

The North East Centre of Excellence, Process Industries Research Institutions & University Core Specialisms document has been prepared by the North East of England Process Industry Cluster, trading as NEPIC. While every care has been taken to ensure that all material documented is accurate at the time of going to press, NEPIC cannot accept responsibility for errors or omissions and no liability is accepted for the omission or failure from any cause. All narrative has been provided and approved by the companies and institutions detailed.

FOREWORD



The North East region continues to build on its reputation as a key location for chemical, industrial and scientific expertise and NEPIC continues to support industry growth in the region by widening and enhancing an understanding of the resources available.

Organisations will undoubtedly benefit from an understanding of who, where and what assistance is available to them. This guide brings together in a single source the diverse range of independent service providers offering advice and assistance for businesses in areas where expertise is essential, including research and development and process based support.

With the range of organisations and services listed, businesses have a comprehensive resource to help them improve the operation of their business. This applies to all organisations from large multi-nationals to new start-ups.

Organisations listed also combine their expertise to offer industry the skills and expertise to develop opportunities that would very often just not move forward without this pooling of resources.

This is the case with the Materials Processing Institute, an Open-Access Technology Centre supporting organisations which work with materials and materials processing and specialising in challenging processes, particularly those involving high temperatures, hostile environments and high specification materials. The Institute utilises its science based expertise to work either directly with organisations, or in combination with other supporting bodies, to further materials and process enhancement.

The expertise listed in this guide is an excellent resource for businesses, commercial centres and research institutions. It showcases a broad spectrum of capabilities and shows why the North East Region is recognised as the Centre of Excellence in the UK for chemical and related processing industries. **Chris McDonald - CEO Materials Processing Institute**



NEPIC's main strategic focus is to rejuvenate and grow the chemistry-based process industries in North East England through collaboration, business growth and attracting inward investment. Within NEPIC's overarching remit lie eight strategic themes, one of which is the support of industrial innovation and since its inception NEPIC has led the study of innovation capability in the region and the development of four innovation strategy projects for the process sector.

Strategy projects include innovation in chemical & biotech technologies, biomass & waste material technologies and biorefinery technologies. These projects, details of which are available on NEPIC's website were precursors of a number of innovation centres being developed and built in the region including several UK national facilities.

In line with our core objectives, we are publishing this document in conjunction with Materials Processing Institute, as a reference document to Process Industry Centres of Excellence, Research Institutions and university core specialisms in the North East of England. Inevitably the document will be a snapshot in time but we intend for it to be used as a reference point and also for promoting the North East of England region to potential collaborators and potential inward investors. **Stan Higgins - CEO NEPIC**

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SECTION ONE

NATIONAL CENTRES OF
EXCELLENCE

1.0 NATIONAL CENTRES OF EXCELLENCE

1.1 NEPIC (nepic.co.uk)

NEPIC is an organisation that represents 720 participant companies drawn from across the process sector and includes representation from pharmaceutical, petrochemical, fine and speciality chemicals, bioresources, biotechnology, polymer and rubber, commodity chemical and supply chain companies based in North East England. NEPIC is a not-for-profit organisation set up by industry to develop the long-term future and improve competitiveness of the process sector in North East England that:

- Employs over 35,000 with a further 200,000 employed indirectly
- Generates over £26 billion – over 30% of the North East England GDP
- Is the region's largest industrial sector

NEPIC's vision is to be a world class, high value, process industry cluster based on innovative, sustainable high tech manufacturing. Its strategic themes include:

- Collaboration, growth and investment
- Grow cluster membership
- Provide a voice for the process industry
- Increase international awareness of the cluster and process industry
- Improve connectivity of the supply chain
- Develop and support innovative projects
- Develop and grow business opportunities for SMEs

1.2 Materials Processing Institute (mpiuk.com)

The Materials Processing Institute is an open-access technology centre working with industrial partners, government and academia. The Institute has expertise in materials, materials processing and energy; specialising in challenging processes, particularly those involving high specification materials, high temperatures and hostile operating conditions.

Success at the Institute is founded on a culture of research excellence. The Institute's team of experienced and capable scientists and engineers work across all industrial sectors to deliver cutting edge process technology and technical support. World class purpose built laboratories, scale-up capability and pilot plant facilities, enables a full spectrum of research and development, including laboratory experiments, construction and operation of pilot plants, experimental rigs and industrial processes. The Institute works with clients to develop a fundamental idea or innovation right through to commercial technology delivery. The Institute has an enviable track record of delivering simple, robust solutions to complex engineering challenges.

The Institute manages multi-partner projects using innovative technology to create and develop new processes and products. This often results in major breakthroughs that lead to lasting improvements in energy efficiency and process reliability. Areas of specific expertise are as follows:

1.2.1 Energy, Environment & Minerals

World class expertise and facilities providing dedicated research into raw materials processing at both the laboratory and pilot scale. The Institute has a long established capability to characterise feedstock, develop compositions and evaluate agglomerates for mineral and coal processing, as well as the beneficiation and recycling of process residual materials. The Institute has expertise and equipment for raw material and product characterisation that includes petrography, thermochemistry, pyrolysis, gasification, materials testing and mineralogy.

1.2.2 Chemical Processes

Specialising in understanding the nature of materials (including metals, non-metals, polymers, catalysts, glasses and gases) under both existing and novel innovative processing conditions, which typically involve extreme environments to optimise and improve overall performance, efficiency and sustainability. World class expertise and facilities in the areas of process engineering, thermodynamics, pyrometallurgy, materials testing and chemical analysis.

1.2.3 Mechanical Engineering

Forensic metallurgical investigations using optical and SEM microscopy as well as supporting mechanical testing techniques. The capability to investigate ferrous and nonferrous metals and also refractories and hybrid materials. Support for clients with plant operations and training.

1.2.4 Electronic Systems & Control

Understanding and control of processes and behaviour of systems through fundamental and novel engineering. Expertise in instrumentation measurement and control and use in extreme environments and their integration into plant systems. This expertise is used to provide both bespoke systems and also as part of investigations to understand process performance issues and recommend solutions.

1.2.5 Thermal Technologies

Development capability to provide novel sources of fuel and energy, the recovery of raw materials and reductions in wastes produced. An open-access facility for industries involved with thermal processes, offering knowledge and physical assets to enable industries to develop new processes, revitalise products and improve processes through access to high temperature technologies.

1.2.6 Piloting, Upscaling & Demonstration Facilities

Fully serviced space for large and complex pilot process equipment enabling the Institute to work with clients to reduce the risks associated with new process and product development.

1.2.7 Process Simulation

Specialising in both numerical and physical modelling of all aspects of steel manufacturing. Simulations are carried out to optimise existing processes through performance and efficiency improvements and to aid development of new process routes. Techniques utilised include Discrete Event Simulation, Finite Element Modelling, Computational Fluid Dynamics and analytical and physical modelling.

1.2.8 Specialist Melting

The metals and related industries are supported by tonnage scale melting and refining capabilities, ranging from 10kg to 700kg per heat by either ingot or continuous casting. These facilities are both process development 'laboratories' and also produce small specialist melts and trial quantities in a range of metals and alloys.

1.2.9 SME Technology Centre

Helping SMEs grow by providing a tailored package of support. Assistance includes technical support (e.g. engineering expertise, scale-up capability, process improvement, technical mentoring), facilities support (e.g. equipment access, piloting, lab space, office and conferencing facilities) and business support services and signposting (e.g. grants, networks, potential partnerships).

1.2.10 Doctoral Training Centre

Carrying out industrially applicable research with a strong business focus. Concentrating on sustainable processes and industrial systems, the centre provides technical resources to industry whilst developing the next generation of engineers.

1.3 Centre for Process Innovation (CPI) (uk-cpi.com)

The Centre for Process Innovation is a UK-based technology innovation centre and part of the High Value Manufacturing Catapult. Applied knowledge in science and engineering is combined with state of the art facilities to enable clients to develop, prove, prototype and scale up the next generation of products and processes. CPI's open innovation model enables clients to develop products and prove processes with minimal risk. CPI provides assets and expertise so customers can demonstrate the process and prove it is feasible before investing substantial amounts of money in capital equipment and training. New products and processes can be proven; on paper, in the lab and in the plant before being manufactured at an industrial scale.

By utilising CPI's proven assets and expertise companies can take their products and processes to market faster. There is no down time in production as all of the process development is completed offsite and technology transfer teams can help to transfer the product or process into full scale production.

CPI's Technology Platforms include:

- Industrial Biotechnology and Biorefining
- Printable Electronics
- Biologics
- Formulation and Flexible Manufacturing

CPI's Markets include:

- Personal Care
- Energy
- Aerospace Defence and Security
- Automotive and Transport
- Materials and Chemicals
- Pharmaceuticals

1.3.1 High Value Manufacturing Catapult (HVMC)

CPI operates one of seven national centres established and overseen by the Technology Strategy Board, with over £200 million of government investment. The HVMC is designed to stimulate growth in the manufacturing sector. Operated by the Centre for Process Innovation (CPI), it aims to help accelerate new concepts to commercial reality by offering scientists, engineers and entrepreneurs access to a pool of expertise and experience within academia, research, industry and government.

1.3.2 National Industrial Biotechnology and Biorefining Facility (uk-cpi.com/industrial-biotechnology-and-biorefining/)

CPI provides assets and resources to support innovation in Industrial Biotechnology and Biorefining. Through a range of technology development services and its Industrial Biotechnology facility, CPI helps clients to de-risk process development and provide proof-of-concept testing at scale. CPI's core competency lies in assisting in the development of novel bio-based concepts into robust and economic processes using its state-of-the-art industrial biotechnology facility.

1.3.3 National Printable Electronics Centre (uk-cpi.com/printable-electronics/)

CPI offers world class, open access capability for the scale up and commercialisation of new, innovative printed electronic products and applications. CPI's facilities and expertise provide clients with the environment to understand how their products and processes perform under manufacturing conditions and accelerate their commercial realisation.

1.3.4 National Biologics Manufacturing Centre (uk-cpi.com/biologics/)

CPI is the home to the new National Biologics Manufacturing Centre (NBMC). Expected to start operation in Autumn 2015, the £38m centre, based in Darlington, has been established to support the growth of the UK's biologics industry with open access facilities to support the development and commercialisation of biologic products and process technologies.

1.3.5 National Formulations Centre (uk-cpi.com/formulation-and-flexible-manufacturing/)

The National Formulation Centre, with its hub based at NETPark, County Durham, is a new world class UK based open access innovation centre for advanced formulated product design and manufacture. The £28 million centre is being managed by CPI and brings together leading research, industrial know how and technology infrastructure to provide the environment for companies to accelerate the commercialisation of next generation formulated products.

The capability to develop and deliver the next generation of formulated products and processes across a wide range of market sectors will be achieved through collaborations with universities, innovation centres and companies.

1.3.6 Anaerobic Digestion Development Centre (uk-cpi.com/anaerobic-digestion/about-addc/)

CPI's anaerobic digestion development centre is an open access facility designed to help organisations of all sizes to develop tailored processes that solve organic waste problems quickly and cost effectively. CPI can explore alternatives to traditional waste disposal to create cleaner, more sustainable and more acceptable anaerobic digestion processes.

With digester working volumes of between 1.5 m³ and 5 m³, clients can gain valuable information on how a new AD plant should be configured and the operational costs involved. Novel AD technology can be incorporated into ADDC's reconfigurable infrastructure, allowing tailored solutions to be designed and executed.

1.3.7 Sustainable Engineering (uk-cpi.com/sustainable-engineering/)

CPI's Sustainable Engineering group has unique experience that can be applied in organisations to help reduce technology risk by examining engineering, science, economics and the whole supply chain. In this way, processes can be improved to become cleaner, greener and more sustainable.

1.4 NEBR (nebr.co.uk)

North East Bioresources and Renewables is a cluster of companies and organisations committed to the development of a sustainable low carbon economy in North East England. Its members share the common aims of promoting commercial and economic growth in this sector and building an industrial cluster/consortium to improve supply chains, business practices and efficiency, in addition to promoting the North East as a centre of biomass processing into renewable fuels, energy, chemicals and materials.

1.5 NOF Energy (nofenergy.co.uk)

NOF Energy is a highly proactive business development organisation working on behalf of companies within the oil, gas, nuclear and offshore renewables sectors. NOF Energy actively work to identify global opportunities within these sectors and work with their members and partners to help them secure a share of them.

1.6 NETPark (northeasttechnologypark.com)

NETPark – the North East Technology Park – is a world class location for science and technology companies in the UK providing a dynamic and supportive environment to accelerate the growth of ambitious, innovative, high tech companies into global markets. NETPark encourages collaborative multidisciplinary links, driving innovation, enterprise and economic prosperity.

NETPark through its innovation community, NETPark NET provides companies with access to a focused and international community where talent flourishes, ideas are generated and businesses have the support and resources to compete with the best in the world.

NETPark focuses on supporting companies that are integrating materials into high value innovative products, particularly printable electronics, microelectronics, photonics and nanotechnology, and their application in the fields of energy, defence, and medical-related technologies.

1.7 Wilton Centre (wiltoncentre.com)

Wilton Centre offers high quality office, laboratory and pilot plant/scale-up facilities on one site and located next to the Wilton International site, a major complex for the process industries.

Originally developed as a world-class research and technology centre by ICI, the Centre is privately managed as a multi-tenanted research, technical and business centre. It is currently home to over sixty companies ranging from new business start-ups to SMEs and a number of prestigious multinationals. Collectively, they have helped to establish a significant research, technology and engineering community.

Experienced staff, with an in-depth knowledge of laboratory operations and procedures, are able to assist in the design, build and operation of laboratories. Skilled technicians maintain laboratory services and equipment and there is a wealth of information available on laboratory procedures, training and health & safety.

Pilot plants, experimental rigs, machine testing and light industrial activity can be accommodated at Wilton Centre. Access to professional safety advice, chemical analysis, project design and construction is also available.

The Wilton Centre Innovation Accelerator (IA), www.innovationaccelerator.co.uk, is a 10,000 sq ft fully integrated facility which incorporates ten specialist laboratory/pilot plant units, along with two fully equipped communal laboratories and meeting rooms, and provides office space for SMEs working on new business opportunities.

1.8 NNFCC – The Bioeconomy Consultants (nnfc.co.uk)

Established by the UK Government in 2003 to help extend the competitive non-food uses of crops, NNFCC is now an international consultancy working at the forefront of the bioeconomy. NNFCC's experts have in-depth knowledge of the renewable supply chain and provide professional business services on bioenergy, biofuels and bio-based products.

NNFCC works with a range of global clients to solve complex business challenges and provide vital evidence to policy makers. Over the past decade it has helped hundreds of companies better understand the market. NNFCC offers a range of business services including: market analysis, business planning & opportunity analysis, innovation systems analysis, sustainability compliance & reporting, technology & economic appraisal, feedstock assessment & sourcing, and policy/regulatory guidance & advice.

1.9 **Offshore Renewable Energy (ORE) Catapult (ore.catapult.org.uk)**

The Offshore Renewable Energy (ORE) Catapult is the UK's flagship technology innovation and research centre for offshore wind, wave and tidal energy. It operates the largest concentration of multi-purpose offshore renewable energy technology test and demonstration facilities in the world for testing next generation offshore wind and tidal equipment. Its facilities, along with its highly experienced multi-disciplinary team of experts and engineers, help to de-risk and accelerate the development and commercialisation of the offshore renewable energy industry in the UK.

Delivering world-class testing and research programmes, the ORE works for industry, academia and government to improve technology reliability and take projects through all stages of development from prototype to full scale demonstration, tackling the technical, logistical and commercial challenges of generating offshore renewable energy.

1.10 **Middlesbrough College STEM Centre (mbro.ac.uk)**

This £12 million centre located in central Middlesbrough which was completed in July 2015 will enhance industry's economic competitiveness by directly aligning Middlesbrough College's offer with the region's skills requirements. The centre will provide training in advanced manufacturing, laboratory, process, engineering disciplines, digital, warehousing and logistics to full time students, apprentices and those already employed in industry.

The centre will deliver a genuine competency solution through operation of live equipment in process, manufacturing and logistics operations and those attending will be expected to complete additional behaviour safety training. The centre will operate as a simulated COMAH site to develop the important personnel behaviours required to prevent and mitigate the effects of accidents involving dangerous substances and equipment.

1.11 **National Horizons Centre**

NHC is a partnership between Teesside University, CPI, Darlington College, Darlington Borough Council and C-STATE (Centre for Subsea Technical Awareness Training and Education). The new state of the art centre for skills, leadership and innovation for the biologics, biotechnology, subsea engineering and digital industries will open in central Darlington in 2015. The focus will be on advanced integrated design, production and production support processes and the innovation and management skills needed to embed them.

1.12 **National College for Onshore Oil & Gas (cleveland.ac.uk)**

Redcar & Cleveland College is one of three colleges from across England to be included in the Government's plans to establish a National College for oil and gas, with the aim of providing specialist training and qualifications to both UK and overseas workers and the next generation of specialists. A new facility for the Oil and Gas Training Centre is planned and will focus on both offshore and onshore training.

The college is a first rate provider of higher level specialist, accredited training courses in a variety of disciplines, including Drilling, Petroleum Engineering, Geology, Processing Facilities, Engineering (mechanical, electrical, instrumental), Pipeline Systems, Quality/Project Management, Operations and Maintenance, Health and Safety.

In addition, the college offers extensive range of courses in the renewables sector, including solar power, heat source pumps, thermal hot water systems and rainwater harvesting, which is also a growing industry in the North East.

SECTION TWO

RESEARCH CENTRES

2.0 RESEARCH CENTRES

2.1. **TWI Technology Centre (The Welding Institute) Middlesbrough (twi-global.com)**

TWI is one of the world's foremost independent research and development organisations, with expertise in materials joining and engineering technologies. Working for 700 Industrial Member companies in 80 countries, it specialises in knowledge transfer and solving problems in all aspects of manufacturing, fabrication and integrity management. The company has a first-class reputation for service through its teams of respected consultants, scientists, engineers and support staff. TWI also has a successful international training and examinations network and houses a professional institution, The Welding Institute, with a separate membership of 6000 individuals.

In 2015, TWI opened new facilities in Kuala Lumpur and at its Cambridge headquarters, including a new postgraduate centre for engineering research. The new National Structural Integrity Research Centre brings together academic study and industry-driven project work.

TWI Technology Centre North East was set up in 1992 as a technology and training centre focused on offshore and low carbon energy technologies. It will move into a new purpose built technology and training building in 2016. The centre currently covers a wide range of technologies including arc welding, thick section electron beam welding, advanced coatings, as well as structural and materials modelling. It also draws on technologies from across the TWI group to support local companies. Training activities in the North East cover all aspects of welding, NDT, inspection, as well as hosting Europe's largest deepwater diving and underwater inspection training tank.

2.2. **Neptune National Centre for Subsea and Offshore Engineering (shepherdoffshore.com/neptune-national-centre-subsea-offshore-engineering/)**

The Neptune National Centre for Subsea and Offshore Engineering was unveiled at the end of March 2013 by Business Secretary Vince Cable as a key part of the Government's oil and gas strategy. Building on the region's maritime heritage and Newcastle University's world-leading expertise in marine engineering, the Neptune Centre will be developed on the north bank of the River Tyne on the Neptune Energy Park, part of Shepherd Offshore. The Neptune Centre already has the backing of leading companies through the Subsea North-East Consortium including Shepherd Offshore, BEL Valves and SMD.

2.3. **Northern Institute for Cancer Research (ncl.ac.uk/nicr/)**

This Centre specialises in diagnosing and treating solid and haematological cancers in adults and in children. The Centre receives core-funding from Cancer Research UK, the North of England Children's Cancer Research Fund and the Sir Bobby Robson Foundation. Researchers at the Centre are investigating the basic biology of how and why cancers develop so new treatments can be designed. New drugs discovered by the Centre and other novel treatments are evaluated in clinical trials in adults and children using stratified medicine, where instead of a one-size-fits-all approach treatments are tailored to individual cancer patients' needs. Multi-disciplinary expertise in the Centre allows "bench-to-bedside" research, so that promising new treatments can benefit patients directly.

2.4. **North East England STEM Cell Institute (NESCI) (ncl.ac.uk/nesci/)**

NESCI is a collaboration between Durham University, Newcastle University, the Newcastle Hospitals NHS Foundation Trust and other partners including the Centre for Life in Newcastle. One of its primary aims is the development of new stem cell

treatments and providing research tools for drug discovery. To do this, it has strong links with a range of academic, clinical, commercial and other partners. It has benefitted from partner support and has state of the art laboratories and specialist facilities.

The centre is involved with a range of activities, including:

- Scientific research;
- Collaborations to investigate health solutions for degenerative diseases;
- Engagement with the public in debates and dialogue on ethical issues.

2.5 Biorenewables Development Centre (BDC) (biorenewables.org)

The BDC is a not-for-profit company, based at the University of York that helps businesses develop ways to convert plants, microbes and biowastes into profitable biorenewable products. Using cutting-edge science and technology, they bridge the gap between academia and industry to assist companies both in the development and scale up of new greener processes and products.

The centre offers a unique combination of expertise across the areas of biology, chemistry and chemical engineering with a focus on pre-processing, process development, genetic analysis, plant science, novel equipment demonstration, analytical services and microbiology.

Established in 2012, its expertise, services and open-access facilities have culminated in over 200 projects all along the bio-based supply chain for clients from SMEs to global multinationals. 93.5% of their clients would recommend them to others, and many use BDC's work to inform their business strategy, drive investment and develop improved products and processes.

The Biorenewables Development Centre is part-financed by the European Regional Development Fund Programme 2007 to 2013.

SECTION THREE

UNIVERSITY
CORE SPECIALISMS

3.0 UNIVERSITY CORE SPECIALISMS

3.1 Durham University (durham.ac.uk)

3.1.1 Durham Energy Institute (dur.ac.uk/dei/)

Durham Energy Institute tackles the societal aspects of energy technology development and use. Building upon the expertise, knowledge base, and skills of Durham University in a variety of energy technology areas, the Durham Energy Institute currently has four research themes: Energy Risk, Smart Energy and Energy for development, Energy-Geopolitics. These themes will help continue to build a focused and distinctive profile of energy research at Durham University commanding international recognition.

3.1.2 Centre for Sustainable Chemical Processes (dur.ac.uk/cscp/)

The Centre for Sustainable Chemical Processes (CSCP) addresses the need to integrate a resource-sustainable ethos into chemical research and development – both at the academic and industrial levels. The Centre's members have a wide range of unique synthetic expertise and know-how spanning organic, inorganic and process chemistry and catalysis. CSCP brings together academic and industrial synthetic chemists from Durham University and the surrounding region. CSCP actively seeks to enable and support innovative new collaborations, information sharing, and to provide expertise in synthetic chemistry.

3.1.3 The Integrated Chemical Reaction Facility (ICRF) (dur.ac.uk/cscp/facilities/icrf/)

The ICRF is designed to support industrial and academic research with access to complex chemical process reactor systems and associated analytical instruments. The facility has the capability to undertake high hazard, high pressure flow and pyrolysis reactions including direct fluorinations. Expertise, advice and training is available from dedicated support staff.

3.1.4 Durham Centre for Soft Matter (dur.ac.uk/soft.matter/)

The Durham Centre for Soft Matter brings together internationally recognised expertise from the Departments of Mathematics, Physics, Chemistry and Engineering with the aim of providing a focal point for soft matter and polymer research at Durham University. Within the Centre are academics with an impressive breadth and depth of research interests in soft matter and polymer science including expertise in materials synthesis, characterisation, design, simulation and theory.

3.1.5 EPSRC Centre for Doctoral Training in Soft Matter and Functional Interfaces (SOFI CDT) (dur.ac.uk/soft.matter/soficdt/)

The CDT combines expertise from three universities (Durham University, University of Leeds, University of Edinburgh), industry, and central facilities to deliver a comprehensive training programme and a wide choice of research projects from across the full range of science. It will provide industrially integrated post-graduate training in research, enterprise and innovation for future industrial leaders in Soft Matter and Functional Interfaces (SOFI). The core aim of the CDT is to train the next generation of industrial SOFI science and enterprise leaders by providing a rich programme of industrially integrated post-graduate training.

3.1.6 Biophysical Sciences Institute (dur.ac.uk/bsi/)

The BSI is a community of interdisciplinary academics, researchers and students who have research interests at the boundary between the life sciences and the other sciences including physics, chemistry and psychology, as well as mathematics and engineering. Current areas of research include "Bioactive Chemistry", biological modelling and "Biological Soft Matter". In 2015 Durham University and Procter and Gamble won the RSC Teamwork in innovation Award.

3.1.7 Department of Chemistry (dur.ac.uk/chemistry/)

Durham Chemistry is a thriving centre for teaching at both undergraduate and postgraduate levels and for world-leading research in the chemical sciences. It is ranked in the top 5 of chemistry departments in the UK. Research in the Department is focussed around six main groups:

- Biological Chemistry
- Materials
- Soft Matter, Surfaces and Interfaces
- Sustainable Chemistry and Catalysis -synthesis, organic chemistry, inorganic and organometallic chemistry, catalysis and flow chemistry
- Theory and Dynamics

3.1.8 Department of Pharmacy (dur.ac.uk/school.health/ug.pharmacy/)

The first member of Durham University's Pharmacy Division (within the School of Medicine, Pharmacy and Health) joined the University in January 2012 and since then the Division has grown rapidly, now comprising of fifteen research active full time academics, the first MPharm cohort, postgraduate research students, a full laboratory support team and dedicated administration office. Expertise is spread over the four areas of: pharmaceutical practice, pharmaceuticals, pharmacology and medicinal chemistry. The pharmaceuticals team is establishing a medicine formulation facility which will provide instrumentation for the investigation of lab scale formulation problems by both internal and external users.

3.1.9 School of Engineering and Computing Sciences (dur.ac.uk/ecs/)

ECS develops and nurtures strong industrial links with world class engineering and information technology companies. ECS has a strong focus on strategic partnerships with key industrial organisations with research interests that overlap their major research areas. Notable among these is a partnership with DONG Energy, who have provided funding of £1M to endow a Chair in Renewable Energy. The School's areas of research include:

- Computational Mechanics
- Microsystems Technology
- Nanotechnology
- Molecular Electronics
- Terahertz Devices and Materials
- Energy
- Biomaterials
- Thermofluids

3.1.10 Department of Physics (dur.ac.uk/physics/) Condensed Matter Physics (dur.ac.uk/cmp/)

The Centre for Materials Physics encompasses several research groups, covering a wide range of theoretical and experimental physics. These are divided into three main research themes:

- Optoelectronic and Semiconductor Physics
- Quantum Materials
- Soft Matter & Biological Physics

Materials Physics encompasses a huge range of science from technological advances such as the silicon chip and liquid crystal displays to fundamental understanding of phenomena such as superconductivity, advanced many-body quantum-mechanics and elementary spin-charge interactions. They employ a wide variety of different

experimental methods including optical, magnetic, electrical, microscopy, magnetic resonance and X-ray scattering measurements.

3.2 Newcastle University (ncl.ac.uk)

3.2.1 Institute for Sustainability (ncl.ac.uk/sustainability/)

The Institute for Sustainability provides leadership and innovation in sustainability research and demonstration with a focus on research excellence, working across disciplines and developing practical, engaged solutions to real-world sustainability issues. A hallmark of the Institute's activities is to bridge boundaries and be highly collaborative within Newcastle University, and work with industry, academia, policymakers and communities both in the UK and internationally.

- Transform methods used to design and implement integrated infrastructure systems such that they better serve the needs of society, and ensure positive interactions with the environment.
- Through research, innovation and development of solutions, drive forward practical step changes in production and process efficiencies, such that the natural environment and its resources are safeguarded.
- Identify and demonstrate socio-technical techniques to radically reduce resource consumption, eliminate associated waste and mitigate pollution effects on whole ecosystems.

3.2.2 Sir Joseph Swan Centre for Energy Research (Swan) (ncl.ac.uk/energy/)

The overarching focus of Swan Energy Research is to address three key challenges to ensure a sustainable future: "Enough", "For All", "Forever". Enough: Ensuring that there is sufficient energy to meet demand through appropriate and secure resources, and the efficient and resilient conversion, distribution and use of energy. For All: Guaranteeing universal access to affordable energy to meet demand through technological developments and effective policy and governance. Forever: Safeguarding sustainable resources, the natural environment and the health and well-being of all life through environmentally sensitive practices, processes and systems.

The core research activity aims to improve the efficient utilisation of energy and support end use energy demand. Swan research contributes to the global challenges of energy security, energy efficiency, including waste reduction, and de-carbonisation. Its key strengths are the following themes:

- Anaerobic digestion, gasification & pyrolysis
- Biofuel production and use
- Biomass conversion
- Building, industrial & transport demand reduction
- Electric machine design power electronics & control
- Environmental impact, mitigation & policy
- Fuel cells & hydrogen
- Grid systems & energy storage
- Infrastructure & systems
- Logistics & planning
- PV & solar thermal
- Recovery & clean use of fossil fuels
- Sensing, monitoring & control
- Thermal systems & combustion

3.2.3 Nanolab Research Centre (ncl.ac.uk/nanolab/)

NanoLAB is a designated research centre at Newcastle University, with over 80 staff and students from three faculties, specialising in nanoscience and technology and based in the School of Electrical, Electronic and Computer Engineering. Research

interests range from fundamental nanoscience, through mechanical and medical applications to ethical issues.

3.2.4 The Centre for Synthetic Biology and the Bioeconomy (ncl.ac.uk/csbb/)

The CSBB has access to world-class facilities and builds upon internationally renowned expertise across Newcastle University's Science, Agriculture and Engineering (SAGe), Medical Sciences (FMS) and Humanities, Arts and Social Sciences (HAAS) faculties. The centre has world-leading expertise in:

- Core synthetic microbiology and plant synthetic biology, e.g., large scale engineering of transcriptional circuits, protein-protein interaction networks, metabolic engineering and cell wall synthesis.
- CAD/CAM for synthetic biology systems including multicellular (e.g. mixed consortia biofilms), big (bio)data analytics and cloud bioinformatics.
- DNA & RNA nanotechnology and advanced imaging techniques including AFM, TEM, SECPM, super resolution microscopy, etc.

3.2.5 Engineering Design Centre (EDC) (edc.ncl.ac.uk/)

The EDC is a centre for collaborative research between industry, local authorities and the academic sector. EDC has an enviable position in all areas of design research activity from conceptual blue-sky ideas to practical implementations designed to improve productivity and alleviate design costs.

EDC is associated with the School of Chemical Engineering and Advanced Materials and specialises in the design, development and performance of systems for the manufacture and operation of complex products which are made on an engineer-to-order basis with high levels of customisation; as well as the investigation and analysis of more sustainable uses of energy in both the commercial and public sector.

3.2.6 Department of Chemistry (ncl.ac.uk/chemistry/research/) Biological and Medicinal Chemistry

The group is focusing on the discovery, the development, the identification and the interpretation of the mode of action of biologically active compounds at the molecular level. In close collaboration with clinicians in the Northern Institute for Cancer Research and the NHS, researchers are working on the synthesis of novel anticancer and anti-infective drugs, PET imaging agents and studying enzyme mechanisms. For more information visit: ncl.ac.uk/chemistry/research/bm

Synthesis, Structure and Spectroscopy

This group brings together the expertise of chemists from a raft of sub-disciplines, including inorganic and organic chemistry, spectroscopy, and crystallography to tackle the rational design of new molecules and materials and to forge a deeper understanding of their fundamental properties and interactions.

The work undertaken in this research area covers a wide range of chemistry from fundamental studies of structure, bonding and reactivity to the design of new molecules and materials with applications in diverse fields ranging from catalysis to medical diagnostics and solar energy conversion. For more information visit: ncl.ac.uk/chemistry/research/sss

Nanoscience and Materials

To the nanoscale and beyond is the focus here and involves the in-depth study of objects with characteristic dimensions less than about 100 nm. Trying to construct new functional nanomaterials for wide-ranging applications, including electronics, healthcare and sensing, is the aim for researchers in this group. For more information visit: ncl.ac.uk/chemistry/research/nm

3.2.7 School of Chemical Engineering and Advanced Materials (CEAM) (ncl.ac.uk/ceam/)

Research at CEAM is organised into four research groups:

Advanced Materials

Researchers work on a wide range of materials topics including new material development, optimising of materials processing, testing and evaluation at component scale and at high spatial resolution, modelling and failure analysis. Much of its work is related to materials and processes for renewable energy generation, energy efficiency, carbon capture and storage. They also use biological and bio-inspired processes to develop new functional materials.

Electrochemical Engineering Science

Electrochemical Engineering Science (EES) at Newcastle is a multidisciplinary research activity exploring applications of electrochemistry in energy storage, power generation, electrolysis, green energy, sensors and environmental protection and treatment applications. The group carries out novel research into fuel cells, batteries, hydrogen generation and bioelectronics and explores novel techniques to synthesise new catalyst, nanomaterials and membrane materials and optimise electrode structures. More recently, the group have been using electrochemical analysis to understand cellular and microbial catalysis and processes and to develop also in medical and health care applications. The group's laboratories offer facilities to carry fundamental mechanistic studies and to explore application at the pilot scale for electrolysis and fuel cells, as well as micro and nano fabrication, and performing electrochemistry in controlled environment (glove box).

Process Intensification

Process intensification means the development of new process technologies that are orders of magnitude smaller than conventional processes. This usually results in more efficient and safer processes, and substantial capital and running cost savings.

The Process Intensification Group at Newcastle is probably the largest "P.I." research group in the World, currently consisting of 60 researchers. The range of technologies and processes being investigated is very broad: spinning disc reactors, plasma chemistry, chemical looping, membrane processes, rotating packed beds, microreactors, oscillatory baffled reactors and flow chemistry platform development. These are applied to a range of applications including biorefining, carbon dioxide sequestration, biofuel production and crystallization.

Biosystems

From understanding disease, to the optimisation of antibody production, biosystems research at Newcastle encompasses a range of scales and applications. Home to the EPSRC and industry-sponsored Bioprocess and Biopharmaceutical Technology Centre (BBTC) Engineering Doctorate centre, it runs joint industry-academic projects and trains the next generation of engineers for the pharmaceutical industry. Projects include the hunt for new antibiotics, process analytical technology applied to the pharmaceutical industry, scale up of stem cell technology, and the optimisation of vaccine production. Within the group there is expertise in process analytics, systems biology and biotechnology. Linking characterisation with control / modelling is a key strength.

3.2.8 School of Mechanical and Systems Engineering (ncl.ac.uk/mech/)

Over 25 % of the research of this department is classed as world leading by Research Excellence Framework (REF), the system for assessing the quality of research in UK higher education institutions.

Bioengineering

Bioengineering strengths include biotribology, biomaterials, musculo-skeletal modelling, motion analysis, and nanotechnology, rapid prototyping and robotic solutions. It has a focus on the maintenance and optimisation of mobility, which is of particular relevance to the health of the ageing population. Areas of specialist expertise include:

- biotribology
- design and longevity of joint replacements
- biomaterials for tissue engineering and regenerative medicine
- bioprinting and biofabrication.

MEMS and Sensors

This group focuses on innovative technologies combining MEMS (microelectromechanical systems), nanotechnology and smart materials.

MEMS collaborate on research with the Institute for Nanoscale Science and Technology, Institute of Cellular Medicine and the School of Electrical, Electronic and Computer Engineering. They have access to the University's own fabrication facilities as well as extensive laboratories.

The UK's National EPSRC XPS Users' Service is hosted at Newcastle University. XPS, or X-ray Photoelectron Spectroscopy, is one of the principal methods of probing the composition and electronic structure of surfaces. It has an increasing number of research applications in electronics, semiconductor physics, novel materials and biomaterials, surface chemistry and functionalisation, sensor surfaces, adhesion, abrasion and tribology.

Design Manufacture and Materials

The Design, Manufacture and Materials Research Group focuses on the design, development, analysis and testing of novel materials, structures and processes. Their research addresses the design and manufacture techniques, processes and systems required to underpin the development and delivery of innovative materials and products, and much of the research is carried out with industrial partners. Areas of specialist expertise include:

- processing and analysis of composite materials and structures
- additive layer manufacturing (ALM), considering process and materials development, and the use of ALM in mass customisation applications

It has close links to the University's Resource Centre for Innovation & Design ([RCID](#)), a multi-disciplinary engineering consultancy. The Group has facilities for:

- materials testing and failure analysis
- product development and mechanical testing
- metrology
- pultrusion, filament winding, resin infusion and vacuum bag moulding
- selective laser sintering and fused deposition modelling

Fluid Dynamics and Thermal Systems

This group is engaged in a wide range of research work. This covers analytical, computational and experimental investigations of both fundamental and industrial problems of heat, mass and momentum transport. The group has cutting-edge expertise in a number of key areas of thermo-fluid mechanics where its contributions to the relevant areas of research have been internationally significant over the years.

Research Expertise

- Direct Numerical Simulations of turbulent reacting flows (e.g. turbulent premixed, non-premixed, partially-premixed and stratified flames, droplet-laden combustion)
- Modelling of turbulent combustion in the context of Reynolds Averaged Navier Stokes (RANS) and Large Eddy Simulations (LES) using DNS data
- Turbulent heat and mass transfer in solid-liquid phase change problems
- Natural convection of complex non-Newtonian fluids
- Computational Fluid Dynamics (CFD) modelling of single and multi-phase flows

3.2.9 School of Marine Science and Technology (ncl.ac.uk/marine/)

Marine Resources and Renewable Energy (MRRE)

Sustainable and secure energy generation in the future will come from a mix of terrestrial and ocean sources including nuclear, clean coal, carbon capture and storage technology, and renewable resources. Offshore wind and marine renewable energy including tidal, wave and bioenergy, have the potential to provide a significant, “green” contribution to global power generation. Projects include the reliability of wind turbine gear boxes and the design of tidal turbines with the Offshore Renewable Energy CATAPULT and Shanghai Jio Tong University, respectively. The oceans will have a key role to play in the discovery and development of next-generation drugs, bio-products and bio-materials. The key challenges in this area are how to develop strategies for sustainable bio-prospecting and how to scale-up and commercialise production of novel bio-products. Projects include “Seaweed as a source of bioenergy” and “Optimisation of the anaerobic digestion of seaweed”.

3.3 Northumbria University (northumbria.ac.uk)

3.3.1 Department of Physics and Electrical Engineering Advanced Materials and Manufacturing (AM&M)

Researchers in this area explore the fields of condensed matter, smart materials and soft matter physics alongside product development and manufacturing technology. Condensed matter research at Northumbria uses nanofabrication and advanced materials characterisation techniques to probe the physics of structures such as quantum dots and nanocrystals, while the research in smart materials and soft matter physics is mainly focused on the way liquids interact with surfaces and how that interaction can be controlled. Closely aligned to this research is product development and manufacturing technology, which provides state-of-the-art solutions to overcome the challenges of innovative product development on the changing world. The group research areas include materials, complemented by expertise in manufacturing processes and advanced materials.

Sustainable and Renewable Energy Systems (S&RES)

Research is carried out into existing and new energy technologies powered by renewable energy sources, waste energy and fossil fuels. Researchers are committed to improving energy efficiency and reducing both energy demand and environmental pollution. The group research areas include photovoltaics, materials for solar energy conversion, wind power and analysis into the management of electrical smart grids.

Northumbria Photovoltaic Applications Group (NPAG) has been involved in the research and development of photovoltaics (PV) for more than 20 years. The main research themes are the development of new solar cells using compound semiconductors formed from abundant and sustainable elements; the assessment of PV system performance and improvements in system design and operation; the integration of PV systems into the electricity network; and environmental impact assessment of the manufacture and use of PV systems.

3.3.2 Mechanical and Construction Engineering Research

The Advanced Materials group explores its understanding of structure-property relationships and develops cutting edge material engineering technologies with applications in bio-engineering, MEMS, energy, aerospace and marine. Product Development and Manufacturing Technology (PDMT) provides state-of-the-art solutions to overcome the challenges of innovative product development, utilising advanced traditional and Additive Manufacturing techniques. Engineering Design is undergoing a transformation from 'a process leading to producing a product' to 'a product in itself that should be optimally designed' approach. Modern Engineering Design and Optimisation (MEDO) is an interdisciplinary research group with current research interests that include design decision support systems and integrated and multidisciplinary design.

The Construction Technology group focuses on the technology of construction materials. Research interests are in concrete design, the use of advanced materials for the preservation and upgrading of historic structures, and the use of computational modelling of fibre-metal laminates. Environment and Energy research interests are on the development of improved methods for providing low carbon and renewable energy for heating, air conditioning, power and lighting in buildings. The group explores new methods of ground-source heating, renewable electricity generation, advanced thermal storage systems, advanced micro-channel heat exchangers, prediction of future weather data for building simulation and micro-combined heat and power systems. The Construction Economics and Management group has research interest in the commercial, contractual and managerial issues of the various organisations that contribute to the Built Environment, including information and knowledge, cost, and sustainability.

3.3.3 Product Development and Manufacturing Technology

Product Development and Manufacturing Technology (PDMT) provides state-of-the-art solutions to overcome the challenges of innovative product development of our changing world. The core of PDMT is to promote product services, sustainable product development and utilising advanced traditional and Additive Manufacturing techniques. These are the major research growth areas over the coming 10-15 years as new product development and services will be more interrelated to provide more competitive advantages to the UK manufacturing industry.

The aim of PDMT is to improve design decision support for engineers and technical management in the process of product development from the early design concept, application of advanced manufacturing techniques and processes, in-service and product end-of-life. PDMT's research strategy is to become the centre of excellence for multi-disciplinary engineering solutions which combines together a range of analytical and computational techniques. PDMT's strength lies in integrating the most innovative approaches in engineering principles, advanced manufacturing techniques and methodologies, Information and Communication Technology (ICT) tools and systems.

3.3.4 Department of Applied Sciences

The Department of Applied Sciences has research groups focused on the following subject areas:

Applied Chemistry Group – members take chemical synthesis, analytical chemistry and modelling approaches to a range of projects including luminescent metal complexes in materials science; medicinal chemistry, Anti-fouling surfaces and substrates for microorganism detection and identification utilising volatile organic compound analysis.

Mammalian Cell Biology & Immunology Group – highlights include work on Biomarker analysis; cancer and therapy-related leukaemia; molecular mechanisms of arthritis, ageing and neurological diseases; serpins in cardiovascular disease; T-cell immunology and vaccine design.

Microbiology Group – highlights include work on microbial enzymes as biocatalysts (through its Nzomics Innovation Unit); molecular ecology and microbial community analysis in human health and in the environment; genomics and the molecular basis of microbial virulence, particularly understanding the bacterial cell envelope.

Industrial Biotechnology (nzomicsbiocatalysis.co.uk/)

Nzomics Biocatalysis offers products, services and expertise to those companies looking to use biocatalysis to use industrial biotechnology to create sustainable, resource efficient and IP-rich chemical processes. Nzomics Biocatalysis is a supplier of custom-made enzymes using unique sequences harvesting from natural genomic resources which can be further optimised by the latest and most efficient directed evolution techniques.

Design

INNOVATE brings together Northumbria's experts in design, technology, business management, entrepreneurship and people development. INNOVATE works with a broad spectrum of partners including regional SMEs, larger corporate partners such as Unilever and public and third sector clients. Partners can engage in a numbers of ways including Student Innovations Projects, contract research, creative facilitation, innovation sandpits and design-led innovation skill workshops.

3.4 University of Sunderland (sunderland.ac.uk)

3.4.1 Institute for Automotive and Manufacturing Advanced Practice (AMAP) (amap.sunderland.ac.uk)

AMAP, part of the Faculty of Applied Sciences within the University of Sunderland, is an innovative, accessible, and outward facing provider of support for industry based upon the application of research and knowledge of advanced manufacturing recognised regionally, nationally and internationally. AMAP specialises in the following core themes:

- **Automotive:**
Low Carbon Vehicles, including Fuel Cell and Hybrid systems, Light-weight Technology, Human factors and behaviours, Telematics
- **Supply Chain Development:**
Productivity, Maintenance, Quality and Inspection
- **Product Design and Digital Engineering:**
Computer Aided Engineering, Design Processes, Rapid Prototyping, DfX (Design For x, where the x can be Quality, Assembly, Manufacture, Maintenance, Cost, etc.), Scanning Inspection and Reverse Engineering
- **Manufacturing Technology and Process Development:**
Simulation, Robotics, New and Advanced Manufacturing Technologies, Additive Manufacturing, Joining and Welding
- **Materials:**
Light-weighting, Composites, Graphene, Material Modelling

By providing problem-solving solutions to manufacturers of all capabilities, offering training or advice, or working in partnership-based research, AMAP's basic working principle is to improve or develop the current state of a company or individual. AMAP also run the North East Maintenance and North East Productivity Forums, networks providing industrial peer to peer knowledge exchange and sharing best practice in these areas.

3.4.2 The Digital Innovation Research Beacon (sunderland.ac.uk/research/areasofresearch/digitalinnovationbeacon/)

The key aim of the Digital Innovation Research Beacon is to conduct research that leads to breakthroughs in innovation and strategic questions. It brings together researchers from throughout the digital economy and focuses on four key themes.

- Big data – focussing on Computer forensics; data mining; data warehousing; information retrieval; intelligent network security; massive databases
- Energy efficient and safe vehicles – focussing on Engineering; human factors/ergonomics; maintenance and lean manufacture; materials science;
- Informatics for business and manufacturing - focussing on Databases; information systems; intelligent systems; maintenance and lean manufacture; psychology; usability/user experience
- Technology-enhanced living – focussing on Human computer interaction (HCI); human factors/ergonomics; psychology; usability/user experience

Drawing the research together under these themes allows clear identification of the ways in which clusters of researchers bring their different subject expertise together to tackle a range of interesting research problems in the digital economy.

3.4.3 Department of Pharmacy, Health and Well-being Research Beacon (sunderland.ac.uk/research/areasofresearch/healthsciencesandwell-beingbeacon/)

The Beacon has two key themes:

- Pharmaceutical and biological sciences – focussing on chemistry; microbiology; molecular biology; pharmacy
- Mental health, healthcare and health behaviours

Within these key themes, the sub-themes of their research are:

- **Pharmaceutical sciences:** from disease to medicines use:
 - the development and evaluation of drug delivery methods including topical and inhaled formulations, and oral delivery of peptide and protein pharmaceuticals
 - pharmaceutical, metabolomic and proteomic analysis of biomarkers in cancer and other diseases
 - design, synthesis and evaluation of new drugs for the treatment of bacterial and viral infections, psoriasis, and the rare metabolic disease cystinosis
- **Infection and immunology:** from pathogenesis to treatment:
 - detection and identification of bacterial and other microbial pathogens in clinical and environmental samples
 - the investigation of bacterial biosynthetic pathways designed to illuminate the production of toxins and novel antibiotic agents, which informs and shapes the design of novel antibacterial agents.
 - The investigation of the pathogenesis of various diseases, such as psoriasis, skin cancer, neuroblastoma and rheumatoid arthritis
- **Common mental health problems:** from prevention to novel therapeutic interventions.

The Sciences Complex offers an extensive range of state-of-the-art analytical equipment to support advanced research. The high quality multi-disciplinary science laboratories include new equipment for drug discovery, pharmaceutical and health related sciences.

3.5 Teesside University (tees.ac.uk)

3.5.1 Technology Futures Institute (tees.ac.uk/sections/research/technology_futures/)

The Technology Futures Institute undertakes applied, collaborative research and innovation in key areas of strength working closely with industrial partners. There is a particular focus on exploiting knowledge and technology transfer mechanisms, including knowledge transfer partnerships and supporting start up and spin out companies.

Research themes include:

- Engineering sustainability – focuses on the sustainability of the built environment with particular emphasis on the use of information and communication technology for building information management and modelling and for visualisation of construction processes.
- Manufacturing and process engineering – focuses on the development of bespoke, advanced materials for industrial applications, and the use micro and nanomanufacturing to create devices that have high density and enhanced functionality.
- Measurement and control systems – applies intelligent algorithms in systems control, advanced chemical analysis technologies, and process flow measurement in challenging environments. Other work focuses on the development of dependable, real-time embedded control systems and novel analytical methods in forensic and archaeological analysis.

3.5.2 Centre for Resource Efficient Manufacturing Systems (REMS) (tees.ac.uk/sections/research/technology_futures/remscfm)

A collaborative partnership between Teesside University, the Institute for Manufacturing at Cambridge University and the Centre for Process Innovation (CPI). The Centre investigates manufacturing processes and supply chains to help companies to maximise resource efficiency and facilitate sustainability.

3.5.3 Digital Futures Institute (tees.ac.uk/sections/research/digital_futures/)

The Digital Futures Institute is the focus for research activities in computing. The main research topics are artificial intelligence (planning, decision making, autonomous agents), interactive systems (3D graphics, web based) and programming research (embedded systems, program verification, algorithmic theory). Other research interests encompass human/computer interaction, document engineering and visualisation, and intelligent user interfaces, as well as establishing wider interdisciplinary links.

3.5.4 The Graduate Research School (tees.ac.uk/sections/research/grscfm)

The Graduate Research School provides central support for all aspects of research activity, and welcomes queries regarding postgraduate research degrees and students, funding and projects, as well as policy and strategy, and research integrity.

3.6 University of York (york.ac.uk)

3.6.1 JEOL Nanocentre (york.ac.uk/nanocentre)

The York JEOL Nanocentre represents a major collaboration between the University of York, Yorkshire Forward through the European Union and JEOL who are world leaders in electron optics. The Nanocentre draws on the combined resources of the Physics, Electronics and Chemistry departments, with the Departments of Environmental Sciences, Biology and cultural heritage management also participating. It is a leading centre in catalyst reaction studies with single atom resolution under controlled conditions of gaseous environment and high temperature, wet cell studies

and other forms of in-situ and interface research. As well as carrying out high quality nanoscience and materials research, the York JEOL Nanocentre provides rich opportunities for collaboration with UK industry and external partners.

3.6.2 York Environmental Sustainability Institute (YESI) (york.ac.uk/yesi)

YESI's mission is to deliver world-class interdisciplinary research to provide the evidence base for sustainable solutions to global environmental problems. It works with over 160 York academics on the themes "Future Food and Fuel", "Global Change" and "Sustainable Environments".

3.6.3 Green Chemistry Centre of Excellence (york.ac.uk/chemistry/research/green/)

The Green Chemistry Centre of Excellence (GCCE) at the University of York is a world leading research centre which aims to promote the development and implementation of green and sustainable chemistry and related technologies into new products and processes. The Green Chemistry Centre of Excellence has a long established reputation for working closely with industry and fostering interdisciplinary research through close collaboration with chemical engineering and other disciplines.

The research areas of the Centre cover a broad spectrum of subjects and involve both fundamental and applied research. They concentrate on developing new applications and providing practical solutions for existing industrial processes. The group works at the frontiers of modern chemical research in the areas of clean synthesis, natural solvents, microwave chemistry and the application of renewable resources.

3.6.4 Centre of Excellence in Mass Spectrometry (york.ac.uk/mass-spectrometry)

Mass spectrometry is a powerful analytical tool with many diverse applications in biology and chemistry. The York Centre of Excellence in Mass Spectrometry provides a means for organisations to access state-of-the-art instrumentation, along with the necessary expertise to develop research in many areas, such as therapeutic protein discovery and characterisation, post-genomic sciences, gas-phase ion chemistry, chemical catalyst discovery, and many more.

3.6.5 Biological Physical Sciences Institute (york.ac.uk/physics/bpsi)

Established in 2013, the Biological Physical Sciences Institute (BPSI) at the University of York serves to stimulate and fund exciting new collaborative activities at the cutting-edge interface between the Physical and Life Sciences, encompassing multiple exceptional research teams across several different departments of the University, including Physics, Biology, Chemistry, Electronics, Mathematics, Psychology and Computer Science.

Team members have international reputations for core biological physics/biophysics research including:

- biologically-inspired technological applications including bionanotechnology and hybrid bio-electronic devices
- the development of state-of-the-art novel biophysical instrumentation for addressing challenging biological questions
- fundamental research of the physical-biological sciences spanning multiple length scales from quantum biology through to single-molecule biophysics
- single cell physics and the biophysics of cell populations including complex tissues
- biophysical/mathematical modelling of multiple complex biological phenomena

3.6.6 Department of Chemistry (york.ac.uk/chemistry/)

The department carries out high quality fundamental and applied research with a distinctive interdisciplinary structure founded on strong areas of core chemistry. Research income has averaged £7.4 million per annum in recent years.

There are currently 58 members of academic staff of international repute, about 150 graduates (mainly studying for PhD degrees) and over 80 research fellows.

The research groupings are:

- Analytical Chemistry - The development and application of analytical methods
- Biological Chemistry (YSBL) - Structural and chemical biology and biological chemistry. Biocatalysis
- Green Chemistry - Natural solvents provide environmentally sustainable and economically attractive alternatives
- Inorganic Chemistry - Organometallic, coordination and bioinorganic chemistry
- Materials Chemistry - The liquid crystal group designs and creates materials for a range of high technology applications
- Organic Chemistry - Expertise in synthesis, catalysis, bioorganic, supramolecular and nanochemistry
- Physical Chemistry - Atmospheric science, spectroscopy and photochemistry, theoretical and computational chemistry

Should you wish to discuss the North East of England's Centres of Excellence and the research and training capabilities associated with the chemical-processing industry, please contact Joanne Rout via joanne.rout@nepic.co.uk or call +44(0)1642 442575.

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