



Foreword

Welcome to the Centre for Process Innovation's Annual Review of 2017. Over the following pages I want to share and celebrate CPI's many successes which have been achieved jointly with our customers, collaborators, and by our outstanding people.



As a not-for-profit organisation, we have our customers' and the UK's prosperity at the heart of everything we do.

Nigel J Perry MBE FREng

Our proven contribution to UK manufacturing complements the work of the High Value Manufacturing Catapult, of which CPI is a proud founding partner. In 2018 we will continue to work with our partners in local and national government to enable more businesses to translate and commercialise new products and processes and ensure the UK is the world's number one innovation destination.

As a not-for-profit organisation, we have our customers' and the UK's prosperity at the heart of everything we do. We reduce the risk of adopting new technology for businesses small and large, so that innovations to combat world challenges, and to exploit opportunities, reach the marketplace quickly.

CPI is a key player in fulfilling the UK's Industrial Strategy. Ensuring that new processes, technologies and products get to market means that companies based in Britain can be more successful, employ more people, and give benefits to our society that are much sought after.

Now more than ever, it is absolutely critical that CPI succeeds in harnessing the power of UK research to nurture and grow SMEs, and to support larger businesses. This will enable the competitive advantages that are the life-blood of prosperous UK companies.

The process industry in which we operate is the hidden 52% of UK manufacturing that underpins and involves everything we come into contact with in daily life. That's why I am incredibly proud of the efforts of CPI this year in facilitating all types of manufacturing across the UK; the breadth of which grows year on year, with the continual development of our world-class facilities and expertise to meet technological demands.

Through 2017 we have broken ground on a new facility, brought innovations to commercialisation across a number of sectors, welcomed a new chair, and attracted many high calibre employees and partner companies. I am delighted that we have made substantial progress in our commitment to developing our people; our workforce is pivotal in assisting our partners to achieve their visions and is what differentiates CPI as the go-to destination for process innovation.

CPI is now coming of age, and has matured into a recognisable organisation that can deliver the critical difference in a number of markets. It is impossible to fit every one of this year's accomplishments into so few pages, but I hope you enjoy exploring this small selection of fantastic things achieved over the past 12 months at our truly exceptional organisation.

A handwritten signature in black ink that reads "Nigel Perry". The signature is written in a cursive style with a long horizontal stroke at the bottom.

Nigel J Perry MBE FREng

Chief Executive Officer

At CPI, we are passionate about translating the best of British ideas into market-ready products and processes to enrich the lives of everyone.

We assist businesses of all sizes, from start-ups through to large multi-national corporations, to efficiently deliver their innovations as market-ready solutions.

Working across all areas of the process industry, we provide state-of-the-art open access facilities and diverse, independent market knowledge. This reduces the risks that come with developing new concepts, giving businesses the best chance of success.

A flexible approach allows us to support our partners every step of the way, as innovations grow through concept and technology development, to scale-up and supply chain intervention. Throughout every innovation journey, our experienced business minds and technical teams work synergistically, with full commitment, to develop every customer's idea until it reaches successful commercialisation.

As a leader in innovation, we play a key role in fulfilling the UK's Industrial Strategy to improve economic growth through driving productivity. We stay on top of the latest developments, continually expanding and evolving our knowledge base and facilities according to future process manufacturing demands. From clean energy to precision medicine, to smart materials and waste management, our collaborations with innovators solve the complex industrial challenges of today, in a more efficient and sustainable manner.

“ The clear benefit to GSK of working with CPI is that we are able to concentrate on our strengths and have our partner explore the areas where we are more limited.

Ted Chapman

Biotechnology Development Manager, GlaxoSmithKline

“ CPI's contribution has been extremely valuable and highly significant, as we continue our work with them to commercialise our technologies.

Dr Stephen Price

Business Development Manager, Newcastle University

“ CPI saved us at least 18 months of development and allowed us to defer our capital investment until our technology platform and its potential were fully proven.

Scott White

Chief Executive Officer, PragmatIC

“ The variety of work being undertaken by CPI is a boost to our Catapult network and is going to be a real asset to the Northern Powerhouse and the science base in our country.

Jo Johnson

Minister of State for Universities, Science, Research and Innovation

Technologies

We work in technologies that are critical for the future of manufacturing, in the UK and worldwide. Our open access innovation centres enable ideas, research and knowledge to be translated into commercial business propositions by helping companies to develop, prove, prototype and scale up new products and processes at reduced risk.

CPI provides the crucial innovation support required to maintain and extend the UK's position as a world leader in cutting-edge technology. Working with technologies that are critical for the future of manufacturing, we support the growth and development of many industries in the UK and worldwide.

With dedicated state-of-the-art facilities in industrial biotechnology, printable electronics, biologics, formulation and graphene, CPI is able to support major markets such as healthcare, electronics, food and drink, aerospace, automotive, materials and energy.

CPI is the only centre of its kind in the UK with such an extensive combination of equipment and specialist knowledge, in diverse but complementary technologies, creating the environment for horizontal innovation and rapid problem solving. CPI has designed an innovation infrastructure that fits the needs of companies whatever the size and demands, and we strive to deliver above and beyond our customers' expectations.



Printable Electronics

Within the National Printable Electronics Centre we enable applications for the Internet of Things through the development of sensor and communication technologies. Printed flexible circuits and conformable solar cells for next generation energy harvesting are supported by our innovation capability for packaging and devices of the future. This has applications for data collection in automotive engineering, and smart packaging for pharmaceuticals, amongst many others.

Industrial Biotechnology and Biorefining

Our National Industrial Biotechnology Facility supports the development of fermentation-based technologies spanning industrial market applications in pharmaceuticals, personal care, food and drink, performance materials and agri-technologies. The business hosts a team of 60 professionals comprising of Scientists, Engineers, Project Managers and Operational Specialists, alongside £30m of assets. The scale of experimentation can move from 1 mL to 10 m³, and the team apply innovative approaches to bioprocess development, mitigating risk, reducing development time and minimising cost.

Biologics

At the National Biologics Manufacturing Centre, we apply expertise and cutting-edge technology to accelerate preclinical biopharmaceutical development towards clinical manufacture. Our role is to integrate technologies to develop better platforms for manufacture, and improve methods to enable high quality process and product characterisation. We do this by utilising new and improved bioprocess, analytical and formulation technologies.

Formulation

Our National Formulation Centre covers key technology areas including the functionalisation of nanomaterials for enhanced performance and dispersion capabilities, complex solids and liquids, and broad based materials and surface characterisation. We enable continuous processing, with expert support for transitioning batch to continuous operations, and a focus on improving downstream processing. From materials and chemicals, to personal care and food and drink, our capability in high-throughput experimentation enables formulators to develop and scale up advanced products effectively, with increased productivity and with reduced risk.

Key Statistics from 2017

605

Engagements with SMEs

171

R&D&I Projects

£17.5m

CR&D projects that involve an SME

85

Advisory boards represented

136

Engagements with universities

208

Industrial clients (new and repeat)

Scientists, Engineers and Support Staff

National innovation centres



Project

Building the National Formulation Centre

Throughout 2017, CPI has been constructing the National Formulation Centre – an open access, state-of-the-art innovation facility based at NETPark in County Durham. The new centre will provide access to facilities and expertise to allow companies to overcome innovation challenges associated with the development and scale-up of formulated products.



Formulation involves the creation of multi-component, often multi-phase products, which are abundant across markets such

as healthcare, food and drink and personal care. For companies developing formulated products, challenges such as up-scaling, advancing technical knowledge and optimising downstream processing are difficult to overcome and slow down the innovation process.

CPI will guide companies through the steps needed to take their next-generation formulated products to market with reduced risk on their decisions or capital investment plans. This unique centre will create an environment for innovation that will allow companies to be more efficient in the use of resources and generate further value for the UK formulation industry.

The centre is home to world-class laboratories, and accompanying expertise focusing on measurement, high-throughput formulation, chemistry and dispersions, process chemistry, process technology, complex particles, nanomaterials and composites.

Much work is already underway to connect the UK formulation ecosystem with ongoing collaborative projects including leading academics, SMEs and large corporates. Current projects include standardising models for particulate products, a novel research infrastructure for the scale-up and manufacture of liquid formulations and the development of a microfluidic chip for rapid formulation stability screening to quickly understand, forecast and control the stability of formulation products.





Case Studies

CPI has had over 2,000 collaborations with science and technology companies to develop new products and processes. Over the following pages we present just a few of the fantastic companies and projects that we've worked on throughout 2017.

CALYSTA®

Calysta and CPI have piloted the world's only commercially-validated gas fermentation process, and have created a revolutionary single cell protein animal feed. This sustainable source of protein can help feed a growing global population.

“ The opening of the plant represents the end of a decade of development and heralds a new era in the race to sustainably feed the world's growing population.

Dr Alan Shaw
CEO, Calysta

Based in the USA, Calysta is committed to improving the world's supply of food sources. With a growing global population that demands a higher quality of living, a balance should be made between using available protein as a food for humans, or as a feed for animals. Calysta's natural FeedKind® protein offers improvements to the fishmeal-based protein in conventional fish feed. As such, FeedKind® is a sustainable alternative for the market demand for aqua and animal feeds.

CPI has assisted Calysta in establishing a state-of-the-art Market Introduction Facility in the North East of England. The collaboration mitigated the start-up investment needed by integrating Calysta's novel loop reactor into the National Industrial Biotechnology Facility. The plant, which became operational in January works through the fermentation process of a natural microorganism, creating a high protein feed ingredient.

Within just four months, Calysta announced that the plant had successfully produced over four metric tonnes of FeedKind®, with samples delivered to support worldwide markets. The efficient delivery was a testament to the CPI team, providing Calysta with Scientists, Process Engineers and the expertise of the development team to deliver results, fast. Scale-up of production has begun, with CPI's facilities acting as a Calysta R&D centre for the next five to ten years.

These two significant milestones achieved worldwide recognition in November, when Calysta, and partners CPI and Otto Simon Ltd, were announced as joint winners of the prestigious Institution of Chemical Engineers (IChemE) Global Team Award 2017.



BioStreamline is an £11.3 million collaborative project that is focused on improving the development of novel biotherapeutics in order to deliver drugs faster and cheaper, while reducing the costs and risks involved in their manufacture.



The global biotherapeutics market is growing rapidly, but there are many challenges that must be overcome in order to deliver cost-effective drugs to patients more quickly. One of the greatest needs is to reduce the number of failed drugs during development. For biotherapeutics, failure often results from safety issues, or manufacturing and formulation difficulties.

The BioStreamline project aims to overcome these challenges through applying new technologies that will make it easier to identify failing drugs earlier in development, as well as improving development and manufacturing processes.

Ultimately, the project will deliver a novel decision-making tool that can predict key information about a biotherapeutic molecule, including its performance characteristics, and how easy it will be to manufacture and formulate, based on its genetic sequence.

This multi-disciplinary collaboration, funded by the Government's Advanced Manufacturing Supply Chain Initiative (AMSCI), involves six diverse organisations – CPI, Lonza Biologics, UCB Celltech, Sphere Fluidics, Horizon Discovery and Alcyomics Ltd – working together across nine work packages to develop and validate a robust methodology for improved understanding of candidate molecules.

Each work package uses innovative technologies, such as CRISPR and machine learning, to target critical points in the biologics supply chain. The collaboration relies on CPI's facilities and technical expertise, as well as project management skills to take the project successfully through to completion.



Biome Bioplastics teamed up with CPI for guidance through the difficult steps to commercialisation of a technically challenging project: the extraction of high performance chemicals from lignin for use in bioplastics.





Biome Bioplastics is one of the UK's leading developers of intelligent, natural plastics. Its mission is to produce bioplastics that can challenge the dominance of oil-based polymers. In one of its projects, Biome Bioplastics extracts high performance chemicals from lignin (a by-product from the paper and bio-fuels industries) for use in bioplastics. If lignin can be broken down under the right conditions, and the resultant chemicals can be extracted at scale, the process could provide the foundation for a new generation of bioplastics.

When the company came to CPI, an initial feasibility project and a proof-of-concept study had been undertaken, but for the scale-up and following steps to take the product through to commercialisation, the company needed expert help from the outside. To this end, CPI assisted with a roadmapping study considering the economic and commercial opportunities available for the company.

After the initial study, CPI provided technical and economic knowledge, giving Biome Bioplastics a higher degree of scientific and technical product knowledge, as well as important connections with both biological competence and commercial know-how. What started as a £3,000 roadmapping study has translated into a total of £5 million worth of investments for Biome Bioplastics.

SILENT[®] SENSORS

Silent Sensors is an innovative UK SME with a focus on applying the Internet of Things to tyres and tyre management. It develops key components for intelligent tyres, which have the potential to reduce the total cost of operations of fleet vehicles while benefiting the environment.



Increased volume of vehicles on the roads and tighter automotive regulations has led to greater demand for fleet operators to monitor and reduce fuel consumption and CO₂ emissions. Suboptimal tyre inflation exacerbates all these factors and increases the risk of road accidents. However, manual tyre checks are expensive, time consuming and require the vehicle to be off the road.

Silent Sensors is bringing a new, innovative system to fleet operators and major tyre manufacturers that will give them the flexibility needed to stay safe and efficient by monitoring driver behaviour in real time. Once commercialised, the technology will manage tyres throughout the supply chain. From the manufacturing process to the running of the vehicle on the road, a continuous stream of data will be collected and used to inform or warn drivers on the road, becoming part of the whole tyre lifecycle.

Silent Sensors is collaborating with CPI alongside the University of Bath to bring the Internet of Things component of this new product to market. Multiple stages of development are covered, including a printed kinetic energy harvesting element, power management, and sensing devices that enable real-time monitoring of individual tyre performance. The project relies on CPI's world-class manufacturing facilities at the National Printable Electronics Centre, used for the scale-up and commercialisation of innovative printed electronic products, and is on track for completion before April 2018.

CHARIOT

The Chariot project brought together world-class capability in research, innovation and business to drive the commercialisation of new and improved specialist powders for markets such as consumer goods, healthcare, personal care, ceramics, catalysts and food.



Chariot has developed powder processing technologies to profit a broad range of powder producing industries. Part funded by the Advanced Manufacturing Supply Chain Initiative, the project was led by Procter & Gamble and involved high profile academics from the Universities of Leeds, Birmingham, Cranfield and Durham, alongside UK-based SMEs, International Innovative Technologies and Ajax, as well as CPI.

The expertise and capabilities developed within the project have cemented the UK as a world leader in the manufacture of superfine powders and has supported the drive towards next generation powders that are higher performing, cheaper to manufacture and transport, and are also environmentally sustainable. Broader UK industries are also benefitting, as the technologies developed within the consortium can be reapplied and further commercialised.

During the project, CPI made a significant investment into process analytical technology-enabled wet granulation

technologies, a packing and filling testbed, as well as extensive characterisation capability in particle size distribution, powder rheology, and surface properties. The expertise and facilities developed during the Chariot project are available to assist all

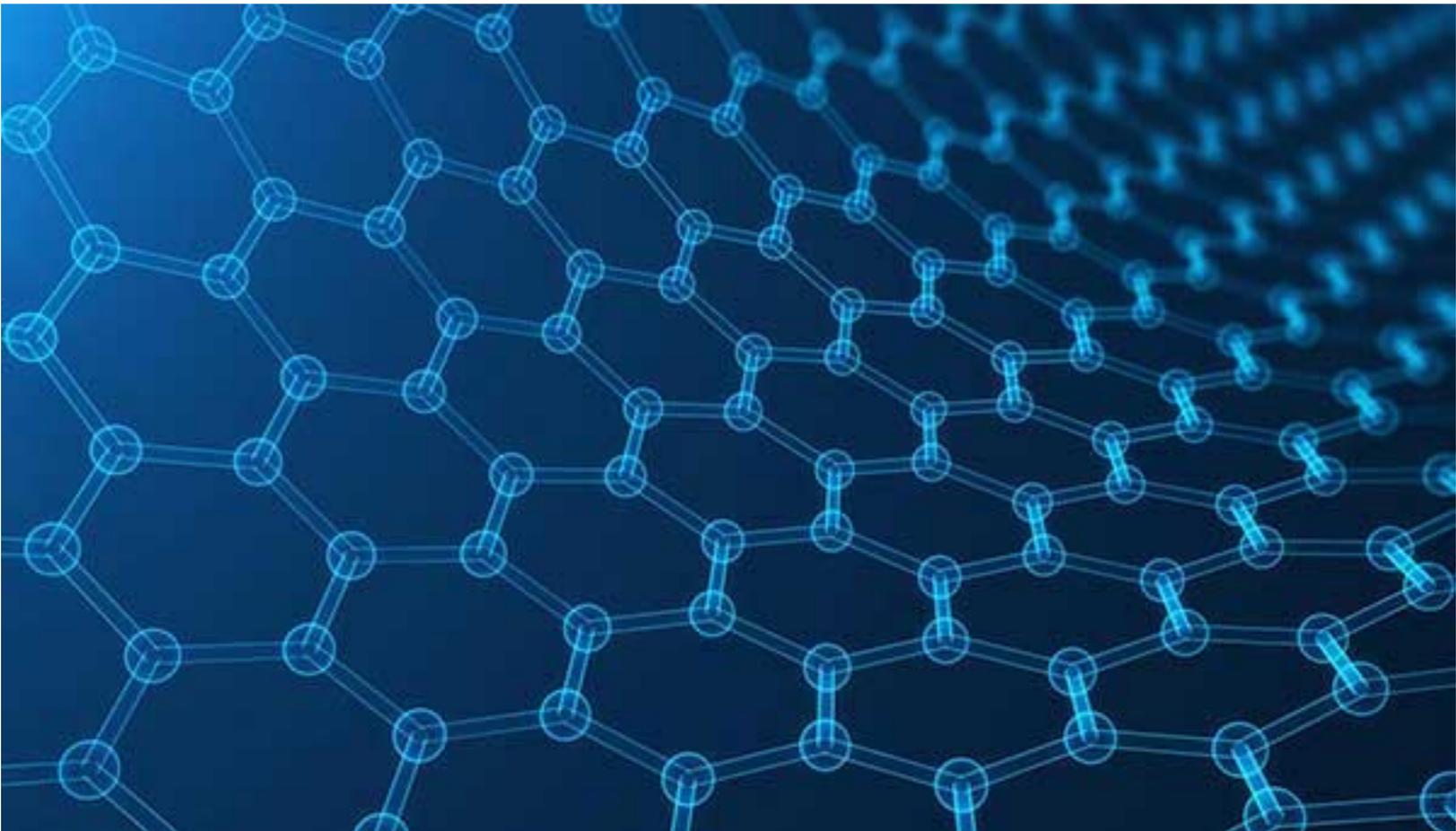
companies in developing new powder processing products and techniques and optimising existing processes, to ultimately improve productivity.

Looking Back at 2017

From breaking ground at the site of our National Centre for Healthcare Photonics, to producing bioenergy from seaweed, 2017 has been another productive year for CPI. Over the last twelve months we have worked with SMEs, universities, large corporates, and our partners in local and national Government to build innovation infrastructure and enable the translation of ideas and concepts into robust, market ready manufacturing processes.



January



Developing smart filters for self-cleaning coating technology

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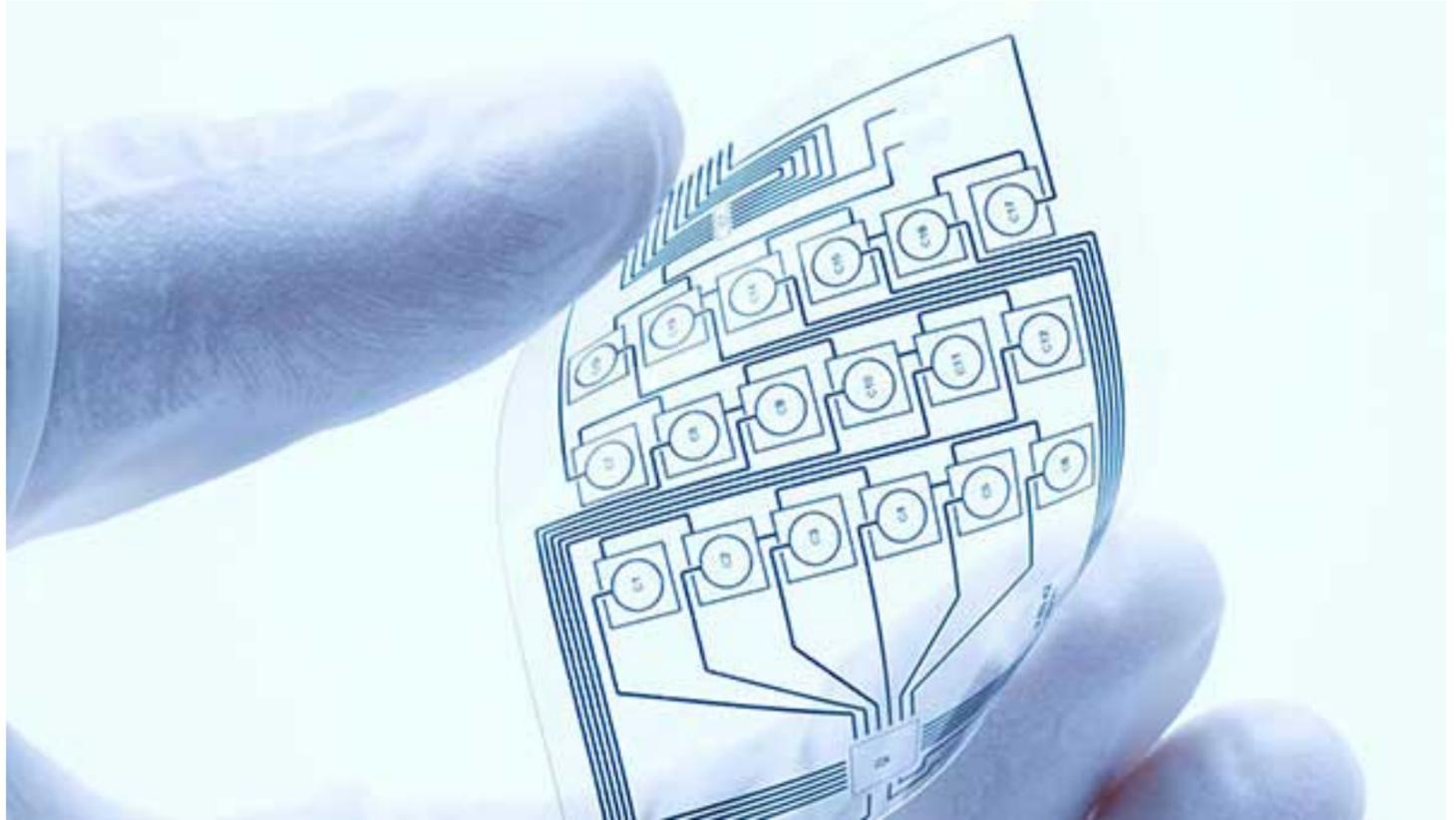
EU funding for formulators announced

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Investment in biotechnology facilities

[Read more](#)



Launch of new facility for Internet Things

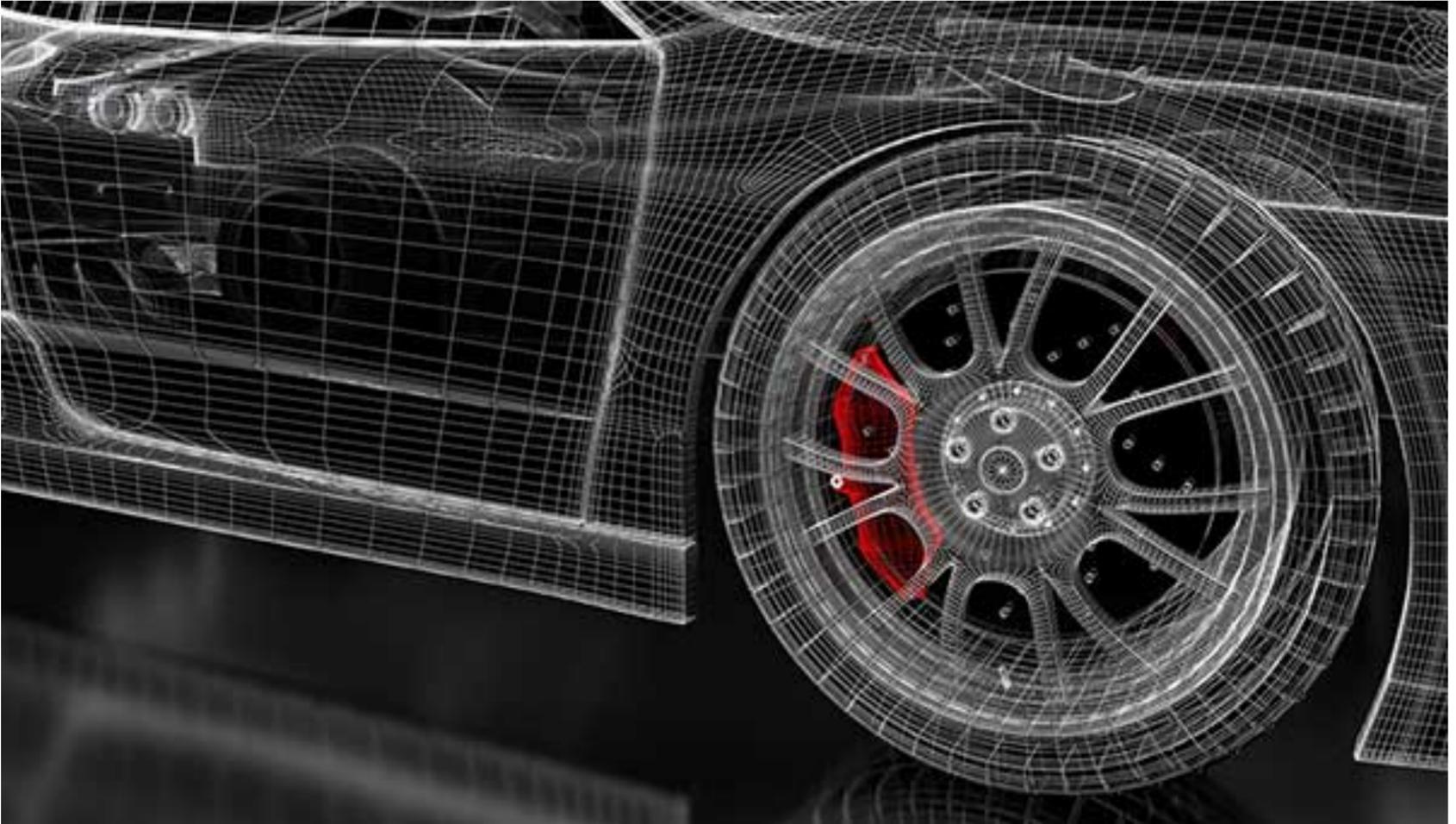
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March



Shedding light on photonics for life science

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Developing intelligent tyres with reduced environmental impact

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May



Enabling flexible integrated circuits to be mass marketed

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New project launched to reduce risk for formulators

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CPI hosts the Knowledge Centre for Materials Chemistry

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Harvesting farmed seaweed to be used as feedstock

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Support for flexible displays

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Collaboration to improve downstream processing

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August



Consortium to develop automated continuous purification

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Novel low-cost conductive coatings for PEM fuel cells

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CPI appoints Jennie Younger as new Non-Executive Chairman

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October



New project brings smart packaging capability

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November



Nanopharmaceutical pilot line

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CPI, Calysta and Otto Simon win IChemE Award

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Formulated liquid product facility

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Collaboration to optimise particulate products

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National Centre for Healthcare Photonics breaks ground

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Looking to The Future

I was honoured to be appointed as Chairman of the Board of CPI in 2017, at such an important time for the company and its future direction.



CPI is committed to developing the UK's innovation capacity, technical capability and know-how within the most significant, high-value technology areas.

Jennie Younger
Non-Executive Chairman

I am delighted to be part of an organisation that plays a significant role in the UK's manufacturing success. With strong, proud roots in the North East of the UK, CPI is helping this nation to become the go-to destination for the development of new science and technology. CPI is committed to developing the UK's innovation capacity, technical capability and know-how within the most significant, high-value technology areas.

I am excited to build on the fantastic work achieved by CPI's previous Chairman, Bob Coxon, the Board and the Management Team over the last 14 years. CPI is an invaluable and reliable partner for small businesses, universities and large corporates, providing crucial access to innovation facilities and expertise. Since it was established, CPI has developed an outstanding reputation and track record for delivering value through driving innovation and improving the UK's manufacturing productivity. This is a strong foundation on which to build our future strategic intent to establish CPI as a world leader in every technology that we offer.

Fundamental to the UK Government's recently published Industrial Strategy is the importance of harnessing the long term value of innovation. It is encouraging that the Government recognises that the Catapults are an important part of the UK's innovation ecosystem and that the High-Value Manufacturing Catapult is a particular success story, supporting thousands of businesses every year to bring new technology to market. CPI makes a significant contribution to that success.

As we move into 2018, I am confident that we can build on the significant growth shown by CPI last year. Key to this will be the opening of the National Formulation and Photonics Centres, and our continued activities within healthcare. Just as important, we are looking to grow the capability of CPI through our people, who continually characterise CPI as the preferred partner for process innovation. Every individual at CPI is crucial to all that we do, truly supporting every project to success.

A handwritten signature in black ink that reads "Jennie Younger". The signature is written in a cursive, flowing style.

Jennie Younger

Non-Executive Chairman