across the University and a research culture characterised by its vitality is pivotal to the future of the institution. By developing the University’s research portfolio, attracting and retaining the most talented researchers and postgraduates, and by working within and across disciplines, Swansea will continue to address the current and future challenges that confront Wales and the wider world.
The University’s development as an internationally recognised, research-intensive institution has been made possible through a commitment to nurturing an environment where scholarship thrives and where research can flourish.

Continual investment in resources and improvements to research facilities ensure that academic and postgraduate researchers have the support they need to pursue their ideas and translate their knowledge into practice, with industrial and public-sector collaboration often integral to their work.

The University enjoys strong and effective partnerships with many multinational organisations. These are supported by an open-innovation environment that is fostered through, for example, the College of Medicine’s Institute of Life Science, which co-locates medical engineering and bioscience companies with our academic researchers.

During the period 2005 to 2011, the University’s research income grew by 119 per cent. The £31 million secured from research grants in 2010/11 represented 18% of the University’s total income, and there are now in excess of thirty major strategic projects being delivered with a total funding value of more than £130 million secured as a result of collaboration with industry.

Although major, state-of-the-art facilities such as the Institute of Life Science, the Centre for Sustainable Aquatic Research, the Welsh Centre for Printing and Coating, and the developing Science and Innovation Campus provide the infrastructure for much of the University’s world-leading research, Swansea University takes pride in having created an environment that supports researchers in all aspects of their work and at every stage of their careers, and which places research excellence at the heart of everything we do.

Enabling collaboration

The University has set in train several major initiatives designed to foster increased collaboration across its research community, with a particular focus on early career researchers.

Bridging the Gaps (BTG) is an Engineering and Physical Sciences Research Council (EPSRC) funded programme with a proven track record of stimulating and supporting interdisciplinary research initiatives and projects. Through a comprehensive programme of funding, events, workshops and sandpits, exhibitions and presentations, BTG provides researchers from across all disciplines within the University, and at all stages of their careers, with opportunities to cultivate novel research ideas and collaborative projects.

The programme has to date supported 55 interdisciplinary projects, linking 118 new collaborations with 23 national partners and nine international partners to the University. Similarly, international collaborations in the USA, France and China are supported through initiatives such as the EPSRC-funded Building Global Engagements in Research (BGER) programme, which develops early career researchers’ capabilities, opportunities and networks in relation to their research, the University’s strategic objectives and the University’s global research partners. The result has been to place Swansea at the centre of a global hub, with partners including the Université Joseph Fourier in Grenoble (France), Soochow University (China’s oldest private university), and leading American institutions including The Methodist Hospital Research Institute, University of Pennsylvania School of Medicine, Rice University, and the Texas AM University. The United States Department of Commerce, National Institute of Standards and Technology is also a partner.

The BGER programme stimulates international encounters in medical technologies and nanotechnology, and is transforming them into effective collaborations. By financially supporting researchers to attend subject conferences and seminars, promoting research opportunities, and bringing together potential collaborators, the programme is helping to understand and remove barriers that in the past have prevented cross-institutional discussion and the commercialisation of research.

BGER activities have included the launch of a joint PhD programme between Swansea and Texas, and bilateral secondments between Swansea and its international research partners. A Memorandum of Understanding for future work in the field of nano research is in place with the Université Joseph Fourier in Grenoble, and a Memorandum of Intent to establish a health sciences and technologies collaborative innovation centre is in
Breakthrough

place with Soochow University, China. The University also has an office in Suzhou, Bobay, a bioman incubator that provides complementary business development services and infrastructure support to its tenant companies. Bobay has incubated more than 150 high-tech enterprises since its launch in 2007.  

Our research community is further supported by the Swansea University Research Forum (SURF), which draws its membership from across all academic Colleges and many administrative departments. SURF is a grassroots community of researchers committed to improving our research culture through a wide variety of cross-disciplinary research and social networking activities. SURF has played a key role in developing a sustainable research culture across disciplinary boundaries at Swansea and engaging and empowering researchers. SURF’s activities include an interdisciplinary research seminar series, Christmas lectures, an annual Research as Art competition, which has sparked worldwide media interest, and an innovative research coaching scheme, which enables early career researchers to be mentored by more experienced academics to unleash their potential.

**Supporting and managing external funding**

Research funding advice, support and guidance is provided by the Department of Research and Innovation (DBR) to the six academic Colleges, individual researchers, project groups and research administrators. This is intended to improve grant application success rates, thereby increasing research income and expanding our research portfolio. Support includes identifying strategically important funding opportunities that meet University objectives, training and development to help research staff increase the quality and volume of research proposals, and leading on contract, costing and pricing negotiations.

DBR also provides support for the financial management of projects through services such as invoicing, claims processing, assisting with financial queries and budgetary management, and ensures that applications are compliant with the policies and procedures of the University, more than 100 different types of research funders, and UK and EU legislation.

The value of research carried out at Swansea has increased dramatically since 2005, and the University has introduced effective systems for managing and maintaining contracts awarded. Feedback from audits by the UK’s Research Councils (RCUK) has highlighted the robustness of the University’s project management procedures. Commercialisation activities are increasingly important to the University. The University has an established track-record of engaging successfully with industry, which has yielded a portfolio of more than fifty patents providing opportunities for revenue generation, licensing, and further research. The University has also helped create numerous startup companies with unique expertise and technologies, helping to ensure that our research fuels the regional and national economy.

DBR works with staff to identify the commercial potential of research undertaken at the University and provides support at all stages of the process, from the registration of patents and proofs of concept, to market assessment and establishing new companies.

**Supporting the institutional research strategy**

The Planning and Strategic Projects Unit (PSPU) is responsible for the development, implementation and review of the University’s corporate and business planning processes, and provides a programme and project management resource through which the implementation of research projects and activities can be coordinated and directed to maximum effect.

The University supports the University’s research strategy and the management of strategic projects and policies designed to develop Swansea’s research capacity and performance, its pioneering interdisciplinary collaborations, and its ambitious internationalisation agenda. Part of the University’s function is to support formal governance and strategic groups including the University Research Committee, Strategy Management Group for Research, the Research Income Generation Group, and the Research Excellence Framework (REF) Strategy Management Group.

The University’s Major Project team supports the successful delivery of significant projects at the University, conducts regular health checks of the major projects, helps project managers conduct risk assessments and manage risk, and delivers project management coaching and training to University staff involved in project delivery.

**Supporting staff development**

Recognising that our greatest asset is our staff, the University has developed a new approach to enabling and monitoring performance. The approach provides clarity for members of staff about their role and the standard of performance expected, ensures that all staff are clear about how they contribute to the delivery of the University’s objectives, and supports their career development with respect to all facets of their work.

Individual Key Performance Indicators (KPIs) that relate directly to measures of organisational success have been integrated into an online Professional Development Review (PDR) form to drive a meaningfully target-based discussion about individual staff performance. For academic staff, KPIs encompass publications produced, grant applications made, funding secured, and the number of research students supervised.

In 2012, Swansea University took great pride in winning both a Times Higher Leadership and Management Award and a Universities Human Resources Excellence Award for its performance-enabling programme.

The University also provides support for the professional and career development of researchers, through the employment of a Development Officer for research staff, who works with the Academic and Professional Enhancement Centre Swansea (APECS) and Human Resources Department to ensure that training in generic and specialised skills is readily accessible to all staff, and that recruitment, induction and probation practices are robust.

Since 2010, the Vitae Researcher Development Framework has been used to shape training provision and has also been included in Professional Development Reviews from 2012.

Swansea University is fully committed to the implementation of the 2008 Vitae Concordat to Support the Career Development of Researchers, and acted quickly to draw up an action plan to identify areas where work was needed to become fully compliant. As a result, Swansea University was one of the second tranche of higher education institutions to be presented with the European HR Excellence in Research award.

Eleven of the University’s early career researchers have been recipients of prestigious RCUK Academic Fellowships, designed to help the UK’s best researchers make the transition from short-term, project-based contracts to full-time academic positions. Each Fellowship is worth £125,000 and is subject to the higher education institution guaranteeing a permanent, academic position following the end of the award. Fellowships were awarded to Swansea in Computational Biomedical Engineering, Computer Science, Geography, Mathematics, Materials Engineering, Nanomedicine and Physics.

Swansea University is also proud to be a Charter Member of Athena Swan, which recognises the commitment of higher education institutions to the advancement of women’s careers in science, technology, engineering, mathematics, and medicine (STEM). The University secured the Bronze Award in 2009. Swansea University is also proud to be a Charter Member of Athena Swan, which recognises the commitment of higher education institutions to the advancement of women’s careers in science, technology, engineering, mathematics, and medicine (STEM). The University secured the Bronze Award in 2009.

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The University has awarded a joint PhD with the University of Padoa, and has had collaborative degrees validated with the University of Oklahoma and the Methodist Hospital Research Institute in Texas.

Through APECs, a comprehensive skills development programme for research students has been expanded to correspond with the areas identified in the Vitae Researcher Development Framework. The programme is freely available to all students enrolled for postgraduate research degrees. Training courses are taught by Swansea University staff and external trainers, and cover a broad range of topics, including:

- Academic writing skills
- Disseminating research and making an impact
- Effective research transferable skills
- Employability
- Entrepreneurship
- Global awareness
- Metacognition, teaching and learning styles
- Professional practice in academia
- Professional research management
- Using IT programmes and platforms in research
- Working with others and leadership

The University is also working with TribAl UK and Gradlink to develop an electronic Higher Education Achievement Report (HEAR) for Research Students. The HEAR is a single document, based on each student's current academic transcript and Diploma Supplement. It provides a description of the nature, level, context and status of the studies, and highlights the student's performance. The HEAR also details the learning outcomes of the programme undertaken by the student, and includes achievements in recognised extra-curricular activities.

Postgraduate training programmes

Swansea University’s postgraduate community has grown significantly in recent years. Between 2005 and 2011, the University saw a 35% growth in postgraduate taught students, and a 57% growth in postgraduate taught students. To generate and sustain this growth the University has provided a range of studentships to be offered every year, over a period of three years.

The establishment of a Doctoral Training Centre (DTC) in Wales, funded by the Economic and Social Research Council (ESRC), allows 33 new postgraduate studentships to be offered every year, over a five-year period by Swansea, Aberystwyth, Bangor, and Cardiff Universities. The DTC supports the successful completion of research degrees and provides the high-quality training needed by the future leaders of our social-scientific community.

Through Access to Masters (ATM) programme, led by the University’s College of Engineering, more than 1,400 Masters’ degrees, with annual bursaries and tuition funding worth up to £8,450, are available to help researchers gain the competences necessary to drive innovation in businesses in Wales. ATM is backed with £12.3 million from the ESF through the Welsh Government.

The Knowledge Economy Skills Scholarships (KESS) scheme is designed to ensure that postgraduate students develop the higher level research and development skills demanded by employers who are aligned with the key priority areas for Wales: Advanced Engineering, Biosciences, Digital Economy, Health, Low-carbon Economy, and Manufacturing. The KESS scheme, funded by a range of collaborative research projects with small and medium-sized businesses. The scheme will provide in excess of 400 PhD and Masters’ places over five years and is backed with £33 million from the European Social Fund (ESF) through the Welsh Government.

The Steel Training Research and Innovation Partnership (STRIP), a £6.5 million programme, was established in 2009 to work with the entire steel supply chain in Wales at the doctoral and master’s levels. STRIP trains high-calibre people from academia and industry in metallurgy, corrosion, coatings, manufacturing, and mechanical properties. The programme funds eight MRes and 10 EngD projects per year. EngD activity has been extended to focus on functional coatings through the Centre of Advanced Training for Engineering Doctors (COATED), which is jointly funded by EPSRC and the Welsh European Funding Office (WEFO), and will support 21 EngD students.

The Manufacturing Advances Through Training Engineering Researchers (MATTER) EngD programme, funded by EPSRC, will fund 26 EngD students for four years. MATTER has been developed to provide doctoral level research in advanced manufacturing across these critical manufacturing areas for the UK economy: aerospace, automotive, and packaging. The programme supports industry-led projects comprising doctoral level research and a range of taught modules to enhance participants’ knowledge of advanced manufacturing and business skills. MATTER is fully accredited by the Institution of Mechanical Engineers (WeChar) and the Royal Aeronautical Society (RAeS). Current projects underway include:

- Computational modelling of the AUM melt pool
- Improving colour reproduction for packaging
- Surface engineering for packaging metal forming
- The flow and curing of multi-resin inks
- Thermal imaging based melt pool depth prediction system
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Breakthrough

The University’s research community contributes to a wide range of activities that showcase Swansea’s research strengths. In November 2011, for instance, the University’s first Interdisciplinary Research Week took place, laid by the BTG programme, the week was a campus-wide celebration of the University’s breadth of interdisciplinary research excellence. More than 800 people attended 25 events and six exhibitions, with speakers including Professor John Harries, Chief Scientific Advisor for Wales, Marc Evans, international film director, and Professor Paul Boyle, Chief Executive, Economic and Social Research Council (ESRC).

The annual Research as Art competition, run by SURF and supported by Bridging the Gaps, aims to capture the diversity and beauty of academic research. The competition is open to researchers, including students, from all disciplines and invites images that are inspired by, or have conditions to which gas turbine engines may be subjected. Hollie’s image, together with others from the competition (see opposite), received widespread international attention through the media including the BBC, The Sun, Fox News, MSNBC, LiveScience, and Scientific American.

The winner of the 2012 competition was Hollie Rosier, a PhD student in the College of Engineering. Her image (see above), a close-up of a grain of salt forming on a component of an aircraft engine, derived from her research to recreate environmental conditions to which gas turbine engines may be subjected. Hollie’s image, together with others from the competition (see opposite), received widespread international attention through the media including the BBC, The Sun, Fox News, MSNBC, LiveScience, and Scientific American.

The University's research is also celebrated and promoted through Momentum, Swansea University’s research magazine, which capture the excitement of pursuing research while showcasing and celebrating the research advances being made across the campus community. The magazine is produced six times a year, with electronic copies provided to staff via the University’s website. Hard copies are also produced for distribution to industry partners, stakeholders and funding providers. In 2012, the University took part in The Times Cheltenham Science Festival, the UK’s largest science festival, which brings together hundreds of the world’s most creative thinkers and attracts approximately 60,000 visitors. As a major partner in this high profile Festival, the University was able to showcase some of its leading research areas, including GLIMPSE (page 142), SPECIFIC (page 66), and EnAlgae (page 124) projects. The Psychology Department partnered with the Festival to undertake a mass experiment with schools, conducting research via a live link-up with classrooms. The activity investigated the relationship between digit (finger) ratio to aspects of cognition and career choice.

The Swansea Science Café offers monthly opportunities for staff, students and the wider public to discover new, exciting and topical areas of science. Designed to be informal and entertaining, the Science Café is accessible to the general public, and entrance is free. Topics covered have included dark matter, the common cold, Dr Who, the Big Bang and alternative therapies.

The University also promotes its research at the annual National Eisteddfod of Wales and the Urdd National Eisteddfod, which forms part of Urdd Gobaith Cymru, Wales’ largest youth organisation. At the Urdd National Eisteddfod, the University has staged the popular Crywyrddlon (science pavilion), where staff and postgraduate students bring science to life for thousands of young people, encouraging them to pursue careers in the key strategic areas that underpin economic growth and prosperity.

Sal Cristallum

Deep within the jet engine lies the turbine. This module drives the large fan and compressor at the front of the engine which can be exposed to extreme environmental conditions within the atmosphere. This striking, unedited scanning electron microscope image is an example of a laboratory reproduction of the salts that have been observed on such components. This tiny, 2mm, grain of salt has recrystallised from an aqueous solution in different phases, to create its unique appearance. This research is leading to the safer design and operation of aircraft engines.

The winning image from the 2012 SURF Research as Art Competition.

Celebrating research

• Di Golli Cardew, Director of Science and Education at the Royal Institution, Vice-President of Euroscience, Wellcome Collection Advisory Panel, EPSRC Peer Review College
• Flora Graham, Deputy Editor of NewScientist.com

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Engaging communities, creating impact

Decades of applied research at Swansea University have resulted in many significant global benefits. The UK Government’s growing emphasis on demonstrating impact plays to Swansea’s strengths, with researchers dedicated to work that enriches our economy and society. This applied approach to research is strengthened by multidisciplinary working across campus, combining world-class research in STEM with that in the arts, humanities, health and social sciences to address multiple and multifaceted challenges.

Public understanding of animal movement: Great Migrations
College of Science researchers, led by Professor Rory Wilson, helped to share new information about animal movement and migrations with over 830 million people. Translated into 34 languages and reaching 166 countries, Great Migrations was a seven-part series showing National Geographic’s high definition coverage of animal migrations around the globe. The project comprised two and a half years of filming across every continent and travel of over 420,000 miles, the largest global initiative undertaken in National Geographic’s 122 year history. Underpinning research was based around one major concept: the realisation of a single generic archival tag that could be attached to free-living animals, revolutionising an understanding of animal biology. (See page 153)

Airbus lifted by composite material research
The College of Engineering has jointly created a novel design methodology with Airbus UK, incorporating deleterious effects on mechanical properties due to environmental moisture over an aircraft lifetime. Coupling fundamental experimentation with numerical modelling, effectiveness has been continually tested and measured through successive rigorous Technology Readiness Level (TRL) assessments at Airbus. The company has helped to fund a continuous series of Swansea University research projects since 2008. Collectively known as EMOC – Environmental Modelling of Composites – the projects relate to an improved understanding and quantification of the effects of moisture ingress into airframe composite materials. The overall objective of EMOC, to deliver Airbus significant and broad-reaching new design software capable of resolving moisture levels in individual pieces, was achieved. (See page 84)

Military literacy: children’s consumption of global politics in an age of terror
Research by Dr Helen Brocklehurst in the College of Arts and Humanities has improved the understanding of stakeholders responsible for global politics’ textbooks produced for children. Drawing attention to the quality of educational material consumed by young people, research has demonstrated problems of bias, inaccuracies, insensitivity and militarism in children’s textbooks. It has stimulated stakeholders to recognise the challenges such literature creates for young readers, and to agree on the need to create a new ‘review culture’. The potential for a UK network that cuts across disciplines and between sectors has also been identified.

Enhancing public understanding of international crime fiction: Mrs Peabody Investigates
Research by Dr Katharina Hall in the College of Arts and Humanities examines the representation of National Socialism and its legacies in transnational crime fiction. Through her blog Mrs Peabody Investigates, Dr Hall disseminates information about German, European and international crime fiction beyond traditional academic audiences, contributing to an enhanced public awareness of their cultural, social and historical value. Established in January 2011, Mrs Peabody’s blog has received over 115,000 views from over 190 countries, and facilitated mutually beneficial dialogues between a number of stakeholders from readers and bloggers, to authors, translators and publishers. (See page 42)

Asylum, age disputes and the process of age assessment
Policymakers and those working in children’s services have been increasingly concerned about the growing number of children and young people who are seeking asylum or are subject to immigration control, but have no documents to verify their age. This can mean that they are unable to access the appropriate support and protection. Research led by Professor Heaven Crawley in the College of Science has examined why age is disputed, concentrating on the process by which age is assessed and questioning dominant concepts of ‘childhood’, as well as the potentially damaging impact of actual and proposed methods for assessing age. Findings led to a steep drop in the number of age disputes, and ongoing procedure reforms in the UK and Europe. (See page 137)
Computational research solves industrial problems

Computational research work in the College of Engineering at Swansea has made a profound impact on the solution of industrial problems. Developments have centred on finite element based procedures for the simulation of nonlinear material problems under finite strain conditions, including rate-dependent plasticity, material damage, contact conditions and multiscale phenomena; and on discrete element computational procedures for multi-fracturing solids. This methodology constitutes the core technology of commercial software system ELFEN, marketed by Rockfield Software Ltd. (See page 83)

Genotoxic thresholds in drug discovery

Research conducted by the College of Medicine has convincingly shown that genotoxic agents display ‘thresholded’ dose responses, therefore low level exposures are insignificant in terms of damage to DNA. This finding changed many regulatory guidelines concerning how drugs and chemicals are assessed. It also offered assurance to tens of thousands of patients and saved millions of euros. (See page 118)

Children and young persons’ rights

Insights gathered from research conducted at the College of Business, Economics and Law have helped to shape an innovative new law in the form of the Rights of Children and Young Persons (Wales) Measure 2011, the first general legislative gauge of the United Nations Convention on the Rights of the Child (UNCRC) in the UK. This concept influenced Scottish Ministers’ recent consultation on Scots law reform, and has been adopted by a coalition campaign for UK-wide law reform, which has attracted international interest. The law obliges law reform, which has attracted international interest. The law obliges the Welsh Government to consider guidance on: ‘escalating concerns’ for care home closures, recommended by the CJA. Two local authorities, Swansea and the Vale of Glamorgan, have used information on the challenges associated with ExtraCare provision to inform the development of future services, while research insights are also being used to advise private sector new-build projects. (See page 92)

Impacts for Tata Steel Europe (Coatings Development)

Research conducted by the College of Engineering’s Materials Research Centre has made significant contributions to the development of two commercial metallic coating systems with improved corrosion resistance, a novel photovoltaic coating for building photovoltaics and significant underwater science. These have enabled Tata Steel to offer corrosion guarantees for up to forty years. (See page 37)

Global satellite observations for improved numerical weather and climate prediction

Global satellite datasets of land surface properties and atmospheric aerosol are vital to the modelling of climate, and to short-term numerical weather prediction (NWP). Between 1995 and 2011 the College of Science Global Environmental Modelling and Earth Observation group (GEOWat) pioneered methods for global dataset generation, used by government agencies for NWP. This was done by the rigorous physical modelling of biophysical parameters, giving rise to the satellite signal and inversion of these models. Research has underpinned global datasets currently used in NWP and the climate models of a number of national agencies. The improved design of satellite instruments in the UK and the adoption of techniques for operational satellite data processing by the European Space Agency are also indebted to work undertaken at Swansea. (See page 154)

Public engagement

Researchers and research groups at the University engage with more than 72 diverse community groups, cultural amenities, schools and colleges to create a culture where public engagement and inclusivity is regarded as an important activity by the research community. The University’s broad range of initiatives encompasses: Technocramps, inspiring young people aged 11–19 to attend workshops on a range of exciting computing-based topics such as robotics, game development, animation, digital forensics and much more. The Wales Institute of Mathematical and Computational Sciences (WIMCS) enhances the standing of mathematics and computation in Wales, fosters links with industry, commerce and business, and provides a forum for education and public awareness of the mathematical sciences. A Pro Bono Law Clinic, developed by professional tutors and law students to provide clinical legal education through the provision of free legal advice to students of Swansea University. Swansea’s physicists provided scientific input for the BBC Stargazing event, and have given a range of public lectures on topics ranging from antimatter to the Large Hadron Collider.

Computational research

The Research Institute for Arts and Humanities (RIAH) has an annual public lecture series, currently in its third year, which is aimed at a lay audience and is well attended by members of the local community. RIAH also organises the annual Richard Burton Lecture, which is funded by a £25,000 endowment from Sally Burton.

The CallSWansea project, led by Professor Huw Bowen, is bringing academic research on the history and global impact of the Welsh copper industry to a community audience in a variety of ways, not least by leading the redevelopment of the former Hafod Copperworks site in Landore, Swansea as a heritage attraction, with major economic and wellbeing benefits for the local community. For more information, please see page 38.

Typically outreach from a project occurs after data have been collected and interpreted, obscuring the scientific process from public view. By undertaking filming before, during, and after a major field season in Greenland, Swansea University’s Centre for Innovative Ageing (CIA) is exploring the history and importance of Swansea City Football Club to the local community. RIAH also organises the annual Richard Burton Lecture, which is funded by a £25,000 endowment from Sally Burton.

A Heritage Lottery Fund-supported project led by Dr Martin Johnes is exploring the history and importance of Swansea City Football Club to the local community. Community members will play an important part in the research process, which will involve oral histories, an online database of memories and an exhibition. Dr Alison Williams, who holds a Wellcome Trust grant for a research project on the work and life of Francois Rablais, is using her research as the basis of a series of ‘Literature as Therapy’ sessions at the Old Mill Foundation, a holistic cancer support centre in Swansea.

As part of the University’s involvement in the BLOODHOUND SSC Project, Swansea has connected its research with thousands of school children across Wales and beyond, through school visits and shows at school conferences.

Swansea University Centre for Digital Computing (SMaRT), a partnership with Rolls-Royce, delivers a strong outreach programme to disseminate technology developed by the project. SMaRT demonstrates a fully operational miniature gas turbine and other equipment to inform, educate and engage schoolchildren, students, industry and the public with an exciting demonstration and interactive activity.

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Society’s most pressing challenges are not easily resolved by individual academic disciplines working in isolation. Research into diseases such as cancer is now as likely to involve engineers and physicists as it is medical experts.

Confronting the realities of climate change requires the skills of lawyers, economists and social scientists as well as geographers and researchers in the arts and humanities can be found working on the regeneration of industrial landscapes alongside those in the physical sciences. Interdisciplinary research, where academics cross traditional discipline boundaries to pursue new ideas and engage in new thinking, is integral to Swansea University’s approach to delivering research that has genuine, global relevance and impact.

In this regard Swansea’s research has been closely aligned to the RCUK-designated priority areas, which encompass: living with environmental change; ageing; lifelong health and wellbeing; digital sciences. Interdisciplinary research, where academics cross traditional discipline boundaries to pursue new ideas and engage in new thinking, is integral to Swansea University’s approach to delivering research that has genuine, global relevance and impact.

The University’s research is also aligned to the European Commission’s Framework 7 priorities which include: health; food; agriculture; fisheries; the economy; nanoscience through engineering to application; and environmental change; ageing; lifelong health and wellbeing; digital sciences and biotechnology; ICT; nanosciences; energy; environment (including climate change); transport (including aeronautics); socioeconomic sciences and the humanities; space and security.

Also, within Wales, the University’s research is mapped against the Welsh Government’s Science Strategy for Wales, which identifies three priority areas driving economic growth: life sciences and health; low carbon, energy, and environment; and advanced engineering and materials. At Swansea, for instance, research addressing life sciences and health ranges from medical technology, diagnostics, immunity, and cell technologies to health informatics, genetics, and public health.

Research into water safety and security, energy generation, ecology and environmental monitoring, plays to the low carbon, energy and environment theme, whilst the University’s world-class strengths in engineering are contributing to advanced engineering and materials, particularly through research into aerospace, advanced materials and composites.

Research that tackles each of these regional, national and international priority themes is underway across the institution, and is evidenced in detail in the following pages. This research is often facilitated through major, cross-cutting centres and institutes that provide world-class facilities and internationally recognised research leadership.

The Centre for NanoHealth

Early diagnosis and treatment of diseases such as cancer could prevent suffering, save lives, and reduce costs for health services. Swansea University is responding to this challenge through the Centre for NanoHealth (CNH), a £21.6 million initiative that draws together expertise from the Colleges of Medicine and Engineering, in partnership with industry and the Abertawe Bro Morgannwg University Health Board (ABMU).

Based in a clinical and biomedical research environment, the Centre is a pioneering, integrated facility where novel devices and sensors can be designed, manufactured and evaluated. Such advances in nanotechnology, together with developments in biomarker discovery, have the potential to lead to the detection of the onset of disease at the earliest possible stage.

A key area of research within CNH focuses on how nanoparticles interact with organic material. Whilst it is important to explore and understand the therapeutic effect, it is also essential to understand how nanoparticles interact with healthy cells. This is an area in which Swansea has taken a lead in partnership with The Methodist Hospital Research Institute, Texas, and which has led to the development of the field of Transport Oncophysics – the ability to develop and deliver therapeutics that are not just personalised to individual cancer patients, but to individual lesions in the patient.

Nano-devices and nano-biosensors will enable health professionals to detect and measure biomarkers present in fluid or tissue samples at a level of sensitivity far beyond current detection methods. They will also allow for point-of-care testing in community clinics, GP surgeries, or in the home, and will be used in the growing area of companion diagnostics, where devices report to a patient’s clinician through new e-health systems.

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Director by Professor Steve Conlan (College of Medicine) and Professor Steve Wills (College of Science); the Centre is funded by the European Regional Development Fund through the Welsh European Funding Office, and engages with small businesses, other universities, international corporations and the NHS through collaborative research and development projects. The Centre also works closely with the University’s Multidisciplinary Nanotechnology Centre (College of Engineering) and the Institute of Life Science (College of Medicine).

Projects undertaken by CNH have been funded by a range of organisations, including EPSRC, the Biotechnology and Biological Sciences Research Council (BBSRC), the Technology Strategy Board (including Knowledge Transfer Partnerships), the European Commission’s FP7 programme, the Welsh Government, and the National Institute for Health Research.

Swansea is also leading an alliance of four institutions from Wales and Ireland in a £1 million Celtic Alliance for NanoHealth venture to pioneer the development of cutting-edge healthcare. The alliance, which includes the University College Dublin Centre for BioNano Interactions, Trinity College Dublin Institute of Molecular Medicine and Centre for Research on Adaptive Nanostructures and Nanodevices (CRANN), and Dublin City University Biomedical Diagnostics Institute and Nanobiophotonics and Imaging Centre, will help companies on either side of the Irish Sea stay at the forefront of innovation and growth in what is a fast-developing and hugely influential healthcare sector.
Welsh Centre for Printing and Coating

Located in the College of Engineering and directed by Professor Timothy Claypole and Professor David Gethin, the Welsh Centre for Printing and Coating (WCPc) is one of the world’s leading centres for research and development of printing and coating processes.

The WCPc has an established track record of working closely with companies and has access to significant industrial printing facilities. Practical applications focus on graphics printing and industrial printing, for example in the areas of plastic displays, industrial sensors and membrane switches. The Centre cuts across a number of research themes through its involvement in pioneering work in areas such as printed lighting, power generation (e.g. with the SPECIFIC project – see page 67), and health diagnostics. For instance, the WCPc is developing printing technologies to produce a low cost biosensor capable of diagnosing a range of health conditions. The aim is to place living antibodies into a specially designed ink which would be printed onto a compatible substrate or material to form a disposable sensor, capable of being mass produced at low cost. Antibody-based arrays are routinely used to detect specific medical conditions but use of these tests is limited because they need to be carried out in laboratories by highly skilled technicians, which is costly and time consuming.

By contrast a printed array of antibodies speeds up the testing process, while reducing the expertise and complexity of equipment needed – introducing the possibility of handheld electronic scanners and quicker diagnosis. Consequently, this aspect of patient care can be moved from existing equipment, while reducing the expertise and complexity of equipment needed – introducing the possibility of handheld electronic scanners and quicker diagnosis.

Research Institute for Applied Social Sciences

The Research Institute for Applied Social Sciences (RIASS) is a flagship, cross-University hub, bringing together the best research within the social, human, health and environmental sciences.

Drawing on the expertise of eight member research centres from four of the University’s Colleges, RIASS builds upon existing strength in applied social science research and is embedding that perspective within innovative research projects which cut across traditional academic boundaries. RIASS is developing a distinctively multi-disciplinary, applied approach.

RIASS is also making a significant contribution to the development and training of Wales’s next generation of social scientists, hosting the Swansea arm of the Wales ESRC Doctoral Training Centre, which provides 33 postgraduate studentships in RIASS every year for five years.

Under the Directorship of Professor Judith Phillips, RIASS is forging research collaborations with similar institutes around the world, while also serving the local community through engagement with businesses, and the public and voluntary sectors. Member research centres include:

Centre for Innovative Ageing

Unique in Wales, the Centre, directed by Professor Vanessa Burholt – provides the infrastructure, focus and leadership for ageing research and scholarship across the University’s Colleges of Human and Health Sciences, Engineering and Medicine. It hosts the Older People and Ageing Research and Development Network (OPAN), and the Wales Stroke Research Interest Group and has strong links with the Wales Dementias and Neurodegenerative Diseases Research Network (NEUDORD Cymru).

The Centre’s work is targeted at identifying gaps in ageing research and generating new interdisciplinary knowledge. Its core research covers four broad themes:

• Civic and social engagement and participation of older people
• Environments of ageing
• Care provision for older people
• Chronic conditions, falls, and prevention in older age.

Centre for Criminal Justice and Criminology

The Centre, under director Professor Kevin Haines, acts as a focus for criminological research and teaching in the School of law and for collaboration with other departments and universities. Research areas include youth justice policy and practice, community-based supervision, sex offender policy and treatment, sex work policy, antisocial behaviour policy and ‘white-collar’ crime. The Centre also hosts the Wales regional branch of the British Society of Criminology.

Centre for Migration Policy Research

Directed by Professor Heaven Crawley, a leading authority on UK asylum and immigration policy, the Centre works with a wide range of stakeholders to encourage the exchange of ideas about asylum and migration and to ensure that policy making is informed by empirical evidence about the nature and causes of migration, the impacts on different countries and communities, and the effects - both intended and unintended - of policy responses.

Swansea Centre for Health Economics

The Centre’s staff undertake commissioned work on the evaluation of programmes and interventions for a number of organisations, including: The World Health Organisation, Welsh Government, Department of Health, Department of Work and Pensions, and a range of social care authorities and pharmaceutical companies. Under director Professor Cari Phillips, the Centre’s research covers health economics and health and social policy, and produces bespoke reports for companies and agencies that, in many cases, have informed submissions to the National Institute for Health and Clinical Excellence (NICE) and other assessment agencies.

Wales Observatory on Human Rights of Children and Young People

Under co-directors Dr Simon Hoffman and Jane Williams, the Observatory provides a forum for research, advocacy and expertise on human rights of children and young people. The Observatory was launched in June 2012, shortly after the introduction of an innovative law on children’s rights in Wales, which imposes a legal obligation upon Welsh Government to have due regard to the United Nations Convention on the Rights of the Child (UNCRC) and its Optional Protocols. As it develops, the Observatory will support public policy, practice, child advocacy and law reform conducive to the implementation of human rights obligations.

Global Drug Policy Observatory

The Observatory has arisen from world-leading research on international drug control, led by Dr David Bewley-Taylor of the Department of Political and Cultural Studies in the College of Arts and Humanities. The research is already influencing policy reform at a parliamentary level, and has been presented to high-level audiences, including ambassadors and national ‘drug czars’, from a range of Latin American and European countries.

Welsh Economy and Labour Market Evaluation and Research Centre (WELMER)

The Centre, directed by Professor David Blackaby, conducts research into the Welsh economy and labour market to provide evidence-based economic policy advice to local and national governments. It produces dynamic benchmarks for each Welsh unitary authority as a basis from which to monitor the effectiveness of EU Objective One funding, it also analyses and reports on trends in economic data relevant to the Welsh labour market, such as population profiles, migration flows, skills and qualifications, inactivity, employment, earnings, GDP growth rates and business.

Wales Institute of Social & Economic Research, Data & Methods (WISERD)

WISERD represents a major investment in research infrastructure in the economic and social sciences across Wales. Funded by the ESRC and HEFCW, WISERD involves five Welsh universities, and researchers from a variety of social science disciplines. At Swansea, WISERD is based in the College of Business, Economics and Law, and is linked with a range of academic and policy-making institutions in Wales and the UK. WISERD provides high-quality, independent research and analysis, and is committed to providing high-quality research for improving policies, programmes and service delivery in Wales and the UK.
Our Research Income
2005 to 2011

119% growth in income from research grants & contracts

£31m income from research grants in 2010/11

18% of the University’s total income
Collaboration with commercial and industrial partners is at the core of our research strategy. Organisations that have supported the University’s research activities include:
The Future: Campus Development

Since 2004, the University has successfully pursued a strategy to increase the quality and scale of its research, with a particular focus on science, technology, engineering, mathematics and medicine, and with the close engagement with industry that has marked the University’s development since its foundation in 1920. This has led to a substantial growth and, in particular, to a doubling in size of its College of Engineering.

To achieve its ambitions, the University needs to radically expand and enhance the quality and capacity of its research facilities. The University’s strategic vision is, therefore, to transform the existing estate into a fit-for-purpose, research-driven exemplar of a 21st century university, fully promoting and championing the student experience.

There is no option for the University to expand its existing site, but its prized location – opposite a beach, within a park – makes a wholesale move to a new site unattractive. A Campus Development Programme has consequently been designed to capitalise on the University’s growing research expertise and interactions with major, international, knowledge-based companies. The £250 million regeneration programme includes the development of a new Science and Innovation Campus, and the renovation and upgrading of the Singleton Campus.

Establishing the Science and Innovation Campus will enable the University to ‘break out’ of its current estate constraints, providing space for growth and facilitating increased collaboration with industry. It will deliver a next generation science park, co-locating University and industry researchers, students and academics – not only on the same site, but using the same laboratories and facilities. This model is already proving successful on the Singleton Campus through the Institute of Life Science.

Phase 1 of the Science and Innovation Campus will include:

• An Innovation Hub and Manufacturing Facility co-locating industry and College of Engineering research;
• Swansea Materials and Research Testing (SWaRT), a materials testing centre to include testing for Rolls-Royce of new and existing materials used in the aerospace and aero-engine industries;
• Undergraduate teaching and research facilities for the College of Engineering and School of Business and Economics;
• Student facilities, including an auditorium, retail, leisure and sports facilities;
• Learning and Resource Centre library and associated facilities;
• Residential accommodation for up to 1,000 students.

The Science and Innovation Campus will encompass academics and industry working together in shared space, supporting industry engagement within cluster areas focused on the Welsh Government priority areas of digital economy, low carbon, and advanced engineering. It will also stimulate collaborative opportunities with higher education and further education institutions, to produce high-calibre graduates with industry-relevant skills.

www.swansea.ac.uk/campus-development

Science and Innovation Campus

Funding secured from:

- Welsh Government £15m
- Welsh European Funding Office £15m
- European Investment Bank £60m
- BP £10m

Land renovated and donated by BP

Over 10 years, the full development will bring an economic impact in excess of £3bn.

Approximately 10,000 jobs will be supported.

It is anticipated that the construction process will stimulate over £430m of economic activity.
College of Arts and Humanities

At Swansea, the College of Arts and Humanities supports a balanced, sustainable portfolio of academic activities across a broad range of disciplines. Research is managed by our Research Institute for Arts and Humanities (RIAH) and is pursued in cross-disciplinary research centres, which showcase excellence in the literary, political and cultural fields.

Whilst there will always be a need for researchers in the Arts and Humanities to produce individual academic monographs and treatises, the College is actively engaged in the transfer and sharing of knowledge. Many of our interdisciplinary and collaborative projects have impact that goes far beyond the higher education community, and it is no longer unusual to find linguists collaborating with computer scientists, or Egyptologists sharing insights with engineers.

All research in the College considers impact in educational communities, but most projects have a public focus too, from informing policy nationally and internationally, to supporting the regeneration of industrial landscapes, and to creating new, interactive tools to explore language and literature. The transfer and sharing of knowledge is important and the College supports many collaborative projects.

Research clusters with an international focus include modern European languages and translation, digital communication, political and cultural studies, history and classics, and applied linguistics. Our strengths in Celtic studies – the history and literature of Wales in particular – provide numerous opportunities to engage with the Welsh higher education sector at national level, and produce detailed research exploring Welsh culture and heritage.

The Arts and Humanities are at the heart of what it means to be a university. Research in these areas enriches our understanding of culture, society, and beliefs, as well as helping us to shape our value systems and identity.

Professor Chris Williams,
Director, Research Institute for Arts and Humanities

Research centres and institutes:

- Research Institute for Arts and Humanities (RIAH)
- Richard Burton Centre for the Study of Wales
- Gallaghian Centre for the Study of Conflict, Power and Empire
- Centre for the Comparative Study of the Americas (CECSAW)
- Centre for Contemporary German Culture (CCGC)
- Centre for Medieval and Early Modern Research (MEMO)
- Centre for Research into Gender in Culture and Society (GERCAS)
- Centre for Research into the English Literature and Language of Wales (CREW)
- Centre for Research on the Narrative Literatures of the Ancient World (KYKNOS)
- Language Research Centre (LRC)

Research in the College attracts external income from a significant number of prestigious funding bodies (research councils, government and third sector organisations), including:

- Arts and Humanities Research Council (AHRC)
- British Academy (BA)
- Economic and Social Research Council (ESRC)
- Wellcome Trust
- Leverhulme Trust
- Cadw/Welsh Government
- European Regional Development Fund (ERDF)
- McDougall Trust
- Open Society Foundation
- Heritage Lottery Fund
- Nuffield Foundation
- Norwegian Ministry of Foreign Affairs

Research active staff
Postgraduate research students
Postgraduate Masters’ students
Undergraduate Students
International students

122
172
262
2,552
138
Overview
The College of Arts and Humanities (COAH) was established in 2009 when constituent departments formed larger teaching departments and pooled resources. At the same time the Research Institute for Arts and Humanities (RIAH) was established to nurture a specialist research environment for academics and research students.

The College encompasses five large teaching departments: English Language and Literature, History and Classics, Languages, Translation and Communication, Political and Cultural Studies and Adult Continuing Education. It is also home to the Acadami Hywel Teifi, a powerhouse for Welsh and Welsh-medium education.

In numerous ways COAH exemplifies the benefits of doing more together. With over 3,000 full-time students and – since the recent arrival of the Department of Adult Continuing Education – the same number of part-time students, the College has a lively, cross-collaborative research community that values teaching at the highest level and which prizes analysis, argument, and communication.

COAH has a strong tradition of teaching that is focussed on employability. In 2011/12, scholarships were available for Professional Preparation Masters designed to equip students with the skills needed to undertake jobs in fields such as creative writing, translation and interpreting. From the 2012/13 academic year postgraduate research students will have the opportunity to apply for a range of internships and knowledge exchange placements with national and international heritage organisations.

Recently-funded awards have been secured in History and Classics, Translation, Ancient Narrative and International Studies. Areas of further growth include the distance learning PhD programme in Applied Linguistics, Translation, International Relations, English and History. The College is a partner in the Welsh ESRC Doctoral Training Centre, holds an AHRC block grant partnership capacity building award and leads the History Research Wales initiative intended to strengthen postgraduate research capacity.

The College has recently hosted a successful Erasmus Mundus MA in Global Journalism with partners in Europe, the USA and Australia, and there are many agreements with universities in North America (16), in East and South-East Asia (18) and across Europe (48) involving student exchanges with partners in Europe, the USA and Australia, and there are many agreements with universities in North America (16), in East and South-East Asia (18) and across Europe (48) involving student exchanges.

Research Institute for Arts and Humanities
The Research Institute for Arts and Humanities (RIAH) nurtures a specialist environment for research and postgraduate study, bringing together academics, postgraduates and visiting scholars to create a rich and vibrant research community achieving international impact. Classified as an institutional ‘Centre of Excellence’, RIAH supports numerous areas of research across a range of academic disciplines from Creative Writing to Celtic Studies and is directed by historian, Professor Chris Williams. The Institute aims to provide an interface between internationally-recognised Arts and Humanities’ researchers and external partners, such as third sector and government bodies, business and other user groups. RIAH also facilitates the establishment of national/international knowledge exchange projects, consultancies and collaborative doctoral awards.

The creation of a hub for research in the College enables improved communication on research-related matters, enhanced support and mentoring for graduates and early career researchers, and a cross-collaborative research environment that is well-positioned to undertake work with a public impact focus.

RIAH’s key activities include the annual public lecture series, a major cross-disciplinary research seminar series, strategic partnerships with other Colleges and research groups in the University, and support for individual researchers and teams applying for external grants.

RIAH-supported research groups include the Centre for Contemporary German Culture, which produces world-class research on the literature and culture of 20th- and 21st-century Germany, Austria and Switzerland and the Centre for Medieval and Early Modern Research (MEMO), which brings together more than 20 scholars working in the fields of literature, history, philosophy, European languages and classical studies.

Research clusters which have an international focus include modern European languages, translation, digital communication, journalism, political and cultural studies, American studies, world history, medieval studies, classics and applied linguistics.

Currently, RIAH is supporting research funded by the AHRC, ESRC and EPSRC, by the Leverhulme Trust, the Wellcome Trust and the British Academy, and by government departments and agencies in Wales, the UK and beyond, including the Open Society Foundation. Since its inception in 2009, the Institute has significantly improved grant capture (over £2.5 million to date), the volume of research publications, public engagement and the visibility of Arts and Humanities’ research.

www.swansea.ac.uk/riah
The Richard Burton Centre for the Study of Wales

The Richard Burton Centre for the Study of Wales, named after the renowned stage and screen actor, was set up in 2009, and during its short history it has established Swansea University as the leading centre for the study of Wales. It brings together expertise in history, literature, politics and other disciplines to create a vibrant institutional focus for a critical mass of active researchers.

The Centre’s mission is to maximise collaboration across disciplines, to provide support for funding proposals and impact activities, and to develop institutional-wide and external synergies. The Centre also aims, through study and development, to make full use of the valuable collections held at The Richard Burton Archives in collaboration with Library Information Services and Systems, where the archives are housed.

The Richard Burton Diaries, edited by Professor Chris Williams, were launched by Yale University Press to international acclaim in 2012 following donation of Burton’s original diaries to Swansea University. The Raymond Williams’ papers have also proved to be a major attraction for international scholars, including Japanese researchers who are continuing work on Raymond Williams’ Long Revolution in Wales and Japan, a project that is led by the Director of the Centre, Dr Daniel Williams.

Other key members of the Centre include: Dr Kirsti Bohata, Professor Jonathan Bradbury, Professor Huw Bowen, Professor Tudur Hallam, Dr Martin Johnes, Dr Gwenno Ffrancon, Dr Bain Price, Dr Geraldine Lublin, Professor M Wynn Thomas OBE, and Professor Chris Williams.

RIAH hosts two flagship research centres - the Richard Burton Centre for the Study of Wales and the Callegghan Centre for the Study of Conflict, Power and Empire. The role of the Centres is to build areas of research strength through international and interdisciplinary collaborations and networking opportunities, to develop major bids for external grant funding, to provide a dynamic research environment for postgraduate and early career researchers and to nurture external contacts and partnerships.

While the Centre’s primary focus is Wales, it also has a distinct international flavour. Dr Kirsti Bohata’s multidisciplinary project on Amy Dillwyn funded by the Arts and Humanities Research Council (AHRC), the British Academy and the Learned Society of Wales has resulted not only in the deposit of the Dillwyn collection at the Richard Burton Archives but also in the development of a major strand of research on the transatlantic and scientific background of the Swansea-born novelist. In addition, a ‘Wales and Empire’ workshop in early 2012 led by Professor Huw Bowen, and attended by Manchester University Press, has led to a planned collaboration on Wales and Empire in 2013. A working group on Wales and India, bringing together scholars from English and History, is currently developing a themed seminar series to commence in 2013-14.

Close to home, Swansea’s 18th- and 19th-century history is the focus of research by Dr Louise Miskel, while sport historian Dr Martin Johnes, author of Wales Since 1939 (UP, 2012) is working with the Swansea City Supporters’ Trust on a unique community heritage project celebrating the Centenary of Swansea City Football Club (the Swans). The aim of the project, funded by the Heritage Lottery Fund, is to create an online archive in which the experiences of Swans’ fans will be recorded and preserved for future generations.

The literature of Wales is also one of the principal research strands of the Richard Burton Centre. The 15th-century poet, Hywel Dafydd, is the subject of a British Academy-funded project undertaken by Dr Cyndael Lake, whilst Robert Rhyys is working on the author and nationalist D J Williams. The centenaries of the births of authors R S Thomas (2013), Gwyn Thomas (2013) and Dylan Thomas (2014) will be marked by major events led by Professor M Wynn Thomas OBE and Dr John Goodby.

A prestigious AHRC fellowship totalling £86,000 was awarded to Dr Goodby to complete a new edition of the collected poems of Dylan Thomas for publication in 2014, the centenary of Thomas’s birth. Dr Goodby, an international expert on the poet, is also publishing the first full-length study of Thomas’s poetry to appear since the 1960s. The Poetry of Dylan Thomas: Under the Spelling Wall will be published in Spring 2013 with Liverpool University Press. The Centre’s research publications and projects, major conference programme and seminar series are complemented by a series of National Assembly Briefings, arranged by Professor Jonathan Bradbury, through which Swansea scholars present their current research to the Welsh Government. This highly successful series has public engagement at its core, further enhancing the already vibrant research environment of the Richard Burton Centre for the Study of Wales.

The Richard Burton Diaries

Interest in the Richard Burton Centre for the Study of Wales has intensified since the publication by Yale University Press in 2012 of The Richard Burton Diaries, edited by Swansea University Historian and Director of RIAH, Professor Chris Williams.

Richard Burton’s diaries, dating from 1939 until shortly before his death in 1984, were donated to Swansea University by his wife Sally Burton and now form part of the Richard Burton Archives. The volume presents in their entirety the surviving diaries of Richard Burton, which cover his career and the years of his celebrated marriages to Elizabeth Taylor. Diary entries appear in their original sequence, with annotations to clarify the people, places, books, and events he mentions.

The Diaries reveal a very different man from the acclaimed actor, international film star, and celebrity the world has come to ‘know’. From his private, handwritten pages there emerges a different person – a fully-rounded and a surprising burden of insecurity, which featured prominently in the Diaries.

The Diaries’ publicity and impact from the Diaries has included a three-day serialisation in the Daily Mail and feature pieces in the Daily Telegraph, the Daily Express, The Times and Sunday Times. The Diaries have been the focus of a 30-minute BBC Wales production, and featured in news items for BBC Wales and ITV Wales, in addition to continued coverage in local press. Internationally, the story has been covered in Europe, and as far afield as the Philippines, India and South Africa. In New York, Professor Williams conducted a live, primetime interview for the NBC Today show, which featured a seventeen-piece homage on the launch of the Diaries.

The publication of the Diaries strengthens the research focus of Richard Burton Archives which currently holds a world-class collection illustrating Burton’s illustrious career. These archives also house local and literary material as well as the South Wales Coalfield collections. This major research facility is not only open to scholars and students, but also welcomes enquiries from the public on research projects of personal or local interest.

www.swansea.ac.uk/richard-burton-centre

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www.swansea.ac.uk/richard-burton-centre
The Callaghan Centre for the Study of Conflict, Power and Empire

The Callaghan Centre produces world-class research, manages major Research Council-funded projects, and promotes collaboration between scholars, policymakers and cultural providers. As a hub for research activities under the themes of conflict, power and empire, it has a broad remit that reflects the diversity of research in the Centre. Under the direction of Professor Nicola Cooper, it brings together scholars and postgraduate students engaged in research projects on Callaghan-themed topics such as civil war, security and policy-making.

The Centre has held several Economic and Social Research Council (ESRC) grants for work in numerous areas, including counterterrorism, European (particularly Francophone) relations with China, and security in the Association of Southeast Asian Nations (ASEAN). In collaboration with Bath University, the Centre is working on an Arts and Humanities Research Council (AHRC)-funded project on cultural diplomacy, whilst other projects are investigating heritage protection in wartime, military veterans, and civil war.

The Callaghan Centre hosts major public lectures as well as collaborative workshops to share expertise with external organisations and key stakeholders and works closely with the Richard Burton Archives to utilise and promote its collections on the Spanish Civil War and the American Civil War.

Recent high-profile visitors to the Centre include Dr Bryan Ward-Parkinson (from Trinity College, Oxford), Pulitzer prize-winning historian Professor Alan Taylor, and Sir Alex Ferguson. Dr Bryan Ward-Parkinson visited the Centre to give a public lecture entitled ‘A Real Economic Meltdown: the End of Roman Britain’ that problematises ideas related to veterans. Both these publications are related to a 2009 conference organised by the Callaghan Centre which put ‘Military Masculinities’ under the microscope.

The Callaghan Centre is centrally involved with the AHRC/Wales Doctoral Training Centre, and has been hosting, and hosting with Cardiff University, training events related to identity politics, area studies, and postcolonialism. PhD students in China/Europe studies have been recruited, and new PhD studentships in the politics of the Arab Spring, particularly the politics of the new Tunisia, have recently been agreed.

Recent years have seen the regulatory regime of drugs come under increasing scrutiny. Dave Bewley-Taylor’s research offers an innovative scientific framework for understanding how the resulting policy shifts impact the global control system and constitutes a must-read for anyone interested or engaged in the drug policy debate. It is timely work that has practical application in the Americas and beyond.

Eduardo Medina-Mora, Ambassador of Mexico to the UK, Former Attorney-General and Secretary of Public Security of Mexico

The Centre also operates as the organising central locus for impact-driven research activities. For example, in 2012 he spent time in Kabul conducting research into the formulation of Afghan counter-narcotics policy. Dr Bewley-Taylor continually engages in a number of impact-driven research projects, and also uniquely investigate and emphasize the processes and triggers behind them. In an effort to increase the impact of its publications and help improve the interface between evidence and policy formulation, the Observatory will also convene seminars and policy dialogues.

Dr Bewley-Taylor’s research on the operation of the UN-based international drug control system has been, and remains, of great value in helping to understand and interpret the contemporary landscape. A growing number of States Parties to the UN conventions are moving away from a punitive approach to drug use, confronted with the public health and the security challenges (or consequences) of the policy followed for decades. Bewley-Taylor’s ideas on soft detection from the control regime and ‘regime weakening’ provide a useful conceptual lens through which to consider a global system more able to accommodate the complex and specific needs of individual nation states.

Ruth Dreifuss, Former President of Switzerland and Minister of Home Affairs, current member of the Global Commission on Drug Policy

The Callaghan Centre is producing evidence-based drug policy through the comprehensive and rigorous reporting, monitoring and analysis of policy developments at national and international levels. Acting as a platform from which to work out and engage with broad and diverse audiences, the Observatory will aim to improve the quality and horizons of the current policy debate, particularly among the media, the general public, elite opinion formers and ultimately within policy-making circles.

To this end it will engage in a number of dynamic and complimentary work streams producing a range of deliverables. These will include regular production and dissemination of accessible yet sophisticated high calibre policy briefs on a wide range of existing and emerging drug policy issues; construction and operation of an interactive website/news media platform; production of in-depth and rigorously researched policy reports that not only monitor policy developments over time but also uniquely investigate and emphasize the processes and triggers behind them. In an effort to increase the impact of its publications and help improve the interface between evidence and policy formulation, the Observatory will also convene seminars and policy dialogues.

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Copperopolis: History, Heritage, and Urban Regeneration

By 1851 Wales had become the world’s first industrial nation and the copper industry was at its heart. Welsh businesses led the global copper trade for almost a century, and their activities dramatically changed the fabric of communities and landscapes in Swansea and elsewhere.

In September 2010 Swansea University embarked on the ESRC-funded project ‘History, Heritage and Urban Regeneration: The Global and Local Worlds of Welsh Copper’ (£95,384) to tell the story of Welsh copper through a national travelling exhibition, websites, social media, 3D animations and a series of events. Project partners encompassed academia, the heritage sector, and local and national communities, including: the National Waterfront Museum, the Royal Commission on the Ancient and Historical Monuments of Wales, the University of Glamorgan, and the City and County of Swansea.

Led by Professor Huw Bowen (Department of History and Classics) this project examined the relationships between history, heritage and urban regeneration by combining recent academic research with contemporary issues that have arisen as a consequence of the Welsh copper industry. The project also sought to impact on local policy-making in urban regeneration, heritage and education, placing emphasis on contextualising the interpretation and care of the extensive industrial archaeological sites of world significance located in the Lower Swansea Valley.

Research findings have been communicated through a variety of media, bringing diverse benefits to public audiences locally, nationally, and internationally. A one-day Copper Festival in Swansea attracted 104,492 visitors.

Cu@Swansea

In January 2011, Swansea University entered into a partnership with the City and County of Swansea to explore ways of regenerating the site of the former Hafod-Morfa Copperworks. The development of the Cu@Swansea project, also under the leadership of Professor Bowen, has ensured that the research has been a key driver of a major regeneration programme, and in turn this has generated an income of over £500,000 in the form of Heritage Tourist Project grants from City and County of Swansea (£100,000), Swansea Area Regeneration Board (£150,000), Cadw/Welsh Government (£127,622), and the European Regional Development Fund (£243,450). These grants are being applied to improvements to the environment, infrastructure, and historic buildings on the site of the former Hafod-Morfa Copperworks, and this will enhance not only the visitor experience but also the quality of life of local people.

Plans for the site include the creation of a digital arts/science hub, a type of ‘Living History Laboratory’, where a range of digital, virtual reality, and handheld mobile technologies developed by researchers at Swansea can be applied to the interpretation and understanding of Swansea’s key contributions to Britain’s Industrial Revolution and the emergence of the modern global economy.

The potential wider significance of this project was noted in an RCUK report of June 2011 which concluded that ‘The example set by the research in Swansea could be used across the UK.’

www.welshcopper.org.uk

Uncovering the Demons of Ancient Egypt

Swansea University was awarded a Leverhulme Trust grant worth £158,000 to fund the ‘Ancient Egyptian Demonology Project: Second Millennium BC’ directed by Dr Kasia Szpakowska from the Department of History and Classics.

The project is exploring the world of demons in the 2nd millennium BC Ancient Egypt (2000-1000 BC) and one of its aims is to help develop criteria to map or construct an encyclopaedia, (or demonology), as no such resource currently exists.

In both the modern and ancient world, hostile demons are blamed for a host of physical and psychological afflictions, while helpful entities are called upon to aid the sufferer. But while much is known about temple religions and gods of Ancient Egypt, the darker side of Egyptian religion remains hidden. Luckily, many spells have survived that mention demons, and many images and objects remain that were used to fight them – these resources are crucial to the project.

One of the distinctive aspects of this project is that its usefulness will not end with 1st millennium BC Egypt. The database, or demonology, will be available for colleagues working on supernatural entities from other times and cultures, and this will allow an understanding of demonic entities through time.

This data pool will also be an enduring resource for the general public to search for information on ancient demons while a web-based innovative visualisation will allow them a glimpse into the, until now, hidden aspect of Ancient Egyptian life.

On a practical level, the objects that are included in the research will be classified allowing the public, and researchers, access to many objects that would have been previously unidentified in collections.

The Leverhulme-funded project will last for three years and during that time Dr Szpakowska, and her team, will be working in Swansea, and attending conferences in Egypt and North America.

Attached to the project are two fully-funded Leverhulme Trust PhD studentships and the successful applicants will join Swansea from 2013 under the supervision of Dr Szpakowska.
Precisely this outcome. True representation of an author’s intentions and author, cannot possibly be done justice in a word for word translation. David Jones, Business Development Manager, Wolfestone Translation Ltd.

Digital Tools to Explore World Culture

The world’s first prototype Translation Array has been developed by a team at Swansea University led by linguist Dr Tom Cheesman. Dr Cheesman was awarded an AHRC grant (£28,000) to create innovative digital tools for exploring world culture by comparing how the same text is translated differently many times, over time and space.

A crowd-sourcing website (www.delightedbeauty.org) was set up in 2009 to collect versions of one couplet from Shakespeare’s Othello in all languages, worldwide. Approximately 100 volunteer researchers, students, translators, and interested readers have so far participated, providing versions of the couplet in 25 languages, and demonstrating widespread interest in variation version.

At the new site www.delightedbeauty.org/vvv experimental interfaces enable users to explore one scene from Othello through 32 different German translations, dating from 1766 to 2010. As well as viewing the translations (with machine back-translations into English), readers can explore graphic visualizations of the differences among them.

The variations in the way Shakespeare’s work is interpreted in translations in different times and places can be used to identify and explore cross-cultural differences, as well as historical changes in a culture.

This collaborative project with far-reaching potential includes academics from Swansea University’s Departments of Languages, Translation and Communication, and Computer Science, as well as SaphyrMedia, and an interactive design company in Berlin. It was selected for a presentation at the annual world conference on Digital Humanities, held in Hamburg in 2012.

The new site was launched at Shakespeare’s Globe Theatre in London in September 2012 to a group of academics, PhD students (in Shakespeare Studies, Translation Studies and Digital Humanities), and journalists. Berlin-based designer Stephan Thiel, who is part of the project team, also attended and talked about the vast scope of the project. Translation Array has already received significant publicity in both mainstream media and trade press. The team are currently working on the findings of the research, and are considering many new questions about culture and history, and translation and languages; they are also putting together an application for £2 million of further funding.

Centre for the Comparative Study of the Americas (CECSSAM)

CECSSAM aims to bring together scholars and researchers who specialize in the Americas, Canada, the United States, the Caribbean, Central and South America. It seeks to promote, coordinate and provide a focus for comparative and interdisciplinary research on discourses such as cultural production (literature, film, art and music), history, society, politics and the environment.

CECSSAM aims to serve as a national and international network, building ties with other academic, cultural and business organisations, as well as NGOs, with interest and expertise in the region. The Centre hosts prominent speakers and colloquia, including a conference on ‘Villegas’s in 2011’, and brings together scholars working in diverse backgrounds.

Key Members of CECSSAM’s management board include Dr Lloyd H Davies (Director), Dr Patricia Rodriguez-Martinez, Dr Nina Wisselomeier and Dr Geraldine Lublin.

Dr Davies, a specialist in the literary representation of Peronism, women’s writing and the New Historical Novel, is a member of the UK-wide Standing Conference of Centres of Latin American Studies, and contributes to the formulation of national policy in this academic area.

Dr Rodriguez-Martinez specialises in Afro-Latin American poetry while Dr Wisselomeier is a specialist on comparative political institutions, with a focus on political parties, public opinion and political behaviour.

Patagonia is a relatively new area of interest for CECSSAM, but it is a future research direction that will reflect the Welshmedium research interests of Dr lublin, as well as Dr Roica Pirez Tattan, who has investigated bilingual education within the Welsh/Argentinian community in Patagonia. This research strand will also enhance the Centre’s cross-disciplinary remit, providing scope for collaborations with the Academi Hywel Tal, which drives Welsh-medium research and teaching across all six University Colleges.

CECSSAM has a well-established research seminar series and in the last academic year brought scholars to Swansea to deliver lectures on a range of topics from Welsh impressions of Portugal to political culture in Colombia and Venezuela. The Centre has a strong research trajectory in Latin American studies and has recently welcomed a number of new members, including postgraduate researchers working on such topics as social marginality and testimonial literature. A Latin American Postgraduate Research Day is planned for 2013-14.

The Centre has collaborated on a number of joint research projects and seminars, such as Professor Stephen Hart’s work on the contemporary Brazilian writer, Clarice Lispector, and maintains strong links with other Colleges, most recently with Geography (Professor D B Clarke) in the preparation of a major leverhulme bid on ‘The Value of Value’. Dr Wisselomeier has recently submitted a European Research Council (ERC) starting grant on political polarization, populism and social conflict. Through its association with local museums, art galleries and cultural centres, CECSSAM maximizes its public engagement activities with well-attended poetry recitals, theatrical performances, film festivals, and cultural workshops.

www.swansea.ac.uk/rsh/researchgroups/cecssam/

Centre for Contemporary German Culture (CCGCC)

The Centre for Contemporary German Culture (CCGCC) produces world-class research on the literature and culture of 20th and 21st century Germany, Austria and Switzerland. The Centre is unique in Wales and makes an important contribution to German Studies in Britain, Europe and North America. It aims to promote understanding of contemporary German-language authors and filmmakers in the English-speaking world.

In the last five years its work has been funded by the Modern Humanities Research Association, the AHRC, the Austrian Cultural Forum, and the German Academic Exchange Service.

The CCGCC is directed by Professor Julian Peace, other members include the WalesPoetryForum’s Managing Director, Dr Tom Cheesman, Dr Brigid Haines, Dr Katharina Hall and Professor Duncan Large.

The Centre hosts regular research seminars and has recently organised symposia on the author Ifka Peiper and German “Text Crime”, and two colloquia in collaboration with Leeds University on Religion (2008) and Building the Nation (2012), which attracted speakers from the United States, Canada, Australia, Croatia, Germany and Austria. It has also hosted visits from high-profile writers, such as Zdenka Becker, Peter Wawezmik and Siusi Tao. In addition, it overseas two publication series: the interlachen Contemporary German Writers and Filmmakers and the Wales-Swiss Series in Contemporary German Literature, both edited by Professor Peace and Professor Frank Finlay (Leeds) and published by Peter Lang. Dr Katharina Hall, editor, was awarded an Honorary Fellowship and to give a public reading. Müller was writer in residence at Swansea in 1995 and her return is her only reading. Müller was writer in residence at Swansea in 1995 and her return is her only reading. Müller was writer in residence at Swansea in 1995 and her return is her only reading.
Dr. Katarina Hall’s current research examines the representation of National Socialism and its legacies in transnational crime fiction. Through her blog Mrs. Peabody Investigates, which recently received coverage on Radio 4, Dr. Hall disseminates information about European and international crime fiction beyond traditional academic audiences, contributing to an enhanced public awareness of its cultural, social, and historical value. Established in January 2011, the blog has thus far generated over 115,000 hits and 1100 comments and facilitated mutually beneficial dialogues between a number of diverse stakeholders (readers, reviewers, bloggers, authors, translators, publishers).

mspeabodyinvestigates.wordpress.com/
www.swansea.ac.uk/riah/researchgroups/ccge/

Centre for Medieval and Early Modern Research (MEMO)

MEMO is an interdisciplinary research centre which brings together scholars from across Swansea University who have an interest in the following areas:

- Wales, England and the Marcher lands: borders and cultural exchanges
- Social, spiritual and cultural identities
- Health humanities: histories of medicine and the body
- Medieval towns and cities: urban and rural cultures
- Natural philosophy and history of ideas
- Language and multilingualism
- Modern Languages
- Social, spiritual and cultural identities
- History, Classics and Egyptology
- English Language and Literature
- Translation Studies
- Medicine and Midwifery
- Business Studies
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- Language and multilingualism

The main focus of MEMO is to provide an active and supportive intellectual environment for academic staff whose research is focused on the historical periods from Late Antiquity up to and including the Early Modern period and for postgraduate students interested in these areas.

Key members of the executive team include Dr Alison Williams (Director), and Associate Directors, Dr Liz Herbert McAvoy, Professor Daniel Power, Dr Deborah Youngs, and Dr Adam Mosley. Professor John Spurr and Dr John Law are members of the management board.

One of MEMO’s flagship events is its annual ‘Symposium by the Sea’, held each summer. This event’s symposium focused on an emerging area of interest for the Centre, the medical humanities and the representation of illness and disability in literature and images. The conference invited eminent keynote speakers from Arizona and York, but also encouraged junior postgraduate researchers to attend a series of workshops.

The significance of MEMO as a Centre for Medical Humanities has been recognised by the Wellcome Trust through a series of prestigious research funding awards, including a fellowship award of £83,084 to a project on cognitive impairment in the Middle Ages led by Dr Irina Matzler. This two-year project will uncover narratives of mental disability in medieval sources, investigating the constructedness of medieval terms involving madness and mental incapacity in general, and what modern scientific discourse calls cognitive impairment in particular.

Dr Matzler’s work sits naturally alongside the research of other Wellcome Trust-funded projects on disability and medical humanities. Dr Patricia Skinner has received a fellowship (€150,000) to develop her major new project ‘Losing Face: Facial Deformity in the Middle Ages’, while Dr Alison Williams has been developing research on Francois Rabelais’ Medical Humanist (€43,756).

Dr David Turner is co-director with Professor Anne Boroway (Human and Health Sciences) of a Programme Award for ‘Disability and Industrial Society: A Comparative Cultural History of British Coalfields, c.1780-1948’ (total value of award: €972,501) and has recently won Wellcome Trust-funded projects on disability and medical humanities.

MEMO also has a proven track record in public engagement. Professor Daniel Power, for example, has collaborated with Cadw-Welsh Government, Neath Port Talbot Borough Council, Royal Commission on the Ancient and Historical Monuments of Wales (RCAMHW), West Glamorgan Archive Service, Glamorgan-Gwent Archaeological Trust (GGAT), Neath Antiquarian Society and the Historical Association (Swansea Branch) on research on the Neath Abbey Estates. This project resulted in a Neath Abbey workshop that explored the Abbey’s architecture and archaeology. Further collaborative work on uncovering the past of this local landmark is planned.

www.swansea.ac.uk/riah/researchgroups/memo/

Centre for Research into Gender in Culture and Society (GENCAS)

Founded in 2003, GENCAS brings together staff and postgraduate students from across Swansea University who conduct research into gender, enabling members to share their expertise and work collaboratively. The Centre hosts conferences, symposia and workshops, provides a stimulating environment for PhD students, and runs a highly successful MA in Gender and Culture. GENCAS runs its own conferences and supports a number of public engagement events. For example, the AHRC-funded Elizabeth Montagu’s Letters project hosted an international academic colloquium ‘Bluestockings: The Social Network’ at Swansea University in June 2011 followed by public lectures on ‘Bluestocking Businesswomen’ at the National Waterfront Museum in an event in collaboration with the Swansea branch of the Historical Association. In April 2012 the network held a workshop with the librarians at the Huntington Library, California, entitled ‘Editing Enlightenment Letters: Elizabeth Montagu’s Correspondence’. In November 2012 the project organised its third conference in conjunction with King’s College London and the Victoria and Albert Museum in an event in collaboration with the Historical Association (Swansea Branch). In April 2012 the network held a workshop with the librarians at the Huntington Library, California, entitled ‘Editing Enlightenment Letters: Elizabeth Montagu’s Correspondence’. In November 2012 the project organised its third conference in conjunction with King’s College London and the Victoria and Albert Museum.

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GENCAS has a proven track record in public engagement and has won two of its most recent, high profile, awards made to Dr Kasia Szapokowska and Dr Jill Lewis (History and Classics). Dr Szapokowska’s Ancient Egyptian Demonology: 2K BC project, funded by the Leverhulme Trust, relies on the inclusion of a gendered analysis and Dr Lewis’s research on an Austrian socialist feminist and political activist in the interwar years in Vienna, Käthe Schirmacher, is funded by a research grant from the Viennese Chamber of Labour and the International Research Centre for Cultural Studies.

Centre for Research into the English Literature and Language of Wales (CREW)

CREW leads in the field of literary and cultural study and has developed an extensive programme of research and teaching. Alongside a number of collaborative projects that have increased grant capture from external bodies, the Centre hosts a busy postgraduate programme and vibrant postgraduate research community that has resulted in a generously-funded studentship from the Wellcome Trust

The Centre for Research in Ancient Narrative Literature (KYKNOS)

KYKNOS is the Swansea and Lampeter Centre for Research on the Narrative Literatures of the Ancient World and is concerned with all literary and cultural aspects of genres and texts which are intrinsically narrative.

The aim of the Centre is to stimulate, co-ordinate and promote research on the narrative literatures of ancient Greece, Rome, Egypt and the Near East through collaborative work, conferences and publications, and to form a focal point for national and international networks of scholars working in this field.

To further strengthen the work of the Centre, the MA in Ancient Narrative Literature was set up to provide a channel for high-quality students to progress to doctoral research in Swansea in the field of ancient narrative. In the last two years it has attracted students from the US, Norway, China and other UK universities, as well as all of its own graduates.

All members of staff and postgraduate research students working on any aspect of narrative literature within the KYKNOS remit, at Swansea and Lampeter, are automatically eligible for membership.

The Centre for Research in Ancient Narrative Literature (KYKNOS) has organised panels at the Celtic Conference in Classics, Edinburgh 2010 (‘Toldt Narratives’), with speakers from the US, France and Holland, as well as the UK, and at the Conferences of the Classical Association (Exeter 2012, Reading 2013); a one-day workshop on the presocratic Greek novel at Lampeter June 2012; and at the Conferences of the Classical Association (Exeter 2012, Reading 2013); a one-day workshop on the presocratic Greek novel at Lampeter June 2012, with speakers from the US, Belgium and Italy and regular research seminars in both Swansea and Lampeter.

One of the key strengths of KYKNOS is the stature of the Centre’s Associate Members who include scholars from the US, Canada, South Africa, France, Italy, Belgium, Israel, Greece, Russia, Germany, Japan and China. This has led to the recognition of Swansea as an international hub of ancient novel studies.

Projects on the horizon for KYKNOS include a major funding application to the AHRC for a research project on Hadodoros. Professor Morgan, Dr Raphat and Dr Herrmann will be working on the project and the aim is to produce a new critical edition and an original commentary, on four of the 10 books (Books 5-8) of the Aithiopika, a novel written in ancient Greek in the 3rd or 4th century CE. The intention is that this project will be the first stage in the production of an edition of this important text.

The Creative Writing programme’s staff and students contribute regularly to our literary programme. Not only do they launch new books and give readings from their work, but they are also instrumental in setting up new initiatives and events, and reviving old ones, most notably the Swansea-Cork exchange. The breadth of their work brings new people to the Centre each time and encourages audience crossover. Their impact on the cultural life of Swansea is enormous, the Swansea Literary Programme and all its audiences continue to benefit from this involvement.

Jo Farber
Director of the Dylan Thomas Centre
Academi Hywel Telfi

In 2010, Swansea University launched Academi Hywel Telfi (AHT), named in honour of Professor Hywel Telfi Edwards (1934-2010), former Professor of Welsh who served the University for over 40 years and is remembered as an outstanding researcher, public lecturer and broadcaster.

Academi Hywel Telfi brings together the Welsh department and the South-West Wales Welsh for Adults Centre, as well as Welsh-medium researchers from the Department of Translation and Digital Communication. The Academy is not only an academic department for Welsh, but it is also a promoter and facilitator of Welsh-medium teaching and research across all six University Colleges.

Directed by Dr Gwennol Ffroncon with Professor Tudur Hallam (Professor of Welsh) as its Head of Research, the Academy has its own interdisciplinary research forum, Seminar y Gymraeg (the Welsh-language seminar which supports the Richard Burton Centre for the Study of Wales).

Research interests within the Academy include applied linguistics (including Welsh for Adults), literary criticism, poetics, heritage, creative writing, textual analysis and editing, theatre, radio, film, television and animation.

Steve Morris of AHT co-ordinates the national Welsh for Adults Centre and has served on the editorial board for several projects in the field of second-language acquisition.

Current research projects in AHT include:

- Dr Aynael Lake’s scholarship edition of Hywel Daith, the only major 15th century Welsh poet whose work remains to be edited, which is funded by a prestigious British Academy Mid-Career Fellowship.
- Dr Lake was part of Swansea’s AHT-funded daddyddwpwyln.net project and is also developing a website to present the life and ballads of Huw Jones, Llangwm, the subject of his monograph in 2009. Professor Tudur Hallam was awarded a scholarship by the Saunders Lewis Memorial Trust and will publish a monograph on the playwright’s work in 2013 entitled Saunders y Dafydddydd, a subject which was also the focus of his public lecture sponsored by the Learned Society of Wales at the National Library in 2012. That same year, Steve Morris and Hanns Groth created an important report on Welsh learners’ comics and networks, commissioned by the Welsh Government, and Morris is currently involved in several projects in the field of second-language acquisition.

Key members at the Academy have secured funding from various bodies to support short sabbaticals to concentrate on creative writing, and 2013 will see the publication of Dr Christine James’ first volume of poetry, coinciding with her inaugural year as Archivist at the National Eisteddfod. Recently successes in the field of creative writing in Welsh by AHT and colleagues in the English department saw Howell’s Ensii Trl, the commemorative poem to Hywel Telfi which was awarded the Chair at the National Eisteddfod in 2010, Dr Filfr Dafydd’s novel, Y Sylfaen, which won the Daniel Owen prize in 2009 and was officially the Welsh Book Council’s bestselling volume; and more recently Jon Gower’s Welsh Book of the Year, Y Sienin, in 2012, and Gwerneth Lewis’s Ymys, which won her the Crown at the National Eisteddfod in 2012.

Several academic journals and publications are edited by members of AHT, and include Francon, co-editor of Cyfryng Media Wales Journal, with John Jewell of Cardiff University and Lisa Lewis of Glamorgan University (08), supported by board members Dr Ian Price and Prof Vaughan Williams, Hallam co-directs the Yr Ymag Beirniad series with Angharad Price of Bangor (12). Lake co-edits D воздух with Blodwyn Huws of Aberystwyth (995). Robert Rhys has served the editorial board of Y Fyddiad, and Bwn, the current affairs publication, for a number of years; Dr Christine James, former co-editor of Tâlisen, is on the editorial board of Y Llyfrgell Cenedlaethol.

In 2012, Academi Hywel Telfi hosted two distinguished lectures in the field of Celtic Studies, the Ó'Donnell’s and the J E Cawrwn Williams memorial lecture. That same year, Dr James delivered the Griffith John Williams memorial lecture at Cardiff University, and Professor M Wyyn Thomas OBE was invited to deliver the televised Hywel Telfi memorial lecture at the National Eisteddfod. Forthcoming distinguished lectures in 2013-14 include: Dr Lake, invited by the Centre for Advanced Welsh and Celtic Studies to deliver the T H Panny Williams memorial lecture, and Professor Hallam, invited to deliver the British Academy’s Chatterton lecture on poetry in London.
Recent and Forthcoming Publications: A representative selection of the diverse productions produced across the College of Arts and Humanities is given below.

Wales Since 1939 (2012) was published by Manchester University Press and written by leading historian, Dr Martin Johnes, Head of History and Classics. It is the first major survey of Wales in this period and has a particular emphasis on social history and national identity. This highly readable work will be a core text on many programmes of study, but it also offers a complete, objective and modern survey of Wales that is interesting to the cultural historian and anyone wanting to find out more about the development of Wales in recent times.

Oxford University Press has published Professor Michael Franklin’s book ‘Orientalist Journeys: Sir William Jones, Post-Lawyer and Linguist’ (2011). Professor Franklin, from the Department of English Language and Literature, conducted extensive archival research to reveal new insights into this radical intellectual. Unpublished poems and new letters shed fresh light upon Jones in rare moments of relaxation and Professor Franklin’s research of the legal documents in the courts of the King’s Bench, the Court Martial and the Supreme Court of Bengal illustrates Jones’ passion for social justice, his legal acumen, and his principled independence.

Dr David Turner from the Department of History and Classics has won an award to complete a new edition of the collected poems of Dylan Thomas for an early 21st-century context. Oxford University Press will be publishing ‘Dylan Thomas: Collected Poems 1914-1953’ in Spring 2013 with Liverpool University Press. Both works aim to reinterpret Dylan Thomas in an early 21st-century context.

The Philosophy of Social Science: Case and Method in the Digital Age (2011) published by Palgrave Macmillan is written by Senior Lecturer in Digital Media, Dr David M Berry. Publishing widely since he joined the College, Dr Berry’s research covers a broad theoretical area problematising questions raised by the computational, from software studies to ‘the computational turn’ in Arts & Humanities and Social Sciences (e.g. Digital Humanities), he is a noted expert in his field.

Cambridge University Press has published Dr Kiepe-Peters’ book ‘The Mental and Social History of Youth in Sierra Leone’ (2011). Based on extensive fieldwork periods during and just after the war, the text includes numerous interview extracts with young and under-age combatants, and a discussion on the so-called ‘crisis of youth’ which currently manifests itself in Sierra Leone as well as other African countries. The book is chosen for an honourable mention in the category of best book published on African politics in 2011 by the African Politics Conference Group (APCG). Dr Peters’ current research focuses on armed conflict and post-war reconstruction in Africa and drug trafficking in West Africa. He has previously provided consultancy services for a number of international organisations including the World Bank and the Institute for Security Studies.

The Red Army Faction or the Baader-Meinhof Group (1970-1998) has been the subject of a very large number of German and international novels, from serious literary fiction to bestselling thrillers. Through an analysis of plot lines, recurring character types, narrative disavowals and omissions, and adaptations of national classics, Professor Piecee’s study reveals an unease at the heart of the democratic settlement in the Federal Republic. ‘Baader-Meinhof and the Novel’ sheds new light on the emotional character of post-war Germany, its troubled relationship with its own past and the authority of the state. It is the first book to examine this rich literary corpus, treating it as a political unconscious which expresses submerged anxieties and moral blind-spots in Europe’s most powerful country.

Together with Alan D Schilt (Grenfell College), Professor of German Duncan Large has taken over the General Editorship of The Complete Works of Friedrich Nietzsche, published by Stanford University Press. This is the first English edition to include the fragments and variants from Nietzsche’s notebooks. One volume appeared in 2012, another is in press, and a total of 19 volumes will appear by the end of the decade.

The surviving diaries of Richard Burton, dating from 1959 until shortly before his death in 1984, were donated to Swansea University by his wife Sally Burton and now form part of The Richard Burton Archives. Historian Professor Chris Williams, Director of RAH, was invited to edit the diaries and the volume has just been published by Yale University Press (2012). It presents in entirety the surviving diaries, which cover his career and the years of his celebrated montages to Elizabeth Taylor. Diary entries appear in their original sequence, with annotations to clarify Elizabeth Taylor mentions.

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The Postgraduate Research Community

Academic and professional development is an integral part of the student experience in the College: and its importance has been recognised by the development of a Graduate Centre within the Research Institute for Arts and Humanities (RIAH). The Graduate Centre offers a vibrant and supportive environment for students pursuing postgraduate research and taught masters study.

Postgraduates in the College have access to state-of-the-art facilities, opportunities to attend postgraduate training, to enhance academic and professional development, and the chance to participate in seminar programmes, workshops and international conferences. All postgraduate students enrolled in Arts and Humanities subject have access to an allowance for conference participation and research trips.

RIAH has recently awarded a number of College-funded masters and PhD studentships and a further seven were sponsored by the Arts and Humanities Research Council (AHRC). Some of the projects to which the students will be attached, such as a project linked to Port Talbot steelworks, focus on Wales and have a high-level of public engagement, while other studentships offer professional skills and are designed to meet the needs of the employment market.
Researchers in the College of Business, Economics and Law share a commitment to undertaking research that makes a significant contribution to the way we understand the systems that shape our world; many working within the Research Institute for Applied Social Sciences (page 22), which fosters an effective interdisciplinary approach.

Our research portfolio covers areas as diverse as empirical work on stock market and foreign exchange markets, to labour market economics, and fraudulent claims in insurance law. The broad spectrum of research activity underpins several globally prominent research centres and groups, which avoid the academic introversion of single disciplines and embrace interdisciplinary approaches that promise greater understanding of societies and communities.

These are, after all, challenging times that require close engagement from researchers in all aspects of business, economics and law. In this regard the College is informing policy development that will impact on issues such as economic inactivity and social inclusion and is undertaking research that will help to improve business productivity. We are also producing work that tackles some of the social issues that arise as a result of recession and unemployment: crime, health, social inequality and community cohesion.

The School of Law also hosts the Wales Observatory on Human Rights of Children and Young People, and IP Wales, an innovative initiative designed to promote the knowledge economy in Wales.

Research in the College attracts funding from a significant number of prestigious funding bodies nationally and internationally. These include the:

- Higher Education Funding Council for Wales
- Economic and Social Research Council
- British Academy
- Welsh Government
- Department of Trade and Industry
- Advanced Institute for Management
- Australian Research Council (ARC)
- Leverhulme Trust
- Economic Society
- Hans Beekhler Foundation
- Social Sciences and Humanities Research Council of Canada
- Department of Work and Pensions
- Low Pay Commission
- Sector Skills Development Agency
- Equal Opportunities Commission
- Department of Justice
- European Social Fund

The School of Law hosts several research centers that focus on various areas of legal, economic, and business studies. These centers are:

**Research Centres and Institutes**

**Research groups in Business include:**
- Centre of Consumer Confidence Studies (COCS)
- Finance and Risk Management
- Institute for Entrepreneurship and Leadership (IFEL)
- People, Organisations and Work
- Marketing
- Centre for e-Business Research (CebBR)
- Technology and Innovation Management

**Research groups in Economics include:**
- Labour Economics
- Macroeconomic Theory and Time Series Econometrics
- Transitional Economies and International Development
- Welsh Economy Labour Market Evaluation and Research Centre (WELMERC)
- Wales Institute of Social and Economic Research, Data and Methods (WISERD)

**Research centres in Law include:**
- Centre for Criminal Justice and Criminology
- Centre for Environmental and Energy Law and Policy
- Hywel Dda Institute
- Institute for International Shipping and Trade Law
- Richard Price Centre for the Study of International and European Law

Furthering our understanding of the legal, economic and business environments is integral to supporting growth in the regional and national economy, and Swansea’s researchers are at the forefront of this effort.

Professor David Blackaby,
Director of Research, College of Business, Economics and Law

College of Business, Economics and Law

We believe that one of the most important things we do is educating the next generation of global citizens for the big challenges ahead. This in our view is one of the most fundamental of missions a university can undertake. Our research, much of it world leading, not only informs our teaching but also deals with some of the most pressing and relevant issues facing societies today.
The College of Business, Economics, and Law (CBEL) was formed in 2010 with the bringing together of the University’s School of Law and the School of Business and Economics. The discipline of Criminology came to the School of Law and adds substantial social science depth to research and teaching relating to institutions of criminal justice. Within these disciplines are a number of flagship research centres and research groupings, some of which are among the top in their fields with substantial global reach and reputation.

Two of the College’s most dynamic and significant areas of research are in international shipping and trade law, and labour economics.

Institute for International Shipping and Trade Law

Law at Swansea has always been the subject of a dialectic that focuses on the most profound of human interactions on a global scale and also on the regional and the local, where law affects the lives of individuals most directly. Swansea law School’s research centres reflect this dual focus.

A prominent example of globally oriented research is in the Institute for International Shipping and Trade Law (IISTL). The Institute’s staff are extensively cited by courts and the law Commission, and the Institute enjoys significant influence in the legal profession, with extensive ties to City law firms which respect its expertise and use its research.

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Dr Richard Caddell is working on a book addressing the legal protection of marine mammals and a series of articles examining the role of the Welsh Government in the promotion of the marine environment. Dr Arwel Davies is engaged in comparative work on state liability for judicial conduct, and Dr Theodora Nikaki is working on a publication that will evaluate the legal regime relating to multimodal transport. Professor Baris Soyuer is writing about the legal aspects of insurance fraud, and Professor Andrew Tattenborn is preparing a new edition of Manser’s Collisions at Sea.

IISTL runs an annual international colloquium attended by academics and lawyers, including many lawyers from the City of London and from Europe, which results in an annual book. The colloquium is funded by IISTL’s Law, the most prestigious of publishers in the field. The eighth colloquium, in September 2012, was on the law relating to carriage of goods, and the speakers included the Honourable Mr Justice Blair of the High Court of England and Wales. The 2011 colloquium was on pollution at sea, and the papers have been published in a book by Informa, entitled Pollution at Sea: Law and Liability. The book included 15 chapters written by practitioners, industry experts and academics and is edited by Professors Baris Soyuer and Andrew Tattenborn, with a foreword by The Hon Mr Justice Tindale of the Royal Courts of Justice.

Labour Economics

The Department of Economics has a longstanding tradition of world class research, with Labour Economics a major research group within the field.

Dr Nigel O’Leary, with a foreword by The Hon Mr Justice Tindale of the Royal Courts of Justice.

Labour Economics

The Department of Economics has a longstanding tradition of world class research, with Labour Economics a major research group within the field. Labour Economics has attracted financial support from a number of government departments and agencies. The Welsh Economy and Labour Market Evaluation and Research Centre (WELMERC) has been funded by the European Social Fund since 2001, maintaining strong links with policy makers in the National Assembly, interested in evidence-based policy advice. Economics undertakes cutting-edge research on regional economics, the economics of disability, the economics of education, and incentives and worker performance.

Closely aligned with research in Labour Economics, the Wales Institute of Social and Economic Research, Data and Methods (WISERD) is a major investment in research infrastructure in economic and social sciences across Wales. Swansea economics and business staff play a leading role in WISERD, whose research focuses on international comparisons within Wales, as well as cross-national comparisons between Wales and other regions and nations in the UK and internationally. Of particular succe is WISERD research on Swansea and the impact of policies on wellbeing, productivity, competitiveness, innovation and regional inequalities.

The labour Economics group collaborates with colleagues in both the UK and overseas. Three recent examples include an ESRC-sponsored project on Graduate Over-Education and Economic Performance which is jointly being carried out with the University of Melbourne, Australia; a European Union Framework 7 Collaborative Research Programme on Health and Safety at Work, and other work he has done on the effect that computer use has on earnings and compensating wage differentials. In the area of disability and the labour market, Dr Melanie Jones and Professor Peter Snaize have estimated the impact of health on labour market outcomes and have considered the effects of the Disability Discrimination Act on access to the labour market for the disabled.

Research by Professors Blackaby and Murphy and Dr O’Leary in connection with the Spatial Economics Research Centre, based at the LSE, seeks to explain why disparities exist in economic growth and prosperity at different spatial levels including regional, city-region, local, and individual neighbourhoods. Moreover, it seeks to influence and improve policy decision-making at national and local levels.

Research on labour markets and employment undertaken in Swansea has also considered a variety of other issues, including employment tribunals, pay incentive schemes and returns to higher education. Furthermore, the recent appointments of Dr John Moffat, Dr Mamata Parhi and Dr Catherine Robinson in the area of industrial economics has broadened the scope of the microdata analysis into the related areas of firm performance, productivity and innovation.
The College produces research that has substantial relevance to law, policy, society and organisations. The following pages demonstrate the significant impact that College research has on individuals and groups within the global people and society.

Business

People, Organisations and Work

The People, Organisations and Work (POW) research group is an internationally recognised group of multidisciplinary researchers who investigate the human dynamics and relationships found in organized work contexts. POW, under Director Professor Alison Pullen, encompasses the subject areas of organisation studies, critical management studies, human resource management, international business, organisational psychology, and industrial relations. POW members are known internationally for leading scholarly debates in and around ethics, politics and gender, and conduct empirical research in public and private, international organisational contexts. The group’s research has been funded through a variety of prestigious funding bodies, nationally and internationally, including the Department of Trade and Industry, the Advanced Institute for Management, the Economic and Social Research Council, the Australian Research Council, the Welsh Government, the Leverhulme Trust, the Economic Society, the Hans Boeckler Foundation, and the Social Sciences and Humanities Research Council of Canada.

As an example of POW’s dissemination work, in July 2012, POW hosted a colloquium, The Art of Caring. Dwelling, Affective Relationality and the Organisation of Hospital Work, an interdisciplinary gathering of European researchers and policy makers across the social sciences, management, and health care, to deal with the fundamental challenges of caring for the elderly in acute hospital settings.

Gender and diversity at work form a significant part of POW’s research. POW has undertaken empirical work on gender and equality in public accounting firms, health care organisations, the manufacturing sector and utility organisations worldwide. Professor Pullen and Dr Sheena Vachhani have worked on issues of gender, ethics and power relations in organisations. Dr Helen Williams investigates difference and diversity from the discipline of organisational psychology. POW research has also focused on gendered ways of researching and writing, the relationship between men and masculinity, and women and leadership. Groundbreaking research has been conducted on the subjectivity of employees, middle managers and senior executives, including the ethical and political nature of managing identity at work.

POW members conduct important research on human resources and international management. This research theme, led by Professor Yaw Debrah, examines the multifaceted ways that global competitive forces impact on organisations and human resources in both developed and developing/transition economies. Among other issues, it explores how multinational corporations (MNCs) deal with cross-cultural management issues, MNCs and talent development and how MNCs seek to transfer human resource management (HRM) practices and strategies, knowledge, technology and people across national borders. Professor Debrah has organized strategic responses to changing global and environmental forces with particular reference to the construction and aviation industries in Africa, and Dr Karen Williams has investigated the internationalisation strategies of European food retail multinationals and the impact on work and employment relations.

POW research also deals with the relationship between individuals and the collective. Dr Geraint Harvey’s work on the role of trade unions in the airline industry falls within this category, as does Dr Vachhani’s analysis of worker identity in the manufacturing industry and Dr Helen Williams’ work on the psychology of teams in manufacturing and health services.

Finally, POW investigates the management and organisation of health care. Dr Karen Williams is engaged in comparative research on health care coordination across Europe, with a specific interest in cancer care. Professor Pullen has conducted empirical research in the UK National Health Service focusing on issues of boundary management between professional groups, ethics and working relationships between general practitioners and nurses, and the role of executive women in health care management. Dr Vachhani is exploring the relationship between patients and bodies in cancer care treatment in South West Wales Cancer Network. Members of the School of Business Technology and Innovation Management Research Group, Professor Michael Williams and Navoni Mustofa, are working with Aberystwyth Bio Mangenmy University Health Board in a study of the planning of bed capacities at the Cardiac Intensive Care Unit at Morriston Hospital in Swansea.

Economics

Understanding the Welsh economy

Published research by Swansea economists substantially influences public policy.

Professor David Blackaby sits on the NHS Pay Review Body which makes recommendations on pay issues to the UK Government covering over one million employees working in the NHS. He is a member of Nuffield Trust Advisory Group for research on NHS Workforce, and within Wales as a member of Dr Stephen Drinkwater, of the Joseph Rowntree Foundation’s Wales Poverty and Ethnicity Advisory Group. He also sits on the Welsh Government’s Economic Roundtable Discussion Group for the Minister for Business, Enterprise, Technology and Science, and in January 2010 he was invited to participate in a roundtable discussion on the future of economic strategy in Wales resulting in the Economic Renewal Programme.

In March 2009 Professor Blackaby and Professor Phil Murphy provided evidence and were interviewed by the Enterprise and Learning Committee on unemployment and the recent recession. Professors Blackaby and Murphy, Dr Drinkwater and Dr Catherine Robinson were invited to provide evidence to the Welsh Assembly Select Committee on Inward Investment in Wales. Reflecting on their research on the Welsh economy and the labour market in particular, members of the team have been in demand by the press and media to help interpret economic events. Since 2008, they have undertaken many television and radio appearances, as well as numerous interviews for the press.

Building on an extensive list of published papers in regional and labour economics in its very active research centre, and research grants totalling £2.4 million, Swansea Economics has produced over 30 reports and has impacted on policy, including the introduction of the ProAct programme in Wales, underfunding of Wales through the Barnett formula, resulting in a request for an extra £300 million (Holhnam Commission), and the debate initiated by the Chancellor of the Exchequer in 2011 for more market facing pay for over 6 million public sector employees in the UK.

One of the most significant areas of research by Swansea economists has been that of identifying Barriers to Economic Activity in Wales, work commissioned by the Welsh Government published initially in 2003 and 2004 and uploaded to the Welsh Government website in 2010. The UK Government has taken on board recommendations from the report, and it was cited in Government reports including in A Review of Local Economic and Employment Development Policy Approaches in OECD countries, OECD 2008. The report also noted the importance of redundancy for increasing inactivity in Wales, the role of training, and wage subsidies in reducing unemployment. During the current recession, the Welsh Government introduced the ProAct and ReAct programmes (estimates suggest 10,000 jobs were safeguarded in Wales). The ProAct programme is unique in the UK and involves offering wage subsidies and funding for training to firms to keep workers in employment that they would have made redundant.

In 2009 Swansea economists provided influential evidence to the Holtham Commission, which was looking at fairness and accountability in the funding settlement for Wales. The Chancellor of the Exchequer announced in the Autumn Statement of 2011 that the public sector pay freeze would come to an end in 2012-13, with public sector pay awards of 1 per cent planned over the next two years. Research by Swansea economists, Professors Blackaby and Murphy, and Dr Nigel O’Leary was quoted in the evidence of the Welsh Government to the Pay Review Bodies and appears on the Office of Manpower Economics website. The Welsh Government commissioned economists at Swansea in 2010 to lead Professor Murphy and involving Professor Blackaby, Dr Melanie Jones, and Dr O’Leary at Swansea and Richard Marsh of Verso Economics to undertake research aimed at improving understanding of the likely labor market implications of introducing a living wage policy in Wales.
Reducing labour market inequalities

Research undertaken in Swansea has also had a major impact on policy relating to inequalities in the labour market. This research relates to many dimensions of inequality including gender, age, ethnicity, religion, sexual orientation and disability; as well as to educational outcomes, covering all the main categories identified in the Equality Act 2010 as protected characteristics. This research has had an impact at several levels including funding received to carry out research for a range of government departments and other organisations and at the policy level, relating particularly to the increased interest by policy-makers in labour market performance of ethnic minorities in the UK and its links with poverty. Swansea economists have undertaken research on gender pay inequality and occupational segregation for the Equal Opportunities Commission and the Welsh Development Agency, disability and the labour market for the Department for Work and Pensions (DWP) and the Welsh Government, and on these areas for the Equality and Human Rights Commission (EHRC). This latter report was the main news item on virtually all of the Welsh media on the day that it was launched in May 2011. The EHRC’s Commissioners for Wales, Baroness Onora O’Neill has described the report as “groundbreaking”.

Macroeconomic Theory and Time Series Econometrics

The Department of Economics maintains a strong research grouping in macroeconomic theory and time series econometrics. Research on macroeconomic theory is mainly on central bank behaviour and optimal monetary policy. Given the Department’s overarching theme of labour economics, some of the work of this group is examining the connection between macroeconomic policy, wages and unionisation. There is also substantial themed research on the role of central bank disclosures policy in macroeconomics.

Time Series Econometrics is a significant area of research, with many research articles published in major international academic journals. In addition, members of the group occupy editorial positions on a range of international journals. Professor Steve Cook is a member of the editorial boards of Applied Economics, Applied Economics Letters and The Open Urban Studies Journal.

In the area of unit root testing and cointegration analysis, Professor Cook and Dr Dimitrios Vougas produce research on:

Invariant and Logrange Multiplier based unit root testing,

Threshold Autoregressive (TAR) and Momentum Threshold Autoregressive (MTAR) based testing procedures,

development, examination and application of smooth transition unit root tests,

behaviour of modified unit root and cointegration tests in the presence of outliers and structural change,

use of alternative estimation procedures.

The relevance of the research undertaken has been emphasised via its application to numerous national and international economic and financial time series. All members of the group have undertaken research, both jointly and independently, in the area of financial econometrics. While Dr Vougas has undertaken a number of projects examining the Greek Stock Index Futures Market, Professor Alan Speight has written widely on the modelling and forecasting of volatility in high frequency data. Professor Speight also researches the highly topical issue of real-time risk pricing which has generated a number of research articles. Research by Professor Cook has investigated the impact of conditional heteroskedasticity upon the properties of commonly employed hypothesis tests and the development of alternative methods of incorporating time varying variances within existing testing procedures.

The analysis of non-linear and asymmetric behaviour is a further research theme with the time series econometrics group. Professors Cook and Speight have examined asymmetric and non-linear behaviour in a range of international macroeconomic time series using a variety of methods.

Research on macroeconomic theory by Professor Phil Lawler and Dr Jonathan James has focussed principally on issues relating to central bank behaviour and optimal monetary policy design. Related research by Dr Joshay Easaw seeks to gain a better understanding of the role of expectations on the macroeconomy.

Research undertaken by staff has had significant impact on the making of Welsh Government policy and law on Wales.

Bilingual juries in Wales and Ireland

Professor R Gwynedd Parry’s research demonstrates that significant impediments face speakers of languages other than English when seeking to use their own language in legal proceedings. His work has become an important point of reference in discussions of the status of minority language speakers in legal processes, and in particular in jury trials. Professor Parry’s research has been cited in a report on criminal justice by the Lord Chancellor’s Standing Committee on the Welsh language, by the then Senior Presiding Judge of Wales, The Hon Mr Justice Rodrick Evans, in his evidence to the Richard Commission on devolution, and by the House of Commons during the first reading of the Bilingual Juries (Wales) Bill, by the UK Ministry of Justice, by the Law Commission of Ireland, and is influential in a case before the Irish Supreme Court.

Youth justice and Risk Factor Prevention

Research and critical analysis by Professor Kevin Haines and by Dr Stephen Case on the Risk Factor Prevention Paradigm (RFPP) has contrasted the methodological validity of a wide body of international risk factor research. It has produced insights into the paradigm, leading to fundamental challenges and changes of direction for research, and contributed to a wide critique of risk factor research (RFR) which, in their case, has led to the articulation of an alternative paradigm. This work has led to a review of assessment and intervention planning in youth justice by the Youth Justice Board for England and Wales (YJB). It has provided evidence which has led the YJB to abandon “risk” as the central animator of youth justice policy and practice, and provided further evidence which underpins the YJB’s new framework for assessment and intervention planning in youth justice.

In 2009, Professor Haines and Dr Case’s critique of RFR and the application of the RFPP in youth justice was published as a monograph under the title Understanding Youth Offending: Risk Factor Research, Policy and Practice. Before and after publication, they engaged with the Chief Executive of the YJB in a series of informal discussions about the findings emerging from the research underpinning the book which led to a decision to integrate a review of current policy and practice. The Chair of the YJB stated, that he believed “this is a moment to pause and think about the fundamentals that underpin our [YJB] approach to assessment”. The Case and Haines research was instrumental in the YJB’s formulation of a new assessment and intervention planning framework which quite closely aligns with their research.

Furthering the human rights of children and young people in Wales

An emerging research area in the School of Law is Human Rights law, with staff developing an international reputation for children’s rights. A conference, funded by the Welsh Government on Children’s Rights: Wales and the World, attracted attendees from Argentina and a number of other countries. The conference saw the launch of the Wales Observatory on Human Rights of Children and Young People. The research undertaken by staff has had significant impact on the making of Welsh Government policy and law in Wales.

Law

Bilingual juries in Wales and Ireland

Professor R Gwynedd Parry’s research demonstrates that significant impediments face speakers of languages other than English when seeking to use their own language in legal proceedings. His work has become an important point of reference in discussions of the status of minority language speakers in legal processes, and in particular in jury trials. Professor Parry’s research has been cited in a report on criminal justice by the Lord Chancellor’s Standing Committee on the Welsh language, by the then Senior Presiding Judge of Wales, The Hon Mr Justice Rodrick Evans, in his evidence to the Richard Commission on devolution, and by the House of Commons during the first reading of the Bilingual Juries (Wales) Bill, by the UK Ministry of Justice, by the Law Commission of Ireland, and is influential in a case before the Irish Supreme Court.

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The research of Dr Simon Hoffman and Jane Williams has been highly influential in the drafting of innovative new legislation. The Rights of Children and Young Persons (Wales) Measure 2011. The Measure is the first general legislative measure of implementation of the United Nations Convention on the Rights of the Child (UNCRC) in the UK. Hoffman and Williams provided intellectual capital, advice and advocacy to support the National Assembly for Wales in enacting the law. The new law gives further legal effect to international human rights obligations within one part only (Wales of a State party to the UK to a treaty). The key mechanism is a ‘due regard’ duty binding on Welsh Ministers. This concept, which influenced Scottish Ministers’ recent consultation on Scots law reform, has been taken up by a coalition campaigning for UK-wide law reform and has attracted international interest. The law obliges Welsh Ministers, when exercising any function, to have due regard to the requirements of the UNCRC and its protocols.

Influencing practices by probation services

Swansea criminologist Professor Peter Raynor’s research on the Level of Service Inventory-Revised (LSI-R) has been influential, and is a quantity survey of offender attributes and situations relevant to their supervision and treatment, and has led to the use of new assessment methods by probation services for thousands of criminal offenders in several jurisdictions and new approaches to measuring the risk of re-offending. His research has also led to a comprehensive evaluation of outcomes by the probation service in Jersey.

Influence of case law and national legislation in maritime, trade and shipping law

For a legal scholar’s work to be cited by a court or a law commission is a significant achievement. In Sinclair v. Versailles [2011] EWCA Civ 347, the Court of Appeal referred to and endorsed the argument of Professor Andrew Tatt cannons in law of restitution in England and Ireland that an agent’s secret profit is not only owed to, but held on trust for, the principal, thereby overturning the sentiments of the Privy Council in AG—Hong Kong v. Reid [1994] 1 AC 224. In K (Apparatus) v Home Secretary [2011] EWHC 1388 (Admin) the decision on the law of conversion was based to a large extent on Professor Tatt cannons contributions to the relevant chapter of Clerk & Linford’s on Torts, 20th ed, which were quoted verbatim. Likewise, Tatt cannons views on (2009) Lloyd’s Maritime & Commercial Law Quarterly 417 were quoted, and were highly influential.

In the Marconi Lady [2011] EWCA 1145, concerning the effect of a particular exemption clause agreed by the parties, Tatt cannons view was closely debated in the Court of Appeal, which was, ultimately, only able to apply it because of the impracticality of overriding an admittedly antique but unfortunate precedent. In Formedge v. Chester-le-Street DC [2011] EWHC 1226 (QB) at [141], his paragraphs 12-99 to 12-111 in Clerk & Linford on Torts, 20th ed, were again quoted from and were instrumental in frustrating the definition of ‘occupier’ in the Occupiers’ Liability Act 1957, and in Cassa di Risparmio della Repubblica di San Marino SpA v Barclays Bank Plc [2011] EWCA 484 at [210] f his paragraphs 18-14 to 18-21 in the same book were instrumental in ensuring that a defendant not truly dishonest was not held civilly liable in deceit.

Professor D Rhidian Thomas’s view in The Law and Practice Relating to Appeals from Arbitration Awards [1994], Lloyd’s of London Press to the effect that an arbitration award should not lightly be upset on an issue of fact was specifically referred to and endorsed by Hammerschlag in the New South Wales Supreme Court in Barry Smith Grains Pty Ltd (in liquidation) v. Rordan Group Pty Ltd [2012] NSWSC 1291 at [40], Thomas’ views in Fraudulent Insurance Claims: Questions of Legal Definition, Consequences and Limitations [2006] Lloyd’s Maritime and Commercial Law Quarterly 485-516 were also referred to, and in the event were helpful in determining the effects of the withdrawal of a fraudulent claim in Direct Line v. Fox [2009] EWCA 386.

ISTL research has also informed advocacy in particular cases, with the work of Professor Baris Seyer (i.e. ‘Defences Available to a Marine Insurer’ [2002] Lloyd’s Maritime and Commercial Law Quarterly, pp. 199-213) having been cited in skeleton arguments submitted to the Court of Appeal in Kosar Villa Holidays v. Trustees of Syndicate 1243 [2008] EWCA Civ 147.

Professor Seyer’s Warranties in Marine Insurance has had a strong impact on the trajectory of insurance law reform. The second edition was cited in the Law Commission’s Consultative Paper No 182, and in the Issues Paper No 5 (April 2009), there was express acknowledgement of the assistance provided by Professor Seyer in the project, while in Issues Paper No 7 – concerning the insured’s postcontractual duty of good faith – considerable reference was made to Seyer’s article ‘Continuing Duty of utmost Good Faith’in insurance Contracts: SM Alker [2003] WJCIG 39 as ‘an excellently illustrating the difficulties surrounding this area of law.

Dr Richard Caddells work has had a particular influence on the Convention on Migratory Species (CMS). Caddell co-authored Review of the Cineray Organisation and Activities of CMS and the CMS Family (UNEP) CMS/G/10.14 (2008) which informed Future Shape reforms of the Convention. The report has formed the basis of the future shaping negotiations, under which the parties will determine the future operating conditions, institutions structure and policy priorities for the Convention for the coming decades. These negotiations concluded at the Ninth Conference of the Parties (convened 21st November 2011), but the report was endorsed and commended as a ‘sound basis’ for future intergovernmental discussions on this issue and identified the key issues requiring attention within the convention structure (Report of the Thirty-Sept Meeting of the Standing Committee, Document UNEP/CMS/SG/11/1, at 68).

Centre for Criminal Justice and Criminology

The Centre for Criminal Justice and Criminology (CCJC) acts as a focal point for criminological research and teaching and for collaboration with other departments and universities. The Centre, under Director, Professor Kevin Haines, has been awarded Doctoral Training Centre (DTC) status and has put forward two successful bids for Economic and Social Research Council (ESRC) funded studentships. Criminology staff have research interests in wide-ranging areas including youth justice policy and practice; community based supervision; sex offender policy and treatment; sex work policy; antisocial behaviour policy and ‘white-collar’ crime.

CCJC’s recent projects include a study of prisoner resettlement (in collaboration with Cardiff University), a national study of black and Asian offenders on probation in England and Wales (in collaboration with Lancaster, Lincoln and Glamorgan Universities) and a study of the prevention of crime by young people in Swansea. Overseas research projects include work in Romania and in the Channel Islands, and regular links are maintained with researchers in Canada, Ireland and Europe, as well as with the Institute of Criminology in Cambridge and the Centre for Criminological Research in Oxford. The Centre also hosts the Wales regional branch of the British Society of Criminology. In July 2012, CCJC won the British Society of Criminology’s National Award for Teaching Excellence for its undergraduate programme.

Criminology was awarded £500,000 for the Big Lottery Fund Innovation Programme for a three-year project to provide advice and support to student sex workers in Wales. The Interactive Health: Student Sex Workers project is led by Swansea Criminologists Dr Tracey Sagar and Debbie Jones from CCJC. The project is in collaboration with the Terrence Higgins Trust, the Integrated Sexual Health Clinic, Cardiff and Vale NHS, the National Union of Students Wales and Newport Film School. The project team hopes that the award will help them undertake multi-rigorous research which will reveal the motivations and needs of student sex workers for the first time. They will also provide the first comprehensive health sexual service in Wales and will develop best practice guidance for Welsh universities and local services.

The Royan studies were instrumental in providing evidence of [the LHR’s] vitality in a UK contest and paved the way for continued applicability in many UK areas.

Robin Morris-Jones, Cognitive Centre Foundation
The UK is undergoing substantial changes in its constitutional order, and Swansea University’s Law’s major research unit for enquiring into these changes is its Hywel Dda Institute. The Institute grapples with the significant emerging law and policy questions facing Wales in devolution. It maintains close links with the National Assembly for Wales and Welsh Government, and its work is both historical and contemporary. Its historical work provides context for better understanding the state of legal Wales and how its future may be forged. Its research is in both Welsh and English, and it participates in the global and European conversation ongoing about language minorities.

The Hywel Dda Institute regularly invites prominent speakers to Swansea. In June 2011, The Rt. Hon. Lord Justice Thomas PC, QC, former HM Attorney General and Honorary Fellow of Swansea University, delivered the Youard lecture in Welsh by the Hywel Dda Institute in association with the Welsh Legal History Society. Lord Morris of Aberavon KG, PC, QC, former HM Attorney General and Honorary Fellow of Swansea University, delivered the Youard lecture in Welsh Social and Legal History in December 2011. The lecture was hosted by the Hywel Dda Institute in association with the Welsh Legal History Society. Lord Morris’s lecture, which was entitled The Development by Attorney Generals of the Doctrine of Armed Intervention by States, Without Security Council Authorisation, to Avert an Overwhelming Human Catastrophe, contained personal reflections on the legal challenges he faced as Attorney General in Tony Blair’s first administration. The lecture was chaired by Lord Justice Thomas PC, President of the Welsh Legal History Society, President of the Queen’s Bench Division of the High Court of Justice, and Honorary Fellow of Swansea University.

Institute members do their research in both Welsh and English languages. The Institute’s Director, Professor K Gwynedd Parry recently completed a monograph entitled, Cymeri gyflydau: Sylwadur i’n Hyn Fyfed 2012 (In English, legal Wales: Observations on legal identity). The monograph, written in Welsh, analyses those key themes which have inspired the development of legal Wales. It reflects on legal Wales’s constitutional, political, cultural, academic and legal dimensions, and draws on comparative and international perspectives. The Coleg Cymraeg Cenedlaethol provided research funding for this book published by University of Wales Press. The book is destined to be among the most influential of academic legal treatises written in Welsh in a generation.

The issues facing Wales resonate throughout Europe and globally. Professor Parry has contributed to a collaborative project involving scholars from universities throughout Europe, evaluating the implementation of the European Charter for Regional or Minority Languages. As part of the project, a conference on the theme of Implementation and Evaluation of the European Charter for Regional or Minority Languages was hosted by the Council for Galician Culture and the University of Santiago de Compostela in February 2010. The fruits of the conference and the subsequent collaboration will be published in a volume entitled, Shaping the Language Rights of Traditional Minorities which was being published by Council of Europe Publishing in 2012.

Professor Parry has been appointed a member of the Welsh Language Commissioner’s Advisory Panel by Welsh Government Minister for Education and Skills, Leighton Andrews AM. The Advisory Panel, a statutory panel established under the Welsh Language (Wales) Measure 2011, is tasked with providing impartial and independent advice to the Welsh language commissioner.

Centre for Environmental and Energy Law and Policy

Among the most pressing issues facing the globe today are those to do with the environment and climate change. The Centre for Environmental and Energy Law and Policy (CEELP) deals with these issues. The Centre is affiliated to the International Union for Conservation of Nature (IUCN) Academy of Environmental law and the United Kingdom Environmental law Association. Following the Centre’s collaboration with representatives of the wider environmental law academy in Wales, Centre co-director Professor Mark Stallworthy and Dr Patrick Bishop are editing Environmental law and Policy in Wales: Responding to Global and Local Challenges, to be published by the University of Wales Press. The book has contributions from Dr Bishop and Professor Stallworthy as well as from fellow co-director Professor Karen Morrow and Dr Victoria Jenkins.

Centre members have been active in the re-establishment of a Wales working party within the UK Environmental law Association (UKELA), consisting of practitioners, academics and others in the environmental law and policy sphere, UK-wide, and have contributed to a response by the UKELA working party to the proposed Welsh Government Sustainable Development Bill. They have also participated in an external reference group convened by the Sustainable Futures Commissioner/Chairman of the Climate Change Commission for Wales, reviewing proposals for a Sustainable Development Bill. They have also participated in an external reference group convened by the Sustainable Futures Commissioner/Chairman of the Climate Change Commission for Wales, reviewing proposals for a Sustainable Development Bill. They have also participated in an external reference group convened by the Sustainable Futures Commissioner/Chairman of the Climate Change Commission for Wales, reviewing proposals for a Sustainable Development Bill.

Recent interdisciplinary collaborations by CEELP members include: Dr Victoria Jenkins, The Sustainable Development Bill: at a UKELA Wales conference, Cardiff, Legislative Changes in Wales (July 2012), Professor Mark Stallworthy, Climate Change – Implementing Policy Responses, Our Changing Climate – Understanding Complex Science and Contentious Policy Public lecture Series, at Cardiff University in June 2012.

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Publications

A selection of the recent and forthcoming publications from the College is highlighted below.

Dr Babhini Donnelly-Lazarov is producing interesting work in the philosophy of law. In articles published in Ratio Juris and the Canadian Journal of Jurisprudence, she has contributed to the literature on Ronald Dworkin’s account of the relationship between law and morality. Her recent work also includes rigorous philosophical investigations into the concept of attempts in the criminal law and she is working on a book on the subject.

Dr Donnelly-Lazarov’s work closely aligns with that of Professor Dennis Patterson, who is working on naturalised epistemological accounts that connect to the law, in his work on law and neuroscience. Professor Patterson has written a series of articles on the philosophical foundations of law and neuroscience and continues his work in this new field.

Professor Patterson’s work in international law connects to that being done by Professor John Linarelli. Professor Patterson’s book, published by Cambridge University Press and co-written by An Afflalo (Rutgers University-Camden law), The New Global Trading Order, The Evolving State and the Future of Trade, makes the bold argument that current international institutions regulating the global trading order are ineffective and prescribesthat they might be reformed. The article book promotes multidisciplinary approaches to understanding the problems of economic fairness and distributive justice that societies must contend with which interdependence continues unabated. Professor Israelsi is also editing, for Edward Elgar Publishers, the Research Handbook on Global Justice and International Economic Law.

Dr Helen Quane is publishing ‘A further dimension to the interdependence and indivisibility of human rights?’ Recent developments concerning the rights of indigenous peoples in the Harvard Human Rights Journal.


Collaborative research undertaken by Professor Phil Lawler and Dr Jonathan James examines how central bank announcements regarding current economic developments influence the effectiveness of monetary policy. The work thus contributes to the important and topical debate concerning whether central bank transparency is invariably desirable. A significant conclusion arrived at by the research is that, depending on the underlying economic structure, central bank disclosures can inhibit the efficacy of stabilization policy and thereby reduce welfare. Aspects of the work, which is ongoing, have been published in several leading Economics journals, including the American Economic Review, the Journal of Economic Behavior and Organisation and the Journal of Money, Credit and Banking.

A recent article in Nature Climate Change by Dr Tapas Mishra explains how the persistence of stochastic shocks can influence national pathways of carbon-based emissions and the dynamics of sustainability. It is found that, despite variations in the measure of carbon emissions and its sources, the control of stochastic shocks is of paramount importance to determining the extent to which national policy forums can change sustainable and socio-economic development. The research indicates that carbon emissions and economic development may be at odds with each other, and that consumption-based emissions standards alone with controlling for the speed of convergence of stochastic environmental shocks can further our understanding of human development and economic growth.

Recent research within the econometrics group has sought to examine how the volatility exhibited by economic and financial data impacts upon various hypothesis tests commonly employed by econometricians and statisticians. The resulting work has involved analysis of the distortions such tests, are subject to, along with the derivation of ‘improved’ testing procedures. Outputs from this research have appeared in a number of mathematics and statistics journals and also the highly prestigious Cambridge University-based Journal of Applied Econometrics. Another body of research within the econometrics group has involved the empirical analysis of crime and its linkages with economic conditions, with a recent paper by Professor Steve Cook appearing in the highly regarded Journal of Quantitative Criminology.

The postgraduate research community

The postgraduate research community is integral to the College’s culture and environment, which supports a vibrant doctoral programme in a wide range of subject-specific and multidisciplinary areas. All aspects of PhD provision are aimed at identifying and supporting talented researchers with the potential to make lasting contributions to research communities in Swansea and beyond.

Doctoral candidates are supported by, and work closely with, academic staff within the College’s research groups. Doctoral candidates come from around the world to study at Swansea, bringing an international perspective to research programmes. All research students are invited to attend staff research seminars and are encouraged to participate in discussions.

The College’s Taught Master’s programmes (LMs) in international maritime and commercial law are among the best of their kind, with students from all over the world coming to Swansea to develop critical lawyering skills that are highly prized by law firms, companies and organisations across the globe, and which have resulted in a number of our students landing jobs in elite City of London law firms.

The Business School has a wide and continuously developing portfolio of postgraduate programmes. The generalist MSc Management programmes allow students from all academic disciplines to develop a sound understanding of the key principles of management. They also offer the opportunity to focus on a specific area such as marketing, finance, international management, international standards or human resource management. The specialist MSc programmes are designed for those who already have a background in business management and who wish to gain an in-depth knowledge of their chosen area, such as marketing, finance or international banking. Some of the MSc modules have been designed so that exemptions may be gained from professional bodies including the Chartered Institute of Management Accountants (CIMA) and the Association of Certified Chartered Accountants (ACCA). The Master’s of Business Administration (MBA) is designed for high-calibre graduates, usually with at least two years’ work experience, although this is not compulsory.

The College also participates in the ESRC Wales Doctoral Training Centre, with Economics and Criminology taking a lead in fostering these programmes. In 2011 Economics within the College had two students starting the PhD programme in 2011 and a further two started in September 2012. These will be working on macroeconomic stabilization policy, the role of macroeconomic policy in reducing systemic risk, economic returns to a graduate education, and the public/private sector pay differential in the UK.

The College takes a proactive approach to enhancing graduate employability, with a range of activities and courses available to postgraduate researchers. Career enhancement opportunities include guest lectures, networking events, internships and student-led projects. Recent highlights include talks from the Judiciary, lawyers and commercial directors and IP brand managers from multinational companies, and a range of internships in legal and commercial departments of businesses from across Asia.
College of Engineering

Following its foundation in 1920, Swansea University quickly established itself as a scientific and technical academic base to support the former heavy industries of south Wales, with Engineering among its founding subjects.

To this day, the College of Engineering continues to strive to engineer a difference and for our teaching and research to have a real impact on business and industry.

We are proud to have developed some of the University’s strongest links with industry at a Wales, UK, and international level, supporting and helping to realise the University’s vision to be a research-led university of international quality.

The College pioneers technological progress in both traditional and emerging disciplines within the field of engineering. Our research themes range from aerospace and manufacturing to energy and environment to health and sport, driven by the world-class academics in our strategic technology centres and research centres and groups.

We are continually expanding and enhancing our reputation worldwide, through significantly increasing our research income, and we have established ourselves as leaders in engineering development, working in partnership on major projects with such blue chip companies as Tata, Rolls-Royce, Airbus UK, BAE Systems, and BASF.

Engineering at Swansea is recognised internationally for the quality of its research output — we are currently ranked 8th in the UK, according to the latest Research Assessment Exercise (RAE).

Engineering excellence will be the cornerstone of the new Science and Innovation Campus (see page 28), which will result in an increase in our research impact through growing capacity, further industrial collaboration, spin-ins and spin-outs and the development of high-tech clusters in the region.

We are excited about the future; this growth means there will be new challenges and opportunities for us as a College in the exciting times ahead and our continued vision is to provide an excellent research and teaching environment with international recognition for the advancement, dissemination and exploitation of knowledge in engineering and related disciplines.

Professor Javier Bonet, Head of College, and Director of Research, College of Engineering

Research Centres and Institutes:

Research Centres and Institutes in the College include:

- Centre for Complex Fluid Processing
- Civil and Computational Engineering Centre (C2EC)
- Electronics Systems Design Centre
- Materials Research Centre (MRC)
- Multidisciplinary Nanotechnology Centre (MNC)
- Centre for NanoHealth (CNIH)
- Applied Sports Technology, Exercise and Medicine Research Centre
- Institute of Structural Materials (Rolls-Royce UTC)
- Sustainable Product Engineering Centre for Innovative Functional Industrial Coatings (SPECIFIC)
- Swansea Materials Research and Testing Ltd (SMaRT)
- Wales Institute for Mathematics and Computational Sciences (WIMCS)
- Centre for Water Advanced Technologies and Environmental Research (CWATER)
- Welsh Centre for Printing and Coating (WCPC)

Research in the College attracts funding from a significant number of prestigious funding bodies and companies. These include:

- Airbus UK
- BAE Systems
- BASF
- Engineering and Physical Sciences Research Council (EPSRC)
- The EU Convergence European Regional Development Fund through the Welsh Government
- Rolls-Royce
- Tata and Tata Steel
- Welsh Government

<table>
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<tr>
<th>Research active staff</th>
<th>161</th>
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<tbody>
<tr>
<td>Postgraduate research students</td>
<td>368</td>
</tr>
<tr>
<td>135 Postgraduate Masters’ students</td>
<td>1,521 Undergraduate Students</td>
</tr>
<tr>
<td>401 International students</td>
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SPECIFIC – Buildings as Power Stations

The Sustainable Product Engineering Centre for Innovative Functional Industrial Coatings – or SPECIFIC – is an academic and industrial consortium led by Swansea University with Tata Steel as the main industrial partner.

The £20 million, five-year project is led for Swansea University by Professor Dave Swan, Head of the College’s Materials Research Centre and Principal Investigator at SPECIFIC.

The project is funded by the Engineering and Physical Sciences Research Council (EPSRC), the Technology Strategy Board, the Welsh Government, and the main partners, and its vision is to develop functional coated steel and glass products for roofs and walls, which generate, store and release renewable energy.

Establishing these products will effectively transform buildings into power stations, delivering significant environmental and economic benefits.

Located at the Baglan Bay Innovation and Knowledge Centre, the project involves a robust partnership between leading university groups from Imperial College London, Bath, Bangor, Cardiff, Glyndwr and Sheffield, as well as multinational industry organisations such as BASF, Akzo Nobel, Beckers, and Pilkington.

The key thematic areas of research for the SPECIFIC project are photovoltaics, battery technology, and energy release coatings.

Photovoltaics

More energy falls on the Earth’s surface every day than we currently use in 27 years, indicating the phenomenal power of solar energy.

Photovoltaics involves converting solar energy into electricity, which is an attractive addition to the renewable energy mix. Dye sensitised solar cells are a third generation device with exciting potential in lower light climates. Made from earth abundant materials, they are suitable to scale across very large areas.

For photovoltaics to succeed they must move quickly from the laboratory bench to the factory gate. SPECIFIC is dedicated to developing technologies that enable the manufacturing and scaling processes for thin film photovoltaics.

Removing process bottlenecks is critical to successfully scaling a photovoltaics product and it’s for this reason that novel heating technologies have been developed to turn long and static batch manufacturing steps into fast and fluent stages.

SPECIFIC is also involved in the understanding of stability and lifetime of these devices, from characterisation of degradation mechanisms to solutions for improving longevity.

Battery Technology

Traditionally energy storage has meant the transformation of electricity into batteries in a power station, only to reconvert it to heat in a remote building.

But when combined with locally generated renewable electricity, this technology provides a viable option for heating applications.

One of the technologies SPECIFIC is researching is the use of painted coatings, which would allow the incorporation of unobtrusive heating elements into the fabric of the building.

Most sources of renewable energy are intermittent in their nature and sunlight or wind cannot be stored. This demands attention on how the energy-generated product is stored, in particular thermal energy storage, and interseasonal storage of heat.

Most current research on electrochemical storage of electricity examines increasing energy densities for applications in mobile electronics, medical implants and electric vehicles.

SPECIFIC understands that this research cannot directly translate into static utility scale energy storage. In this environment energy density plays a secondary role to safety, longevity, low maintenance and cost.

Heating Coatings

Using grid-supplied electricity to produce heat is not a sustainable option in Britain. This is due to the significant efficiency losses associated with converting heat energy into electrical energy in a power station, only to reconvert it to heat in a remote building.

But when combined with locally generated renewable electricity, this technology provides a viable option for heating applications.

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Establishing these products will effectively transform buildings into power stations, delivering significant environmental and economic benefits.
Transparent Barriers and Conductors

It’s not difficult to imagine that a number of devices will be incorporated into building structures to collect and store renewable energy. But there are important common requirements including protection from the environment and, in many cases, a transparent conducting layer – especially vital in the area of building-integrated photovoltaics (BIPV).

A desirable material would be a cost effective, transparent flexible film with strong conductivity, good moisture and gas barrier properties – as well as a rugged consistency which doesn’t degrade under UV radiation. Such a material is viewed as an enabling technology for many different flexible electronic applications, such as organic light-emitting diode (OLED) devices and organic photovoltaic (PV) cells.

First-class facilities

To enable its work, SPECIFIC has installed state-of-the-art laboratories at the Baglan Bay Innovation Centre, allowing researchers to quickly test new ideas and collect robust and reliable scientific data. This supports the development and understanding of new products and processes.

The laboratories’ wealth of facilities include scanning electron microscopes (with EDS capability), atomic force microscopy with a Kelvin Probe attachment, NIR lamps and electrochemical equipment. SPECIFIC has also developed, designed and delivered a class 10,000 (ISO7) cleanroom facility to house its two pilot production lines.

The pilot production lines enable the demonstration and full scale manufacture of 1.2m² sheet steel, glass and polymer substrate based technologies, and other potential flexible and non-flexible materials. This includes 350mm wide coil materials such as steel and polymers.

Alongside the cleanroom installation, SPECIFIC is expanding its laboratories and offices for world-class investigations into solving manufacturing challenges associated with delivering functional coatings to the marketplace.

Over a short space of time the results of this pioneering research will come to fruition, giving strong foundations for the power-efficient buildings of tomorrow and renewable energy as a whole.

www.specific.eu.com

Engineering at Swansea

Engineering has been a key subject for Swansea University since its formation, and its teaching and research has evolved and adapted with time and technology throughout the 20th Century and right up to the present day.

In 2001, the former Departments of Chemical, Civil, Electrical, Materials and Mechanical Engineering were combined to form a single integrated College. This integrated College has proved extremely successful from both teaching and research perspectives, helping to address future challenges within engineering where a multidisciplinary approach is crucial.

A broad portfolio of undergraduate and postgraduate programmes reflects research strengths which are enriched by industry collaboration, while a number of programmes are accredited by the Engineering Council.

The College of Engineering is a cutting-edge learning and research environment with state-of-the-art facilities. Pioneering technological progress in both traditional and emerging disciplines have led to partnerships with major industrial companies.

All activities are driven and underpinned by world leading research, as recognised by the Research Assessment Exercise (RAE) in 2008, where a combined College of Engineering score ranked 8th in the UK and the best in Wales.

Swansea University has been recognised for its outstanding teaching by an international award, the QS Stars global university rankings system, which awarded the University five stars for its teaching quality.

The leading research centres and projects within the College are profiled in these pages.
Advanced Sustainable Manufacturing Technologies (ASTUTE)

The Advanced Sustainable Manufacturing Technologies (ASTUTE) project aims to improve the competitiveness of the manufacturing sector in West Wales and the Valleys, by enabling the sector to grow by adopting more advanced technologies, while enhancing sustainability by reducing environmental impact.

The five-year, £27 million project, which has been part-funded with £14 million from the EU’s Convergence European Regional Development Fund through the Welsh Government, targets the aerospace and automotive sectors, as well as other high technology manufacturing companies, with the goal of bringing sustainable, higher value goods and services to a global market.

The project is led by Swansea University under the direction of Professor Johann Sienz, in collaboration with the Universities of Aberystwyth, Bangor, Cardiff, Cardiff Metropolitan, Glyndŵr, Swansea Metropolitan the University of Wales Trinity St David, and the University of Wales, Newport.

This unique partnership of universities harnesses combined engineering, science and business expertise, enabling many of the technical and operational challenges facing Welsh companies to be addressed, and boosting economic prosperity in the Convergence Region.

Since the start of the project in May 2010, ASTUTE has successfully worked with 166 Welsh companies engaging on 60 collaborative projects across different sectors. Examples include Mustang Marine (Wales) in Pembroke Dock, EBS Automation in Llanelli, and Silverwing (UK) in Swansea.

The initiative aims to assist 350 enterprises and work together with industry through 40 collaborative R&D projects, and is expected to attract further investment of £4 million and launch 120 new or improved products, processes, or services.

ASTUTE is improving the competitiveness of Welsh companies by applying advanced engineering techniques to both the design of products and to manufacturing processes, securing jobs and leading to the creation of more highly skilled new positions in the sector. Wide-ranging business expertise including experience in sustainable business practice, a topic considered to be of great importance by the EC, is enabling companies to find different ways of improving operations and management systems.

Focusing on the needs of industry and working with companies on developing solutions which are fit for purpose, projects range from the small scale, lasting just a few weeks, to longer projects or cluster projects which can last for up to a year, offering a substantial business input www.astutewales.com/

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“We [EBS] are already participating in one project and have signed up for another. The importance of support provided by this project to SMEs should not be underestimated by anyone in such challenging times, when the demands of the customer base are increasing. The output of project work can be the difference between success or failure for an SME.”

Mike Evans, MD of EBS Automation Ltd
Group Chairman of the Carmarthenshire Manufacturing Group

“- stunning piece of work, I spent 14 months and thousands of pounds trying to solve a problem, then I linked up with ASTUTE and they solved the problem in four months.”

Gareth Jenkins, Managing Director FSG Tool and Die Ltd
Head of Advanced Materials and Manufacturing Sector Panel
Civil and Computational Engineering Centre (C2EC)

Swansea University has been at the forefront of international research in the field of computational engineering for the last 30 years.

It has pioneered the development of numerical techniques such as the finite element method and associated computational procedures, which have solved a number of complex engineering problems.

Civil Engineering at Swansea is ranked second in the UK for research quality (2008 RAE), while the Civil and Computational Engineering Centre (C2EC) is recognised as a Centre of Excellence by the Welsh Government.

Professor Oubay Hassan, Head of C2EC and recently elected Fellow of the Royal Academy of Engineering, is currently leading research which spans across a number of areas in computational and applied mechanics. These areas include applied mechanics, biomedical engineering, computational electromagnetics, computational fluid dynamics, geotechnics and human-computer interfaces.

C2EC has access to one of the most advanced university computing facilities in Europe. Hardware includes a 450 cpu cluster, high-end graphics workstations and high-speed network links. Powerful software packages include in-house developed and off-the-shelf commercial solutions.

Active research and industrial applications include computational fluid dynamics, structural analysis and structural optimisation, geomatics, geometry modelling and grid generation, graphical user environments and solution visualisation, high performance computing and computational electromagnetics.

An extensive record of industrial collaboration has helped C2EC to become a preferred academic partner for BAE Systems in the areas of computational electromagnetics and computational engineering.

Additional C2EC contributions to prestigious projects include aerodynamic design of the THRUST Supersonic Car, which still holds the world land-speed record set on 15th October 1997, and the design of the double-decker superjet Airbus A380, the largest civilian aircraft built to-date.

Now the BLOODHOUND SSC project plans to create a new world land-speed record of 1000mph with its supersonic jet and rocket powered car and research from C2EC, led by Dr Ben Evans, is contributing to its aerodynamic design.

www.swansea.ac.uk/engineering/research/centres-and-projects/civil-and-computational-engineering/

Centre for Complex Fluid Processing

Processing complex fluids is a major feature of modern industry. Complex fluids are extremely diverse in origin and composition, ranging from fermentation broths and food products to inks and mineral slurries.

Understanding this diversity is complex properties which need to be thoroughly understood in order for processing to be effective and efficient. These include flow behaviour in process equipment, how fluid components determine overall properties and how individual components can be selectively separated.

Understanding such properties and processes is the core focus of the Centre for Complex Fluids Processing, which is led by Professor Rhodri Williams.

The Centre for Complex Fluids Processing has state-of-the-art laboratories, which house cutting-edge facilities for use in both research and commercial projects.

Equipment includes a new biotechnology pilot plant, pilot-scale membrane filtration equipment (micro to nanofiltration) and reverse osmosis. Many systems have been adapted for a variety of environments and novel applications, such as urine growth of organic and inorganic material.

The combination of atomic force microscopy (AFM) with high-speed photography (iris interval) allows the study of cavitation in fluids, while a variety of spectroscopic techniques are available including XPS, AES, confocal RAMAN, mass spectrometry, ICP, spectroscopy and photo correlation spectroscopy for particle sizing down to 1nm.

Further techniques include laser diffraction particle sizing, piezoelectrochemistry BET and gas porosimetry, microcalorimetry, a comprehensive range of rheometers, gas liquid chromatography and high-performance liquid chromatography (HPLC).

Equipment includes a fully-equipped cleanroom for device fabrication, theoretical modelling of quantum properties of nano-structures, cavitation in fluids and process control.

All experimental work is complemented by detailed mathematical modelling to enable the quantification of fundamental material properties and process operation, which is supported by high performance computing facilities.

And with additional access to a plethora of techniques and facilities through our partners in the Complex Fluids and Flows Portfolio Partnership and the Pwll-Wales Nanotechnology initiative, the Centre is growing in status as a world-leading resource and an important hub of major scientific breakthroughs in the field of complex fluids.

A special feature of the Centre’s work is the use of finite element techniques – a field in which Swansea University is a world-leader – to quantify fluid flow, heat and mass transfer and colloidal interactions.

The Centre receives extensive funding from the UK Research Councils and the European Commission, and enjoys strong partnerships with other leading laboratories throughout the world, including joint projects and exchange of staff.

A firm commitment to the industrial implementation of research findings has earned the Centre recognition as a Centre of Excellence for Technology and Industrial Collaboration (CETIC). This scheme aims to promote Wales as an area of research excellence, stimulating a strong economy through the support of small and medium sized enterprises.

The Centre specialises in six areas which are well matched to recent business growth areas in Wales and readily applicable to industrial requirements.

Biomedical Engineering

Recent developments have seen Biomedical Engineering emerge as a major new area for the Centre. Expertise in rheology has been applied to blood coagulation, helping to forge a substantial collaboration with the NHS.

The combination of haemorheology with research into developing biomaterials for implantation and wound healing has led to projects with spin-off company Haevar Ltd.

It has also led to the establishment of the £1.5 million Haemostasis Biomedical Research Unit at Morriston Hospital in Swansea, funded by the Welsh Government’s National Institute for Social and Healthcare Research (NISCHR), and led by Unit Director Professor Adrian Evans, Professor of Emergency Medicine and Haematology at the University’s College of Medicine. (See College of Medicine, page 106.)

This new avenue of expertise, knowledge and resources represents a major new market with an associated range of opportunities for the NHS, for the development of new medical devices and for the whole pharmaceutical industry.

Bioprocess Engineering

Successful scaling and exploitation of biotechnology developments depends on the effective operation of bioreactors and the efficient recovery and separation of desired products.

Such biological materials are extremely complex in their composition and physical properties, with their processing a key area of research. Expertise in this area is highly relevant to the bioscience and food industry, and well established commercial relationships mean a number of Welsh bioscience companies are in regular collaboration.

Environmental Technology

Environmental and process engineering issues are relevant to many industries. The Centre’s research focuses on wastewater treatment, landfill and aquaculture issues.

Fluidics

Expertise in rheology and cavitation have been merged to create Fluidics. This expertise benefits the food and process industries, where understanding fluid dynamics and flow properties of materials is vital for effective and efficient processing.

Membrane separation processes

The Centre is an internationally leading exponent in the development of quantitative methods that predict the industrial performance of membrane separation processes – microfiltration, ultrafiltration, and nanofiltration.

These are the most important modern developments in the separation of multicomponent fluids and expertise in this area benefits the food, bioscience, environment and pharmaceuticals industries.

Surface and Particle Characterisation

Traditional fields of expertise in atomic force microscopy and colloids and interfaces have merged to form surface and particle characterisation.

Supplementary expertise and resources from the Multidisciplinary Nanotechnology Centre (WNiC) helps towards the availability of a characterisation service. Applications promise to range from food and process streams to the medical and silicon industry.

complexfluids.swan.ac.uk/
Electronics Systems Design Centre (ESDC)

The ESDC’s current research is supported by grants totalling more than £4 million from the Engineering and Physical Sciences Research Council (EPSRC), Royal Society, Higher Education Funding Council for Wales (HEFCW), European Regional Development Fund (ERDF), and for specific projects by EU Consortium grants, under FRAMEWORK and other initiatives.

The Centre’s industry sponsors have included BT, Siemens, Plessey, GE Lighting, Schlumberger, CLOGSYS, SILICONX, Morganst, Newbridge Networks, Alton, City Technology, BNR Europe, Philips, SVALEC, DERA, BTG, Toyota and Hitachi.

The Centre’s design and modelling laboratory is equipped with industrial standard SIVACO TCAD, CADENCE design tool, PSICE, MATLAB and COMSOL. A device characterisation laboratory consists of oscilloscopes, function generators, power analysers, microprocessor development systems, spectrum analysers, high-voltage test equipment and thermal device characterisation equipment.

Additionally, the Centre enjoys separate laboratories for postgraduate projects and biometrics research and a PhD office, as well as eight computer cluster nodes with two-sinecure Xeon processors (96 CPU’s) and two-freese GB memory per core, as part of the Civil and Computational Engineering Centre [C2EC] Supercomputing Cluster.

Electronics research has been rejuvenated within the College of Engineering thanks to a number of academic appointments including Dr Karol Kahan, Dr Antonio Martinez and Dr Uija Li.

These key appointments have helped to gain the critical mass of expertise needed to attract research investment from UK research councils, industry and the Welsh Government – as well as to achieve national and international recognition for research excellence.

Researchers from the Centre, under the direction of Dr Peter Igic, actively collaborate across the College of Engineering and the University. Dr Paul Holland has also been working on a groundbreaking Engineering and Physical Sciences Research Council (EPSRC) funded project entitled ‘Multi-Technique Bio-Analytical Investigation of the Single/ Sub-Cellular Level Using a New Lab-On-A-Chip Technology Platform’, together with Dr Cathy Thornton from the College of Medicine’s Institute of Life Science. This work forms part of the Centre’s silicon health (SiHealth) initiative, looking into applying well-established as well as novel silicon-technologies to develop sensors, devices and systems for medical applications.

ESDC researchers also collaborate across other leading universities in the UK, including Southampton, Cambridge, Glasgow, Bristol, Sheffield University, and University College London.

Dr Kahan has been working in partnership with IBM on the ‘Multiscale Modelling of Metal-Semiconductor Contacts for the Next Generation of Nanoscale Transistors’ project, which was awarded a grant of almost £299,000 by the EPSRC. He is also a co-investigator on the EPSRC-funded project ‘Atomic Scale Simulation of Nanoelectronic Devices’ project, led by Professor Asen Asenov from Glasgow University, which was awarded a grant of almost £1.190,000.

Dr Martinez is leading another EPSRC-funded research project, with a grant of more than £640,000, entitled ‘Quantum Simulations of Future Solid State Transistors’, working in partnership with the University College London, University of Southampton, Swiss Federal Institute of Technology.

An area of rapid research growth within the group is applied power electronics in embedded energy generation. While it has sustained interests in micro/nano electronics devices and technology, the Centre is best known for its groundbreaking research into Power IC technology. This technology combines power devices with low voltage control IC technology and is vital for energy efficient electronics.

Collaboration with two of the largest multinational semiconductor companies – Diodes ZETEX and X-FAB – led to a £1 million ‘Power System on Chip Development – TCNC (100I Integrated Circuit) Technology Strategy Board (TSB) grant.

The industrial part of the TSB-funded research was led by Professor Glenn Birchby, Chief Scientist at Diodes ZETEX, and Dr Brandon Bold, Process Development Director, X-FAB Semiconductor Foundries.

ESDC is a world leader in semiconductor device modelling, initial element method (FEM), and compact modelling, the Centre also specialises in quantum transport and ensemble Monte Carlo simulations of nanoscale transistors.

Other research areas include microelectromechanical systems (MEMS) and Energy Harvesting, PV Technology and Systems, Systems, Control and Software Engineering, Computational Electromagnetics, Speech and Image Processing.

MEMS activity, lead by Dr Li, is currently supported by an EPSRC grant of almost £101,000 for the ‘Smart Microelectromechanical Systems (MEMS) Actuators’ project, looking into developing so-called ‘smart’ microactuators that integrate conventional microactuators with driving electronics to address the limitations of present microactuators.

ESDC researchers also support all the research groups within the Low Carbon Research Institute (LCRI), a pan-Wales university initiative, whatever particular electrical or electronic systems are required to achieve world-class performance.

These activities have been supported with grant of £1 million from the Higher Education Funding Council for Wales (HEFCW) and £1.3 million from the European Regional Development Fund (ERDF).

ESDC researchers are also contributing to the ICBP’s Solar Photovoltaic Academic Research Consortium (SPARC), developing new types of PV panels that will radically reduce the energy used in production. The list of industrial partners includes Pilkingtons, Sharp, Egnitec and Tata.

www.swansea.ac.uk/esdc/
Low Carbon Research Institute Marine Consortium (LCRI Marine)

The Low Carbon Research Institute (LCRI), which was established in 2008 with an initial investment of £5.17 million by the Higher Education Funding Council for Wales (HEFCW), and European structural funding of £19.2 million in 2009, unites the diverse range of low carbon energy research across the universities of Cardiff, Swansea, Glamorgan, Glyndwr, Bangor, and Aberystwyth.

This initial government funding has built low carbon research capacity in Wales with a current programme of £82.1 million, including £40 million from UK research councils, another £20.2 million from EU framework and other sources, with a further £15.1 million support from industry and the partner universities.

Working with industry and government, the LCRI’s research agenda includes, low to zero carbon energy supply systems, reduced energy demand, knowledge and skills transfer, and dissemination and industry partnerships.

The Low Carbon Research Institute Marine Consortium (LCRI Marine) is one of the multidisciplinary Low Carbon Research Institute’s (LCRI) project areas.

LCRI Marine, led by Principal Investigator Dr Ian Masters at Swansea’s College of Engineering, brings together the leading academic marine institutions in Wales, including the universities of Swansea, Cardiff, Bangor, and Aberystwyth, Swansea Metropolitan University of Wales, Trinity St David, and Pembrokeshire College, and aims to enable and support a sustainable marine energy sector.

LCRI Marine undertakes independent and world-class research into the generation of renewable electrical energy from waves, tides and currents in oceans, estuaries and rivers.

Specialist tools are developed to optimise the performance of technologies which recover energy from waves, tidal streams and tidal ranges around the Welsh coast.

The group is especially focused on the effects these technologies and devices have on environments such as seabed communities, sediment transport and marine wildlife.

Marine energy is a rapidly growing industry and LCRI Marine is working to develop supply chains to maximise the economic benefits to Wales of generating electricity from the sea.

Swansea leads LCRI Marine’s work on marine technologies, in close collaboration with Cardiff and Bangor. The teams are researching both the engineering and environmental aspects of deployment sites on every coast of Wales.

LCRI Marine works in Pembrokeshire with Tidal Energy Limited on the first grid connected tidal stream turbine in Wales, and in Anglesey with Marine Current Turbines (a Siemens subsidiary) on one of the world’s first tidal turbine arrays.

www.lcrimarine.org.uk/

Materials Research Centre (MRC)

Swansea is a ground-breaking centre for materials teaching and research, where internationally significant research is funded by organisations from Rolls-Royce and Airbus through to Tata Steel and the European Space Agency.

The Materials Research Centre (MRC), led by Professor Dave Worsley, has pioneered postgraduate degrees tailored to the needs of industry, producing high-quality research.

A successful approach is reflected by a research grant portfolio in excess of £40 million and Materials Engineering ranking joint 8th in the UK in the 2008 Research Assessment Exercise.

The Centre incorporates internationally recognised research areas including structural materials, corrosion and functional coatings, grain boundary engineering, environment and sustainable materials, and steel technology.

In key research areas include design against failure by creep, fatigue and environmental damage; structural metals and ceramics for gas turbine applications; grain boundary engineering; recycling of polymers and composites; corrosion mechanisms in new generation magnesium alloys; development of novel strip steel grades (IF, HSSA, Dual Phase, TRIP); and functional coatings for energy generation, storage and release.

The Engineering and Physical Sciences Research Council (EPSRC) Strategic Partnership in Structural Materials for Gas Turbines, in collaboration with Rolls-Royce, is designed to extend the capability of existing high temperature metallic systems and develop novel alloys for potential use within a 20-year horizon – the so-called ‘Vision 20’ materials.

In partnership with Birmingham and Cambridge Universities, this £50 million scheme supports post-doctoral level research and a Doctoral Training Centre with a rolling scheme supports postdoctoral level research and a Doctoral Training Centre with a rolling postgraduate degrees tailored to the needs of industry, producing high-quality research.

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Multidisciplinary Nanotechnology Centre (MNC)

Since its foundation in 2002, the Multidisciplinary Nanotechnology Centre (MNC) has developed an international reputation in fields that stretch traditional concepts of engineering to the extreme. Thanks to radical thinking which combines engineering with physics, chemistry, biology and medicine, the MNC, led by Professor How Summers, has developed a strategy of developing projects to bridge traditional disciplines and provide a step-change in technology.

The relatively young field of nanomedicine, for example, has seen recent investment leading to the creation of a dedicated £22 million Centre for NanoHealth (see page 21), in collaboration with the Multidisciplinary Nanotechnology Centre (MNC). Since its foundation in 2002, the Centre for NanoHealth has established external network links nationally and internationally, for example with the European Technology Platform (ETP), Nanomotive, XGEN, Texas/UK collaborative, and various Knowledge Transfer Networks in Electronics, Sensors, Photonics, and Nanotechnology.

Nanomedicine research within the MNC is funded by over £2 million in research grants from the Engineering and Physical Sciences Research Council (EPSRC), for the development of new nanomaterials and nanoscale health devices.

Researchers are collaborating with Welsh technology companies in a £470,000 research project to develop a hi-tech diabetes blood glucose monitor, which will send a text alert to emergency personnel if the patient is in danger of hypoglycaemia attack.

The overall aim is to develop a low-cost, non-invasive, ambulatory and continuous monitoring system using novel sensors and mobile network.

The project, led by Dr Vincent Teng, is backed by the Welsh Government’s Academic Expertise for Business (AE4B) programme, and the monitoring system will have the capability to be adapted for other chronic conditions, such as coronary heart disease, stroke, cancer and asthma.

www.swansea.ac.uk/engineering/researchcentres-and-projects/multidisciplinary-nanotechnology-centre/

Rolls-Royce University Technology Centre (UTC) in Materials

Swansea University engineers have worked closely with Rolls-Royce for more than 30 years; with research examining diverse engine technology requirements often directly informing component design.

Led by Professor Martin Boche, the Rolls-Royce University Technology Centre (UTC) in Materials at Swansea is a key member of the £50 million Engineering and Physical Sciences Research Council (EPSRC) Strategic Partnership in Structural Materials for Gas Turbines, with the Universities of Birmingham and Cambridge.

This partnership aims to harness key academic expertise in addressing frontline materials requirements for Rolls-Royce gas turbine engines, with fundamental materials research critical to improving efficiency and environmental sustainability.

The UTC is the ‘pump primer’ for access to major research contracts involving the Technology Strategy Board (TSB), Engineering and Physical Sciences Research Council (EPSRC) and associated industrial sponsors.

The value of research funding obtained through these combined sources is substantial, with research examining diverse engine technology requirements often directly informing component design.

The next generation of world-class materials scientists and metallurgical engineers are trained at the UTC, which is a focal point for postgraduate research into structural metals and ceramics and a vital asset to the College of Engineering.

Students work closely with Rolls-Royce engineers and, in the case of the EngD programme, are even based with the company to maximise knowledge transfer. Over 90 per cent of UTC postgraduate students go on to work for Rolls-Royce or similar companies in the aerospace industry.

www.swansea.ac.uk/utc/

Research Centre in Applied Sports Technology, Exercise and Medicine (A-STEM)

The Sport and Exercise Research Group was established in 2001 to examine aspects of the physical sciences, life sciences and behavioural sciences which influence participation and performance in sport. In 2008/09 the group was integrated into the College of Engineering and expanded its research interests to include technology and sports medicine.

Key fields of research include the exercise-related enhancement of health and sport performance, covering these multidisciplinary research areas: applied physiology in sport, cognition and behaviour in sport performance, and biomechanics and motor control.

While the group’s expertise lies mostly within the disciplines of physiology, psychology and biomechanics, a base within the College of Engineering provides avenues to exciting research areas such as human instrumentation and healthcare product design. An increased emphasis on interdisciplinary research also offers collaborative opportunities with medicine and other sciences.

Since 2008 Sports and Exercise Science staff have produced over 120 peer-reviewed publications in sports, exercise, health and medicine periodicals.

Researchers have also generated almost £1.5 million in research grant awards from charities, research councils, the Technology Strategy Board (TSB), the EU FP7 framework, Welsh Government, and industry.

Current research projects are concerned with the impact of training, competition and travel stress on sports performance, and the role recovery strategies play in managing this physiological stress. Other key interests involve the development of automated control systems for artificial lungs and the neuroscience of group behaviour.

The Department of Sport and Exercise Science has developed specialist research facilities, which rank alongside the most prestigious and well known universities in the UK, including a Motor learning Laboratory, a Biomechanics Laboratory, which is home to a state of the art motion analysis system, a Notational Analysis Laboratory, an Exercise Physiology Laboratory, and a Teaching and Research Laboratory.

Swansea University also hosts a £20 million sports village, which houses a Sports Centre, an Indoor Athletics Centre, the Wales National Pool, and outdoor facilities including rugby and football pitches, all-weather tennis courts, water based Astroturf pitches, and an eight-lane running track.

www.swansea.ac.uk/sportscience/research/
Steel Training Research and Innovation Partnership (STRIP) and the Centre of Advanced Training for Engineering Doctorates (COATED)

The Steel Training Research and Innovation Partnership (STRIP), made possible by the EU’s Convergence European Social Fund through the Welsh Government, is helping to build a robust metals and manufacturing sector in Wales. Led by Swansea’s College of Engineering, the project trains people from academia and industrial backgrounds in a range of fields from metallurgy and corrosion, to coatings, industrial backgrounds in a range of fields from metallurgy and corrosion, to coatings, industrial backgrounds in a range of fields from metallurgy and corrosion, to coatings.

Previous projects include:
• Study of localised corrosion on aluminium using electrochemical techniques;
• Functional coatings for dye solar cells;
• Study of Boron Steels as suitable ‘Spring Steel’ for automotive rear chassis twist beams.

STRIP is currently running projects with Tata Steel, BASF, EM Coatings, Joseph Ash galvanisers, Valeo, Matramet, RITech Services, Novolex, Vector International, Crown Packaging and Akzo Nobel.

EngD activity has been extended to focus on functional coatings through a new doctoral centre called COATED – the Centre Of Advanced Training for Engineering Doctorates. COATED is joint funded by the EPSRC and the Welsh European Funding Office (WEFO) and will provide funding to recruit a further 21 EngD students between 2012 and 2014.

www.strip-project.co.uk/
Engineering: making an impact

Impacts for Tata Steel Europe (Coatings Development)

The Materials Research Centre at Swansea University has made significant contributions to the development of two commercial metallic coating systems with improved corrosion resistance, a novel photovoltaic coating for building photovoltaics and significant underpinning science. These have enabled Tata Steel to offer corrosion guarantees for up to 40 years.

Tata Steel UK’s Shotton Steelworks now produces a five per cent aluminium containing galvanised steel for construction, underwritten by a full consequential loss warranty of up to 40 years. This has been made possible through mechanistic understanding of the critical links between microstructure and corrosion resistance, involving new techniques to visualise and quantify corrosion. Bespoke equipment combines with traditional metallurgical study to accurately determine how process parameters affect performance enabling manufacture.

Tata Steel Ijmuiden now produces a magnesium for the automotive industry, containing galvanised steel with high corrosion performance and half the coating weight of traditional steel coatings. Understanding potential corrosion mechanisms has again been at the centre of this introduction. Initial testing using salt spray methods did not reveal the potential failure mechanism, which was discovered by the use of Swansea-designed scanning Kelvin probes. This resulted in a key breakthrough in pre-treatment and primer chemistry, preventing a damaging aesthetic corrosion known as filliform. Without this the product could not have been launched.

The Sustainable Product Engineering Centre for Innovative Functional Industrial Coatings (SPECIFIC) (see page 66) has continued a successful collaboration to develop and scale-up dye-sensitised cell (DSC) photovoltaics on steel. New process technologies have converted what was a batch process into a continuous process, resulting in a 40 million pound industrialisation investment in Wales in 2012. The key breakthrough helps to reduce process times, with new near infrared heating methods solving the three main bottlenecks in DSC manufacture.

Continued funding support from EPSRC and the Welsh Government in the Engineering Doctorate programme has supported the technical impacts detailed above and facilitated a talent flow from the university to industry. This provides a clear and sustainable positive impact on industrial partners, and supports a more diverse set of research interactions.

Led by Professor Dave Worsley and Professor Neil McMurray, the Corrosion and Coatings Group at Swansea has developed world-leading capability in the science and technology around coatings required for steel products. The group expanded with the appointment of Dr Geraint Williams and Dr James Sullivan in 2003 and 2007 respectively, and has grown to 15 post doctors and 32 research students. It is now located in a bespoke facility at the Baglan Innovation Centre, co-located with industry staff for maximum impact in the SPECIFIC Innovation and Knowledge Centre.

Research has focussed on areas of corrosion and photostability (durability) and increasingly on functionality, from aspects of controlled release technology to functional coatings such as photovoltaics. A key aspect of Swansea’s competence is the science of scaling and the importance for real-world construction and automotive products of durability. This is underpinned by a fundamental understanding of electrochemistry and photochemical effects.
Airbus lifted by composite material research

A novel design methodology has been jointly created with Airbus UK incorporating deleterious effects on mechanical properties due to environmental moisture over an aircraft lifetime. Coupling fundamental experimentation with numerical modelling, effectiveness has been continually tested and measured through successive rigorous Technology Readiness Level (TRL) assessments at Airbus.

Airbus has helped to fund a continuous series of Swansea University research projects since 2006. Collectively known as EMOC – Environmental Modelling of Composites – the projects relate to an improved understanding and quantification of the effects of moisture ingress into airframe composite materials over the lifetime of an aircraft. Increasing use of thicker composite materials and the drive for lighter weight aircraft means a more sophisticated approach, leading to a less conservative design but simultaneously maintaining safety.

The research sought to understand and quantify moisture ingress into composite materials including temperature, environmental and anisotropy effects, to generate data to aerospace design standards for designers, and to devise or validate computer-based design tools for incorporation into Airbus design software across the company.

The overall objective of EMOC to deliver Airbus significant and broad-reaching new design software capable of resolving moisture levels in individual plies was achieved. Moreover, the considerable achievement within EMOC of moving from TRL2 to TRL6 is an excellent demonstration of research work evolving into commercial engineering practice, in this case with associated financial and environmental benefits.

 Finite Element and Discrete Element

Computational research work at Swansea has made a profound impact on the solution of industrial problems. Developments have centred on finite element based procedures for the simulation of nonlinear material problems under finite strain conditions – including rate-dependent plasticity, material damage, contact conditions and multiscale phenomena; and on discrete element computational procedures for multifracturing solids.

This methodology constitutes the core technology of commercial software system ELFEN, marketed by Rockfield Software Ltd. It has enabled the company to develop an international reputation as a leading provider of computational technology to the defence, manufacturing, oil recovery and mining sectors.

The work was led by Professor David Roger Jones Owen and Professor Djordje Peric, with substantial contributions made by Professor Yunton Feng, Professor Eduardo de Souza Neto, Dr Wulf Dettmer, and Dr Chenfeng Li.

Core research has involved numerical modelling of the deformation of solids under finite strain conditions, leading to material damage and to the ultimate development of a multifracturing state. Computational treatment necessitates a blend of continuous and discrete computational processes to provide an adequate solution.

Modelling aspects related to continuum mechanics include the development of constitutive models for a range of materials under a variety of loading conditions, element technology for near-isochoric deformation conditions, and adaptive mesh refinement and damage modelling for predicting the onset of fracture.

Computational issues include strategies for discrete crack insertion that preserve the system energy, adaptive remeshing to accommodate the fracture distribution and global search algorithms to monitor contact between the resulting particle system.

These computational developments have informed a world-leading computational technology platform designed by Rockfield Software Ltd, solving a range of real-world multi-physics problems involving nonlinearly deforming and multifracturing materials.

Rockfield Software Ltd is a spinout company, which was principally formed by Professor David Roger Jones Owen and initially based in the University’s Innovation Centre. The aim of the company was to transfer high quality computational modelling research from the University and into the commercial sector.

The company initially employed two engineers and over subsequent years expanded to over 30 personnel, with over two-thirds of the staff possessing PhD degrees. This made the company a leading regional employer of high technology graduates.

The last two decades have seen continuous collaboration between Rockfield Software Ltd and Swansea University. This collaboration is still in progress through joint research projects, with research developments from the university embedded in the company’s technology base. In return, Rockfield has supported further research through research grants and postgraduate funding.

Widening research work embedded within the ELFEN system has allowed the company to operate in several commercial areas and develop a wide portfolio of clients. Rockfield Software Ltd is now internationally recognised as a highly valued provider of computational services to both SMEs and worldwide conglomerates.

Rockfield Software Ltd has built strong relationships with many of the world’s leading companies. These include Uniliver, DSTL, Qinetiq, Conoco, Proctor & Gamble, Deenever Marine Ltd, Rio Tinto, BP Amoco, Shell, Exxon Mobil, Total FineELF, MiningTek, Ocina, Anhauser Busch and Los Alamos, Sandia and Lawrence Livermore National Laboratories.
A selection of the recent and forthcoming publications from the College is highlighted below.

Publications:

Brown, S.

Claypole, T.

Daniels, D.


Higgins, A.

Hilal, N.


Jo-Nam, Y.

Rees, P.

Summers, H.


2010, ‘Single cell nanoparticle tracking to model cell cycle dynamics and compartmental inheritance’, Cytometry.


Teng, V.


Tizzoni, C.

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College of Human and Health Sciences

Researchers at Swansea University are working to tackle pressing challenges facing the health and social care system in the UK. These challenges range from biomedical testing, service organisation and workforce practice, through to chronic conditions, public health, policy and ethics.

All research is delivered through discipline-focused research centres, which examine fields such as child research, ageing, psychology and social care, as well as midwifery, nursing and allied health professions. External funding from a number of prestigious bodies has played a large role in supporting these research centres. Funding bodies that have supported the College’s work include Welsh Government, NHS Wales, the Health Foundation, Research Councils, The British Academy, The Leverhulme Trust, The Wellcome Trust, The Ministry of Defence, private sector organisations in the pharmaceutical industry, Tenovus, the Multiple Sclerosis Society and the National Institute for Health Research.

Research areas where Swansea University leads Wales include social work and social policy and administration, while previous assessment results highlighted internationally recognised research excellence in psychology, and nursing and midwifery.

Academic findings are crucial to identifying the necessary changes for services. As a forerunner in the field, Swansea University is well placed to rapidly respond to changes in the delivery of care, while establishing links with the NHS and other key service providers in Wales. Research from the College also directly informs teaching to ensure new generations of practitioners have the latest relevant knowledge.

Professor Ceri Phillips,
Director of Research, College of Human and Health Sciences

Research Centres
• Centre for Innovative Ageing (CIA)
• Children and Young People’s Health and Well-Being (CCYPHW)
• Swansea Centre for Health Economics (SCHE)
The College of Human and Health Sciences contributes to the health and prosperity of Wales through the open exchange of ideas within an environment that promotes research of the highest quality and integrity. This approach has been crucial in ensuring our research remains relevant to the needs of service users and policy makers, and brings with it real impact for health and social care services.

Collaborative links and partners are highly important to the College’s research, and have been fostered throughout the Welsh policy, voluntary, and healthcare sectors at all levels. Similarly, academic links have been formed with schools of similar expertise throughout Wales and the UK, such as the Universities of London, Exeter, Keele, Manchester and Oxford. These collaborations have been crucial in ensuring research informs, and is informed by, the wider healthcare environment. This was demonstrated in the 2008 Research Assessment Exercise, which showed that 85% of the College’s research in this area was of international or world-class quality.

Researchers have also been proactive in forging links with highly regarded and influential bodies throughout the healthcare sector and beyond, and are members of a diverse range of groups:

• Children and Young People’s Partnership
• Children in Wales
• Council of the Association for Medical Humanities
• Honour Society of Nursing Wales
• International Council of Sport Science and Physical Education
• International Philosophy of Nursing Society
• Ioanita McAuley Trust
• Wales Health Work Partnership
• Wales Institute of Cognitive Neuroscience (WICN)
• Older People and Ageing Research and Development Network (ORAN)

The College is also represented on the All-Wales Medicines Strategy Group, which in addition to technology appraisals plays a pivotal role in determining policies relating to medicines management within Wales. Equally important are the links that have developed with our international academic colleagues in places such as Mahasarakham, Thailand; Jinja, Uganda; Cape Town, South Africa; Adelaide, Australia; and New Jersey and Minnesota, USA.

Some recent influences of the College’s research are detailed here:

Tackling drug abuse in the USA

The significance of the College’s research has been recognised internationally. For example, in 2010 Professor Andy Parrott was invited by the Deputy Attorney General’s Office in the USA to appear as an expert witness in a court case involving MDMA trafficking. The Attorney General’s Office had approached the National Institute on Drug Abuse (NIDA) to provide the names of experts who could describe scientific evidence on the damaging effects of recreational human use of MDMA. Professor Andy Parrott was recommended and delivered a forty page summary document for the Attorney General’s Office. Professor Parrott was extensively cross-examined in court, with the judge noting his extensive publication record in this field. The resulting court judgment was that MDMA was similar in its overall damaging effects to cocaine.

Infant feeding

The Economic and Social Research Council (ESRC) has awarded £771,070 to Dr Amy Brown for research into breastfeeding and the role it may play in reducing risk of childhood overweight and obesity. The current findings are part of a study examining the importance of feeding behaviours such as breastfeeding and timing of introduction to solid foods and long term health outcomes for children.

Work on infant feeding was adopted by the NICE guidelines for intrapartum care (2007). The University’s researchers, led by Dr Sue Jordan, were the first group to identify a dose-response relationship between epidural fentanyl and chances of breastfeeding. Accordingly, high doses are no longer administered, and NICE recommends a maximum of 100 micrograms. Implementing this change will allow 20,000 to 40,000 more babies to be breastfed every year in the UK. Recent work, which has received considerable media coverage, has highlighted another association between infant feeding and drugs in labour, which with further research could increase the numbers of women breastfeeding.

Improving the delivery of care – cardiac services

Through work with healthcare professionals in South Wales, the health informatics team have developed technology to support the delivery of care to patients with suspected cardiac problems. This technology is the first of its kind in the UK. By speeding up the diangosis process, and through the reduction of waiting times, the service is better able to respond to patients’ needs by enabling patients to see a cardiacologist within weeks of visiting their GP with symptoms of chest pain or heart failure. The system has since received a National Leadership and Innovation Agency for Healthcare award for innovation in healthcare.

Eating disorders among elite athletes

Professor Michael McNamee and Dr Jacinta Tan led a team of researchers from Swansea University in partnership with British Gymnastics in a project aimed to explore the welfare of elite gymnasts in relation to the presence of eating disorders. The study combined social science methods with theory from the fields of psychiatry and philosophy to study eating disorders in elite gymnastics and make recommendations regarding policies to improve the welfare of elite gymnasts, who are pushing the boundaries of their athletic potential.

The intention of the research was to identify issues relevant to eating disorders with a view to prevention and improvement of elite sports practice in the longer term, both within the UK and internationally. Michael McNamee is Professor of Applied Ethics at Swansea University. He is the editor of the journal Sport, Ethics and Philosophy, the Ethics and Sports Series Editor for Routledge books, and Executive Member of the British Philosophy of Sport Association.

Disability history research

The Wellcome Trust has granted a Swansea University-led research team £972,501 for a research project entitled ‘Disability and Industry: A Comparative Cultural History of British Coalfields’, which will bring together academics from Swansea, Aberystwyth, Northumbria and Strathclyde Universities to focus on how industrialization shaped perceptions and experiences of disability between 1780 and 1948. The grant makes Swansea the leading UK centre for disability history with a research programme of international significance. The research team is led by Professor Anne Borsay.

Combating MRSA

Hospital acquired infections are headline news due to microbes increasing resistance to conventional antibiotics. Work underway in the College is showing promise in working towards developing new antimicrobial compounds which could help address this problem. Potential compounds have been patented and are being commercially assessed for pharmaceutical use.

Health and wellbeing in work

The impact of health on work is a complex issue, involving interactions between medical, occupational, economic, cultural and psychological factors. The Wales Health Work Report, commissioned by the Welsh Government and Department of Work and Pensions, looked to investigate new ways of addressing the adverse impact on work caused by health inequalities and social exclusion. Research in collaboration with Cardiff and Keele Universities aimed to focus on the relationship between health, wellbeing and work within Merthyr Tydfil, one of the most deprived communities in Wales in terms of child and working-age poverty.

The team initially focused on musculoskeletal disorders. However, over time this was expanded to encompass other more common health problems such as chronic pain and mental health complaints. Addressing the problem meant a mixed method approach was required, investigating the problem through a quantitative longitudinal employee survey and a qualitative study using focus groups and semi-structured interviews. In drawing its conclusions, the study suggested that the underlying multifactorial issues needed a multi-faceted response. However in the short term, interventions could be introduced at the level of individuals, organisations, health professionals, and/or the general public, which would likely be successful in addressing the impact of health on work.
**Children and Young People's Health and Well-Being (CCYPHW)**

CCYPHW leads rigorous multidisciplinary and interdisciplinary research and evaluation through high quality applied investigations into the stages of human life from birth through to early adulthood.

Research within the Centre is focused on four main themes: Children and young people's health includes issues of obesity, cardiovascular risk factors, diabetes mellitus, metabolic syndrome, inactivity, health promotion, mental health, palliative care, intermediate care; children and young people; designing or manufacturing products for an ageing population; managing and delivering services for older people; managing and delivering services for older people; older people; designing or manufacturing products for an ageing population; and taking a perspective that examines contradictions, values, assumptions and consequences associated with ageing populations. The Centre nurtures innovation, and is a place that values to different, unconventional and novel.

Although ageing is accompanied by biological changes, the CIA believes that, in order to understand, explain and contextualise ageing, a holistic approach is needed - one that shifts from medicine and the medical model, to one that encompasses a range of disciplines and that views ageing more positively (and not as an abnormal state). It believes that by rejecting disciplinary boundaries and adopting the most appropriate methods for approaching particular research questions, it can help to place Wales at the cutting edge of multidisciplinary research in ageing.

The CIA has a distinctive feel – it houses an energetic group of researchers and academics who are passionate about advancing research and educational missions, yet maintain their critical curiosity, and take a perspective that examines contradictions, values, assumptions and consequences associated with ageing populations. The Centre nurtures innovation, and is a place that values to different, unconventional and novel.

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The Centre provides the infrastructure, focus and leadership for ageing research and scholarship across the College of Human and Health Sciences, as well as Engineering and Medicine. It hosts the Older People and Ageing Research and Development Network, and the Wales Stroke Research Interest Group, and has strong links with Wales Dementias and Neurodegenerative Diseases Research Network (NEURODEM CyMR).

The Centre’s current research falls into four broad areas:

- Civic and social engagement and participation of older people including: intergenerational relationships, social and support networks, civic participation and the disruption of these types of engagement based on personal (e.g. migration, psychological resources) and structural (e.g. multiple disadvantage, discrimination, national or local policies, transport factors).
- Environments of ageing including: natural and built physical space; functional design, community, housing; climate change and extreme emergencies caused by natural and human-made events.
- Care provision for older people including: social care, health care; intermediate care; residential care; palliative and end-of-life care.
- Chronic conditions, falls and prevention in old age including: falls, stroke, cancer, dementia; depression, and health promotion.

The CIA is also creating a business network, linking industry to researchers at the forefront of research in their fields, and is developing a series of business breakfasts to engage with employers in new ways.
Supported living environments for older people

A programme of research into the acceptability and suitability of supported living environments for older people was initiated at Bangor University in 2000-2002 under the leadership of Professor Vanessa Burholt. It was backed by a grant, Housing for an Ageing Population: Planning Implications (HAPPI), funded by the National Institute for Social Care and Health Research (NISCHR).

A publication on research undertaken at Bangor University identified the preferences of older people for certain features of supported housing and what models of care may meet these preferences. Extracare sheltered housing was judged more likely to meet needs in six key domains than either sheltered housing or residential care.

The Welsh Government subsequently pledged £41 million for the provision of Extracare housing. Guidelines for Developing Extra Care Housing in Wales stated that Extracare should “take into consideration the likely impairments that residents will experience with increasing age and frailty”. However, the burgeoning provision of Extracare in Wales was not evaluated as it was implemented, and it was not clear whether it accommodated the changing needs of both fit and frail older people.

Between July 2008 and June 2010 Swansea University’s Professor Judith Phillips and Professor Vanessa Burholt obtained £231,560 from NISCHR for a project entitled Extracare: meeting the needs of fit or frail older people? This research sought to establish whether Extracare accommodates the changing needs of both fit and frail older people, particularly those with cognitive impairments. It also asked if complex integrated health and social care could be delivered in Extracare; if the views of managers and social workers, residents and family members and older people in Extracare schemes were compared to residential and home care; if Extracare cost effectiveness, compared with residential and home care, was similar, and if it evaluated the specific quality and practice implications for Wales.

The research found that Extracare sheltered housing provides for proportionally fewer frail older people than the other care environments. It also found evidence that older people with cognitive impairment were systematically excluded from these living environments through assessment and admissions processes that consider these settings inappropriate for those who may pose a risk to themselves or others.

It was also revealed that Extracare sheltered housing provided the conditions for increased social interaction which was particularly attractive for older widows, although increased interactions did not necessarily lead to high quality and emotionally satisfying social relationships.

As a result of the findings, eight recommendations were given for changes in guidelines regarding the development of Extracare provision, and local Registered Social Landlords (RSL) and private landlord practices for the provision of Extracare. These recommendations were supported by the National Partnership Forum for Older People in Wales which advised the Minister with responsibility for Older People to adopt them.

During the course of the research it became clear that several local authorities were closing local residential care homes and remodelling facilities to provide Extracare sheltered housing for older people. Closure of care homes has high policy relevance because of the impact on the well-being of older people, and potential litigation.

The Welsh Government guidelines introduced in May 2009 provided an opportunity to examine how care homes are closed and explore the process from the view of various stakeholders. In collaboration with the Older People’s Commissioner (OPC) in Wales, Professors Burholt and Phillips obtained funding from NISCHR to examine the closure of care homes for older people in Wales. Findings identified substantial gaps in local authority protocols and practice employed during care home closures. Researchers drafted new guidance for the Welsh Government entitled: Escalating concerns with, and closures of, care homes providing services for older adults. This comprised two separate documents dealing with in-calculation concerns, and with the closure of care homes.

This wide-ranging research has had, and will continue to have, significant impacts on the organisational activity of Extracare sheltered housing providers, local authorities and policymakers through the adaptation and adoption of amended guidelines.

The Older People and Ageing Research and Development Network (Cymru) organised regional seminars with the Office of the Older People’s Commissioner in Wales for practitioners and policymakers with an interest in supported living environments. Seminars consisted of preliminary findings regarding the closure of residential care facilities in Wales (including remodelling to Extracare), a summary of the findings of the Extracare project, an overview of recommendations, and a presentation on how Extracare facilities could be adapted for older people with mild to moderate cognitive impairment.

In 2010 and 2011, Professor Burholt and Dr Paul Nash presented recommendations from the Extracare project to meetings with RSLs, (Coastal Housing, Cymorth Cymru), and provided evidence to Gwynedd Housing Review, the South East Wales Improvement Collaborative (SEWIC) and the Commissioner for Older People in Wales. The latter led to collaboration with the Older People’s Commissioner on research on the closure of care homes. Evidence of the influence on RSLs, SEWIC or Gwynedd Housing Review is not yet available.

Professor Burholt is the research member on the National Partnership Forum for Older People in Wales and in July 2011 presented the recommendations from the Extracare project to the Forum. Recommendations were accepted by the group and the Minister for Older People (Gwenda Thomas AM) was advised to adopt the recommendations.

Knowledge gained from the programme of research is currently being used to inform the private sector, with Professor Phillips advising Glam Goch, and Professor Burholt advising SS Plus on new build projects. Evidence from the project of care home closures will be presented at a series of OPMH/OPC seminars and will feed into the Social Care Review on Residential Care.

Extracare: meeting the needs of fit or frail older people? was led by Professor Vanessa Burholt in collaboration with Professor Judith Phillips. The Swansea University team included members of the Centre for Innovative Ageing (Dr Paul Nash - lead researcher), Dr Shane Dobbs, Dr Hannah Marston; the Centre of Social Work and Social Care (Dr Sharril Evans) and Centre for Health Economics (Professor Gwn Philips). The team also collaborated with Dr Sinead O’Mahoney (Blandough Hospital, CareAP).
Health Economics and the Swansea Centre for Health Economics (SCHE)

Health Economics work programmes have all generated impact in terms of presentations, policy and practice, publications and opportunities for further research.

In relation to the economics of pain and pain management, outputs have included book contributions, peer-reviewed publications and invitations to contribute specific articles. These have also been a number of invitations to present at meetings and conferences, notably to:

- The Associate Parliamentary Health Group, House of Commons, London, June 2003;
- British Pain Society Plenary Lecture, Edinburgh, 2005;
- Plenary Lecture at International Collaboration on Evidence-Based Critical Care Anaesthetics and Pain/International Association for Study of Pain, Alicante, 2006;
- Lecture at Europe against Pain Conference and the EPIC Symposium on Societal Impact of Pain held at European Parliament (Brussels, 2011).

Work undertaken has been used, and advice provided, in the development of policy documents at Wales and UK levels. Various media interviews were conducted following a Pain Summit hosted by Policy Connect and involving a range of stakeholders from politicians and policymakers to patients and professionals. The Summit directly led to the inclusion of his research in the Annual Report of the Chief Medical Officer for Wales. Further work was then commissioned by the Welsh Government relating to prioritisation and prevention expenditure. Research undertaken within this workstream has involved collaboration with colleagues from across Swansea University and other institutions, with one project funded by the Department of Health resulting in a publication in the Injury Prevention journal that was selected as the Editor’s Choice for that particular edition.

Research undertaken within the policy and practice workstream has led to the appointment of Professor Phillips as a member of NICE Programme Development Groups for Physical Activity and the Environment, Long-term Sickness and Disability, Injuries in Children and Obesity.

The economics of public health and health promotion workstream resulted in publications and public presentations, leading to the establishment of important working relationships with Welsh Government and National Institute for Health and Clinical Excellence (NICE). Professor Ceri Phillips was involved in the production of a health economics manual for health promotion practitioners which has been used in Wales, across the UK and further afield. Collaboration with the Welsh Government has also helped access funding to evaluate how far alcohol and obesity influence NHS expenditure. This activity reflected work undertaken for ASH Wales on the impact of smoking on NHS expenditure in Wales, but also led to the inclusion of his research in the Annual Report of the Chief Medical Officer for Wales. Further work was then commissioned by the Welsh Government relating to prioritisation and prevention expenditure.

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The economics of pain and pain management workstream was developed by Professor Phillips at Swansea in conjunction with colleagues at other institutions. It harnesses work undertaken to assess the impact of adverse events from the treatment of pain with non-steroidal anti-inflammatory drugs. Parallel workstreams were also developed in public health and health promotion, after earlier work undertaken in smoking cessation, alcohol and obesity. This work has been pivotal in the establishment of the Swansea Centre for Health Economics (SCHE). SCHE delivers a first class research and consultancy service to organisations in the healthcare sector. With over 60 years of experience and a team of health economic experts, this Centre bridges the gap between academia and industry to lead health economics research in Wales and throughout the UK.

Expertise developed in economic evaluation and evaluation methods has resulted in a portfolio of over 40 collaborative projects funded through a mixture of National Institute for Health Research (NIHR) RDG programmes, governments, health authorities and pharmaceutical industry organisations. Studies include evaluations of interventions and programmes such as an MRC funded study to assess the relative effectiveness and efficiency of a family based intervention to prevent alcohol and drug misuse among younger teenagers; an NIHR HTA evaluation of schemes designed to prevent dental decay; an NIHR HTA multi-centre trial in diabetic foot ulcers; and a CRUK funded trial of chemoradiation regimens in oesophageal cancer. Further work has been undertaken on assessing the health and social burden of chronic pain, conditions affected by smoking, alcohol and obesity, injuries and spondylitis.

Research undertaken in recent years has been directly responsible for engagement with strategic national developments and influential bodies. Professor Phillips has been a member of the Bevan Commission, established on the 60th Anniversary of the NHS, to oversee the developments within NHS Wales. Research undertaken was also pivotal to Professor Phillips’ invitation to contribute to strategic developments in Welsh health policy, as formulated with Setting the Direction, and more recently in the appointment as University representative on the Abertawe Bro Morgannwg University Health Board and the Saving 1000 Lives+ Programme Board.

Wales Centre for Practice Innovation (WCPI)

Two extensive research programmes have resulted in a network of practice innovation units (PIUs) across two Local Health Boards (LHBs) in West Wales. PIUs are wards, units or clinical teams committed to developing practice to improve patient and service user care. The network currently comprises five accredited PIUs and expressions of interest from 17 other aspiring PIUs. The network is founded on a collaborative relationship between academics and practitioners derived directly from principles of academic engagement with nursing practice and methodologies for reflexive working developed in the programmes of research.

The Wales Centre for Practice Innovation seeks to make a positive and measurable difference to healthcare practice, for service users and providers. It seeks to overcome organisational constraints and communication challenges by facilitating governance, capturing evidence, and structuring the progression of work to improve practice and care. It provides a focal point where innovations in practice may be planned, debated, collated, coordinated, appropriately researched, supported and disseminated.

Wales Centre for Practice Innovation is strategically managed by the Wales Centre for Practice Innovation Steering Group, a multidisciplinary and unique collaboration between Abertawe Bro Morgannwg University Health Board, Hywel Dda Health Board and the College of Human and Health Sciences. The College of Human and Health Sciences has engaged with five independent reviews of service activity from 2010 to 2012, with both coalition Health Boards. As initiatives and projects develop, more definitive outputs in terms of publications and evidence based practice will be seen.

The College of Human and Health Sciences
Brain and Behaviour

This group integrates neuroscience and behaviour research within the themes of brain chemistry, neuropsychology and brain injury, and psychophysiology – particularly Electroencephalography (EEG). Expertise includes the effects of nutrition and drug use on cognition, mood and behaviour, dyslexia and closed head injury; and sleep disorders.

Brain and behaviour research aims to produce high-quality investigations which combine neuroscience and behaviour. Its research programme is arranged under three themes. Its strengths in brain chemistry research lie in eating, nutrition, recreational drug use and their effects on cognition, mood and behaviour. A line of research in neuropsychology and brain injury has strong research interests in laterality, dyslexia and other disorders of reading, closed head injury and its consequences. Thirdly, psychophysiology research concerns EEG and neurofeedback research applied to clinical disorders and sleep.

Clinical and Health Psychology

Clinical and Health Psychology researches into areas such as diet, exercise, sleep, working conditions and brain injury to examine how the brain and human behaviour affect, and are affected by, physical and psychological well-being. This research group tests and develops psychological theory, and informs policy and practice. It does this by conducting experimental studies in the laboratory as well as studies in the field, many of which are supported by grant giving bodies including the ESRC, MRC, and NASCHR, the Welsh Government, Nuffield Foundation, and The Institute of Occupational Safety and Health. Research work is published in journals as varied as Health Psychology, Neuroscience and Biobehavioral Reviews, Appetite, Psychoneuroendocrinology, Psychology, Psychology and Health, and Applied Ergonomics.

Key areas of study include the control and consequences of various dietary practices, including examination of food preferences, attitudes towards food, family influences on food choice, the impact of nutrition on psychological functioning, as well as longer term issues of body image and decisions related to bariatric surgery.

Research Groups

Brain and Behaviour

The group also has expertise in clinical or behavioural change interventions. This involves clinical analogue treatment studies using mindfulness and Acceptance and Commitment Therapy, anxiety and avoidance; rehabilitation of brain injured individuals; the treatment of nightmares; brief interventions to reduce the emotional distress associated with a number of long-term health conditions or their treatments; public health and individually targeted programmes of health-related attitude and/or behaviour change; and cognitive behaviour therapy for people with intellectual impairment.

Investigations into cognition and health span broadly from emotion-based decision making and the impact of depression and a depressive coping style on memory, to memory for health-related behaviour, and reasoning by people with intellectual impairment.

Drug and alcohol research covers the adverse effects of recreational drugs on everyday wellbeing, and the effects of these drugs on mood and cognition. Workplace research has looked at the long-term effects of shift work and implications for health and safety management.

Cognition and Perception

This group offers further depth in areas of attention and perception, reading and language, memory and implicit learning. A range of techniques are employed including mathematical modelling, eye movement recording, neuropsychological testing, electroencephalography and functional magnetic resonance imaging.

Research is conducted here that can be broadly grouped into three areas: attention and perception, reading and language, memory and implicit learning. One line of work in the field of perception examines the perception and identification of static and dynamic visual objects, together with events and the nature of mediated representations. Another line of work examines attentional processing and its modulation by the presence of static and moving objects in the visual scene. A strand of research in the field of learning and memory examines mathematical laws that describe and explain human understanding of rules, similarity and implicit learning, and the ability to spontaneously form categories. This includes a focus on whether or not it is sensible to formulate a distinction when examining accessibility to consciousness. Another line of work concentrates on the inhibitory processes in memory and forgetting within both theoretical and applied settings, as well as the inhibitory mechanisms in memory.

In the field of reading and language, one research area looks into word production and recognition in monolingual and bilingual speakers, first and second language acquisition, children’s literacy acquisition and the skills required for successful reading. A second area involves the causes and mechanisms underlying developmental dyslexia, deep dyslexia in bilingual patients across shallow and deep orthographies, together with the role of dyslexic brain hemisphere asymmetry. A third area concerns cross-cultural interpretation of icons and the skills underpinning children’s understanding of icons and signs.

Evolutionary Behavioural Science

This group explores how evolution and ‘survival of the fittest’ prevails within current society and influences continued development through modern day relationships and interactions. Questions under consideration include why some people are jealous and possessive in their relationships, while others take a more relaxed approach. Group research concerns mating behaviour and relationships, altruism and aggression, and the philosophical implications of evolution.

Learning and Behaviour

Learning and behaviour research examines mechanisms which allow behaviour and thoughts to adapt to the environment, and it investigates the role of learning and memory processes in generating flexible and adaptive behaviours. These behaviours allow efficient learning and processing of information in a wide variety of contexts, across age ranges and even across species. While adaptability and flexibility promote psychological wellbeing, there can be unfortunate negative effects of these behaviours. Research includes autism and early interventions, schizophrenia, and reward sensitivity theory.

Specialised research facilities include a sleep laboratory, computer-controlled visual and auditory displays for work on perception, attention, memory and language; an eye movement laboratory; and a nutrition laboratory. Researchers and students also have access to state-of-the-art MRI (Functional Magnetic Resonance Imaging) brain scanner and EEG facilities.
Health History and Culture

This joint initiative between the College of Human and Health Sciences and the College of Arts and Humanities applies concepts and methods of history, literature and the visual arts to the analysis of health and the provision of healthcare.

In 1959 the novelist C.P. Snow provoked a stir in popular culture by arguing that science had replaced the humanities in the arts and sciences. This led to the famous ‘two cultures’ debate. Nevertheless, the humanities have continued to be important in popular culture. In healthcare, the rise of evidence-based medicine has led to a breakdown in communication between art and science, where the former has become marginalized. Although medical developments have brought many benefits, they have also reduced care and human rights. The related topic of trauma, which includes life-changing events, domestic and political violence, war and natural disaster, also raises crucial questions about mental health and human rights.

Another key theme is power, knowledge and human rights. Interactions between political and professional power, expert medical knowledge and the practice of providing healthcare constitute a crucial nexus which is investigated through historical and contemporary contexts. Medical thinking, diagnosis and treatment have always had a significant relationship to the political regime by engaging the arts and humanities with healthcare practice.

Activities of the practice cluster around three main themes: one of which is disability; trauma and the body. Disability is fundamental to the human condition and is not solely of interest to the impaired, their carers or advocates. Questions relating to physical stigma and disability belong to both medicine and historiographic scholarship. The human body has been central to all healthcare professions since antiquity. The human body is one of the foundational concepts of human medicine, which is one of the most ancient professions, and has been a subject of study throughout history.

Disability is defined as a medical condition and an impairment. Disability is the result of interaction between an individual’s body, the environment and society. Disability is a multidisciplinary field that involves experts from different disciplines, such as medicine, psychology, sociology and philosophy.

Disability is a condition that can affect physical, mental, and social functioning. It can be caused by a variety of factors, including genetic factors, environmental factors, and accidents. Disability can range from mild to severe, and can affect people of all ages.

Disability is a complex and multifaceted condition that can affect all aspects of a person’s life. It can cause physical and mental health problems, as well as social and economic challenges.

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Research projects

The Application of a Neurobehavioural Paradigm to Traumatic Brain Injury Rehabilitation

This research covers the development of a neurobehavioural paradigm and its application to traumatic brain injury rehabilitation. Traumatic brain injury (TBI) is a major cause of long-term disability in industrialised and developing countries across the world. An estimated 10 million people will be affected annually by TBI and it has been predicted that by 2020 it will surpass many diseases as the major cause of death and disability. It constitutes the third largest contributor to the global burden of disease and disability.

Many who sustain TBI will experience major changes in cognition, personality, and behaviour. Most never recover full social independence while many end up unemployed and dependent upon their families, even though they may have no physical disability. They often impose a significant psychological burden on their families and many marriages or partnerships break down, increasing the risk of social isolation and subsequent psychological distress. Mood disorders are common and there is a high risk of suicide, although most survivors have a normal life expectancy.

Swansea University research was based on research and clinical suicide, although most survivors have a normal life expectancy.

Over the last 10 to 15 years the neurobehavioural paradigm has been adopted directly or indirectly by a large number of specialist centres throughout the world, both for assessment and for the design of specific treatment interventions. The neurobehavioural paradigm has influenced both translational research and clinical practice in the rehabilitation of brain damaged people presenting complex patterns of disability. It thereby improves the potential for many individuals to return to the community and live in an independent or semi-independent manner. Swansea University’s research was based on research and clinical suicide, although most survivors have a normal life expectancy.

The neurobehavioural approach to brain injury rehabilitation is now widely credited for introducing a ‘theory to practice’ approach in post-acute brain injury rehabilitation, offering the attitude of many practitioners from an approach of ‘what works generally?’ to ‘what works for a particular patient, with a particular kind of brain injury, and a particular pattern of neurobehavioural disability, under a particular set of circumstances?’

Compared to a standard non-treatment intervention, the self-help intervention proved successful, with people in the intervention group reporting less worry and distress over the testing period. One potentially negative outcome was that this reduction in worry may result in a rebound effect if individuals subsequently received ‘bad news’. Further research assessed the presence and severity of any rebound effect and the effect was not found. Indeed, there was continued benefits post-treatment provision. On the basis of results, the intervention was included as part of the information pack sent to all patients in the Cancer Genetic Service for Wales breast cancer programme, which affects approximately 3,000 women per annum. Approximately 1,000 of these women will evidence sufficient levels of worry to benefit. It has also been available on the Tenovus cancer charity website since early 2011.

Lessons From Thailand Universal Coverage Health Reforms

This research followed Medical Research Council guidelines for the development of ‘complex’ or non-pharmacological interventions. A pilot study provided patient feedback on the design of a written self-help intervention designed to reduce anxiety during genetic risk assessment prior to formal piloting. Next a pilot study was conducted in sufficient participants to show a benefit during the risk assessment process. After this came a definitive randomised trial, showing benefit both during and following the risk assessment process. The final randomised controlled trial (RCT) was completed in late 2009 and the intervention has been used on a regular basis since this time.

The intervention has shown to significantly reduce levels of intrusive cancer-related worry in women and men during the four to six week risk assessment process, and in the month following risk provision. In particular it benefits women at moderate to high levels of anxiety.

Swansea University’s research was based on research and clinical suicide, although most survivors have a normal life expectancy.

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The Thai purchaser/provider reform study was an offshoot of earlier research conducted in Swanswick on the NHS internal market reforms. Past studies have included a study of NHS contracting supported by the ESRC and Competition Programmes (1993-96, Hughes, £110K); a comparative UK/US study of healthcare contracts with Professor Timothy J. Fox (1995-96, Hughes, £80K); an evaluation of the Welsh Health Service (1997-98, Hughes, £100K); and a World Bank-funded review of cancer services in England and Wales (2006-2010, Hughes, £200K). These projects have led to many published papers on the NHS internal market and healthcare contracts.

Needs of informal carers

Another research project involved working with Polish mothers through the Polish Mutual Association in Lisnaway and with the formerly named Health Visitors in Hywel Dda NHS Trust, to produce health information resources. This participatory project produced laminated place mats on weaning and on Family Health Services in Carmarthenshire in Welsh, Polish and English. These materials were distributed to every health visitor in Hywel Dda as place mats and as electronic copies and to the Polish Mutual Association, and to the Polish mothers who participated.

Hughes is advising current Mahasarakham and past research methods workshops. He worked closely with the Head of HISRO and the Director of the Bureau of Strategy, Assessment team, focusing on implementation. Following several presentations at the MoPH and Thai universities, Professor Hughes was invited to join the Ministry’s 10 Year Assessment team, focusing on implementation. He participated in three workshops in Bangkok through August and October 2011 and also assisted in planning and administering interviews with key informants. He worked closely with the Head of HISRO and the Director of the Bureau of Strategy, National Health Security Office, on the final draft of the implementation chapter. He has taken part in discussions regarding the content of the full draft report with representatives of the World Bank, World Health Organisation (WMO), International Labour Organisation and Rockefeller Foundation.

Thailand has recently signed a 10 Year Assessment report as a major document that will present a balance sheet of achievement to the Yingluck Shinawatra government, and provide a definitive account of the Thai experience for other countries contemplating universal coverage reforms. Professor Hughes’ involvement partly reflects the impact of featured research outputs and partly his ongoing activities in Thai public health circles, as reflected in his current visiting chair positions at Mahasarakham and Khon Kaen Universities, as well as research presentations and past research methods workshops. Hughes is advising current Mahasarakham University researchers on current studies on health desegregations reforms and local government community health funds.
Consequently this has relevance for how we plan our environments to make them age-friendly.

Dr Jaynie Rance and colleagues publish research which contributes to public health policy decision-making for major bodies including the NHS, for example evaluating the outcomes of initiatives such as NHS Direct. One recent article in The European Journal of Public Health explored the role of economics in prioritization in public health, taking into account the views of stakeholders. This research found that the perceived validity of estimates of effectiveness was strongly important, along with sufficient information to gauge whether designs were appropriate and to assess implementation practicabilities. Cost-benefit analysis and cost-utilty analysis were the preferred approaches despite their complexity, although participants agreed benchmarks to place net-benefit estimates from cost-benefit analyses into context. Further research will work to develop clear, rigorous and standard guidance relating to economic evaluation, recognizing the diversity of public health strategies.

Professor Andy Parrott and colleagues have published a number of articles on MDMA (Ecstasy). Ecstasy is a recreational drug whose active ingredient is known to be neurotoxic in animals, but whose long-term effects in humans remain controversial. One commonly reported consequence is mild cognitive impairment particularly affecting verbal episodic memory. Professor Parrott’s recent study in Psychopharmacology examined the effects of past Ecstasy use on recognition memory for both verbal and nonverbal stimuli. Evidence emerged that left hemisphere cognitive functions are disproportionately affected by Ecstasy. Overall, the results suggest that Ecstasy has a durable effect on a specific component of recognition memory, recollection, and that this is most probably caused by the serotonergic neurotoxicity of MDMA; although the role of other drugs cannot be excluded.

Professor Dave Benton continues to publish widely on diet and its interaction with cognitive function, with articles in Appetite, Clinical Nutrition, and Biological Psychology. His article ‘The effect of the consumption of water on the memory and attention of children’ in Appetite, co-written with Naomi Burgess showed that schoolchildren’s recall was significantly better on occasions when water had been consumed than when it had not. Drawing on the fact that in childhood, the brain uses relatively more glucose than when adult, his research has shown that a child may be particularly susceptible to the provision of blood glucose. After drinking a glucose-containing drink, children aged 9-11 years were found to have better memories and spent more time on task when working in class, although the ability to sustain attention was not influenced. Some of Professor Benton’s further research has shown that while high-sugar consumption may be correlated with obesity, there is no support from the human literature for the hypothesis that sucrose may be physically addictive or that addiction to sugar plays a role in eating disorders.

Professor Mark Blagrove has recently published an article in PLoS ONE investigating evidence, from dream reports, for memory consolidation during sleep. It is well known that events and memories from waking life can be incorporated into dreams. These incorporations can be a literal replication of what occurred in waking life, or, more often, they can be partial or indirect. When dreams incorporate features from events occurring five to seven days prior to the dream, this is called the ‘dream-lag effect’. Professor Blagrove’s study addresses whether the dream-lag effect occurs only for REM sleep dreams, or for both Rapid Eye Movement Sleep (REM) and non-Rapid Eye Movement Sleep (NREM) stages 2 (N2) dreams. In a sleep-laboratory study, the dream-lag effect was found for REM but not N2 dreams. The results provide evidence for a seven-day sleep-dependent non-linear memory consolidation process that is specific to REM sleep, and accord with proposals for the importance of REM sleep to emotional memory consolidation.

The College has a vibrant community of research students. The welfare and monitoring of these students is overseen by the College’s Framework Director for Postgraduate Research, Dr Jaynie Rance.

All research student have at least two academic supervisors from within the college and many benefit from wider supervisory teams comprising of additional members (who may offer specific expertise) from outside of the college, or maybe from another institution. The research students benefit from access to regular seminar series held throughout the University and through the College’s Research Interest Group, through which students have the opportunity to present their own research in an informal setting.

The College also runs an annual Conversazione event, during which students, from across the College (and sometimes from other Colleges) have the opportunity to present and discuss their work with their peers, academic staff and healthcare practitioners.

Training is offered to students via a portfolio of skills training available from within the College, and as part of the Research Skills Training Programme at University level. Students also have the option to study (fee of charge) on any MSc level module provided by the College, subject to sufficient space on the module. The College of Human and Health Sciences is a member of the ESRC All Wales Doctoral Training Centre.

The College Research Office also has a member of staff dedicated to supporting postgraduate research student admission and progressions, and can provide pastoral support where needed.
The College of Medicine is committed to innovative health and life sciences research from basic research about mechanisms of disease through to improving health and social care delivery. Alongside and integrated with this is a distinctive approach to innovation and learning and teaching. The College translates basic research into medical discoveries, which positively impact the health, well-being and wealth of the nation.

The strength of the College’s research was emphasised by the results of the 2008 Research Assessment Exercise (RAE), with 87% per cent of staff assessed as producing research of international quality or above, placing the College seventh in the UK rankings. The 2012 UK Health Research analysis shows that whilst Swansea is still small by UK medical school standards, it was the fastest growing medical school in the UK between 2005 and 2010, the most recent year for which figures are available.

The College adopts an interdisciplinary approach to translational medicine from basic laboratory science to health care delivery, underpinned by health informatics, mathematical modeling, world-class supercomputing and mass spectrometry. There are outstanding laboratory and clinical research facilities in the College’s Institute of Life Science (ILS).

More than £80 million has been invested in our research and innovation facilities in the ILS phases 1 and 2. This collaboration between Swansea University and the Welsh Government, together with Abertawe Bio Morganwg University (ABMU) Health Board, IBM and external business partners, is partly funded through the European Union Convergence Funding Programme and is the single largest investment made in a university campus by the Welsh Government.

Central to delivery is our cross disciplinary research pipeline from research groups working in nanotechnology and biological sciences through to improving health and social care delivery. Alongside and integrated with these themes, a range of excellent basic and clinical scientists contribute to delivering our outputs.

The pipeline delivers research in a number of areas including, cancer, diabetes immunity and allergy, microbiology and infection, neuroscience and reproductive health the cell biology of cancer and reproduction. Research in nanomedicine, medicine from basic laboratory science to health care delivery, underpinned by health informatics, mathematical modelling, world-class supercomputing and mass spectrometry, medical physics and clinical engineering, and bioinformatics represent crosstheme cognate activity.

Since its launch in 2001, the College has grown to become one of the UK’s leading centres for medical research, and the opening of the second phase of the ILS in 2011 was a significant milestone in its history.

With an ambitious approach to its strategy for future research growth, the College looks forward to strengthening its position as at the forefront of medical innovation, which will positively impact the healthcare of millions.

Professor Ian Russell,
Director of Research, College of Medicine

Research Centres and Institutes:

Research Centres and Institutes in the College include:

- Centre for Improving Population Health through E-Health Research (CHIR)
- NHS Wales Health Informatics Research Laboratories, home to the e-Health Industries Innovation (EHHI) Centre and the Health Information Research Unit (HIRU)
- Institute of Mass Spectrometry, home to the EPSRC National Mass Spectrometry Service Centre
- Centre for NanoHealth (CNH)
- Centre for Health Information, Research and Evaluation (CHIRE)

Research groups within Medicine include:

- Bioinformatics Research Group
- Cell Biology of Cancer and Reproduction Research Group
- Diabetes Research Group
- Immunity and Allergy Research Group
- Medical Physics and Clinical Engineering Research Group
- Microbiology and Infection Research Group
- Neuroscience and Molecular Psychiatry Research Group

Research in the College attracts funding from a significant number of prestigious funding bodies. These include:

- Biotechnology and Biological Sciences Research Council (BBSRC)
- Engineering and Physical Sciences Research Council (EPSRC)
- Epilepsy Research UK (ERUK)
- European Regional Development Fund (ERDF), under the Ireland Wales Cross Border (INTERREG 4A) programme
- European Regional Development Fund (ERDF) by the Welsh European Funding Office (WEFO)
- European Union FP7 scheme
- Medical Research Council (MRC)
- MS Society UK
- National Institute of Health Research
- Welcome Trust
- Welsh Government – including the Academic Expertise for Business (A4B) programme and the National Institute for Social and Healthcare Research (NISCHR)

www.swansea.ac.uk/medicine/
Institute of Life Science

With a strong inter-disciplinary ethos, the College of Medicine’s research is conducted at the state-of-the-art, purpose-built Institute of Life Science (ILS) – the first phase of which opened in 2007.

Described after its opening as ‘The Jewel in the Crown of Wales’ by the Rt Hon Rhodri Morgan, then First Minister for Wales, the ILS is Wales’ premier medical research and business facility.

The ILS phases 1 and 2, an investment of more than £80 million, comprise 12,000 square metres of high quality research and business space, co-located on University and ABMU Health Board land, next to Singleton Hospital, and with access to more than 600,000 patients.

The first phase of ILS has delivered a state-of-the-art building, housing specialists in medical research, business incubation, and technology transfer.

In addition to providing further facilities for an extended range of business incubation units, the second phase of ILS, which opened in 2011, houses a Clinical Research Facility, incorporating jointly-located clinical trials and imaging suites working in close collaboration with the NHS and Siemens, Health Informatics research laboratories, including the ‘NHS in a lab’ facility and eHIt for e-health products and services; The Centre for Improving Population Health through E-Health Research (CIPHER), a new Medical Research Council Centre of Excellence for e-health; the Centre for Health Information, Research and Evaluation (CHIRAL); High Performance Computing (HPC) in collaboration with the Centre for Improving Population Health through E-Health Research (CIPHER) is one of four new UK e-health research Centres of Excellence, based at Swansea, London, Manchester and Dundee, and established with a £19 million investment from a consortium of funders led by the Medical Research Council (MRC)*.

Nearly 90 per cent of ILS research was independently judged (2008 RAE) as international or world-leading standard.

**Innovation space and commercial partners**

The ILS is dedicated to building links with business and creating a vibrant life science and healthcare cluster in south west Wales. It is home to a growing number of companies including standard-based software development company Cal2Cal Europe Ltd, Calon Cardio-Technology ltd, which specialises in the development of blood pumps for the treatment of chronic and acute heart failure; CyDen Ltd, the beauty and health company pioneering light treatments for use at home; Haemair Ltd, which provides support for people with lung disease or injury through the development of its “artificial lung”; Maironis Ltd, a specialised pharmaceutical company developing drugs for treating autoimmune inflammatory diseases and cancer, and Pulsi Medical Technologies and Pulse Innovate, which focus on the development of innovative pain relief solutions.

The ILS business incubation suites bring businesses closer to scientists and experts in medicine and other fields across Swansea University from Engineering to Economics to Law.

Businesses and individuals can choose to affiliate themselves with the ILS. This is a ‘soft landing’ option developed for organisations and individuals that are not yet ready to base themselves permanently at the ILS, but want access to its facilities and expertise.

Membership provides early stage businesses with one of the swiftest and most effective ways of developing a relationship with ILS, as well as accessing many of the benefits of being part of the growing life science cluster.

A few examples of the excellent research being conducted in the College of Medicine include:

*Funding bodies: Arthritis Research UK, British Heart Foundation, Cancer Research UK, Chief Scientist Office (Scottish Government), Economic and Social Research Council, Engineering and Physical Sciences Research Council, Medical Research Council, National Institute for Health Research, National Institute for Social Care and Health Research (Welsh Government) and the Wellcome Trust.

The Centre for Improving Population Health through E-Health Research (CIPHER)

The Centre for Improving Population Health through E-Health Research (CIPHER) is one of four new UK e-health research Centres of Excellence, based at Swansea, London, Manchester and Dundee, and established with a £19 million investment from a consortium of funders led by the Medical Research Council (MRC).*

led by Professor Ronan Lyons and Professor David Ford, CIPHER is an international centre involving co-investigators from 10 universities across Australia, Canada, Scandinavia and the UK. CIPHER is designed to undertake research which dramatically shortens the time it takes before new discoveries have an impact on many people’s lives. By combining clinical, social and research data, researchers aim to identify more effective treatments, improve drug safety, assess risks to public health and study the causes of diseases and disability. The Centre will focus on research to investigate important topics that place a large burden on the global and UK population such as injury, infection, substance misuse, psychological problems, obesity, arthritis, cardiovascular disease and cancer.

A network will be formed to capitalise on the expertise in the Centres, and to encourage wider collaborations among UK and international researchers to make sure there are effective links between different types of health and social data sets. The Centres will also offer career development and training opportunities to increase the UK’s capacity and capability in research using health records.

Public understanding of the importance of using health data for research is crucial to advancing drug discovery and improving patient care. The new Centres will play an active role in engaging with the public to promote better understanding of the benefits of e-health records research. The Centres will also act as a vital point of contact for industry, the NHS and policy makers.

*Funding bodies: Arthritis Research UK, British Heart Foundation, Cancer Research UK, Chief Scientist Office (Scottish Government), Economic and Social Research Council, Engineering and Physical Sciences Research Council, Medical Research Council, National Institute for Health Research, National Institute for Social Care and Health Research (Welsh Government) and the Wellcome Trust.

"These e-health centres ... have the potential to revolutionise health research. They will provide a vital insight into conditions affecting millions of people and ultimately bring benefits for patients."

David Willetts, UK Minister for Universities and Science

"This is a watershed moment ... that will help establish the UK as a world leader in this field."

Professor Sir John Savill, Chief Executive of the MRC.
The BEACON Biorefining Centre of Excellence

The ILS has an international reputation in microbial and molecular technologies using yeast, other fungi and bacteria. ILS researchers Professor Steven Kelly and Professor Diane Beynon FRS co-lead Swansea University’s role in the £20 million collaborative BEACON initiative, led by Aberystwyth University’s Institute of Biological, Environmental and Rural Sciences (IBERS) with collaborators Bangor University, which aims to make a vital contribution to tackling climate change.

The world consumes 30 billion barrels of oil each year, and there is concern that a growing population will mean there is not enough resource for use in basic products such as food and fuel.

Using pioneering techniques known as biorefining, the project is investigating the production of second generation fuels by using a process which aims to replace some of the industrial chemicals currently produced from oil with similar molecules from plants.

The project, supported with funding through the European Regional Development Fund (ERDF) by the Welsh European Funding Office (WEFO), part of the Welsh Government, has allowed BEACON to move to large scale production and allow the development of Centres of Excellence across Wales to respond to this major global challenge.

BEACON will work with companies in Wales and overseas to convert biomass relevant to Welsh agriculture and food into a wide range of products including pharmaceuticals, chemicals, fuels, cosmetics and textiles.

The initiative is a key part of a drive which could put Wales in a leading position in the use of renewable bio-based materials. The Swansea research team is focused on developing their expertise in using bacteria and fungi to digest, or ferment, plant matter within the biorefining process.

A key to success in building Wales’ world leadership in biorefining capacity is the development of overseas collaborators and technical “intelligence”, to complement and accelerate the BEACON initiative.

The USA consumes 40 per cent of the world’s oil resource and US researchers are keen to explore alternatives to the resource. BEACON is building on and extending contacts with leading R&D centres in the USA who are conducting similar activities.

It is also expected that international institutions will provide co-sponsorship and support for their scientists to visit BEACON partners.

The Institute of Life Science and Centre for NanoHealth

Swansea University has long been established as a centre of excellence for mass spectrometry, dating back to the mid 1970s, with the establishment of the Royal Society Research Unit led by Professor John H Beynon FRS.

The established mass spectrometry research unit attracted the sting of the Engineering and Physical Sciences Research Council (EPSRC) Centre in 1986. This prestigious EPSRC mid-range facility is open to all UK university research groups, with priority given to EPSRC-funded research, and some capacity is reserved for commercial service.

It specializes in difficult analyses that scientists cannot do within their own institutions due to lack of expertise or instrumentation and is particularly relevant in the fields of chemistry, biological sciences, medicine, materials science, forensics, pharmaceuticals and environmental analysis.

Mass spectrometry involves the ionisation of a sample to produce either positive or negative ions of the molecule species. These ions are passed to the mass spectrometer analyser where the mass, elemental composition and structure of the molecule are determined from the spectra produced. Analysis of complex mixtures can be accomplished by attaching a chromatographic technique to the mass spectrometer to separate the various species in the mixture prior to mass measurement.

Research at the Institute of Mass Spectrometry includes medical mass spectrometry, led by Professor William J Griffiths and Dr Yuyin Wang, and analytical mass spectrometry and instrumentation development/design by Professor Gareth Brenton.

Professor Griffiths’ group leads research into lipidomics, metabolomics and proteomics and has established an international reputation in the field of cholesteral metabolism. Current work involves studies of the involvement of cholesterol metabolites in the aetiology of neurodegenerative and inflammatory diseases.

The Institute of Mass Spectrometry has, over the last three decades, been responsible for many innovations in mass spectrometry and instrumental design that have been taken up by major manufacturers’ of scientific instrumentation.

The Institute of Mass Spectrometry has developed postgraduate and professional training courses in Mass Spectrometry and separation sciences. These unique programmes are designed to give science and engineering graduates a vocationally-relevant qualification which will equip them with skills and expertise to enter a wide range of industries.

The Institute of Life Science and Centre for NanoHealth is a world-class facility based here in Swansea. It is leading the way in vital research into areas such as cancer and obesity that blight our society and it is providing a crucial role in finding new answers to these problems.

It is a unique collaboration between government, academia and the private sector that not only provides medical expertise and research, but also economic development by nurturing new companies and creating jobs. The ILS and CNH are already internationally renowned for the high quality of their research projects. This facility will boost the economy by providing businesses with both skilled graduates and leading-edge research. The Welsh Government is proud to support the University and invest in research and development and the growth of the knowledge economy.

Carwyn Jones, First Minister for Wales, speaking at the opening of ILS phase two in 2011.
The College’s vision is to build on its success by producing sustainable excellence in research and industry engagement, as well as in learning and teaching. Its vibrant research environment is divided into two areas of expertise – laboratory-based biomedical research, and public health, population sciences, and health services research.

These two areas of expertise cover research interests from the molecular aspects of disease and treatments, to promoting health and enhancing the delivery of health and social care.

Inter- and multi-disciplinary research is the College’s mantra and the most prominent example of collaboration is that between the Colleges of Medicine and Engineering in the Centre for NanoHealth (see page 21).

Some of the leading laboratory-based biomedical research undertaken at the College includes the following projects:

### Preventing infections in the womb

Microbial infection of the female genital tract is a major disease problem in humans and cattle, with a substantial impact on their health and welfare.

Research conducted by Professor Martin Sheldon at the Centre for Reproductive Immunobiology (CRIB) in the ILS, focuses on the mechanisms of infection, inflammation and immunity in the female reproductive system of dairy cattle.

Dairy cows help feed the world by converting proteins from plants to higher value proteins in milk for human consumption. Lactation depends on pregnancy, but there is a problem because uterine disease after parturition affects about 40 per cent of animals each year.

Despite treatment many of these animals are infertile, which compromises global food security. Keeping additional animals to replace infertile cows also degrades the environment.

Professor Sheldon is leading a European Commission ERA-NET project worth £3.2 million (approx €2.6 million) to combat microbial disease of the female reproductive system, by uncovering the mechanisms of infection, inflammation and immunity.

The Integrated systems approach for Preventing Uterine Disease in dairy cattle (IPUD) research involves collaboration with research groups at the University of Glasgow, the University of Veterinary Medicine Hannover, Germany, the French National Institute for Agricultural Research (INRA), and Pfizer Animal Health as industry partner.

Professor Sheldon’s Biotechnology and Biological Sciences Research Council (BBSRC) funded work through a grant of more than £420,000 helps maintain food security and improve animal health. However, the fundamental mechanisms of such host-pathogen interactions are very similar between animals and humans – the One Biology One Health concept – so findings are also important for understanding health and disease in the wombs of women.

### Neurological genetics

A £600,000 Medical Research Council (MRC) funded study led by Professor Mark Rees with ILS colleagues Dr Seo Kyung Chung and Dr Rhys Thomas, and Professor Robert Harvey of the University College London (UCL) School of Pharmacy, has helped to identify a second major cause of ‘startle’ disease, which can cause infant deaths.

‘Startle’ disease, also known as hyperekplexia, is characterised by an exaggerated reaction to unexpected stimuli, such as touch or loud noises. The startle reaction can be detected as an abnormal increase in muscle tension causing rigidity and the inability to move. During these rigid periods, breathing can stop for minutes at a time.

Although rare, this disorder can have serious consequences, including infant death.

Professor Rees, who has been involved in startle disease research for more than 20 years, has identified all the main genes in this disorder, which has been adopted into diagnostic programmes worldwide.

In the past, changes in one particular gene were thought to be the only major cause of this disorder.

However, the new study by Professor Rees and his colleagues has identified a number of new changes in another gene in 21 cases from the UK, Australia, Canada, France, Italy, Jordan, the Netherlands, Portugal, Spain, and the USA.

These findings firmly established a second gene – GlyT2 – as a major disease factor. People with GlyT2 changes also had a high rate of early infantile breathing problems and childhood learning difficulties.

Professor Rees, who is Director of the Wales Epilepsy Research Network (WERN) and Chair of the Scientific Advisory Committee at Epilepsy Research UK (ERUK), has also established an expert team at the ILS that works closely with ERUK, attracting some £7 million of funding to investigate epilepsy, particularly in children and young adults.

The team has epilepsy collaborations with the University of Liverpool and University College London (UCL) in the UK, and internationally with Stanford University, Vanderbilt University, and Duke University in the US, with the University of Melbourne in Australia, and with Auckland University in New Zealand.
DNA is becoming ever closer.

Tailored to individual sufferers through their genetic make-up, new therapies are increasingly being developed that can significantly improve their lives. However, with research made increasingly expensive, drug companies have reduced the number of new treatments they are willing to fund. This means that patients with rare diseases, such as juvenile myoclonic epilepsy (JME), are at risk of not receiving the best possible care.

Once a person develops JME, they have it for life and so long-term treatment plans must be formulated. A good understanding of JME is vital so that the disease is seen as on the critical pathway as possible.

Dr Thomas, who is the recipient of an award of almost £10,000, and his colleagues hope that the identification of clinical and genetic subgroups, using DNA sequencing, will help to develop better diagnostic techniques and therapies, and allow clinicians to make more accurate predictions for individual patients.

The project involves the pathophysiological validation of new mutations found in GABRB3 genes in childhood absence seizures with preliminary data generated in the neurology research group.

Diagnosing blood clot abnormalities

One of the College’s particularly successful collaborative research projects with the NHS involves early diagnosis of blood clot abnormalities.

Funding of £1.5 million from the Welsh Government’s National Institute for Social and Healthcare Research (NISCHR) has seen the establishment of a Haemostasis Biomedical Research Unit at Morriston Hospital in Swansea, to develop vital research into clot abnormalities.

The successful bid, led by Professor Adrian Evans, Professor of Emergency Medicine and Haemostasis at the College and Unit Director of the Haemostasis Biomedical Research Unit, has established the unit as a model of multi-disciplinary working, involving specialist biomedical engineers, respiratory experts, cardiologists, colorectal surgeons, consultants in anaesthesia and local businesses.

It builds on work started in 2003 that discovered a new diagnostic biomarker to the potential to improve methods of determining blood clotting abnormalities. The new biomarker is proven to be superior to conventional coagulation tests in healthy and therapeutically modified blood.

Reducing animal testing in cancer research

Professor Gareth Jenkins and the DNA Damage (Genotoxicity) research group, which includes Dr Shareen Doak and Dr George Johnson, are developing new testing methods based on human cells, which will substantially reduce animal testing for cancer-causing chemicals in the future.

The group has longstanding expertise in the study of chemically induced DNA damage in vitro (The paradigm shift of genotoxic thresholds in drug discovery), including close to £2 million of grant income in the last five years from the Medical Research Council (MRC), Engineering and Physical Sciences Research Council (EPSRC), Unilever, GlaxoSmithKline, and AstraZeneca.

Professor Jenkins plans to study how chemicals interrupt the mechanisms by which cells communicate with each other, and to combine this information with current data to provide a better prediction of which chemicals are potential carcinogens.

He was awarded a grant of £400,000 by the National Centre for the Replacement, Refinement and Reduction of Animals in Research (NC3Rs) for a project entitled Developing an integrated in vitro carcinogenicity predictive tool, which aims to find methods using human cells grown in the laboratory for assessing cancer risk that are faster, more efficient and have reduced reliance on animals.

Currently, testing chemicals used in the pharmaceutical, agrochemical, and consumer products industries for their potential to cause cancer (carcinogenicity testing) uses large numbers of animals, and is time consuming and expensive.

Moreover, the latest amendment to the EU Cosmetics Directive prescribes a ban on animal testing of all cosmetic ingredients.

Professor Jenkins’ study, which is being conducted in collaboration with diagnosticians and pharmaceutical giants Roche and GE Healthcare, will also consider how harmful chemical doses that cause effects in vitro can be extrapolated to doses likely to cause effects in vivo in humans.

Some of the leading public health, population sciences, and health services research undertaken at the College includes the following centres and projects:

Centre for the Development and Evaluation of Complex Interventions for Public Health Improvement (DECIPHer)

The Centre for the Development and Evaluation of Complex Interventions for Public Health Improvement (DECIPHer) is one of five UK Public Health Research Centres of Excellence established in 2009 by a £20 million investment by the UK Clinical Research Collaboration (UKCRC)*.

DECIPHer represents a strategic partnership between Cardiff University, the University of Bristol and Swansea University. It is led by Professor Lawrence Moore, Director (Cardiff) with Professor Rona Campbell (Bristol) and Professor Ronan Lyons (Swansea) as Co-Directors.

DECIPHer brings together leading experts from a range of disciplines to tackle public health issues such as diet and nutrition, physical activity; and alcohol, tobacco and drugs, with a particular focus on developing and evaluating multi-level interventions that will have an impact on the health and wellbeing of children and young people. The Centre engages strongly with policy, practice and public user communities as our stakeholders to translate the research results into practical outcomes.

Swansea researchers are focused on the development of population-wide data linkage to help understand the role of particular factors in complex relationships and to provide a platform to support the evaluation of interventions to improve health and wellbeing, prevent self-harm and reduce health inequalities.

DECIPHer has supported the development of a large number of successful collaborative multi-institutional research bids, including the creation of the ground-breaking £804,000 Wales Electronic Cohort for Children (WElCoC), the Carmarthenshire Housing and Health Regeneration Study (www.phr.nhr.ac.uk/funded_projects/09_3007_02.asp), and the Change in alcohol outlet density and alcohol-related harm to population health study (www.phr.nhr.ac.uk/funded_projects/09_3007_02.asp).

The five UK centres have been invited by the Medical Research Council (MRC) to submit an application for a further five years funding from 2014-2019.

*Funding bodies: Economic and Social Research Council, British Heart Foundation, Cancer Research UK, Medical Research Council, National Institute for Social Care and Health Research (Welsh Government) and the Wellcome Trust.

www.decipher.uk.net/
I was pleased to read of the work that you and your team at the MS Society have undertaken in setting up the UK MS Register, and would like to congratulate everyone who has made this project such a resounding success. It stands as a clear example of the benefits of sharing data, whilst ensuring the right protections for patient confidentiality.

Prime Minister David Cameron, in a letter to the MS Society

As a re

Life sciences is one of the key sectors of the Welsh economy and its strategic importance was highlighted in our Science for Wales strategy. I am pleased the Welsh Government is supporting this project to drive forward greater collaboration and knowledge sharing with the aim of increasing research and development and investment into the sector.

Edwina Hart, Welsh Government Minister for Business, Enterprise, Technology and Science

Health Informatics and e-Health

Professor David Ford, Director of Health Informatics, is leading a number of significant projects in the rapidly-developing area of e-health, including the £260,000 Health Cloud project, supported by a £240,000 grant through the Welsh Government’s European funded Academic Expertise for Business (AEB) programme. The project brings the University and Welsh eHealth companies together to develop cloud computing technology to deliver significant longterm benefits to the national NHS and the Welsh economy. The project involves partnership with Monmouthshire-based The Ascent Group, and Applied Health Intelligence Limited, a division of Gesundheitsforen Leipzig GmbH, based in Swansea, to support clinical care and enable the effective allocation of resources across the healthcare system, bridging the gap between Welsh eHealth companies and the NHS UK market.

The initiative aims to create a secure NHS Health Cloud environment, where accredited applications used to analyse healthcare data are developed and hosted, and then made available to NHS staff UK-wide on an on-demand “pay per use” basis. This would allow users to trial various software products at a significantly reduced cost and before reaching the stage where a formal procurement process was required. As a result, this would give the NHS the key advantage of sampling and comparing different applications within the Health Cloud, and before making a significant financial investment in any single application.

Welsh health companies would also benefit from access to their potential NHS market, which has previously been inaccessible to them, with a rapid return on investment when developing applications.

Another initiative led by Professor Ford is the £693,000 project to develop an online Multiple Sclerosis Register for the UK, funded by the MS Society UK.

SAFER 2 (Support and Assessment for Fall Emergency Referrals) – Improving care for older people who fall

Emergent calls to ambulance services are frequently made for older people who have fallen – many of whom are not taken to hospital, but left at home with no ongoing care pathways available. Ambulance services are encouraged, through national policy documents, to develop alternative responses for patients who do not need immediate conveyance to hospital, but there is little evidence about the safety or effectiveness of new models of care.

SAFER 2 is an evaluation of a new clinical protocol which allows paramedics to assess and refer older people who have fallen and do not need hospital care to community-based falls services. Professor Helen Snooks is leading this £1.8 million study, funded through the National Institute for Health Research (NIHR) Health Technology Assessment programme.

Outcomes, processes and costs of care will be compared between the intervention and control groups for six months following the index call. Focus groups and semi-structured interviews will identify factors which facilitate or hinder the use of the intervention and explore how patients experience the new health technology. The research is being carried out in collaboration with Swansea University colleagues from the Colleges of Medicine, Human and Health Sciences and School of Business and Economics, as well as colleagues from universities around the UK.

The research findings will be used to inform policy and service development on a national scale.

www.saferproject.org

Three ambulance services across England and Wales – East Midlands Ambulance Service, the Welsh Ambulance Service and London Ambulance Service – are participating. Volunteer paramedics based at stations randomised to the intervention group received training and support in the use of the new protocol, and access to falls service referral pathways. Paramedics based at control stations delivered their usual care.

College of Medicine

“Health Cloud is a good example of collaboration between academia and Welsh businesses that can potentially benefit the healthcare system and the Welsh economy.”

Edwina Hart, Welsh Government Minister for Business, Enterprise, Technology and Science

“Trusting Health Intelligence to support our commissioning of care is right for the next phase of eHealth. The innovative approach to data sharing will allow healthcare professionals and researchers to deliver improved care, whilst respecting patient confidentiality.”

Prime Minister David Cameron, in a letter to the MS Society
The paradigm shift of genotoxic thresholds in drug discovery

Research conducted by Professor Gareth Jenkins and the DNA Damage (Genotoxicity) group, including Dr Shareen Doak and Dr George Johnson, has convincingly demonstrated that genotoxic agents – chemical or other agents that damage cellular DNA, resulting in mutations or cancer – display “thresholded” dose responses, meaning low level exposures are insignificant in terms of damage to DNA. This finding changed many regulatory guidelines concerning how drugs and chemicals are assessed. It also offered assurance to tens of thousands of patients accidentally exposed to a genotoxic substance and saved millions of Euros for the pharmaceutical company involved.

DNA damage was previously assumed to be linear with respect to dose, and any chemical or drug showing genotoxicity was discarded. This often led to the discarding of drugs and chemicals at late stages of development and after a significant investment of time and money.

Theoretical discussions continued for over a decade about whether non-linear or thresholded dose responses existed for genotoxic agents. The implication was that “safe” low doses could exist for some genotoxins and human exposure to such low doses may theoretically be tolerated, but the idea remained controversial. Conversely, much of the “linear” argument stemmed from estimations of radiation risks, but these were not always relevant to chemicals and there was little or no data to inform the argument.

The concept of genotoxic thresholds was discussed theoretically by the late Professor James (Jim) Parry and colleagues at Swansea University from the mid-1990s onwards, and they drove these discussions at an international level. This work was taken on further by Professor Gareth Jenkins and colleagues after the retirement of Professor Parry.

The work at Swansea on genotoxic thresholds during a 15 year period stimulated a paradigm shift, which led to an acceptance of genotoxic thresholds and the acceptance of the concept of “safe” exposure levels to some genotoxins. Swansea researchers embarked upon an ambitious programme to generate data addressing the shape of the dose response to known genotoxins in vivo. The work initially concentrated on genotoxic dose response curves for alkylating agents, classic genotoxins often used as chemotherapeutics.

After five years, comprehensive data could be provided to demonstrate that two alkylating agents, ethyl methanesulfonate (EMS) and methyl methanesulfonate (MMS), showed clear thresholds for chromosome damage and point mutation in cultured cells in vivo.

These data resulted in a paradigm shift that was accepted by major regulatory agencies and the scientific community as a whole. A significant contribution to the paradigm shift involved an infamous contamination incident reported by Roche pharmaceuticals in 2007, where one of their drugs – Viracept – had accidentally been contaminated with EMS (one of the alkylating agents shown to be thresholded).

Discussions between the Swansea researchers and Roche toxicologists led to a major in vivo study investigating the genotoxic dose responses of this alkylator in mice. The largest and most expensive study of DNA damage in vivo ever undertaken, this study confirmed that there was a threshold for EMS in vivo.

The new threshold dose identified from this in vivo study was extrapolated to a safe human exposure level through complex risk assessment models. It revealed that patients taking contaminated tablets were not at risk of DNA damage and the doses of alkylator that they received were well below the threshold dose. These data were accepted as unprecedented proof that the patients were not at an elevated risk of cancer.

Swansea University research has directly offered a reprieve to some substances with genotoxic activity, resulting in changed international regulations. The European Medicines Agency (EMA) also accepted that there was no long term risk to the patients who received the contaminated Viracept tablets because of the threshold dose response to the contaminant.

In 2009, Professor Gareth Jenkins was invited to join the UK Government’s Committee on Mutagenicity (COM), which subsequently issued a statement on genotoxic thresholds in 2010, citing the role of the work at Swansea.

www.iacom.org.uk

The threshold paradigm also has the potential to impact on the use of animals in safety testing and may lead to fewer animals being used in the future (see page 114, ‘Reducing animal testing in cancer research’).

“We know that Swansea University is heavily supporting research into thresholds for genotoxic effects and their impact on cancer risk assessment. It is needless to say that the original in vivo work published by Shareen Doak and colleagues in Cancer Research in 2007 was the ultimate and indispensable trigger for Hoffmann-La Roche to enter further work in vivo to conduct a proper risk assessment for HIV patients that have ingested Viracept tablets contaminated for some period in 2007 with EMS.

Based on the in vitro studies conducted in Swansea under supervision of the late Professor Jim Parry, Roche was successful in proving a threshold in vivo and justifying that the affected patients were not at an increased mutation, cancer or teratogenic risk. This reasoning was accepted by many authorities around the world after having been presented to the EU authorities in 2008.

The studies served as a basis for further research activities around the world and proved to withstand all investigational challenges so far. Hence, we can assume that the scientific basis of what has been originally done in Swansea is rock-solid. It continues to be worthwhile to prove the mechanisms behind it and to extend the evidence beyond simple alkylating agents.

There is enormous value of such basic research for the industry and for the society at large. In this context, I hope that the research into this area can continue with sufficient funding at Swansea University.”

Dr Lutz Mueller, Lead Late Stage Projects – Toxicology, F Hoffmann-La Roche Ltd, in a letter to Dr George Johnson, College of Medicine
Selected recent publications

Allen, S.

Cheung, W.
2009, 'Cost effectiveness of nurse delivered endoscopy: findings from randomised multi-institution nurse endoscopy trial (WINuET)', BMJ.

2009, 'Effectiveness of nurse delivered endoscopy: findings from randomised multi-institution nurse endoscopy trial (WINuET)', BMJ.

Doak, S.
2012, 'The role of von renox state in the genotoxicity of ultralime superparamagnetic iron oxide nanoparticles', Biomaterials.


Evans, A.
2010, 'Gel point and fractal microstructure of incipient blood clots are significant new markers of hemostasis for healthy and anticoagulated blood', Blood.

Prior, S.

Russell, I.


Francis, N.


Harrison, K.
2008, 'Intestinal IgA disease guideline', Thorax.

Hawkins, K.
2010, 'Gel point and fractal microstructure of incipient blood clots are significant new markers of hemostasis for healthy and anticoagulated blood', Blood.

Stephens, J.

Stephens, J.

Taylor, R.

Thomas, B.
2012, 'Incidence of diabetic retinopathy in people with type 2 diabetes mellitus attending the diabetic retinopathy screening service for Wales: retrospective analysis', BMJ.

Wagstaff, J.
2010, 'Pazopanib in Locally Advanced or Metastatic Renal Cell Carcinoma: Results of a Randomized Phase III Trial', Journal of Clinical Oncology.

Supporting higher level skills and innovation:

Tought and research programmes within the College of Medicine demonstrate innovative links with industry.

MB BCh Graduate Entry Medicine

The programme involves early and repetitive exposure to clinical practice through learning Opportunities in the Clinical Setting (LOCS) community-based learning, clinical apprenticeships and specialty attachments.

The College works closely with the Welsh Postgraduate Deanery to aid transition into ‘Foundation’ training, and there is an annual medical careers evening with talks from GPs, consultants and careers advisors.

A project entitled Tracking our Graduates examines the ambitions and aspirations of current and past trainees to improve future training.

MSc and PG Diploma in Liquid Chromatography Mass Spectrometry and PG Certificate in Applied Liquid Chromatography Mass Spectrometry

The College has developed three hands-on schemes (MSc, PG Diploma and PG Certificate) in conjunction with major UK industrial partners.

Course content has been designed with industry, for industry and to support professional development programmes, and there are opportunities for handson training in a research-led institute with extensive inhouse equipment to improve analytical science skills.

Students benefit from expert guest lecturers from industry, and there will be assessments to encourage transferable skills essential for employment, including case studies, presentations, data processing and informatics exercises.

MSc and PG Diploma Trauma Surgery and Trauma Surgery (Military)

The College has developed two innovative, hands-on programmes (Trauma Surgery and Trauma Surgery (Military)) in association with the NHS as well as the Academic Department of Military Surgery and Trauma (ADMS), Royal Centre for Defence Medicine, Birmingham and associated military facilities.

Educational sessions focus on moulage scenarios and surgical skills simulations to cement experience and factual knowledge with clinical application. The courses provide handson experience of practical skills, including planning, execution and communication of treatment strategies and surgical tactics.

The College is working with trainees to plan further professional development.

Postgraduate research degrees

Students on the College’s research degrees have access to undergraduate and taught master’s modules to broaden their knowledge, and attendance at a ‘statistics for biomedicine’ course and at weekly biomedical and health services research seminars is compulsory. These regularly feature eminent speakers from academia and industry.

Research students benefit from links with the industrial and pharmaceutical sectors, and visits from industrial bodies.

An annual postgraduate research day helps develop transferable skills, including presentation, poster development and networking, and there are case-related courses offered by the University’s careers service as well as studentship sponsors, such as the Biotechnology and Biological Sciences Research Council (BBSRC).
The College was formed in February 2011, with the amalgamation of the School of the Environment and Society and the School of Physical Sciences, and unites teaching and research expertise in the areas of biosciences, computer science, human geography, physical geography, mathematics, physics, and pure and applied ecology.

The College ethos promotes research that matters in the long term and inspires students towards fulfilling employment.

Swansea researchers have made important contributions to global debates for over 40 years, spanning both traditional and modern sciences. From monitoring climate change through the study of tree-rings, developing new, safer devices for the care of hospital patients, to computational artefacts and abstract theories, to elucidating the nature of antimatter, the College of Science produces high-impact research with wide-reaching and globally relevant benefits.

In the near future we look forward to the establishment of a £1.3 million Imaging Laboratory to support the work of the Swansea Moving Animal Team and Technologies for Ecological Research (SWATTER), supporting the visualisation and analysis of complex data derived using state-of-the-art tags.

Our research recognises no boundaries.

Professor Simon Hands,
Director of Research, College of Science
Global Reach and Reputation

The College of Science is research intensive and internationally-focused and its work is organised through academic disciplines, research centres and institutes, and major projects, all supported by superb research facilities.

Within these disciplines there are a number of flagship research centres and research groupings, some of which are among the top in their fields with substantial global reach and reputation.

One of the College’s flagship research centres is The Swansea Moving Animal Team and Technologies for Ecological Research (SMATTER) Centre.

The Swansea Moving Animal Team and Technologies for Ecological Research (SMATTER) research centre investigates animal movement in its broadest sense. Its world-leading work includes examining the role of the environment on movement and distributions, and using new technologies to access particularly intractable species.

The study of animal behaviour is key for disciplines ranging from animal husbandry to psychology. While early methods used simple observation, a recent approach uses triaxial accelerometers in animal-tagged tags, to record all aspects of an animal’s daily life, irrespective of where it may travel. Because these sensors record movement, it should be possible to unravel the recorded data to derive behaviour.

Led by Professor Ruary Wilson, biologists in SMATTER have been working with College of Engineering researchers Dr Mark Holton, Professor How Summers and Professor Paul Rees, through the Swansea Nano Knowledge Transfer Centre, to produce a tag that records triaxial acceleration at high rates, and they have already collected large amounts of data from wild animals as well as humans.

Further collaborations with Computer Science researchers, including Ed Grundy and Dr Mark Jones, led to the development of a framework for precise quantification of behaviour based on hierarchical signal processing.

The approach uses novel and award-winning visualisations to allow the user to see and quantify how the data are grouped at the various hierarchical levels. There is no black box, just clever, visible, algorithms.

A Royal Society Wolfson Laboratory Refurbishment Grant of £400,000, combined with further funding from Swansea University, were collected in association with National Geographic, and featured in the largest production in its 125 year history Great Migrations. (See page 153)

Dr Emily Shepard investigated the link between the distribution of raising and the flight paths of soaring birds, in particular those of the Andean condor, through a Leverhulme Early Career Fellowship of more than £50,500.

PhD research student Rebecca Scott is exploring similar themes in the ocean environment, through a Natural Environment Research Council (NERC) funded studenthip, where hatching sea turtles rely on ocean currents for transoceanic dispersal. Global ocean particle tracking models are being used to study the movements of juvenile sea turtles indirectly during their first few years of life, previously termed the “lost years”.

Over the past seven years, Dr Gail Scholfield, Dr Sabrina Fossatte and Professor Graeme Hays have tracked the movement patterns of over 100 endangered loggerhead sea turtles at the Mediterranean’s largest breeding ground with funding from NERC and a number of conservation charities.

This information has been applied to improve existing fine-scale legislative ‘blacklist’ and zoning of vulnerable marine rockfishes, Greece, and identify regional-scale foraging grounds of importance to this and other sea turtle populations around the Mediterranean.

Professor Hays travelled to the Chagos Archipelago in the Indian Ocean with Nicola Esteban, Sustainable Expansion of the Applied Coastal and Marine Services in Wales (SEACAMS) project manager, to equip nesting green turtles with accelerometers and satellite-linked GPS tags as part of a sea turtle conservation and research project supported by a spoofing award of almost £25,000 from the Darwin Initiative Challenge Fund.

SMATTER is also using animal-tagged technology to document the behaviour of captive-bred and rehabilitated animals, from budgerigars to raptors, following their release into the wild.

This approach aims to inform rehabilitation techniques and reintroduction programmes, with organisations such as the Royal Society for the Prevention of Cruelty to Animals (RSPCA) and Proyecto de Conservación y Rastreo de Aves Rapaces (the Bird of Prey Conservation and Raccoon Programme) in Argentina.

A crucial consideration when instrumenting animals is the minimisation of any negative effects of the loggers on their animal bearer. This is particularly true for birds, which are sensitive to both logger mass and drag.

Grants of more than £58,000 from the Chiled Wildlife Care Network and the RSPCA have enabled PhD student Sylvie Vandenabeele to assess how these factors influence the energy expenditure of animals in the wild.

Working with local partners, Dr Carlos Garcia de Leon has been among the first to put a figure to the extent and scale of salmonid escapes in Chilean Patagonia.

Dr Garcia de Leon is also using a range of tools to monitor and improve the returns of salmonid stocking and quantify population connectivity. Through a series of studentships matched-funded by the Environment Agency Wales totaling £24,000 and through the EU-funded SALSEA-MERGE FP7 project with an award of more than €156,000 ($126,000 approx)

www.swansea.ac.uk/biosci/research/Smart/
The College has a wealth of expertise in biosciences, computer science, human geography, physical geography, mathematics, physics, and pure and applied ecology, and produces agenda-setting research of the highest calibre.

**Biosciences**

The Department of Biosciences, led by Professor Rory Wilson, has a thriving research culture and many of its academics are involved in biodiversity conservation, working closely with a variety of conservation organisations and local and national government to protect habitats and species throughout the UK and abroad.

Seventy-five per cent of Swansea’s research in biological science is judged to be of international quality (2008 RAE).

**Centre for Sustainable Aquatic Research (CSAR)**

The Centre for Sustainable Aquatic Research (CSAR) was commissioned in 2005, with a £2 million infrastructure investment funded by the European Union, Welsh Government and Swansea University, to support 750m² of state-of-the-art controlled environment laboratories for sustainable aquatic food production (aquaculture, fisheries).

Since its inception, CSAR, headed by Professor Kevin J Flynn with Dr Robin Shields as Director, has grown rapidly and diversified its research to span fundamental questions of aquatic ecology and physiology, alongside applied technology development work. This ranges from theoretical and modelling work to experimental and field trials with organisms including bacteria, microalgae, shellfish, finfish and aquacultural engineering.

The Centre currently supports 16 research staff, nine technical staff and five administrative staff via projects funded by the EC Framework Programme, RCUK, BESI programmes, UK government departments and the private sector. Fourteen academic staff members from the College of Science and the College of Engineering are directly involved in this research. During the period 2010–2012, the Centre attracted more than £5.5 million in new research income to the University.

CSAR currently leads a three-year, £1 million collaborative research project funded by the Natural Environment Research Council (NERC) to study ocean acidification and its impact on commercial marine fisheries. The project partners are Plymouth Marine Laboratory and the Universities of Exeter and Strathclyde. CSAR is conducting complex experimental work and providing support for mechanistic modelling. Additional NERC funded work on ocean acidification is being conducted between the Marine Biological Association of the UK (MBA, Plymouth) and CSAR, modelling the effects of acidity on phytoplankton physiology.

The Centre also runs a £98,000 Leverhulme Trust International Network, which seeks to enhance its ability to model the activity of mixotrophic protists – a collective group of organisms that dominate primary production in certain areas of the world but whose activities have been largely ignored. These include organisms responsible for harmful algal blooms.

Within the European Commission’s Seventh Framework Programme for Research (FP7) integrated science programme, the Centre participates in the €7 million (approx. £5.7 million) EuroBASIN project, through a grant award of £953,000 for modelling trophic dynamics in the Atlantic food chain, with particular interest in the zooplankton component leading to fisheries.

Such research, and other modelling projects, makes CSAR a world leader in the development and application of plankton functional type models, and especially in models which show adaptable traits. The models are used also in support of the algal biofuels/business projects, described further below, being used to explore not only the optimisation of commercial productivity, but the potential risks to the environment through the accidental release of genetically modified microalgae.

The Research Centre is also highly experienced with the EC Capacities Programme, having participated in numerous industry-led projects on innovative technologies for the European aquaculture and fisheries sectors (Research for SMEs scheme, FP6 and FP7). Topics include water quality control and sustainable feed development for aquaculture, and new shellfish hatchery technologies as a tool for fisheries stock enhancement.

By integrating its research skills and class leading facilities into a multidisciplinary research collaboration with the University’s College of Engineering, CSAR has attained widespread research prominence in the expanding field of algal biotechnology. The Centre hosts several large programmes encompassing algal biomass for added value products, biofuels, bioenergy and bioremediation.

The CSAR-led Horizon 2020 project EnErgy Algae (EnEAlgae) is a €14 million (€11 million approx) four-year strategic initiative bringing together 19 partners and 14 observers across seven EU member states, with the aim of developing sustainable technologies for algal biomass production. The project aims to reduce reliance on fossil fuels by developing algal biofuel technology at nine pilot facilities across north west Europe.

CSAR’s specific role, in addition to overall project management, is experimental – mass algal culture and engineering solutions for harvesting – and modelling based – including development of an online decision support tool that will help producers, investors, regulators and policymakers explore the capabilities and suitability of the different technologies developed by the project.

The algal work, more than any other within CSAR, has potential to contribute to the outputs of the Swansea Natural Products research group (SNaP).

As well as offering applied research services, the CSAR team provides information and advice to industry and governments; examples include European Regional Development Fund (ERDF) funded and Welsh Government administered Academic Expertise for Business (A4B) projects, such as the Algal Biotechnology for Wales Knowledge Transfer Centre. Key partners include local and European SMEs and large companies such as Tata Steel and Welsh Water. In its government advisory role, CSAR staff drafted the aquaculture section of the Wales Fisheries Strategy (2008). The Centre is currently represented on the post-2013 Workstream group on European Territorial Cooperation.

Education and training activities at CSAR include hosting industry-relevant research studentships, vocational training for undergraduate and postgraduate students, and tailored training courses for industry and public institution personnel.

SEACAMS, otherwise known as the Sustainable Expansion of the Applied Coastal and Marine Sectors in Wales, is the largest and most diverse component of CSAR’s industry-facing operations. This £23.6 million project is led by Bangor University in collaboration with Swansea and Aberystwyth Universities and is part-funded by European Regional Development funding, through the Welsh Government, until April 2015. The objective is to assist businesses with their product and service development in order to expand the coastal and marine business sectors in Wales.

CSAR hosts a multidisciplinary SEACAMS team of 13 research officers and technicians with interests covering four broad areas: marine ecosystems, environmental water quality, coastal catchment processes and design engineering. The team works across traditional subject divides to bring economically attractive solutions to business challenges. To date, the team have assisted over 70 businesses with technical advice and workshops; a further 14 research and development projects are underway with a diverse range of marine and coastal businesses across Wales.

New lectures, Dr Mike Fowler (theoretical ecologist), Dr John Griffin (community ecology) and Dr Andy King (behavioural ecology) have recently joined CSAR and will help further develop research portfolio: [www.aquaculturewales.com/index.html](http://www.aquaculturewales.com/index.html).
"I can honestly say that without Dr Adam Powell’s [Knowledge Transfer Centre] intervention, there is little doubt that we would not have maintained our direction, and would most likely have ceased trading some time ago.

“We have already brought two products to market, and we will shortly have a third. On top of this, by providing a network into other avenues of Welsh universities he has helped ensure that we are able to continue looking forward, as we are now involved with SEACAMS.

“A report which Dr Powell and Dr Alla Silkina prepared for us has already enabled ReefShotz to open talks with a major ornamental plant nursery. I can honestly say that without Dr Adam Powell’s [Knowledge Transfer Centre] intervention, there is little doubt that we would not have maintained our direction, and would most likely have ceased trading some time ago.

“Joe McDonald, Managing Director, Varicon Aqua Solutions

"We are looking forward to continuing our collaboration with Swansea University.

"I’m pleased to say we have already put to good use much of the data generated over the lifetime of the project which is leading to improved commercial success for Varicon.

“We are looking forward to continuing our collaboration with Swansea University.

"Joe McDonald, Managing Director, Varicon Aqua Solutions

Swansea Natural Products (SNaP)

The Swansea Natural Products (SNaP) group, led by Professor Tariq Butt, focuses on the development of natural products, whether whole organisms or their metabolites, for the socioeconomic benefit of mankind.

The group’s work is divided into two broad categories: biocatalytic and natural products. The former focuses on developing natural agents for the control of investigate pests which impact on food security and human and animal health. The latter focuses on exploiting agents or their by-products for use in various biotechnologies that contribute to protecting the environment and generation of new therapeutics for healthcare.

The group conducts multidisciplinary research funded by various sponsors including research councils, the Royal Society, British Council, EU, industry and the Welsh Government.

The group has developed benign agents such as the insect pathogenic fungus Metarhizium anisopliae for pest control. It has also developed strategies which enhance the efficacy of insect pathogenic fungi and concomitantly reduce or eliminate inputs of harmful chemical pesticides.

The work is timely because many pesticides have been withdrawn following a major review by the EC. EU legislation requires increased use of integrated pest management (IPM) strategies, and there is increased consumer and supermarket pressure to reduce pesticide residues in food.

The research of Professor Butt and his team assessed the risk of microbial biological control agents. This work, supported by the EPSRC and the USA Department of Energy, Joint Genome Institute, has led to a number of exciting results relating to the evolution and mechanisms of wood decay, which have been published in the journals Science and Proceedings of the National Academy of Sciences.

The SNaP group also works closely with the Swansea Moving Animal Team and Technologies for Ecological Research (SMATTER) group (see page 124) in developing novel methods and tools for rapid screening of insect attractants and repellents from natural sources such as plants, fungi, algae, and insects.

SNaP is currently engaged with companies ranging from micro-enterprises to multinational, and has contributed to education and training activities which include hosting industry-relevant research studentships, vocational training for undergraduate and postgraduate students and tailored training courses for industry and public institution personnel.

The team has shown that fungi, developed to control agro-forest pests are also highly efficacious in controlling the disease vectors. The group is also a partner in a £5 million ($7 million approx) EU project to develop fungi for the control of agro-forest pests in soil and soilless substrates.

With an award of almost £544,000, Professor Butt is leading the Welsh Government Academic Expertise for Business (WAB) funded project BIOPROTECT, which is developing Metarhizium anisopliae and botanicals for the control of pests of socio-economic importance using novel "live and kill" and "stress and kill" pest control strategies. This grant includes a contribution of £278,000 from industrial partners.

The group is also active in exploiting by-products from microbial sources. Professor Butt is investigating bioactive metabolites of Metarhizium anisopliae, which have immune modulation and antibiotic properties.

Dr Dan Eastwood has joined the SNaP group, bringing expertise in the higher fungi - Agaricomycetes, or mushroom forms. He has worked on methods for controlling quality, flavour development and virus disease control of the cultivated white mushroom, or Agaricus bisporus, crop.

Dr Eastwood has worked in the exploitation of fungi for the use in novel biorefineries where lignocellulose waste, such as wood or straw, are decomposed by fungi to release novel compounds. This work, supported by the EPSRC and the USA Department of Energy, Joint Genome Institute, has led to a number of exciting results relating to the evolution and mechanisms of wood decay, which have been published in the journals Science and Proceedings of the National Academy of Sciences.

The SNaP group also works closely with the Swansea Moving Animal Team and Technologies for Ecological Research (SMATTER) group (see page 124) in developing novel methods and tools for rapid screening of insect attractants and repellents from natural sources such as plants, fungi, algae, and insects.

SNaP is currently engaged with companies ranging from micro-enterprises to multinational, and has contributed to education and training activities which include hosting industry-relevant research studentships, vocational training for undergraduate and postgraduate students and tailored training courses for industry and public institution personnel.

"The [SEACAMS] workshop has been invaluable in giving me a better understanding of other types of surveys, the organisations wanting them and their requirements. As a result I have already widened my client base.

Dan Worth, Owner, Razorbill Rib Charter Marine Services

"SEACAMS will be helping us to gather all the scientific information required to not only prove the technology, but to demonstrate long-term effectiveness to the industry and the Environment Agency who regulate effluent discharge.

Phil Morgan, Managing Director, Hydro Industries Ltd

"We are now enjoying the extended life SEACAMS has brought to the HydroCamel. This continues to be an important tool in our armoury and this has made us substantial savings in repair and replacement costs.

Dan Owens, Director, Titan Environmental Surveys

"It is important when developing an innovative product to understand its full potential and we are using the funded research expertise and facilities SEACAMS can bring to the project to help us test the potential of a natural waste material from the coal mining industry.”

David Holland, Technical Director, Salix

"As you know the collaborative consortium approach can be difficult to manage and the FP7 Shellplant project is a fine example. The direction provided by Dr. Robin Sheldis and the commitment from his team has been exemplary.

Gareth Bull, Managing Director, ReefShotz

"We have been delighted with the level of communication, quality of work and the scientific output from the [CIDR] team.

"We are now enjoying the extended life SEACAMS has brought to the HydroCamel. This continues to be an important tool in our armoury and this has made us substantial savings in repair and replacement costs.

"We are looking forward to continuing our collaboration with Swansea Natural Products (SNaP)

Joe McDonald, Managing Director, Varicon Aqua Solutions

"I can honestly say that without Dr Adam Powell’s [Knowledge Transfer Centre] intervention, there is little doubt that we would not have maintained our direction, and would most likely have ceased trading some time ago.

"We have already brought two products to market, and we will shortly have a third. On top of this, by providing a network into other avenues of Welsh universities he has helped ensure that we are able to continue looking forward, as we are now involved with SEACAMS.

“Joe McDonald, Managing Director, Varicon Aqua Solutions
Computer Science

The Department of Computer Science, led by Professor Matt Jones, is home to world-class researchers, first-class laboratory facilities and excellent teaching programmes. The Department’s ethos is to pursue research that matters in the long term, inspiring students and encouraging them to help change the world.

For more than 40 years researchers at Swansea have made interesting and significant contributions to computer science in the areas of computer vision, human computer interaction, and the social impact of science and technology. Main research interests now include computer vision, human computer interaction, and formal methods for designing systems.

Swansea computer scientists work with a huge range of collaborators from all over the world and play their part in leading the development of the subject.

Visually and Interactive Computing

Swansea computer scientists have worked in a broad range of subjects in the areas of visual computing. Since 1992, the group has grown to a team of eight academics, eight researchers and 15 postgraduate research students, studying for PhD, MPhil or MRes qualifications.

The group has contributed a large collection of novel techniques and significant breakthroughs in the fields of ray tracing, data visualisation, computer vision, volume graphics and visual interaction.

The group follows an ambitious and curiosity-driven programme to develop new algorithms and methods, as well as advanced software techniques and tools, for computer graphics, visualisation and interactive systems.

Ray tracing

Dr Mark Jones and Dr Ben Mora have made several significant contributions in the field of ray tracing leading to two patent applications.

Ray tracing is a significant field of computer graphics used for rendering highly realistic imagery for computer animated films, scientific data visualisation, architectural and engineering designs. Challenges include rendering imagery of the highest quality indistinguishable from reality, in a cost and time-effective way. The group in Swansea has concentrated on both aspects.

New methods significantly improve the visual quality of global illumination at reduced rendering cost by pre-processing a photon map. In these techniques, the source photon positions are relaxed or capacity constrained. This greatly reduces the variance of the resulting images. Bias has been greatly reduced by constraining the relaxation process in the vicinity of edges of photon density. The overall result is that fewer photons need to be considered in the density estimation phase, resulting in a significantly faster rendering time, but still achieving higher quality images (due to the reduced variance).

This is a significant result for global illumination, and the resulting technique applied to the leaf image won the cover competition for the journal Computer Graphics Forum (2009).

The first application of divide-and-conquer ray tracing led to a new fundamental data structure-less approach for ray intersection. Since ray tracing became widespread 30 years ago, all approaches have used algorithms based on pre-computed data structures to improve the speed of the algorithm.

Divide-and-conquer ray tracing is a radical departure from all previous work, simplifying software engineering by allowing deterministic memory consumption and providing state-of-the-art performances. The new approach is faster than other techniques and is a significant advance when used with massive and dynamic scenes. This approach is implemented inside a high-charge graphics library available at www.directtrace.org.

There are a significant number of other contributions in the area including combined progressive photon mapping for caustic light paths and path tracing into one framework for creating low variance and low bias realistic images. New data structures for ray tracing have been proposed such as Row Tracing, Restricted BSP-trees, and Hierarchical Photon Maps. These three dimensional constructive radiosity renderings were created from artist capture styles and a single subject photo.

Three-dimensional emissive displays create “holographic” like images that can be viewed from any vantage point around the device. A problem with these displays is that they produce x-ray like transparent objects. A major contribution has been to create 4D light fields from 3D objects to enable opaque fully shaded views of 3D objects on these devices.

Data Visualisation

Dr Daniel Archambeaut, Dr Rita Bongo, Dr Philip Grant, Dr Mark Jones, Dr Robert Laramee and Dr Gary Tam are collaborating with universities overseas and in the UK, and the group is very much focused on creating application-driven visualisations in the area of data visualisation.

The group created novel data visualisation and data analysis approaches for inverse-acceleration data from animal behaviour data tags. New interactive views of the data projected onto a sphere allowed animal behaviour and foraging patterns to be discovered. Higher order smoothed graphs were created in order to investigate behaviour in a posture state graph. The aim is to link multiple animal postures and transitional behavioural into groups in order to classify animal behaviour. The work achieved a best paper award at EuroVis 2009, organised by the Eurographics Working Group on Data Visualisation and the Institute of Electrical and Electronics Engineers (IEEE) Visualisation and Graphics Technical Committee.

Swansea has a long history of scientific contributions to the vibrant field of flow visualisation. Advanced algorithms for the placement of streamlines on complex surfaces from computational fluid dynamics (CFD), the visualisation of flow data and stream surfaces algorithms have been developed and novel feature-extraction methods, e.g., high-impact topological flow visualisation algorithms have also been introduced. These visualisation techniques extract an abstract representation of a flow field known as the topological skeleton.

The group’s algorithms are the first of their kind because they include the inherent uncertainty of the data in the resulting visualisations. The utility of all their algorithms has been demonstrated on real-world engine simulation data. A new approach for creating key statistics for integral curves that allows computing similarity using a lightweight chirp-based measure and clustering has enabled enhanced flow visualisation through adaptive rakes and allowing the user to gain full interaction with their data.

The Swansea researchers have also developed advanced visualisations for high-dimensional data. These methods are well-known contributions because they...
address the challenge of very large data sets. The information contained in very large data sets requires special handling because there are far more data items than available pixels on a typical screen. Thus, they have developed novel frequency-based visualisations that process high-dimensional data based on extensions to the well-known parallel coordinates technique.

Recognising emotion from video is a difficult task. Visual analytics have been used to tackle the problem by transforming the multiple feature-based time-series for each expression into a multi-dimensional parameter space. This enables the group to utilise parallel coordinates visualisation to gain an understanding of the algorithm space, providing a fast and cost-effective means to support the design of analytical algorithms.

The group augments parallel coordinates with scatter plots to support interactive construction of decision trees or rules for classification of emotions. This approach complements and enhances traditional methods where researchers typically rely on automated learning mechanisms to establish classifiers and have little knowledge of how the algorithm works on the data.

From the visualisation perspective, the group has demonstrated how to utilise a large collection of low-level analytical measurements mostly utilised in computer vision to support interactive visualisation and analysis of time series data in its parameter space.

Dr Borge, a young scientist who joined the group recently, has made a number of important advances in developing time series visualisation techniques, including scalable pixel-based visualisation techniques for generalised data exploration, programmable icons for visualisation of sound related information and visual metaphors based techniques to augment spatial and temporal perception of visually-sensitive data.

Much of the work was utilised directly in the creation of off-the-shelf software: (i) to support glaciologist's data analysis process to gain insights into a 10-year record of termini positions of 199 glaciers, around Greenland ice-sheet, resolving both their seasonal and interannual fluctuations, (ii) and in the design of a standalone tool to generate background noise visualisations within a video sequence for support to hearing impaired viewers.

A significant contribution in the field of visualisation made by Swarzes is the introduction of video visualisation as a visual analytics technique for extracting meaningful information from video sequences. This work has now been applied to sports video analysis in a new area of Sports Visualisation.

The group has created new interactive and glyph-based visualisations for rugby data, which was used by the Welsh Rugby Union in the 2011 World Cup and 2012 Six Nations, and an interactiveinker table for training and visualisation for shot and match summaries. The aim has been to produce novel methods for the interaction with data for team and individual performance enhancement.

**Computer Vision and Medical Image Understanding**

The Visual Computing Group has expanded its research activities into Computer Vision since 2007, when Dr Xianghua Xie joined the Department. Currently, there are 10 researchers and PhDs working in this area and there have been several significant contributions in the field of image processing and video analysis, particularly in deformable modelling, image segmentation, registration and 3D human pose estimation and tracking.

The group has proposed several novel techniques in analysing single images and sequences of images for low-level and high-level understanding, and new approaches in analysing colour textures that are random in appearance and in dynamics. Applications to novelty detection have shown great potential in industrial inspection and medical diagnosis.

The group has undertaken extensive research on deformable model-based image segmentation and registration. Proposed methods include novel edge and region integrated approaches towards modelling, physically-inspired external forces for active contour and active surfaces, deformable model segmentation with complete initialisation independency that is reported in the literature for the first time, models that can be generalised to arbitrary dimensions, and context-based methods for tracking and online adaptive shape learning and registration.

The group has also made significant progress in 3D human pose estimation, especially, from single images. The methods proposed can handle large uncertainties associated from the root node, i.e. torso position and orientation, which then allows more efficient and effective estimation and tracking of human body position using optical sensors. It has great potential in automated learning of human behaviour and interaction.

Many of those developed techniques have been applied to medical problems, in which the group has extensive research interest and activity. There have been several projects on cardiovascular imaging data analysis and disease modelling.

The group is particularly interested in extracting anatomical structures from various modalities, including ultrasound, Magnetic resonance imaging (MRI), Single Photon Emission-Computed Tomography (SPECT), Computed tomography (CT), and Optical coherence tomography (OCT), and motion patterns from dynamic sequences, e.g. myocardium wall tracking for heart muscle compliance analysis and functional assessment. Research works have been carried out on coronary stenosis, aortic stenosis, carotid stenosis, and new medical interventions such as transcatheter aortic valve implantation.

**Human-Computer Interaction**

The Future Interaction Technology (FIT) Lab is a leading research centre in Human-Computer Interaction (HCI). The FIT lab mission is to explore and apply advanced computer science to make interaction technologies dependable, enjoyable and effective. Interaction technologies include mobile devices, the web, implants, home TV, medical devices, microwave cookers, ticket machines and navigational aids.

Since its foundation in 2005, the FIT lab has, in collaboration with other universities, won external grants of more than £10 million. It has collaborated extensively with companies and other partners including Nokia Research, Microsoft Research, IBM Research, University of Cape Town, FIT Bombay, Huawei, Ordnance Survey and the NHS.

Funded projects have led to research focuses on HCI for medical devices and well-being: persuasive technologies, mobile and ubiquitous computing user experience; and interaction techniques to bridge the global digital divide.

As well as permanent faculty members, the FIT lab is staffed by a large and growing number of PhD researchers and research officers. The FIT Lab often welcomes international visitors for collaborations, research talks and workshops.

Professor Harald Thimbleby leads the CH+MED (Computer Human Interaction for Medical Devices) project at Swansea. This large-scale EPSRC collaborative endeavour with University College London (UCL), Queen Mary University and City University, aims to improve the safety of programmable medical devices, such as infusion pumps.

Professor Thimbleby focuses on the mathematical and formal analysis of interfaces in an attempt to identify and fix designs that might cause users to make potentially life-threatening errors.

Taking a complementary perspective on the medical device problem, Dr Parisa Eslambolchilar applies her expertise in sensor-based multimodal interaction to consider innovative solutions that fit the healthcare context.

Dr Eslambolchilar has further focused on persuasive technology methods, exploring whether mobile and ubiquitous computing systems can nudge people towards better lifestyle choices. The EPSRC-funded CHARM project led, for example, to a series of experiments centring on the bActive Android phone app.

Using the accelerometer inside the phone, the application measures a person’s physical activity throughout the day. If a group of people are using the application on their own phones, then bActive allows each person to view not only their own step counts, but also the average step count within the group. Studies have been carried out to consider whether such group awareness can help motivate an individual to do better.

Dr Stephen Lindsay joined the FIT Lab in October 2012. His research focuses on applying participatory design techniques, where future users of a system are asked to engage in the creation of its conceptualisation and design, with older adults, people living with dementia and other vulnerable groups. At the FIT Lab he will be developing his research by working with local social services and charitable organisations.

Dr Lindsay also conducts research into the design and development of assistive technologies to be used by people living with disabilities both inside the home and while they are outdoors to promote health and independent living.

Professor Matt Jones’ work centres on mobile and ubiquitous computing. He has been a Visiting Fellow at Nokia Research and was given an IBM Research Faculty Award to work with the Spoken Web Group (Daih) on information access solutions for users with low textual and computer literacy.

Over the past several years, Professor Jones has received several research grants to map out the HCI issues and solutions for ‘developing world’ users. In July 2012, this led to the launch of the ComNma toolkit at the Royal Geographic Society. ComNma is a collection of hardware and software components providing solutions for content creation and sharing in locations around the globe where there is low textual and computing literacy and limited power and network coverage.
Theory of Computation

Swansea has one of the largest groups of theoretical computer scientists in the UK with a research programme focussed by these questions:

- Computability – What can and what cannot be computed, now or in the future? The group is extending the classical theory of digital computation, expanding the conception of computation to deal with any form of discrete and continuous data, any physical form of data representation, and any physical means of computation.

- Specification and programming – What is a system supposed to do? The accurate and unambiguous specification of software and hardware systems is a massive problem. The group pursues radical new approaches to the design and construction of programming and specification languages.

- Proofs – Does a system actually do what it is supposed to do? Reasoning about huge systems is necessary and difficult. The group’s work pushes the limits of proof, builds tools using constructive type theory and logics, and applies them to problems such as railway signalling systems.

- Complexity – How hard is it to verify the correctness of programs? This question intrigues researchers who want to measure the complexity of proofs, find the fastest SAT-solver, and improve model checking tools for systems.

- Railway verification – How do we increase the capacity of the rail network without jeopardising safety? The Swansea Railway Verification Group carries out research which has having impact on both current practices and strategic planning within the railway industry.

Theory of data: representation, computation, and measurement

At Swansea, research is underway on data and on developing the new paradigm of data-centric computation. Typical general questions are:

- How do you specify and represent data, both mathematically and physically?
- What can you compute and communicate using data?
- Surprisingly, data in all their digital and analogue forms can be unified by a general mathematical theory based on algebra and logic. It is a theory with profound implications, useful software tools and many applications.

- Data arise from measurement and have both digital and analogue forms. Classical computability theory deals with digital data and needs to be generalised to include analogue data. Since analogue data can only be approximated, a successful theory must include a theory of representations of approximations.

Using Domain Theory, Dr Jens Blanck has made a deep investigation of the nature of representations and possible reductions between different representations, which gives insight into the diversity of operations that are computable with respect to different representations of the data.

- The unification of theories, methods and tools for computing with analogue and digital data has been tackled by Professors John Tucker and Jeff Zuckler of McMaster University, Canada, who have developed an extensive theory of computable functions on algebraic structures, which model any kind of data. Analogue data types, such as the real numbers, waveforms and signals, can be modelled using topological algebras. The aim is to create a comprehensive theory for the specifying, computing and reasoning about functions on topological algebras that can help answer the question: What are the technological limits of analogue computation?

- How, however, to complete the analysis of the nature of data, we need to examine the physical process of measurement and, indeed, search for new physical foundations for computation and information processing.

Dr Edwin Beggs of the College’s Department of Mathematics, Professor John Tucker, and Professor Felix Costa of the University of Lisbon, have developed a theory of combining physical systems with algorithms. They add physical experiments to measure quantities as “oracles” to algorithms.

In a large programme of research they have studied mechanical, optical, electrical, atomic measurements and classified the boost in computational power the analogue systems produce. Remarkably, they have found that if a wide range of experiments lead to the same computational class under practical constraints of polynomial time, then this class is called P/log and proves that such systems routinely break the Turing Barrier, a theoretical limit on the power of computers discovered in 1936. This suggests that new technologies exist that go beyond those we know at present.

Furthermore, instead of thinking of the measurement boosting the algorithm, the algorithm can be thought of as controlling the measurement. New conceptions of the measurement process arise that show that uncertainty is common and inherent in simple measurement experiments.

Programming language specification

Since the middle of the last century, hundreds of programming languages have been designed and implemented — and new ones are continually emerging. The syntax of a programming language can be specified quite precisely and efficiently using formal grammars.

However, to give a formal specification of its semantics is much more challenging. Research in semantics has allowed us to reason about software and has provided valuable insight into the design of programming languages, but language designers, implementers and programmers commonly regard precise semantic specifications as impractical and too costly.

Professor Peter Mosses has previously developed techniques for radically improving the practicality of language specification. He is now leading the PlanCompS research project based at Swansea, Royal Holloway and City, funded by EPSRC (2011-13), with Microsoft Research Cambridge as project partner.

PlanCompS aims to establish and test the practicality of a component-based framework for the design, specification and implementation of programming languages. The main novelty will be the creation of a substantial collection of highly reusable, validated language components called fundamental constructs (funcons).

Crucially, the semantic specification of each funcon will be independent, not needing any reformulation when funcons are combined or new funcons are added to the collection.

Case studies include specification of major languages (C#, F#, Java). All specifications will be provided online in an open access repository, with browsing and searching supported by a digital library interface.

www.plancomps.org

Swansea Railway Verification Group

How do we increase the capacity of the rail network without jeopardising safety? The Swansea Railway Verification Group carries out research which is having impact on both current practices and strategic planning within the railway industry.

In 2007, Professor Foron Moller started a collaboration with Invensys Rail, a multinational company based in Chippenham, which provides state-of-the-art signalling, communication and control systems for mainline and mass transit rail networks across the world. This successful collaboration resulted in the creation of the Swansea Railway Verification Group, which is now supported by various academic members of staff, research associates and students. It is financially supported from industrial and research council grants, in particular from direct support from Invensys Rail, and from the Rail Safety and Standards Board (RSSB) and EPSRC Project SafeCap.

The main academic collaborators are Professor Steve Schneider and Dr Helen Tishame of the University of Surrey, Professor Alexander Romanovsky of Newcastle University, and Dr Yoshiki Isobe of the National Institute of Advanced Industrial Science and Technology (AIST), Japan. The main industrial collaborator is Invensys Rail.

The aim of the group is to impact on both current practices and strategic planning within the Railway Industry. Regarding current practices, research led by Professor Moller, Dr Anton Setzer and Dr Monika Seisenberger has led to the adoption of formal verification techniques within the interlocking design stage at Invensys Rail. The group continues to work in partnership with Invensys Rail to develop tools for practical verification.

Regarding strategic planning, research led by Professor Moller and Dr Markus Roggenbach is addressing the problem of the adoption of ETMS (Electronic Train Management System) by the UK as a replacement for — or supplement to — traditional track-side interlocking. ETMS, which uses GPS for positioning and a digital radio system to monitor train location and speed, is being introduced throughout Europe as part of ETCS (the European Rail Traffic Management System), but UK train companies will naturally resist this change due to the high cost of entry (replacing and equipping rolling stock). The group’s research is producing data for the potential use by RSSB and the network operators to convince train operators — and government — of the need to invest in change.
Geography

The Department of Geography, led by Professor Stefan Doer, aims to be one of the foremost international centres for research in Human and Physical Geography.

All academic staff in Geography are active researchers and the department has a thriving research culture and a strong postgraduate community.

In the 2008 Research Assessment Exercise (RAE), 95 per cent of Swansea’s research in Geography was judged to be of international quality, and 62 per cent was regarded as world-leading, or internationally excellent.

Human Geography

Research in Human Geography at Swansea covers all parts of the globe, exploring both urban and rural contexts, and ranges from the global to the local scale – exploring both the conflicts and creative tensions between mobility and stasis, boundaries and connections, people and place, and society and space.

Members of the Department lead two University research centres, which promote interdisciplinary research and develop collaborative research partnerships both nationally and internationally.

Centre for Urban Theory (CUT)

Cities represent the most complex, dynamic, and vibrant of human environments. As cities become ever more dominant sites of social, economic, political, and cultural life, the Centre for Urban Theory (CUT) is dedicated to advancing internationally renowned, cutting-edge understandings of the global urban system.

Directed by Professor David Clarke, Professor Marcus Doel, and Dr Richard Smith, the Centre focuses on new conceptual approaches to the city, drawing on a truly interdisciplinary range of knowledge and expertise to provide theoretically informed, empirically rich, critically engaged understandings of the city for a range of academic and non-academic users. CUT embraces a range of conceptual and methodological approaches to urban space, including poststructuralism, actor-network theory, and ethnography.

Research is conducted within a wide variety of socio-spatial contexts, including globalisation, the consumer society, visual culture, performance, urban regeneration, the knowledge economy, the media, healthcare, and financialisation. Key themes include urban theory, the global city, urban networks, the cinematic city, urban cognition, memory and affect, creativity and cultural production, innovative urban movement and mobility, and cultural politics and urban diversity.

Recent projects include:

Utopologies
Against a backdrop of nostalgia for a lost utopia, Professor David Clarke’s project adopts the standpoint that utopia has been achieved, an accomplishment that serves only to place the utopian imaginary in question. The basic plotline concerns utopia’s entrapment behind the mirror, and the consequences that ensue from the subsequent implosion of the utopia and the imaginary.

Reflecting on Jean Baudrillard’s association of utopia with the figure of Lichtenberg’s knife, as well as Louis Marin’s assimilation of the utopic to the neutral, Professor Clarke examines the relations between the seat, the symbolic, and the imaginary with respect to utopian thought and characterises the achievement of a minimal utopia.

The myth of the global city
The theoretical basis for researching global cities as structures, networks, and actor-networks is the target of Dr Richard Smith’s and Professor Marcus Doel’s deconstruction of Saskia Sassen’s and Peter Taylor’s notion of ‘global urban command’ within the world-city network, and Bruno Latour’s concept of socio-spatial ‘plasma’ within the field of actor-networks. They suggest a route out of this theoretical impasse by arguing for a poststructuralist re-conceptualisation of cities modelled on Alain Badiou’s subtractive ontology.

Subject to finance
The financialisation of everyday life has brought with it a demand for more financially literate and capable citizens, neo-liberal investor-subjects equipped with the capabilities required to negotiate successfully an increasingly complex and ambivalent financial system. This is in stark contrast to both the passive, welfare-dependent subject associated with deprived communities and the active, value-subject associated with affluent communities – each of whom is increasingly anachronistic in these newly financialised times.

Conversely, the lack of financial capability is increasingly considered to be a key determinant not only of financial exclusion and welfare dependency, but also of social exclusion and disengagement in a world in which differential access to the financial system has become an important determinant of life chances.

This EPSRC ‘Bridging the Gaps’ supported project, led by Professor Marcus Doel, with Dr Yogaisk Dwivedi of Swansea’s College of Business, Economics and Law, Yvonne Jones of the College’s Department of Biosciences, and Shaun French of the University of Nottingham, is breaking new ground in the theorisation of financial subjectivities and the empirical study of what it means to be ‘subject to finance’.

www.swansea.ac.uk/science/researchcentresandinstitutes/cutcentreurbantheory/

Centre for Migration Policy Research (CMPR)

Asylum and migration issues have never been higher on the political and policy agendas, grabbing the attention of policy makers, the media and the general public. As the pace of international migration has accelerated affecting virtually all countries and communities in dynamic, complex and sometimes contradictory ways.

The Centre for Migration Policy Research (CMPR), directed by Professor Heaven Crawley, a leading authority on UK asylum and immigration policy, works with a wide range of stakeholders including policy makers, practitioners, and migrants themselves, to encourage the exchange of ideas about asylum and migration.

The aim of the Centre is to ensure that policy making is underpinned by empirical evidence about the nature and causes of migration, the impacts on different countries and communities, and the effects – both intended and unintended – of policy responses.

Since its launch in September 2006, the Centre has undertaken research on a wide range of topics and themes including the reasons why asylum seekers come to the UK, the experiences of child asylum seekers, including those who are detained, and issues around age-disputes and guardianship, the processes by which refugees and migrants integrate into society, temporary migration, urban-rural migration, and public attitudes towards contemporary migration flows.

The Centre’s researchers have worked with the Welsh Government, the European Foundation for the Improvement of Living and Working Conditions, Orfan, Shelter Cymru, Refugee Council and the Council of Europe, among others.

Detention of asylum seeking children
Research undertaken by Professor Crawley for Save the Children UK and culminating in a major policy report, entitled No Place for a Child: Children in Immigration in the UK – Impact, Alternatives and Safeguards, found that around 2,000 children are detained with their families every year for the purpose of immigration control.

The research found evidence of physical, mental and educational impacts on children and a lack of appropriate safeguards to reduce the length of time that children are detained.

The research recommended an entirely different approach towards children who are subject to immigration control, one that placed their needs and interests at the centre of decision making.

In May 2010, following a long campaign to and the detention of children, which drew upon the research undertaken for the No Place for a Child report, the Coalition Government made a commitment to end the detention of children for immigration purposes.

A review process was established by the Home Office to identify how this commitment would be delivered and Professor Crawley was invited to contribute to this process. There is now a new process for the removal of families, which has significantly reduced the number of children being detained in the UK.
Understanding why asylum seekers come to the UK

Research by Professor Crawley, commissioned by the Refugee Council, investigates the decisions made by asylum seekers who come to the UK and explored the extent to which these decisions are a reflection of chance or choice. It builds on the growing, but as yet still limited, body of evidence about the ‘choices’ that individuals are free are not able to exert over the country in which they will seek asylum, and the factors that might contribute to the decision making process.

The findings were published in 2010 in the Refugee Council report ‘Chance or Choice: Understanding Why Asylum Seekers Come to the UK’. The research found that many of those who claim asylum in the UK had left within only a few days or weeks and had little time to prepare for the journey or make any choice about where they might go. The primary objective for all was reaching a place of safety. Over two-thirds did not make the key decisions about their destination and helped to facilitate the journey to safety.

The findings of the research have been published in 2010 by Professor Crawley, which includes a number of recommendations for policymakers and service providers. The report highlights the need for greater understanding of the factors that might contribute to the decision making process. The findings also provide evidence about the ‘choices’ that individuals are made to make when they come to the UK and explores the extent to which these decisions are a reflection of chance or choice. It builds on the growing, but as yet still limited, body of evidence about the ‘choices’ that individuals are free are not able to exert over the country in which they will seek asylum, and the factors that might contribute to the decision making process.

The final Millennium experiment involved running more than 2,500 model variants from AD 800, over the full millennium and for 200 years into the future (IPCC scenario A1B). The models were run by more than 30,000 volunteers worldwide, using the distributed computing facility Climatemodelling.net.

Each model run is scored according to how well it is able to reconstruct the climate of the past, assuming that models with high scores are more realistic predictions for the future. The Millennium experiment produced a vast amount of data – more than 40 million years of model runs – so detailed analysis of this dataset remains in progress.

Preliminary results suggest that the combination of proxy-based climate reconstructions and meteorological data can be used to constrain the uncertainty in predictions for the future climate of Europe. The simulations suggest that the key drivers of climate change over Europe are the North Atlantic Oscillation and the Northern Hemisphere temperature. The simulations also suggest that there is a significant uncertainty in the prediction of climate change over Europe in the future.

The Millennium project, coordinated in Swansea and led by Professor Danny McColl, brings together an interdisciplinary team of researchers from 38 partner institutes across Europe and has already resulted in more than 350 scientific papers.

Physical Geography

Environmental Dynamics

The Environmental Dynamics research group, led by Professor Stefan Doer, is a multi-disciplinary team providing leadership in key aspects of contemporary environmental dynamics and global change. Its research focuses on regions especially sensitive to environmental change, such as polar, alpine and fire-prone environments, and regions with sparse environmental archives, such as tropics, to reduce uncertainty in modelled future-change scenarios and advance understanding of the Earth system. It combines field investigations with state-of-the-art laboratory analytical approaches.

The Millennium Project

Funded by the EU 6th Framework Programme, the €13 million (€10 million approx.) Millennium project, coordinated in Swansea and led by Professor Danny McColl, brings together an interdisciplinary team of researchers from 38 partner institutes across Europe and has already resulted in more than 350 scientific papers.

The project has two central aims: to produce new, high-quality proxy palaeo-climate data and use these to reconstruct the climate of Europe over the last 10,000 years, and to use the climate of the past to better constrain predictions of the climate of the future.

The temperature reconstructions are seasonally and regionally explicit and based on a very wide range of information. Results suggest that the first three centuries of the last millennium were relatively warm and that cooling after about AD 1300 culminated in colder conditions during the 16th and especially the 17th centuries. In most regions warming is rapid in the 19th or early 20th centuries. The warm 20th century thus reverses a general declining trend in temperatures over the last millennium.

Although the late 20th century in Europe was warm in the context of the last 500 years, it was probably not much warmer than medieval times. Past changes in temperatures have been associated with large-scale changes in circulation and thus in the amount, distribution and seasonality of precipitation.

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Coastal change remains uncertain. Professor Doerr and Dr Cristina Santti also examined a large experimental forest wildfire in North West Canada in summer 2012 allowing, for the first time, a full inventory for black carbon deposition under wildfire conditions to be carried out.

Black carbon is very resistant to decomposition. The resulting data will shed light on what extent wildfire-vegetation synergistic effects may lead to long-term sequestration of atmospheric carbon, which has direct implications for carbon emission accounting and climate change.

www.swansea.ac.uk/geography/postgraduatestudy/researchtopics/wildfireimpactoncarbonstorage/

Soil water repellency

Projects led by the group and funded by Natural Environment Research Council (NERC), the European Commission, the Engineering and Physical Sciences Research Council (EPSRC), the Biotechnology and Biological Sciences Research Council (BBSRC), and industry, have examined the origin, characteristics and implications of water repellency in soil.

The project, funded by a Royal Society Dorothy Hodgkin Fellowship of almost £500,000 to Dr Emilia Urbanek, will address whether water repellency causes carbon emissions or sequestration in soil.

The latest project, funded by a Royal Society Dorothy Hodgkin Fellowship of almost £500,000 to Dr Emilia Urbanek, will address whether water repellency causes carbon emissions or sequestration in soil.

Soil is the largest terrestrial reservoir of carbon, which can become a net source of CO2 if carbon mineralisation rates exceed carbon accumulation. The research will provide a better understanding of the carbon mineralisation processes in water-repellent soils, reduce uncertainty in CO2 afflux estimates from soils, and enable development of UK land management approaches for increased carbon sequestration, for current and predicted future climate conditions.

Understanding peat bogs and environmental change: PRECIP, PATAGON and CORS projects

Peat bogs cover approximately three per cent of the Earth’s land surface, but globally store an estimated 500 Gigatonnes of carbon. They are widely distributed and many bogs have accumulated peat (partially decomposed plant remains) over many thousands of years. They are important in terms of their role in the hydrological cycle, the sequestration of carbon and their contribution to biodiversity. Their response to contemporary global environmental change remains uncertain.

Professor Alyayne Street-Perrott and Dr Neil Loader are engaged in two international collaborative research projects funded through the Natural Environment Research Council (NERC) – the £156,500 Palaeo Reconstructions of ocean-atmospheric Coupling In Peat (PRECIP) project and the £215,000 Palaeo Reconstructions of ocean-atmospheric Interactions (PATAGON) project.

These projects aim to reconstruct and compare climate variability over high-latitude areas of both North and South America during the Holocene. Through a combination of modern process studies and the analysis of ancient peat deposits, they are able to track the plant physiological (isotopic) response to climate variability and to use this to reconstruct changes in large-scale atmospheric circulation and land-ocean-atmosphere interactions through the stable carbon, hydrogen and oxygen isotope analysis of Sphagnum moss extracted from peat cores.

By analysing the peat archive they will be able to reconstruct a climate history spanning recent millennia. This information will be used to explore relationships between climate and the circulation of the Atlantic and Antarctic Oceans that will support climate model experiments and develop a better understanding as to the likely response of the Atlantic climate system to projected future climate change.

This work is possible in Swansea through the second in the world – for on-line pyrolysis – thermal decomposition with little or no oxygen – for use as a soil amendment. Biochar production takes advantage of low-cost waste biomass generated by conservation and forestry operations, focusing particularly on invasive rhododendron and diseased trees. This research has been conducted by Bristol-based charity the Soil fertility Project and the Countryside Council for Wales. The Welsh Livery Guild has also provided a travel scholarship.

www.swansea.ac.uk/geography/research/environmentaldynamichmonalgroup/

Biochar production takes advantage of carbon fixation through photosynthesis by green plants, to draw down atmospheric carbon dioxide and store it in a long-lived (charcoal) form in soils. Hence, it has potential for combating climate change at a variety of spatial scales and levels of economic development. Many additional benefits of biochar for soil function and greenhouse-gas fluxes have been reported.

The informal Biochar Research Team, coordinated by Professor Alyayne Street-Perrott, which includes researchers from the Colleges of Science, Engineering, and Medicine (Institute of Life Science), aims to answer key questions relating to the benefits and practical applications of biochar. A group of PhD and MSc students has been investigating cutting-edge topics such as the potential maximum global contribution of sustainable biochar production to greenhouse-gas mitigation, the impacts of biochar addition on earthworms and soil hydrology, the rate of degradation of anthropogenic charcoal in European soils, and the benefits of peat-free bracken compost as a delivery medium for adding biochar to horticultural soils.

The first results of their research on sustainable biochar were published as an open-access article in Nature Communications. Together with a local industrial partner, Common Vision Ltd has been supported by Bristol-based charity the Soil fertility Project and the Countryside Council for Wales. The Welsh Livery Guild has also provided a travel scholarship.
The Glaciology Group

The Glaciology Group, led by Professor Tavi Murray, undertakes research and teaching in glaciology and the Cryosphere, specialising in understanding the processes that regulate the flow speed of glaciers.

The group uses techniques including geophysics, numerical modelling and remote sensing, and field projects span the Arctic, Antarctic and Himalayas.

It aims to address issues including the past and future contribution from glaciers and ice sheets to sea-level rise; understanding the processes driving current rapid and dramatic changes observed in glaciers; and understanding the record of palaeo-ice mass changes in Greenland’s contributions to sea-level rise.

The group has also concentrated on the stability of present-day outlet glaciers in a warming climate. In recent decades many ice shelves on the Antarctic Peninsula have disintegrated in response to above-average regional climate warming. The land-based outlet glaciers that formerly fed these floating ice sheet extensions are consequently able to speed up, contributing significantly to sea-level rise.

Dr Sarah Thompson and PhD student Bernd Kulessa, Adrian Luckman, and Dr Daniela Jansen have carried out novel investigations of the stability of moraines damming large glacial lakes, focusing particularly on a debris-covered glacier in the Everest region of the Himalayas.

Using in-situ field geophysics and satellite remote sensing, Dr Bernd Kulessa, Dr Daniela Jansen, and Dr Adam Booth, has studied the effects of increased surface melt-water supply on the flow dynamics of the landterminating margin.

The research team has also highlighted the presence of basal crevasses which penetrate up to two-thirds of the way through the ice shelf.

Hazardous glacial lake outburst floods, Himalayas

Using in-situ field geophysics and satellite remote sensing, Dr Bernd Kulessa, Adrian Luckman, and PhD student Sarah Thompson have carried out novel investigations of the stability of moraines damming large glacial lakes, focusing particularly on a debris-covered glacier in the Everest region of the Himalayas.

The research revealed that glacial lakes on this glacier have been growing in recent years, with considerable future risk potential.
The Global Environmental Modelling and Earth Observation Group

The research focus of the Global Environmental Modelling and Earth Observation group (GEMEO), led by Dr Sietske Los, is on understanding the response of the biosphere to variations in climate. The group's research uses satellite and airborne remote sensing data, land-surface models and ecosystem models. It has expertise in the analysis and processing of long-term global vegetation and aerosol data sets from satellite data, modelling of photosynthesis and of light interactions in the vegetation canopy, and analysis of carbon dioxide and water vapour flux observations from towers.

The group led the £2.2 million Natural Environment Research Council (NERC) Climate and Land Surface Systems Interaction Centre (CLASSIC) – a NERC Centre of Excellence – and is participating in the NERC National Centre for Earth Observation (NCEO).

The group was highlighted during the 2008 Research Assessment Exercise (RAE) as one of the key research groups in the Department of Geography.

National Centre for Earth Observation (NCEO)

With a grant award of £910,000, Swansea University forms a part of the National Centre for Earth Observation (NCEO), a NERC-funded collaboration between 26 UK universities and research centres, aimed at improving knowledge of the Earth as a system.

The work, led by Dr Sietske Los, involves using observations from satellites to improve our understanding and prediction of climate change, working closely with NERC Centre for Ecology and Hydrology and the Mat Office Hadley Centre.

GEMEO has had particular success in developing operational datasets for use in climate modelling. Dr Los collaborated with US space agency NASA to produce global land vegetation products for the International Satellite Land Surface Climatology Project. The group improved the Moderate Resolution Imaging Spectroradiometer (MODIS) land surface albedo product and derived a unique global vegetation height product from satellite-borne laser measurements. The data sets produced by the group are among the most widely used satellite datasets worldwide and are incorporated by weather forecast and climate modelling agencies. The group's work has led to improved weather forecasts and climate simulations.

Swansea researchers, led by Professor Peter North, also form part of the European Space Agency's (ESA) Climate Change Initiative to Swansea researchers, led by the late Professor Mike Barnsley, led design of the land-surface specification. The sensor acquires high spatial resolution (17m or 30m) images of Earth's surface in up to 62 narrow spectral channels located in the visible and near infrared wavelengths, and can sample the Earth's surface and atmosphere at multiple view angles by maneuvering in space. The ESA PROBA/CHRS mission was intended to last one year, but is now in its 12th year of operation.

Swansea researchers, Professor Peter North, and Dr Andreas Heckel and Will Davies, are also leading in developing the operational algorithms for the ESA/Global Monitoring for Environment and Security (GMES) Sentinel-3 satellite, designed to provide global monitoring of land and ocean for 2012-2030, to improve numerical weather forecasting and climate modelling. The group has been funded under eight projects by the ESA towards developing operational algorithms and datasets, totalling more than £500,000.

www.swansea.ac.uk/geography/research/globalenvironmentalmodellingandearthobservation/

Modelling Land/Climate Feedbacks

The group studies the effect of climate variability on changes in the land surface, such as how droughts or an earlier spring affect vegetation greenness, and how these changes alter the exchange of carbon dioxide, energy and water between the land and atmosphere.

For its research, the group relies on analysis of global data sets, mostly derived from satellites, and regional data from airborne campaigns, towards modelling of land-surface vegetation light interactions, photosynthesis, carbon, water and energy exchange.

In drought-stricken vegetation, for example, the level of photosynthetic activity is typically reduced, as is the release of water vapour into the atmosphere. These and other vegetation-related changes feed back onto the climate system in some cases accentuating, in others diminishing, the initial climatic perturbation.

A model developed by the group allows predicting uncertainties in quantifying carbon dioxide and water vapour fluxes from the global network of flux tower observations. The high significance of this contribution is reflected in the visits to the online webtool for this model developed by Dr Natascha Kljun (footprint kluj.net), which has been accessed by more than 600 researchers from 40 countries in North America, Europe and Asia.

Model development has focused on light interactions in vegetation canopies and modelling the pathway of carbon dioxide towards the measurement sites. These activities are an important complement to the development of data sets and allow understanding of data and processes leading to global change. Dr Paul Altan has combined information from land-surface models with flux tower estimates, under NERC funding, to investigate global flux of water and carbon at the land surface.

The FLIGHT (Forest LIGHT) model, developed by Professor Peter North, describes the absorption of solar radiation by vegetation canopies and links this to photosynthesis. It compared favourably against other models in three international comparisons and is used at NASA with collaboration developed by Dr Jackie Rosette for designing new instrumentation, and at other research centres worldwide.

New Satellite Sensor Technology

The Swansea group works closely with the UK and international space agencies and industry, feeding their research findings into the development of new electronic sensors, which better match the needs of the science and end-user communities. The group also calls on these companies as a further source of external advice to guide research.

The group has active links with ESA and NASA, and a number of companies including Surrey Satellite Technology Ltd, European Aeronomic Defence and Space Company (EADS) Astrium and BAE Systems, through its involvement in a range of satellite-sensor missions.

One example of these links is the ESA’s PROBA/CHRS mission, where Swansea University researchers, led by the late Professor Mike Barnsley, led design of the land-surface specification. The sensor acquires high spatial resolution (17m or 30m) images of Earth's surface in up to 62 narrow spectral channels located in the visible and near infrared wavelengths, and can sample the Earth's surface and atmosphere at multiple view angles by maneuvering in space. The ESA PROBA/CHRS mission was intended to last one year, but is now in its 12th year of operation.

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Mathematics

Mathematics, with more than 6,000 years of academic history, is regarded by many as the dominant academic subject of our times. There would be no progress in science or engineering, no development in health care and no running the economy without advanced mathematics.

Research tends to be driven by individuals, rather than groups, although Swansea mathematics researchers collaborate with each other and with colleagues across the world.

The research excellence of Mathematics at Swansea was recognised in the 2008 Research Assessment Exercise (RAE) with top ratings of four stars and three stars.

Dr Edwin Beggs is working on two seemingly unrelated topics: non-commutative geometry and problems in “unconventional computation”. The work on noncommutative geometry is jointly with Professor John Tucker of the College’s Department of Computer Science, and was initially funded by an EPSRC grant. It examines the theoretical basis for physical computation outside usual digital computation. The work on noncommutative geometry is related to differential geometry and applications to physics, and involves categorical methods and techniques from operator algebras.

Professor Tomasz Brzezinski’s research interests are in algebra and its applications. More specifically, his research is concentrated around symmetry aspects of non-commutative geometry (i.e. a theory of geometric objects on which a location or coordinates of a point can never be exactly specified and which has applications to physics of fundamental interactions), and include ring and module theory, Hopf algebras and quantum groups, category theory, geometry as well as some aspects of mathematical physics.

His main research achievements include the development of the theory of non-commutative principal bundles and connections, jointly with Professor Shahn Majid of Queen Mary University London, and the revival of the theory of corings as unifying algebraic systems that connect various branches of mathematics – algebraic and differential non-commutative geometry, ring and module theory, category theory, Hopf algebras and quantum groups, mathematical computer science.

Professor Brzezinski’s most recent research projects include developing correct mathematical environment in which non-commutative geometric objects can be placed as well as computational aspects of specific examples of such objects (integration and resolving of singularities). Professor Brzezinski was a holder of many grants from funding bodies in the UK and EU, and collaborated with more than 40 mathematicians in the UK, Europe, Asia, Africa, North America and Australia.

Dr Elaine Crooks works on nonlocal partial differential equations with part of her research being related to mathematical biology, to material science, and to image processing. A common theme running through her work is...
single limits. A singular limit of a system of differential equations is a limit, as a parameter in the system tends to some value, which has a qualitatively different nature from the original problem. Such limits are fascinating and ubiquitous. Not only do they often arise in conjunction with key biological and physical phenomena, such as spatial segregation of species in population dynamics, or phase separation, for example, but they are also mathematically deep and powerful.

Funded by a Visiting Professorship from the Leverhulme Trust and a £50,000 grant from the EPSRC, Professor Norman Dancer of the University of Sydney, who is one of the world’s foremost experts on nonlinear partial differential equations, has made several extended visits to Swansea to collaborate with Dr Crooks on strong-interaction limits of nonlinear elliptic and parabolic systems, modelling populations that compete in some region.

Dr Martin Crossley works in algebra, algebraic topology, and algebraic combinatorics, studying Hopf algebras that sit on the boundary of those fields. The classical Steenrod algebra in topology and the associated Leibniz-Hopf algebra in combinatorics are typical examples, within Dr Crossley’s study of the former leading to a proof of the Ditters conjecture concerning the latter. His work in K-theory led to wider questions of coalescing and combinatorial structures, for which there are still some basic categoric questions to be answered satisfactorily.

Dr Iain Davies is an applied mathematician collaborating with biologists and engineers and with contributors to probabilistic methods in mathematical physics.

Dr Kristian Evans works on the analytic theory of jump-type processes and a Fourier analytic approach to Markov chains.

Dr Grigory Garkusha’s research is mathematically interdisciplinary, combining topological methods in algebra, K-theory, motivic homotopy theory, algebraic geometry, homological algebra, ring and module theory, category theory, model theory of modules and the Ziegler spectrum. His recent work is in motivic homotopy theory.

The versatility of the theory created in the 1990s and its associated range of cohomological techniques have made it an important branch of mathematics.

Dr Garkusha’s research in this field covers many aspects of the theory such as algebraic K-theory of algebraic varieties and the theory of motives for algebras. Dr Garkusha maintains various academic contacts overseas and within the UK. His research over the past several years was supported by two EPSRC grants and three London Mathematical Society grants.

Dr Jeffrey Granirer holds a Career Acceleration Fellowship grant of £438,000 from the EPSRC. The theme of his research is the topology (shape) and geometry of moduli spaces, which are the algebraic objects that describe how the solution set of a system of polynomial equations changes as one varies the coefficients. This work sits at the interface of topology (one of the youngest branches of mathematics – only a century old) and algebraic geometry (one of the oldest branches – it traces its roots to the Greeks).

Moduli spaces are extremely important in many parts of mathematics, from number theory to the modern theoretical physics of string theory. Dr Granirer’s research covers a wide range of aspects of this area, touching on topics in topological field theory, operad theory, tropical geometry and abelian varieties. He is particularly interested in the limiting behaviour of sequences of moduli spaces, where the structure of any given moduli space is too complex to describe, but in some limit the structure organises itself into a particularly elegant and simple form when viewed through an appropriate lens. He has collaborated with researchers across Europe and North America.

Professor Niels Jacob is a mathematician working at the interface of analysis and probability theory.

Professor Eugene Lytvynov’s research interests are in probability theory and its applications to mathematical physics. He has worked on stochastic processes of an infinite system of interacting indistinguishable particles in a Euclidean space. He has studied diffusion processes of such type, as well birth-and-death and jump-type processes. Important information about these dynamics has been derived through appropriate scaling limits, including the mean-field and Wasserstein limits.

Professor Lytvynov also worked on infinite dimensional analysis related to both classical and non-commutative generalised stochastic processes with independent values. His main research interests concerned processes of Meixner’s type, including the remarkable Gamma process. Recently, Professor Lytvynov has also worked on non-commutative probability related to anyon statistics. The latter statistics forms a bridge between boson particles (respectively, Conical Correlation Relations) and fermions (respectively, Conical Anticorrelation Relations).

Professor Lytvynov has collaborated with researchers across Europe. His collaborations have been financially supported by Royal Society, London Mathematical Society, DFG (German Research Foundation) and the Polish National Research Council.

Dr Vitaly Moroz’s research interest is in the theory of nonlinear partial differential equations (PDE). It is focused on the fundamental questions of existence, non-existence, and structure of solution sets of nonlinear elliptic equations and inequalities.

Non-linear PDEs are ubiquitous in almost all applications of mathematics, where they provide a natural mathematical language for modelling many phenomena. The last decade has seen vigorous research activity to understand systems involving large-scale, and to directly incorporate such effects in the modelling and analysis.

This research has led to fundamental theoretical questions about several classes of nonlocal PDEs, and this is where the most recent research interests of Dr Moroz lie. He is particularly interested in the limiting behaviour of solutions of nonlocal PDEs in the microscopic or macroscopic length scale, when various delicate critical exponent phenomena may occur. Dr Moroz collaborates with researchers across Europe and North America.

Dr Andrew Neate works mainly on the application of probabilistic methods to problems from mathematical physics. His work has focused on topics including semiclassical quantum mechanics, theories of stochastic mechanics, models for turbulence and stochastic heat and Burgers equations.

Dr Alexander Potyrykus works in the areas of stochastic and harmonic analysis. In particular, he is interested in the connection between the theory of pseudo-differential operators and stochastic processes of jump type. He is also working on applications of stochastic processes to modelling problems in engineering.

Dr Irina Rodionova recently started to work on orthogonal polynomials in the setting of free probability theory.

Dr Zeer Solabil is contributing to the theory of nonlinear elliptic and parabolic partial differential equations.

Professor Feng-Yu Wang is working in a cross area of stochastic analysis, functional analysis and differential geometry. The main topics involved in his research include stochastic partial differential equations, functional inequalities and applications, and stochastic analysis on Riemannian manifolds.

In particular, Professor Wang has developed a general theory on functional inequalities and application, found a dimension-free Harnack inequality which was widely applied and called Wang’s Harnack inequality in references, and introduced new arguments to investigate the conflicting diffusion processes on non-convex manifolds. He holds a 1300,000 Chinese Yuan (€130,000 approx) grant from the National Natural Science Foundation of China, a 500,000 Chinese Yuan (€50,000 approx) grant from the Educational Ministry of China, and is a member of a joint grant from DFG in Germany organised by Professor Michael Röckner, University of Bielefeld, Germany and Professor Ziming Ma, Institute of Applied Mathematics, Chinese Academy of Sciences, Beijing.

Professor Jing-Lin Wu’s current research focuses on several topics in the area of stochastic analysis. He is working on noise effects on nonlinear partial differential equations such as conservation laws, Burgers’ and KdV equations and integro-differential type Hamilton-Jacobi-Bellman equations. He also works on Neufeld’s theory for stochastically integrable dynamical systems in Lagrangian and Hamiltonian mechanics.

Professor Wu is interested in applying stochastic differential equations and stochastic calculus to analyse modelling problems arising from economics and finance. His research covers a wide range of topics in analysis and probability, and he has collaborated mainly with researchers from China, Japan, Germany, Portugal and USA.

Dr Changgui Yuan is an expert in the theory and applications of stochastic delay differential equations as well as in their numerical analysis.
Physics
Research within the Department of Physics at Swansea is pioneered by the Theoretical Physics and Experimental Physics groups.

The Theoretical Physics group is the fourth largest particle physics theory group in the UK, and its work is supported mainly by the Science and Technology Facilities Council (STFC) with a rolling grant of over £3 million for the period 2008-2011, a consolidated grant of £1.3 million for the period 2011-2014, block training doctoral grants for the period 2008-2014 of over £550,000, as well as ‘Special Programme’ grants of £167,000 for 2008/2010 and a capital grant of over £1.2 million for High Performance Computing. Its work is also supported through grants from the Engineering and Physical Sciences Research Council (EPSRC), the EU, The Royal Society and the Leverhulme Trust.

The work of the Experimental group is supported by grants from the EPSRC, the EU, The Royal Society, the Higher Education Funding Council for Wales (HEFCW), and various industrial and government sources, with ongoing support of over £3 million.

The Department of Physics received top ratings of four stars and three stars in the national Teaching Excellence and Quality Assessment (TEQA) and remains the only ‘Excellent’ Physics Department in Wales.

Theoretical Physics
Lattice Field Theory, Quantum Fields under Extreme Conditions

The lattice Quantum Chromodynamics (QCD) group comprises Professors Gert Aarts, Chris Alton, Simon Hands and Bragio Lucini. Its research mainly focusses on QCD, the theory of interacting quarks and gluons, which are the fundamental building blocks of sub-nuclear matter.

Because the interaction between quarks and gluons is strong, the most reliable way to understand the transition quantitatively is to formulate the equations of QCD on a four-dimensional space-time mesh and then simulate the quantum fluctuations of the theory on a computer. Such calculations are extremely compute-intensive; and in February 2010 the group acquired a 2 rack IBM Blue Gene/P computer with a peak speed close to 30 Tflop/s (1 Tflop/s = 1 trillion floating point operations per second).

This £1.7 million capability machine was funded by the Science and Technology Facilities Council (STFC) and is operated by Swansea University on behalf of the eight-university UKQCD collaboration, forming part of STFC’s new DIACR national facility for high performance computing.

To date, the main topic studied is the fate of bound states of heavy quarks (‘bottomonium’) in a bottom-antibottom bound state in the QGP, by careful analysis of the propagation of such a system through the hot medium. Technical innovations, such as the use of a much smaller mesh size in the timelike direction to ensure better energy resolution, and the analysis of field correlation functions using a sophisticated Bayesian “Maximum Entropy Method”, have been required.

The main result is that ground states of bottomonium survive the formation of plasma, whereas excited states melt away as temperature increases above the Curie point (Tc). These results will inform experiments at the Large Hadron Collider (LHC) at CERN – the European Organisation for Nuclear Research, in Geneva.

In the future, the same analysis will be adapted to study lighter quarks, with the goal of determining transport coefficients such as electrical conductivity and shear viscosity, the unexpectedly small value of the latter has led the QGP to be called ‘Nature’s most perfect liquid’.

Of equal interest is the study of cold, dense matter, such as found at the centre of large nuclei, or within compact stellar objects such as neutron stars. The Swansea team has been investigating new numerical techniques for this research and notable successes include a numerical solution to superfluid condensation in a Bose gas and to QCD with very heavy quarks.

Work is now in progress to establish the conditions needed for the method to be trusted and to extend the methods to describe fermionic particles such as light quarks and electrons. A second approach uses orthodox simulation methods to study certain model theories, such as QCD with just two colours of quark rather than the three found in nature.

The equation of state and phase diagrams of ‘QCD’ as a function of quark density is now well understood, and evidence is emerging for an exotic “quarkyonic” phase in which quarks arrange themselves in an analogous way to electrons in a metal, but remain confined, implying only two-quark states can move freely.

Lattice simulation techniques have also been applied to graphene, a remarkable new two-dimensional material formed from a single honeycomb sheet of carbon atoms. Electron hopping on graphene at low excitation energies is described by a quasi-relativistic Dirac equation (almost with “speed of light” about 0.003 of the real value). The relativistic behaviour is thought to account for graphene’s excellent electronic properties, its conductivity and carrier mobility compare favourably with most metals and semiconductors.

Electron-electron interactions must however be dealt with using field theory, our simulations revealed a “quantum critical point” as the interaction strength is varied, suggesting that electron transport is significantly modified, or even suppressed, in so-called “suspended” samples, with possible significance for the speed and stability of electronic devices fabricated from graphene.

www.swansea.ac.uk/physics/research/latticefieldtheory/

Quantum Field Theory, Strings and Spacetime Group

The research of the Quantum Field Theory, Strings and Spacetime Group, comprising Dr Adi Armoni, Professor David Dunbar, Professor Tim Hollowood, Dr Prem Kumar, Professor Carlos Nunez, Dr Warren Perkins, Dr Maurizio Piai and Professor Graham Shore, is centred on fundamental questions in theoretical particle physics. At the most basic level, our universe is described by the interactions of a set of fundamental particles including the electron, quarks and gauge bosons. These particles and their interactions fit into a single theory known as the Standard Model of particle physics. This model is a quantum theory of fields and can be used to calculate properties of fundamental particles to an amazing accuracy and in exquisite detail.

The Standard Model is being subjected to the most detailed experimental scrutiny at the LHC at CERN, and so understanding Quantum Field Theory (QFT) and how to make calculations using it is one of the biggest theoretical questions that we face.

In the modern era of particle physics there will be an unprecedented input from experiment to old theoretical questions, like the origin of mass, the Higgs boson and the existence or otherwise of supersymmetry and hints of grand unification and quantum gravity.

One of the biggest challenges for theory in this era is to explain the origin and properties of the mysterious Higgs field which is responsible for giving mass to the other particles in the Standard Model.

Dr Piai is at the forefront in investigating the idea that the Higgs boson is a composite bound state of more fundamental particles in a theory known as ‘walking technicolor’, which explains electroweak symmetry breaking in the Standard Model by introducing new strongly-coupled gauge interactions at the TeV scale energy probe by the LHC.

Professor Nunez and Dr Piai are exploring the properties of this new dynamics using innovative string-inspired techniques involving gauge-gravity duality, complimenting the computational approach of the lattice Field Theory group.
The delicate balance between a particle such as the photon and the quantum vacuum is distributed as the photon moves into a region of strong curvature and as it approaches the singularity the curvature can literally strip away the closed cloud of virtual matter-antimatter particles that surround it, leading to a gravity-induced amplification of the corresponding electromagnetic field.

This work was recently recognised by an award from the prestigious international Gravity Research Foundation.

**Experimental Physics**

**Antimatter research**

Swansea physicists Dr Chris Burrows, Professor Michael Charlton, Dr Stefan Eriksson, Dr Aled Isaac, Dr Niels Madsen and Dr Dirk Peter van der Werf have made major contributions to the success of the Antihydrogen Laser Physics Apparatus (ALPHA) project at CERN, which has successfully trapped antihydrogen atoms, the antimatter counterpart of the simplest atom, hydrogen, to enable the study of a fundamental symmetries between matter and antimatter.

The study of antimatter is crucial in our attempts to understand the Universe. Currently, the known laws of physics prohibit the existence of the material Universe as it is observed from Earth. One of the great conundrums is the fate of antimatter, which seems to have disappeared entirely from the Universe shortly after the Big Bang.

ALPHA’s antihydrogen trap was made from the magnetic fields created by a system of superconducting coils. The result is a kind of magnetic trough which can hold some of the antihydrogen created inside it. But even employing the most advanced magnet technology available, the trap is only about 0.5 K deep. Thus, the challenge of the last few years has been to make as many antihydrogen atoms as possible with kinetic energies with equivalently low temperatures, enabling them to be “trapped.”

In 2010, the project reported the first confinement of the antihydrogen in this neutral atom trap. This was followed by the demonstration that the trapped antihydrogen atoms could be held for more than 15 minutes if required.

This allowed the ALPHA project to perform a pioneering study, the results of which were published in 2012, of the structure of antimatter by using microwave photons to induce a resonant transition between some of the energy levels that make up the ground state of the antihydrogen atoms. The microwaves were injected into the trap, and when they had the correct frequency they could flip the magnetic moment of the antihydrogen atoms. This caused any that were in the trap to move immediately to the wall, whereupon they annihilated. The team could co-ordinate the antiproton annihilation with the microwave frequency.

The trapping result was selected as the Physics World’s Physics Breakthrough of the Year for 2010, and Swansea’s Professor Charlton, Dr Madsen and Dr van der Werf were co-recipients of the 2011 American Physical Society’s John Dawson Award for Excellence in Plasma Physics Research for the development of innovative techniques which led to the demonstration of antihydrogen trapping.

The Swansea team is proud to have made the first study of the structure of atomic antimatter, but so far precision is very limited. They are now re-configuring their apparatus to allow faster laser light into the trap, and to improve the trap magnetic field configuration.

The team hope that these changes will allow further progress with the spectroscopy of antihydrogen and begin the quest for a precision comparison of its properties with those of hydrogen.

**Nanoscale and Condensed Matter Physics**

Nanotechnology is finding increasingly wide applications; for example, in the field of healthcare where nanomaterials and devices are being developed for roles in prevention, treatment and diagnosis. An example of this is the Centre for Nanohealth (CNH).

In partnership with the CNH, developments in experimental physics underpin advances in nanotechnology, characterisation and the quantification of quantum phenomena which can dominate at the nanoscale.

Work at Swansea, under the direction of Dr Peter Dunstan, has concentrated particularly on the optical properties of materials on the nanoscale. The partnership with the CNH has led to a significant investment in unique experimental equipment, designed jointly with leading equipment manufacturers, and in particular on the optical properties of materials on the nanoscale.

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The team have found applications in both soft and hard matter characterisation, for example, in the field of healthcare where nanomaterials and devices are being developed for roles in prevention, treatment and diagnosis. An example of this is the Centre for Nanohealth (CNH).

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Recent research by Dr Dunstan has focused on developments used to localise the spectral response of nanomaterials by using Raman spectroscopy. Due to the low cross-section of Raman scattering, research is being conducted on methods to enhance the signal response.

Nanoparticles and nanoprobes are two methods used within the group and they have found applications in both soft and hard matter characterisation.

Examples of continuing research include projects on developing nanoprobes for the characterisation of alginate gels, Raman spectroscopy for blood diagnostics and observing atomic scale defects in nanostructures such as graphene.

The group also continues to consider near-field scanning optical microscopy (SNOM) techniques to perform high resolution optical imaging of cell membranes and protein expression related to metastasis mechanisms in prostate cancer.
Asylum, age disputes and the process of age assessment

Policy makers and those working in children’s services have been increasingly concerned about the growing number of children and young people who are seeking asylum or are subject to immigration control, but have no documents to verify their age. This can mean that they are unable to access the appropriate support and protection.

Research, led by Professor Heaven Crawley in the Department of Geography’s Centre for Migration Policy Research (CMPR), has examined why age is disputed, concentrating on the process by which age is assessed and questioning dominant concepts of ‘childhood’, as well as the potentially damaging impact of actual and perceived age assessment processes undertaken by local authorities, and was based on interviews and discussions with policymakers, legal representatives, voluntary sector organisations and social workers, observation at the Asylum Screening Unit in Croydon and discussions with 32 social workers from 14 different local authorities.

The findings of the research have had a significant and well-documented impact on policy and practice in relation to separated asylum seeking children whose age is disputed by the UK Border Agency or local authority social workers, and was based on interviews and discussions with policymakers, legal representatives, voluntary sector organisations and social workers, observation at the Asylum Screening Unit in Croydon and discussions with 32 social workers from 14 different local authorities.

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The research identified an over-reliance on physical appearance and medical techniques with a wide margin of error, and considerable variation in procedures for age assessment. These problems were linked to prevailing cultures of cynicism and disbelief among immigration officers and social workers, associated in particular with an over-reliance on physical appearance and credibility as indicators of age even though children and young people come from countries and cultures in which childhood is understood and experienced very differently. The use of x-rays to assess age compounds this problem further because of the lack of comparative baseline data on the physical development of children from different ethnic backgrounds.

Significant findings were also found in Home Office procedures for ensuring that appropriate referrals are made and that children are able to access a formal age assessment. There was considerable variation in the quality of the age assessment processes undertaken by local authorities, with a lack of statutory guidance and inadequate support for social workers found to be largely responsible.

The research also identified a potential conflict of interest between the requirement of social service departments to undertake age assessments and the obligation to provide services to children in need.

It was concluded that it is impossible to have a genuinely holistic and multi-agency approach to age assessment at ports and screening units.

Drawing on these findings, a four-step model for policy reform was developed to reduce the number of disputes, improve the quality of the assessment process and establish appropriate review mechanisms where age assessment continues to be disputed following a formal assessment. The key policy recommendation was for the development of regional age assessment centres where holistic assessments would be undertaken by a range of suitably qualified and trained professionals.

In the period since the research was undertaken, 354 individuals had their age assessed and questioning dominant concepts of ‘childhood’, as well as the potentially damaging impact of actual and proposed methods for assessing age.

The findings of the research have had a significant and well-documented impact on policy and services both at home in the UK and across the wider European Union.

Public understanding of animal movement: Great Migrations

College of Science researchers, led by Professor Rory Wilson in the Department of Biosciences, helped to share new information about animal movement and migrations with over 330 million people around the world.

The project, for which Professor Wilson and his team were awarded research grants of almost $70,000 (£44,000 approx), comprised two and a half years of filming across every continent and travel of over 420,000 miles, the largest global initiative undertaken in National Geographic’s 122 year history.

Undertaking research was based around one major concept: the realisation of a single generic archival tag that could be attached to free-living animals, revolutionising an understanding of animal biology. This tag was equipped with a variety of sensors enabling the four cornerstones of animal behavioural ecology to be resolved.

Professor Wilson was awarded a $100,000 (£63,000 approx) Rolex Award for Enterprise to support the development and testing of such a proposed tag in 2006. The proposition for the tag resulted in its translation into 34 languages and reaching almost 330 million people around the world.

Additional products included six books for children and adults, mobile applications, retail merchandise, a DVD and an educational curriculum.

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Professor Wilson’s research and testing of the archival tag laid the foundations for public education about natural migration on the broadest possible scale.

**Global satellite observations for improved numerical weather and climate prediction**

Global satellite datasets of land surface properties and atmospheric aerosol are vital to the modelling of climates, and to short-term numerical weather prediction (NWP).

Between 1995 and 2011, the College’s Global Environmental Modelling and Earth Observation group (GEMEO), comprising the late Professor Mike Barnsley, Professor Peter North, and Dr Sietse Los, pioneered methods for global dataset generation, used by government agencies for NWP. This was done by the rigorous physical modelling of biophysical parameters, giving rise to the satellite signal and inversion of these models.

The group’s research has underpinned global datasets currently used in NWP and the climate models of a number of national agencies.

The improved design of satellite instruments in the UK and the adoption of techniques for operational satellite data processing by the European Space Agency (ESA) are also indebted to work undertaken at Swansea. Surface reflectance has a direct impact on the Earth’s radiative budget, and accurate surface reflectance is needed for further study of Earth’s surface.

Funded by the European Space Agency (ESA), methods have been developed at Swansea for processing existing datasets from three instruments, while code developed in collaboration with Brockmann Consult has become part of the standard processing chain for the Sentinel-3 satellite.

Data and methods have become widely used in a number of international projects aiming to generate accurate information on land and atmosphere for climate studies, including the Exploitation of Meteorological Satellites (EUMETSAT) and ESA for satellite production, and the design of new satellite instruments.

More than 4,000 citations to published work by the Swansea research team give an indication of the huge academic impact this work has achieved.

The Swansea team pioneered the inversion of multi-angle satellite measurements for retrieval of land surface albedo (the fraction of solar energy reflected from the Earth back into space), which contributed to the NASA MODIS land surface albedo product.

These findings were fundamental to the design and launch of a new satellite built by Astrium UK, now operated by Surrey Satellite Technology Ltd.

Swansea University also led the Natural Environment Research Council’s (NERC) Climate and Land Surface Systems Interaction Centre (CLASSIC) – a NERC Centre of Excellence. This brought together researchers in the field of Earth Observation (EO) with practitioners in numerical weather and climate prediction (NWP), and facilitated the improvement of land surface representation used by the UK Met Office.

Inversion of multi-angular models helped to develop a framework for the joint retrieval of atmospheric aerosol and land surface reflectance from multi-angle satellite imagery. Surface reflectance has a direct impact on the Earth’s radiative budget, and accurate surface reflectance is needed for further study of Earth’s surface.

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Computer Science

The SkyBank project explored how the combination of mobile phones with a situated community touch screen display could facilitate social media sharing in rural, "developing world" contexts. Carried out in rural India, the project developed and evaluated appropriate human-computer interaction techniques for people who are semi-literate and who have very limited exposure and access to computing and network resources. The work, carried out by Professor Matt Jones in collaboration with other universities and industrial collaborators including Nokia Research (David M Frisch), Dorothy Rachford, Kinko Riga, Ramnath Bhat, Marine Frank, Evan Edrisingshe, Dhamus Wickramanayaka, Matt Jones, and Will Harwood. 2009. "SkyBank: mobile digital storytelling in a development context." In Proceedings of the 27th international conference on Human factors in computing systems (CHI'09) ACM, New York, NY, USA, 170-173), helped shape the open source community, and a media toolkit launched in 2012

www.digitealsonomytoolkit.org

The "Satisfiability Problem" can be described as the theory of systematically solving logical equations (i.e., "problems"). Since the invention of NP-completeness in the 1970s, SAT is a core area of computer science, and within the last 10-15 years the "SAT revolution" takes place, placed it at the core of the industrial machinery for verifying hardware and software; for example, modern microchips could not be produced without the usage of SAT.


In this series of two articles, these theories are generalised to a wider class of logical equations, where now the basic binary scheme can be replaced by non-binary schemes.

An article published in the IEEE Transactions on Visualization and Computer Graphics journal by Dr Benjamin Mora demonstrates how accurate imaging can be obtained from emissive 3D displays, providing an improved and more natural perception of 3D objects on such displays. In a more recent work published in the ACM Transactions on Graphics journal, he has demonstrated that RayTracing can be done in realtime without pre-computing intermediate data-structures, which may lead to more physically-accurate, realtime lighting affecting 3D games and movies.

Geography

Professor Siwan Davies, Philip Learmonth prize-winner, has published ground-breaking research on the volcanic ash deposits preserved within Greenland ice-core records and North Atlantic marine sediments. Her work has made a significant contribution to our knowledge of the frequency of past volcanic eruptions and most notably she has demonstrated how volcanic ash can help to answer key questions on why climate has changed abruptly in the past.

Professor Davies works in collaboration with the Centre for Ice and Climate at the University of Copenhagen, and her findings also help to test the robustness of the multi-parameter ice-core chronology constructed for the NGRIP record from Greenland. Her contributions have been published in Quaternary Science Reviews.

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been produced by the Swansea group, for northern Norway (lead author Dr Giles Young) and northern Finland (lead author Dr Mary Gagen), and a reconstruction for northern Sweden is in press (lead author Dr Neil Loader).

The papers have been published in leading international journals including Geochemistry Cosmochimica Acta, Climate Dynamics, Geophysical Research Letters. Dr Rutt has been using numerical modelling to help understand the Quaternary Science Reviews and Geophysical Research Letters. The papers have been published in leading international journals including Geochimica et Cosmochimica Acta, Climate Dynamics, including the dimensionless Harnack inequality was introduced by Professor Feng-Yu Wang in 1997, which has been intensively investigated and applied to the study of various stochastic differential equations (SDEs) with additive noise and diffusion processes on convex manifolds. [F.-Y. Wang, “Harnack inequality for SDE with multiplicative noise and extension to Neumann semigroup on non-convex manifolds”, Annals of Probability 39(2011), 1449—1467]. When SDEs with multiplicative noise or diffusions on non-convex manifolds are concerned, the study is however very difficult and thus has been open for many years. In this paper, Professor Wang introduced a new construction of coupling so that SDEs with multiplicative noise and reflecting diffusion processes on non-convex manifolds are well managed. This argument is being used to the study of Harnack inequalities and new sharp criteria are found by taking conditions on these two quantities respectively. The dimension-free Harnack inequality was introduced by Professor Feng-Yu Wang and extended to dimension 3 for the first time in 1997, which has been intensively investigated and applied to the study of symmetric diffusion processes on manifolds; this new perspective allowed the ideas to be extended to dimension 3 for the first time and made important new connection with the theory of operators. In earlier work, he applied some of the highly successful group completion and stability techniques from dimension 2 to dimension 4 for the first time.

**Mathematics**

Professor Feng-Yu Wang has established a general theory of functional inequalities and applications, which contains the classical log-Sobolev inequality as a typical example. [F.-Y. Wang, “Log-Sobolev inequalities: different roles of Ric and Hess”, Annals of Probability 37 (2009), 1587—1604]. In the context of symmetric diffusion processes on manifolds, previous results along with the Bakry-Émery criterion of the log-Sobolev inequality adopt lower bound conditions on the summation of Ric (i.e. the Ricci curvature) and Hess (i.e. the Hessian tensor of the potential), in which those two quantities play the same role. In this paper it is clarified that the roles of Ric and Hess are essentially different in the study of log-Sobolev inequality, and new sharp criteria are found by taking conditions on these two quantities respectively.

To achieve this it was necessary to develop a novel way of making antihydrogen to keep it cold enough to trap. ALPHA’s state-of-the-art trap is only around 0.5 K deep, so the antihydrogen has to have a kinetic energy lower than this to be held. In work described in Physical Review Letters (vol. 106 [2011] article 025002), they exploited a technique called auto-ionization whereby the antiprotons were mixed with the positrons using a drive voltage with a variable frequency. This ensured that they received as little kinetic as possible for them to enter the cloud of positions and form antihydrogen. With these advances under its belt, ALPHA was then ready to attempt the first ever study of the properties of an antiatom. Their landmark experiment was reported recently in Nature (vol. 483 [2012] page 439). Trapped antihydrogen atoms were subjected to microwave radiation, the frequency of which was tuned to a resonant transition that forced the antiparticle into a quantum state that could not be held in the trap. The result was that the trap was emptied of the antihydrogen – but only when the microwave frequency was set appropriately. They were able to tell that the trap had been emptied, and also spot the telltale annihilations as the antihydrogen hit the trap walls. They are currently building the apparatus to improve this experiment, and also to use lasers to address the spectrum of antihydrogen.

**Physics**

Swansea’s scientists, Dr Chris Burrows, Professor Mike Charlton, Dr Stefan Erikson, Dr Aled Isaac, Dr Niels Madsen and Dr Dirk Peter van der Werf, are major contributors to antihydrogen physics research, and in particular to the world-leading ALPHA collaboration. A longstanding aim is to measure the properties of antihydrogen, and compare them to hydrogen to try and shed light on the fate of antimatter, which seems to have disappeared from the Universe shortly after the Big Bang.

Following their success in capturing antihydrogen atoms in a magnetic minimum neutral atom trap in 2010, they were able to go on to show, in work published in Nature Physics (vol. 7 [2011] page 558), that they could be held in the trap for 1,000 seconds or more.

**Supporting higher level skills and innovation:**

Work on computationally-biased projects in particle physics involves both conceptual development of new algorithms to sample the complex multi-dimensional configuration space pertinent to important fundamental problems, such as strongly-interacting quantum field theory describing non-zero matter density, and also technical innovation associated with the efficient programming of massively parallel computer architectures such as that of the multi-node IBM BlueGene system installed at Swansea in February 2010.

Work in Mathematics on the properties of differential equations has resulted in the development of convexity-based global geometric transforms (CGT) capable of smoothing images and identifying points on an image which are geometrically singular. Potential applications lie in e.g. identification of bone edges in a medical image, and subsequent reconstruction of the bone structure using these edges.

In other remarkable applications in medical imaging, researchers in Physics in collaboration with the College of Medicine are investigating how “quantum control” techniques originally devised for applications in precision atomic physics can be used to optimise the design of pulses used in MRI scanning to refine its ability to distinguish healthy from cancerous tissue in a non-invasive way. Another group is developing Raman Spectroscopy techniques to detect tiny concentrations of particular molecules within blood samples.

Computer Science developed “Crystal Ball” software enabling the visualisation of data logged from accelerometers attached to moving animals by Bioscience’s SMATTER research team, which helps to tease out important features of animal behaviour, state and movement as well as providing prompt analysis of the large quantities of data generated.
Acronyms and abbreviations

A

AAB – Academic Experts for Business
ABAU – Abertawe Bro Morgannwg University Health Board
ADAM – Academic Departments of Military Surgery and Trauma
AIM – Atomic force microscopy
AMRC – Arts and Humanities Research Council
AHA – Academy Hyper Test
ALPHA – Anthology Laser Physics for Arta
APSS – Academic and Professional Enhancement Centre, Swansea
ARC – Australian Research Council
ASEAN – Association of Southeast Asian Nations
A-STEM – Applied Sport Technology Exercise and Medicine
ASTUR – Advanced Sustainable Manufacturing Technologies
AZM – Access to Masters

B

BA – British Academy
BBRC – Biotechnology and Biological Sciences Research Council
BCA – Biological control agents
BGER – Building Global Engagements in Research
BBTV – Building biogas technologies
BTG – Bridging the Gaps

C

C2EC – Civil and Computational Engineering Centre
CCL – Climate Change Consortium for Wales
CAE – Childhood Absence Epilepsy
CCCS – Centre of Consumer Confidence Studies
CGCC – Centre for Contemporary German Culture
CCJ – Centre for Criminal Justice and Criminology
CWMW – Wales Network for Children and Young People’s Health and Well-Being
CBLR – Centre for Allied Business Research
CECSAM – Centre for the Comparative Study of the Americas
CEEBP – Centre for Environmental and Energy Law and Policy
CETIC – Centre for Excellence for Technology and Industrial Collaboration
COD – Computational fluid dynamics
CHIRAL – Centre for Health Information, Research and Assessment for Fall Prevention
CLA – Centre for Innovative Ageing
CMIA – Centre for Management, Innovation and Accountability
CIHR – Centre for Improving Population Health through Ethical Research

CLASSIC – Climate and Land Surface Systems Interaction Centre
CMR – Centre for Migration Research
CAMS – Convention on Migratory Species
CNH – Centre for Natural Health
COAH – College of Arts and Humanities
COATED – Centre of Advanced Training for Engineering Doctorates
CORS – Carbon in Organic Soils
CRAAN – Centre for Research on Adaptive Nanostructures and Nanodevices
CREE – Centre for Research into Gender in Culture and Society
CSAR – Centre for Sustainable Aquatic Research
CSWORC – Centre for Social Work and Social Care Research
CT – Computed tomography
CU – Centre for Urban Theory
CWC – Centre for Water Advanced Technologies and Environmental Research
D

D-CIPHER – Centre for the Development and Evaluation of Complex Interventions for Public Health Improvement
DFG – German Research Foundation
DB – Department of Research and Innovation
DSC – Dyslexia-susceptible cell
DTC – Doctoral Training Centre
DWP – Department for Work and Pensions

E

EADS – European Aeronautic Defence and Space Company
ECS – Electrochemical Society
EEE – Electrical engineering
EEG – Electroencephalography
EH2 – Ethical industries innovation
EM – Equality and Human Rights Commission
EMOC – Environmental Modelling of Composites
EPSRC – Engineering and Physical Sciences Research Council
ERC – European Research Council
ERDF – European Regional Development Fund
ERTMG – European Rail Traffic Management System
EUCL – Epilepsy Research UK
ESA – European Space Agency
ESDC – Electronics Systems Design Centre
ESP – European Social Fund
ESF – European Science Foundation
ESRC – Economic and Social Research Council

ETF – European Train Management System
ETP – European Technology Platform
EUROTECH – European Organisation for the Exploitation of Meteorological Satellites
FIT – Future Interaction Technology
FMI – functional magnetic resonance imaging
GAIM – Graphic Arts in Manufacture
GEMEC – Global Environmental Modelling and Earth Observation
GENCAS – Centre for Research into Gender in Culture and Society
GOAT – Gloucestershire Archaeological Trust
H

HAPPI – Housing for an Ageing Population: Planning Applications
HCO – Human computer interaction
HEAR – Higher Education Achievement Report
HEFCE – Higher Education Funding Council for Wales
HHI – Health Information Research Unit
HSRO – Health Systems Research Office
HPC – High performance computing
HPM – High performance liquid chromatography
HRM – Human resource management
IBERS – Institute of Biological, Environmental and Rural Sciences
IERS – Institute of Geophysics and Planetology
IIBERS – Institute of Biological, Environmental and Rural Sciences
IEE – Institute of Electronic and Electrical Engineers
IEL – Institute for Entrepreneurship and Leadership
ISSL – Institute for International Shipping and Trade Law
ILR – Immigration Law Practitioners
CMP – „Institute of Mechanical Engineering
ILS – Institute of Life Science
IMechE – Institution of Mechanical Engineers
IP – Intellectual property
J

JMC – Juvenile Myoclonic Epilepsy
K

KEP – Knowledge Exchange Project
KES – Knowledge Exchange Skills Scholarships
KPI – Key Performance Indicator
KYNOCS – Centre for Research on the Narrative Literacies of the Ancient World

L

LORI – Low Carbon Research Institute
LHB – Local Health Board
LHC – Large Hadron Collider
LOGIC – Learning Opportunities in the Clinical Sciences
LSE – Language Research Centre
LSW – London School of Economics

M

MATTER – Manufacturing Advances through Training Engineering Research
MAP – Marine Biological Association of the UK
MEMO – Centre for Medieval and Early Modern Studies
MEMAS – Meso- to Nanoelectromechanical Systems
MNC – Multidisciplinary Nanotechnology Centre
MNC – Multinational corporation
MODS – Moderate Resolution Imaging Spectroradiometer
MoPh – Ministry of Public Health
MRC – Medical Research Council
MRI – Magnetic resonance imaging
MSAT – Momentum Threshold Superconducting
N

NCEO – National Centre for Earth Observation
NEB – National Environmental Research Council
NEUB – National University for Scotland
NPRC – National Physical Research Council
NEUB – National University for Scotland
NEMS – Nanoelectromechanical systems
NUS – National University of Singapore
O

O3 – Olympic and Paralympic Sport
OECD – Organisation for Economic Co-operation and Development
OPA – Old Age and Ageing Research and Development Network
OPC – Older People’s Commissioner
PAI – Partial differential equation
PDR – Professional Development Review
Penguin – Practical Innovation unit
PGR – People Organisation and Work
PREP – Paleosurveys of seaways: atmosphere Coupling In Peat
PSU – Planning and Strategic Projects Unit
PWC – Partial Wave Correction
Q

QCD – Quantum Chromodynamics
QPR – Quark Gluon Plasma
QFT – Quantum Field Theory
R

RAE – Royal Academy of Engineering
RCAMM – Royal Commission on the Ancient and Historical Monuments of Wales
RCAHMS – Royal Commission on the Ancient Monuments of Wales
RCS – Royal Colleges of Surgeons
RCS – Royal College of Surgeons
RCS – Royal College of Speech and Language Therapists
RCUK – Research Councils UK
RDF – Research Excellence Framework
REM – Rapid Eye Movement
RF – Risk Factor Prevention Partnership
RIH – Research Institute for Health and Social Care
RIAM – Research Institute for Arts and Humanities
RIASS – Research Institute for Applied Social Sciences
RSL – Registered Social Landlord
RSPCA – Royal Society for the Prevention of Cruelty to Animals
RSB – Road Safety and Standards Board

S

SABS – South African Bureau of Standards
SAE – Society for Automotive Engineers
SAND – South Australian National Health and Medical Research Council
SARS – South African Research Council
SFC – Science and Technology Facilities Council
STRIP – Stead Tackling Research and Innovation Partnership
SU – Swansea University
SWRF – Swansea University Research Forum
T

TA – Teaching Quality Assessment
TACE – Technology Assessment Centre
TRAC – Technology Readiness Level
TRUST – Thematic Research in emergency, Unscheduled and Trauma care
TSB – Technology Strategy Board
U

UCL – University College London
UKCRC – UK Clinical Research Collaboration
UKELA – United Kingdom Environmental Law Association
UN – United Nations
US FDA – United States Food and Drug Administration
UTC – University for Wales

W

WCCS – Welsh Centre for Cognitive Science
WCT – Welsh Centre for Training
WCRF – World Cancer Research Fund
WCRC – Welsh Centre for Research Innovation
WEDF – Welsh European Funding Office
WELMERC – Welsh Economy and Labour Market Evaluation and Research Association
WERN – Wales Energy Research Network
WICN – Wales Institute for Cognitive Neuroscience
WMS – Welsh Institute of Mathematical and Computational Sciences
WISE – Welsh Institute for Sustainable Environments
WISO – Welsh Institute of Social and Economic Research, Data and Methods
WHO – World Health Organisation
WMO – World Meteorological Organisation
WUF – Welsh Universities Federation
WYSE – Wales Youth Sport England