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CONFERENCE REPORT

A vision for life sciences in Scotland

Accelerating growth, driving innovation

Picture: University of Glasgow

Collaboration holds key

The Scotsman's conference examined the best ways to achieve the Scottish sector's ambitious strategy of

CONFERENCE REPORTS: **DAVID LEE**
PICTURES: **JOHN DEVLIN**

Scotland must capitalise on the "truly unique" relationship between the private, public and academic sectors to take the life sciences industry on to the global stage and deliver its £8 billion turnover target by 2025.

Dave Tudor, joint chair of the Life Sciences Scotland Industry Leadership Group (ILG), delivered a call to action at a Scotsman Conference attended by more than 150 delegates.

"I get to work in lots of countries with life sciences industries and what we have in Scotland is truly unique," said Tudor, vice-president of manufacturing strategy for GSK.

"I do not see that level of collaboration between the private sector, academia and public bodies in any other country. You have an ability to wrap your arms around Scotland."

Professor Sir Jim McDonald, principal and vice-chancellor of Strathclyde University, said Scotland had to take full advantage of this "triple helix" to sell itself around the world as a location of choice for life sciences businesses.

Opening the conference at Strathclyde's Technology & Innovation Centre, McDonald said his institution had created a successful innovation hub, with a significant focus on life sciences.

This included the Industrial Biotechnology Innovation Centre (IBioIC) and CMAC, the Centre for Continuous Manufacturing and Advanced Crystallisation.

"There are strong messages here about co-location and intense collaboration; that all starts with people working with people," said McDonald. "Collaboration is easy to say but difficult to do at times."

McDonald said CMAC had been a high-risk proposition but all the main drug companies, including GSK, AstraZeneca and Pfizer, were now collaborating on pre-competitive research to help the sector as a whole.

The conference was held at Strathclyde University and among the speakers were Dave Tudor, main left, Paul Wheelhouse, centre, and Jim McDonald.

"Collaboration has to be about sharing trust and confidence. It's a shared vision – a nexus of public, private and academic commitment. We have high ambitions and capturing the moment is key."

Tudor said all areas of life sciences were growing as the sector targeted the £8bn turnover by 2025: "From 2010 to 2014, we have had very good growth in turnover and GVA – competitive with any other country with a strong life sciences sector.

"So is doubling the size of the sector [from the latest figure of £4.2bn in 2014 to £8bn by 2025] pie in the sky? No.

"We have set a very ambitious goal for all sub-sectors within the life sciences industry in Scotland; we don't want anybody to stand still.

"If we carry on at 5 to 6 per cent growth, which we are delivering at the moment, we get to around £6.8bn by 2025, so we need an extra push.

"If we can increase the annual growth rate to 7 to 8 per cent, we can do it."

Tudor said the key to meeting the growth target was delivering more commercial output from the innovations coming out of Scotland's life sciences community.

He said: "Just £1bn of the £4.2bn sector turnover comes from manufacturing, so £3.2bn comes from the front end; R&D, pharma services and start-ups.

"Our ability to create innovation and intellectual property is world-class, but we need to get better at converting that to long-term value.

"In other countries, life sciences manufacturing contributions are much larger.

"That's a big opportunity in Scotland; we need to look at that ratio and improve.

"We have world-class centres – CMAC, Stratified Medicine Scotland at Queen Elizabeth Hospital in Glasgow, the Drug Discovery Unit at Dundee, Edinburgh BioQuarter.

"In time, they will return value; lots are still in their infancy, but they will bring growth through."

Tudor said the overall tax system in the UK and Scotland was positive for life sciences to flourish: "The fiscal situation is as good as anywhere in the world with the introduction of the patent box.

"I look at systems around the world and we are as competitive as anywhere."

He urged Scotland not to be introverted and to move outside "this small bubble".

"Standards are getting higher globally and regulation is getting tougher," said Tudor.

"We shouldn't be worried by that because Scotland has a great

AN INDUSTRY'S DRIVE

Linda Hanna described the contributions to the conference as "incredibly inspiring" – and challenged everyone in the life sciences community to play a part in driving the industry forward.

In a summary of the day, the Scottish Enterprise director of strategy and sectors, praised the strong industry leadership and said: "This needs to be driven by the industry, for the industry – because it's their future."

She identified action as the big theme of the day and said it was clear the triple helix of the NHS, academia and the private sector had a big part to play in Scotland's life sciences future.

But she also stressed there had to be room for constructive challenge to the future direction being mapped out by sector leaders – within the umbrella of a Scotland-wide collaboration: "A Scottish cluster is much greater than the sum of its parts – but let's be clear what it stands for.

"Scotland can be a world leader in life sciences and I hope we can take the actions to move forward."

She challenged delegates: "What investment will you make - and what about those who are not in the room? What can they do?"

Hanna urged anyone who wants to contribute in any way to visit new website www.lifesciencesscotland.com or to email ILG@scotent.co.uk go to Twitter @LifeSciScot

WORLD CLASS AMBITIONS

Dave Tudor said there were five big actions to make Scotland a world leader in life sciences.

- Setting the ambition for the sector.
- Innovating for the good of society.
- Balancing process innovation and technology innovation more effectively in an integrated plan.
- Recognising the journey is evolution, not revolution.
- Learning new skills and taking more risks on technology, partnerships and infrastructure.

to life sciences growth

delivering turnover of £8 billion by 2025

A NEED FOR CLARITY

Paul Wheelhouse said he was confident the life sciences sector in Scotland was ready to "evolve and react at a very difficult time", which included the uncertainties of Brexit.

Asked about the relocation of the European Medicines Agency (EMA) from London to Amsterdam, he said there was a need for "clarity" in the future relationship: "The UK played a big role in the EMA, but it has no-one but itself to blame for the move to Amsterdam.

"Hopefully, we can establish strong and practical arrangements in a post-Brexit world to ensure we have the capability to test drugs and medical devices."

Dave Tudor said he did not think the UK would seek to create its own regulator: "We are treating human beings and countries in the EU want patients to be treated like they are treated in the UK.

"We should aim to remain a partner with the EMA, not create our own regulator."

Tudor said the uncertainty around Brexit is a challenge.

"We need to accept the situation we are in and move forward. I'm not saying it's easy or I like it and there may be increased costs, but I do not think it's a game-changer for the long-term success of this life science strategy and ambition.

"In ten years, we will look back at Brexit as a blip."

reputation and the ability to deal with higher standards."

Tudor urged Scotland to study global trends and embrace areas such as cell and gene therapy and personalised medicine – and to understand people wanted to pay less: "The industry has to drive better productivity and lower cost of goods. That's the reality. People want value."

He insisted Scotland was in a good place to take advantage of macro global trends if it concentrated on three key words in the strategy: anchor, build, attract.

"We need to anchor what we have got; we don't want existing companies shutting down or leaving Scotland," Tudor stressed.

"We want those companies to build and there are real opportunities to do that. Some of them are only operating in two to three markets but if they are in highly regulated markets, like the United States, and many of them are, they can crack anywhere.

"We also need to attract new companies to come in.

"We are getting many more chaps at the door than for a very long time, saying businesses want to come to Scotland.

"Why? We have an attractive taxation landscape and access to skilled people.

"If you cannot grow the workforce, you will not meet the 2025 ambition.

"We have done a good job on skills so far, but there is lots of hard work still to do."

Tudor said the fundamental game-changer was adopting a Team Scotland approach: "The Life Sciences strategy is based on partnering and successful collaborations – it's not north v south, east v west.

"If we think of Scotland as one cluster, we can win.

"This is not Dave Tudor's strategy or the Industry Leadership Group's strategy, this has to be Scotland's strategy.

"We are hurting the growth of the sector if we do not work together."

Paul Wheelhouse, the business, innovation and energy minister and joint chair of the Life Sciences Scotland ILG, told delegates: "Working together is key to achieving the ambition.

"The vision is shared and constantly evolving to face the challenging times we are in.

"The Scottish Government is willing to adapt its policies to suit the needs of industry.

"It is critically important we have a 'one Scotland' approach to promoting ourselves as an international location.

"We ask a great deal of the members of our ILG and sometimes they are under pressure, but we appreciate and understand the support they give us in policy development – and we want to help Life Sciences Scotland achieve our shared economic aims by working in partnership.

"This is an exciting and thriving growth sector which has a direct impact on the health and well-being of people in Scotland and further afield – and that should not be forgotten," the minister added.

Professor Dame Anna Dominiczak, regius professor of medicine at Glasgow University, said Scotland could lead the world in areas like precision medicine.

She added: "The only way we can be the best in the world is as the whole of Scotland.

"The idea of Scotland plc is inbuilt strongly and the triple helix is our special niche and well-known internationally."

Tudor said genuine partnership working was the only way to deliver the Life Sciences Scotland strategy: "We can build the four pillars around that – improving the sustainability of production, commercialising our innovations much better, getting Scottish companies to look abroad but also making Scotland a location of choice for life sciences businesses – and creating a supportive business environment.

We are in the best position we have been in for a long, long time and we have to seize the opportunity

"We need to focus on those four themes of the strategy and the priorities within each theme and asking what we need to do to achieve them – then work on the execution of that.

"We are in the best position we have been in for a long, long time and we have to seize the opportunity." ■

Gathering good data vital to drive strategy

Data can play a key role in increasing business activity and profitability for life sciences companies, delegates were told.

Alix Mackay, of marketing consultancy We Are Quantify, said collecting and analysing data was necessary to drive business strategy.

She urged businesses who were not collecting data to start now, suggesting that metrics should include lead conversion rates, the number of leads by source, the time taken to a sale, the prospect. The quantifiable measures should also include customer conversion rate and the number of website visits.

"Data will take you into precision marketing and customer data will allow you to target the right kind of intervention to the right kind of customer in the right scenario," she said.

Mackay, who is a member of the Life Sciences Scotland marketing and communications team and has a background in the sector, added: "The new suite of marketing tactics is very complex.

"Data can help you eliminate those tactics and channels which are not working for your customers – and concentrate on those which are effective.

"Over time, the more data you collect, the better – it will be more robust and will help provide you with a predictable revenue model, which connects marketing input to sales revenue.

"It becomes compelling and grows confidence in the business. It also puts you on the front foot in terms of adopting future technology."

Alix Mackay believes the more information you have about your customers, the better.

Mackay said there was "a lot of hype about artificial intelligence (AI) and machine learning.

"Good-quality data allows you not to get caught up in the hype, but to select what is right for your business model.

"AI is only as smart as the data that goes in.

"Use the data to help you meet the customer where they are, and to take them where they want to go," she concluded. ■

Getting pieces in place for scale-up

Funding is one of the challenges that has to be met in the quest for growth, reports **David Lee**

The business environment underpins the life sciences ecosystem – and it has to be right if the industry is to meet its £8 billion turnover target by 2025.

Fundamentally, that meant access to funding and to good people, said Ken Sutherland, president of Toshiba Medical Visualization Systems.

He described the £8bn target as "fantastically challenging", but added: "We have to work at it – the Scottish Government, Scottish Enterprise, the Industry Leadership Group (ILG), all of us.

"We already employ 37,000 people, but we can employ tens of thousands more if we can reach the strategy target."

Sutherland said the five pieces of the business environment jigsaw were: financial support; the talent pipeline; scaleable accommodation; a strong, workable regulatory system; and leadership.

He identified one real funding problem as helping small and medium-sized businesses (SMEs) to scale up operations.

"I want to stop talking about SMEs and talk about scale-ups," he said.

"We need to create momentum and talk about wealth creation – we need to be able to grow big companies.

"It's like a rocket ship – you have to reach escape velocity. Whether it's pharma or medtech, it takes a long time to get to the end product, and you use up a lot of fuel.

"It's relatively easy to get small amounts of money in Scotland, but to get large amounts, you have to go elsewhere.

"Nucana raised $115 million to grow their business here by showing how their business worked in the United States."

Sutherland reflected on Paul Wheelhouse, the minister for business, innovation and energy, telling the conference about the Scottish Government's support for life sciences: "The minister is keen to adjust and adapt policies to suit industry and we should take up that offer."

Wheelhouse recognised the funding gap identified by Sutherland: "We understand the need to create a supportive business environment – to support business growth and ambition and offer more targeted assistance.

"There is a gap in risk capital for innovative and tech-based companies and we are extending the range of equity finance available, as well as advice and support from the Scottish Investment Bank.

"Scottish Enterprise is spending more on supporting R&D. We have to attract investment into our economy and our businesses – and continue to attract people."

In The Scotsman Conference's discussion groups on the business environment, there was a sense of a "disconnect" between life sciences companies and funders and a frustration when funding was refused.

Julia Brown of Scottish Enterprise responded later, saying: "When a grant application is rejected it's not necessarily unreasonable. The quality of propositions could be a bit better."

Scott Johnstone of the Scottish Lifesciences Association agreed the quality could improve and said firms had to be realistic about what investors wanted: "If you want to hold on to your company, you'd better have a really good proposition.

Leading the discussions on the business environment at the conference were main: Julia Brown, left, Anna Dominiczak and Scott Johnstone; and Ken Sutherland, above.

"You can get funding in Scotland, but you need to hit the right targets and refine your message."

Sutherland urged the life sciences sector to embrace the "crazy leaders" who could juggle everything and take risks.

"We need to excite them about life sciences and this journey," he said.

"They need the talent pipeline – it can be hard to grow from five to 25 people, but if you want to grow from 50 to 500, that's an awful lot of new recruits, with a real mix of skills needed."

Sutherland said some life sciences businesses also needed "sophisticated environments" in which to operate and we had to be able to provide those, working with government and private sector developers.

"What will businesses which do not yet exist need as premises?" he asked.

Of the five pieces of the jigsaw,

‘Could do better’ at making innovation pay

Scotland has the building blocks in place to start translating more innovations into commercial successes – but it has to step up to the next level, according to a senior industry leader.

Deborah O’Neil, chief executive of NovaBiotics, said: “Our focus is how can we deliver, by driving growth through collaboration, more commercialised outputs.

“We have a proven track record in Scotland, we are innovation-ready, we have a unified health service and access to world-leading research, as well as great entrepreneurial leaders.”

However, O’Neil admitted, the report card still said “could do better” when it came to the three targets – improving the whole ecosystem, maximising economic growth and creating more companies of scale.

In terms of the ecosystem, O’Neil said: “Scotland was one of the first movers to the triple helix, where health campuses had hospitals, private businesses and academia on the same site.

“None of us are innovating in independent silos. We are ahead of the game in terms of innovating and collaborating but could do better [at communicating that].”

O’Neil is co-chair of the Life Sciences Scotland Industry Leadership Group (ILG) innovation and commercialisation workstream, along with Ricky Verrall, head of the Chief Scientist Office.

She said it was typical of the forward-looking attitude of the ILG that there was one co-chair from the private sector and one from the public sector.

“The mechanisms to collaborate and join are better than we thought, and we do not necessarily need to do more of it, just signpost it better,” O’Neil said. “The Health Innovation Partnership (HIP) is a star performer and we need to build on that.”

Dave Tudor, joint chair of the ILG, also praised the HIP, a partnership between trade body the Scottish Lifesciences Association and NHS Scotland, as “a brilliant creation” which had already delivered 174 collaborations between industry and the NHS.

“We have a great relationship with the NHS through the HIP,” said Tudor. “If we can use NHS as a test-bed as real world evidence, wouldn’t that make a big difference?”

In terms of creating companies of scale, O’Neil was clear: “We do not want Scotland to become an intellectual property (IP) factory. Internationalisation is essential but that does not necessarily mean taking the ideas elsewhere.”

How do we get people to say that Scotland is a fantastic and sustainable life sciences cluster?

O’Neil said one key objective was ensuring serial entrepreneurs stayed in Scotland: “We have real talent here, but how do we develop it further and get people to say that Scotland is a fantastic and sustainable life sciences cluster, where entrepreneurs want to be and want to lead?

“It’s about attracting, retaining and developing those leaders, not just in the private sector but also in the NHS and academia. It is these entrepreneurial leaders who will drive growth.” In his keynote speech, Tudor said that Scotland needed to convert just 20 per cent of our innovative ideas into commercial reality to make the difference needed to move towards the £8 billion 2025 target. He praised the Industrial Biotechnology Innovation Centre (IBioIC) and said: “It has 40-plus projects looking at creating enzymes and organisms. That’s game-changing stuff.”

However, the discussion groups on innovation and commercialisation questioned whether the triple helix was as strong as some of the speakers suggested.

A number of contributors thought there was still a way to go to develop a truly Team Scotland approach.

Dr Julie Brady, of Dundee University’s Drug Discovery Unit, said: “Funding is squeezed and sometimes it is hard to take an innovation on to the next level – because sometimes, the focus is your next research grant application.”

Richard Gibbs of patent attorney Marks & Clerk, who chaired the innovation discussion groups, said: “Industry and academia are not always talking and collaborating because the big thing in the middle is IP.”

However, Kirsty Black of Marine Biopolymers, a micro-business employing four people, said her company had entered into shared IP arrangements. ■

ACTIONS FOR COMMERCIAL SUCCESS

- Focus on the scale-up funding gap and examine the apparent disconnect between what companies are trying to achieve and what funders think they are funding.
- Look at extending the 18-month funding round, which is not enough to take companies through to manufacture.
- Bring together all sources of advice and support and signpost clearly to the industry where to find this information.
- Examine whether IP costs could be re-balanced and not all be payable at an early stage when a new company is hard-pressed for money.

MAKE SPACE FOR GROWTH

- Promote access for SMEs to a single location listing all available sources of grant funding and ensure this is well-signposted and communicated to the industry. Consider whether more public sector support is needed to help SMEs navigate this complex landscape.
- Consider a series of roadshows, at home and abroad, to reinforce the positive business environment for life sciences in Scotland.
- Look at creating a place for SMEs, especially micro-businesses, to register if they want to collaborate on grant funding submissions.
- Discuss with Scottish Government whether more funding is needed to support more expensive aspects of academic courses to support the life sciences industry, such as laboratory skills.

Sutherland said: “Good leaders are the most important part.”

Clive Badman, head of pre-competitive collaboration at GSK and industrial chairman of CMAC, said the ILG was working hard to deliver the next generation of leaders through its focused programme, while academics were confident the universities will deliver strong future leaders in partnership with industry.

Professor Sir Jim McDonald, principal and vice chancellor of Strathclyde University, said: “We have worked with GSK on our PhD programme and we are delivering a tsunami of intellectual power.”

Professor Dame Anna Dominiczak, regius professor of medicine at Glasgow University said: “We have plenty of leaders coming out of our university and understand the value of strong links with life sciences companies.

“It’s very powerful if students hear from someone in industry early in their course and get an idea of what the future holds.”

Dave Tudor, joint chair of the Life Sciences Scotland ILG, said the group would continue to look hard at mentoring: “There is certainly a lack of critical mass of manufacturing leaders in life sciences. However, while mentoring is easy to talk about, it can be very difficult to deliver.

“It requires commitment from both the experienced and the inexperienced person.”

Johnstone said universities were making good progress in delivering regulatory skills to students, but he sympathised with the challenge of delivering lab skills for technical jobs in the sector, which could be costly compared to other courses.

Sutherland said industry had to work very closely with education providers to ensure they got the people they needed in future.

“We have to take the Skills Investment Plan [which was developed by Skills Development Scotland, working with the ILG and the wider life sciences industry] out to colleges and universities and say that we stand behind that – and say: ‘Make me people like that and if they are any good, I will employ them’.”

He concluded with an upbeat message on the business environment: “I think Scotland is the best place to live and work in the world and I want it to have the best business environment in the world. We can deliver that.” ■

Deborah O’Neil told the conference Scotland was ‘innovation ready’ but there was still room for improvement in translating this into commercial success.

Sector can put Scotland on world map

Working together a key to international progress. **David Lee** reports

Life science is a global business, offering great opportunities for Scottish companies to sell their products abroad and for Scotland to position itself as a location of choice for companies around the world.

The Scotsman's life sciences conference in Glasgow heard about the sector's massive opportunities.

The pharma industry alone is a $1.3 trillion global sector, with two markets growing in parallel – a mass market for more affordable healthcare products and an increasing demand for more advanced products by the wealthier population.

Dave Scott, of Tepnel Pharma Services, said the job of life sciences businesses was "to improve healthcare outcomes on a global scale".

He added: "You have to go to the end; what does a customer want?"

Scott said he wanted businesses to attack world markets from a base in Scotland – and he hoped more small companies would not just aspire to be bought out by a bigger firm if they were successful.

"I hate exit strategies. I like re-investment strategies, which grow corporations with brass plaques in Scotland.

"That's what internationalisation is about," said Scott.

"To do that, we need to understand better what we have here – to share the good news about what we are doing.

"I want us to grow the pie so everyone can have a bigger piece."

We need to understand better what we have here – to share the good news about what we are doing

Scott argued that you couldn't be truly successful on a global stage without clocking up the air miles: "People buy from people; you have to get out into the international market to customers and to patients, to those who will buy your products and services.

"That's how you learn what the demand is and how you learn what is needed."

He called on life sciences businesses to draw inspiration from the Scottish entrepreneurs of the past and follow "the path of disruptive advancement".

Scott added: "I feel a weight of responsibility because of what has happened in the past.

"We all need to don the metaphorical Scottish jersey, by linking to Life Sciences Scotland from our website, by talking up what we have here.

"We all need to point in the same direction, to work in unison to deliver the strategy.

"I feel very privileged to have travelled the world and everywhere I go, I meet a Scottish person.

"Our people are one of our greatest exports and everywhere we go, they can open doors for us. Talk to them, understand who they are."

Scott said the Scottish Lifesciences Association (SLA) was doing great work in opening up a pipeline of opportunity in Kentucky in the United States and urged companies to "get stuck into their [the SLA's] special interest groups, learn from other companies, share experiences, promote life sciences through all your channels, encourage and motivate each other.

"We really are all in this together."

Scott said the international workstream of the Life Sciences Scotland Industry Leadership Group (ILG) was working on 90-day plans, aiming to help six companies

Dave Scott, main, believes Scottish life science firms can be successful on an international stage.

GLOBAL AMBITIONS

- Leverage Scotland's unique selling-point – the triple helix – to create a strong Team Scotland brand for life sciences across the world.
- Strengthen networks within the life sciences community and take advantage of shared expertise to move into new markets. Leverage contacts on the ground, within new target markets and in Scotland. Expand visibility of Global Scots, create a collaboration hub and look at international mentoring.
- Create a "playbook", a repository of information for companies looking to export – what has happened before, what support is there and examples of good practice.

go into new exports markets outside the UK in each period.

During the panel discussion at the end of the conference, Dave Tudor, the ILG co-chair, was asked if we had to do absolutely everything in Scotland.

"The idea of a one-stop supply chain in Scotland is great, but it's not always practical," he said.

"You have to be ready to look at partnering."

Scott Johnstone, chief executive of the SLA, who has worked in recent months with comparable life sciences clusters in Indiana as well as Kentucky, agreed.

He said we had to be realistic about selling Scotland abroad and ensure when doing so that we had a strong proposition.

Asked how foreign companies might respond to an approach about locating in Scotland, Johnstone said: "They would probably say 'Where is it?'

"The Scotland thing can get you so far but it all comes back to fine-tuning your pitch.

"Whether we partner up with Glasgow or with Peru, it's about lining up with global healthcare – because there are a lot of problems to solve."

Tudor said if companies could succeed in the US, they could probably succeed anywhere – and there were opportunities to move into huge growth markets in countries such as Brazil, China and Indonesia.

Professor Dame Anna Dominiczak, regius professor of medicine at Glasgow University, said Scotland had the opportunity to be a global leader in some areas, but must choose wisely.

She said: "We can be the best in the world at precision medicine, but we cannot be the best in the world at everything. We need to select a few things." ■

A need to find formula for cost-effective drugs

Scotland is making progress towards higher-quality and more cost-effective sustainable production thanks to collaboration across industry and with academia – but there are far more opportunities to grasp.

Clive Badman, who works with both GSK and Strathclyde University, said the NHS spent £15 billion annually on drugs in the UK.

"There is definitely stuff we can do to reduce costs," he told delegates.

"The process from primary to secondary manufacturing [of new drugs] takes 12 to 24 months. That's an enormously lengthy supply chain.

"Also, we are not good enough at getting it right first time. We are operating at about 60,000 errors per million. That's a lot of waste and a lot of extra work and cost because the product that goes out to patients has to be perfect."

At the same time, said Badman, a growing and ageing world population wanted more affordable healthcare products: "We all want to pay less; I want to pay less. How do we do that?"

Badman said the answer involved leadership, commercialising research, bringing parts of the supply chain which had gone abroad back to Scotland – and scaling up some of the work already happening.

SUSTAINING THE FUTURE

- Build leadership capacity early, working with schools and universities and using mentors and role models, as well as peer-to-peer networks. Examine how to encourage risk-taking behaviour.
- Rebuild the supply chain and examine the digital and technological opportunities more effectively – to help make the supply simpler and more efficient.
- Communicate what is available to smaller companies more effectively in terms of tax reliefs, and examine whether more small-scale manufacturing facilities are needed for SMEs.

"We need new technology and new ways of working to get things much more quickly to patients," said Badman.

"It's too big for one company to do on their own. Large drugs companies were spending £100 million-plus each trying to shorten the supply chain, but they were working in silos and having similar problems."

The initial answer, in Scotland, was the creation of CMAC (Continuous Manufacturing and Advanced Crystallisation) at Strathclyde University – a collaboration between eight large pharma companies.

Pfizer has just become the eighth member, joining GSK, AstraZeneca, Novartis, Bayer, Lilly, Takeda and Roche.

Badman outlined the advantages of continuous manufacturing against old-style batch manufacturing – cost reductions of around 50 per cent, up to 90 per cent less space required, 95 per cent less water and a 50 per cent reduction in carbon footprint, with significant overall benefits in terms of time and cost.

Strathclyde University saw the potential for this pre-competitive manufacturing centre, and the £50m CMAC programme, from 2017-2023, is designed to do four main things – to provide industry-leading research, develop crucial skills for the future, deliver important infrastructure and translate to industry.

It was already having a real impact on the industry, with exciting new products emerging into the market, Badman said.

He also highlighted ReMediES (RE-configuring MEDIcines, End-to-end Supply), a clinical and commercial platform to accelerate the translation of promising research into commercial adoption in small molecule pharmaceutical manufacturing.

"It's been enormously successful. It has created and sustained a lot of jobs, but more importantly, it has created a lot of opportunity," said Badman.

"We are very poor at using new technology in the life sciences and chemicals industries – but we are now looking at robotics to prepare and dispense drugs which can

Clive Badman believes we are not always getting it right first time.

reduce the process from up to six 6 months to less than a week, as well as delivering significant cost savings."

Badman said a ReMediES 2 project is on the way, with a much greater focus on digital manufacturing, using diagnostics and devices.

"I think in my lifetime, patients will go to the doctor, who will use a diagnostic tool to prescribe a specific medicine – and ask you to join a compliance regime about how to take the drug and ask you to send information via your phone about what is happening.

"It's a much more targeted treatment, not just about coming back in a week. It should reduce visits to doctors and hospitals, and reduce cost."

Badman said a real game changer could be a proposal for a medicine manufacturing innovation centre in Scotland.

Funding bids are with Innovate UK and Scottish Enterprise to create a place to "test products, reduce risks, shorten times and improve quality".

He added: "More importantly, I see it as the beginning of a science park. IBioIC want to co-locate an enzymes facility and I think we will see technology suppliers and end users wanting to come."

Badman concluded with a call to action for young leaders in life sciences to join the industry leadership master class programme: "Technology is great, but if you do not have good leaders, you will not make the progress you need." ■

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