BioPharma Ambition 2020

An All-Island Event

Connect | Influence | Innovate | Inspire

Tomorrow's Cures

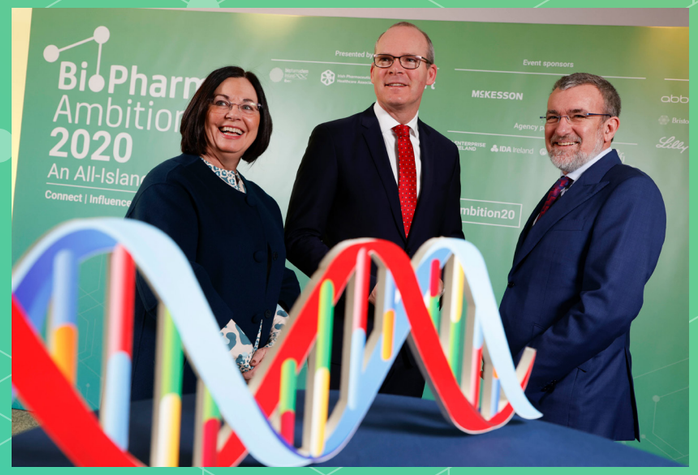
Conference Summary

Presented by

biopharmachem Ireland Ibec

Irish Pharmaceutical Healthcare Association

nibrt



Patricia Quane, President, BPCI, An Tánaiste and Minister for Foreign Affairs and Trade, Simon Coveney TD, Aidan Lynch, President, IPHA

Delegates at the plenary session at the Printworks, Dublin Castle

BioPharma Ambition 2020

March 2020

On March 3rd and 4th, BioPharma Ambition drew some 400 delegates to Dublin to explore the themes defining biopharmaceutical innovation right across the medicines lifecycle. The event was held just as COVID-19, later a global pandemic, began to dominate the news agenda and prompt policymakers to consider their response. The event was held before restrictions were announced. The disease, on which biopharmaceutical innovators globally are working to find vaccines and treatments, was the backdrop to BioPharma Ambition 2020. It brought into sharp focus the purpose of medicines innovation - our shared journey in discovering, developing and making available quickly the best medicines to stop sometimes deadly diseases.

BioPharma Ambition 2020 was the third time the Irish Pharmaceutical Healthcare Association (IPHA), BioPharmaChem Ireland (BPCI) and the National Institute for Bioprocessing Research and Training (NIBRT) came together to create a thought-leadership platform for biopharmaceutical innovation. The aim was to position Ireland at the nexus of globally networked innovation. It was a whole-of-industry event, drawing on experts' perspectives to share an exciting story of medicines discovery, development, manufacture and adoption.

The format for BioPharma Ambition 2020 was a blend of workshops, keynotes and moderated panels covering next-generation therapies, factory 4.0, tax, data and connected health, and the policy environment for a thriving biopharmaceutical industry. The event explored how industry and the State could work together on a shared operating environment for biopharmaceutical innovation and investments. Like in other countries, Ireland needs closer collaboration between industry, policy, clinical, research and patient leaders to yield the dividend of better healthcare outcomes and economic performance.

BioPharma Ambition is not an event in itself but rather part of a series of initiatives aimed at telling a better, more holistic story for Ireland's biopharmaceutical industry and engaging the State in a broader, deeper conversation about the future for medicines innovation right across the lifecycle. For BioPharma 2020, we created a pre-read for delegates. It contained recommendations for joint industry-government action for the future of biopharmaceutical innovation, as well as an independent analysis of Ireland's strengths, weaknesses, opportunities and threats.

Ireland has potential in emerging areas like next-generation therapies, Industry 4.0, immunotherapies and genomics. With the right collaboration between industry and government, we can catch this new wave of biopharmaceutical innovation while sustaining the significant progress we have made in capturing investments in small and large-molecule medicines manufacturing.

We would like to sincerely thank our sponsors for helping us to make this event happen: commercial partners PwC and McKesson; agency partners IDA Ireland, Enterprise Ireland, Science Foundation Ireland and InterTrade Ireland; and the many biopharmaceutical company patrons whose support and help is deeply appreciated. A special thanks to the Department of Business, Enterprise and Innovation for their input and support over many months of planning the event and situating the industry in the public policy context.

We hope you find this summary of BioPharma 2020 insightful. We invite you to get in touch with us with your ideas so that, together, we can take forward the cause of biopharmaceutical innovation for the benefit of society and the economy.

Matt Moran, Director, BioPharmaChem Ireland
Oliver O'Connor, CEO, Irish Pharmaceutical Healthcare Association
Dominic Carolan, CEO, National Institute for Bioprocessing Research and Training

Introduction

As we tackle the global COVID-19 pandemic, the research-based biopharmaceutical industry has a crucial role. In science, manufacturing and the supply chain, and through partnership work with the government, hospitals and charities, the industry in Ireland is making a difference. Globally, we are making progress in the search for a vaccines and treatments, reaching into our libraries to establish what can be medically applied to fight the virus, and intensifying research collaborations with partners across industry and academia. The conference heard that by working together the disease can be stopped in its tracks.

Ireland has a large biopharmaceutical manufacturing presence relative to other sectors and to other similar-sized countries. The industry is responsible for over 45,000 jobs and accounts for 62% of the country's exports. Its presence is regionally distributed.

This cannot be taken for granted.
The biopharmaceutical industry is not static and now is not a time for complacency. Product life cycles, industry consolidation patterns, the draw of emerging markets, skills readiness and slow speeds of adoption of new medicines in the health services are creating headwinds that could decelerate the pace at which the industry scales into the future in Ireland.

In December, the biopharmaceutical industry, in partnership with the government, organised the 'BioPharma Ambition Policy Forum'. The event, 'Preparing Now For The Future of Medicines Innovation and Investments', was aimed at gathering expert perspectives on the future for medicines innovation and investments. It was supported by the Department of Business, Enterprise and Innovation under the banner of 'Future Jobs Ireland', the government's enterprise agenda.

The event drew about 60 leaders in industry, policymaking, research, academia, clinical care and patient advocacy. As part of our preparations for the Policy Forum, the partners behind BioPharma Ambition 2020, IPHA, BPCI and NIBRT, commissioned an independent analysis of the biopharmaceutical industry in Ireland from PwC. This identified the strengths, weaknesses, opportunities and threats facing the industry.

It is clear that the exponential growth of Advanced Therapy Medicinal Products (ATMPs), including cell and gene therapies (CGTs), hold clinical and economic potential for Ireland. But the future for biopharmaceuticals in Ireland should not be a binary choice between continuous improvement in small and large-molecule medicines and the development of ATMPs. The opportunity is in both.

As sectors like technology, medical technology and biopharmaceuticals converge, similarly the gap between industry, policy, research and clinical leaders is narrowing. Planning is essential. We must focus on driving innovation, connecting and aligning key players across sectors, and work on enhancing Ireland's reputation for life sciences and competitiveness proposition.

Future-proofing the industry

The need for speed

Ours is a global success story. The number of biopharmaceutical manufacturing sites has grown from three in 2003 to 22 in 2019. We are known for complex biological medicines manufacturing. Biopharmaceuticals account for 62% of Ireland's goods exports. We need to perform much better in areas like access to medicines, and in research and discovery. We must harness the new wave of biopharmaceutical innovation breaking around the world. Genomics, CGTs, artificial intelligence, big data – these areas and more will define the new era of medicines. It is up to us to make it happen for Ireland. But we need to move fast.

Dominic Carolan, CEO of NIBRT, attributed Ireland's achievements to a range of success factors he called "the four Ts" – taxation, talent, track record and technology.

He noted that our track record has been "hard won" – Ireland's security of medicines supply and reputation for manufacturing excellence are key factors in global investment decision-making.

All of this is underpinned by a strong supportive ecosystem of engineering, construction and consulting. Emerging supportive research will play a key role in the years ahead.

Ireland should strive to position for equivalent success with CGT, he said. Preparedness is key. "Ireland is in a unique position to capitalise on the move to CGT," said Carolan.

Our success in capturing foreign direct investment in biopharmaceuticals so far is down to strong public policy planning. We positioned ourselves well for small and large-molecule manufacturing investments, he said. The engineering and biotechnology courses already established in higher education institutions will help prompt progress in CGT production and adoption.

Nonetheless, the demands of Iindustry 4.0 will see a 60% increase in demand for skilled employees and the concern is that Ireland risks underinvesting in the key areas required to provide the biopharmaceutical workforce of the future. Globally, 70 sites are being benchmarked in preparation for CTG manufacturing. Ireland has just one - Takeda at Grange Castle, Dublin.

A multi-stakeholder approach to this is key, and to this end, the CGT Forum was established. Bringing together stakeholders from government, industry, academia and regulation, the forum has met several times since its establishment in December 2018. Last year, it produced a White Paper which articulates the actions required.

Training and education activities are the cornerstone of the strategy. But while there are some higher education courses and training programmes offered or planned, this needs to be accelerated, Carolan warned.

In his inspiring speech at the conference, **the Tánaiste and Minister for Foreign Affairs the Tánaiste and Minister for Foreign Affairs, Simon Coveney TD**, said skills and talent will be a challenge for the industry. Ireland faces stiff international competition for investments, he said.

And while Ireland can plan for some eventualities, some are out of our hands. The top 10 biopharmaceutical companies have increasingly used M&A to maintain their position. That pattern is likely to continue, meaning Ireland remains exposed to consolidation in the industry.

Meaningful collaboration will require a clear strategy for Ireland and a governance model. This must be signed up to by all stakeholders. It must have an implementation plan. The existing base must be protected while securing fresh investments in new areas.

An Tánaiste and Minister for Foreign Affairs and Trade, Simon Coveney TD

Collaboration, collaboration, collaboration

Cross-discipline, cross-border, cross-sector partnerships necessary to drive biopharma innovation

Speakers extolled the benefits of partnership. The biopharmaceutical industry has an opportunity now to explore cross-sector collaborations, engage local innovative partners and identify and build new competencies.

Professor Mark Lawler, Associate Pro-Vice-Chancellor and Professor of Digital Health in the Faculty of Medicine, Health and Life Sciences, Queen's University Belfast, said collaboration can help unlock the power of innovation.

"For me, the theme of this conference is partnership and how we can work together to be better than the sum of our parts." New ways of thinking are needed so that discovery science continues but it is translated into diagnostics, prognostics and therapeutics, he said.

Different skillsets are needed to answer the grand challenges that society faces. Lawler works with a theologian, teasing out some of the ethical issues that clinical trials can often present.

In the two decades since its inception, the All-Ireland Cancer Consortium has doubled collaborative cancer research, with 35,000 patients taking part in cancer clinical trials. It delivered significant additionality on the island of Ireland, promoting transnational cooperation, enhancing cancer research activity and underpinning improved cancer services and better cancer outcomes.

Mark Lawler, Associate Pro-Vice-Chancellor and Professor of Digital Health in the Faculty of Medicine, Health and Life Sciences, Queen's University Belfast

"Small countries can do big things."

Professor Mark Lawler, Queen's University Belfast

"Cancer does not respect political borders so why should we? We need to compete, not against each other but against our common enemy, cancer." Professor Lawler issued a call to action for a data-enabled, all-Island cancer institute - something that "everyone in the room could contribute to and also be proud of". This strategic partnership approach means that we can continue to punch above our weight globally. "Small countries can do big things."

Collaboration, whether cross-sectoral, cross-discipline or cross-border, will ensure the promise of biopharmaceutical research is realised. The Tánaiste emphasised the all-island nature of the conference, calling it emblematic of "a shared ambition in terms of where this industry is going", both North and South.

The future for the biopharmaceutical sector is collaboration, **Gary Hartnett, General Manager, Janssen Ireland Supply Chain,** told the conference.

"We must focus on speeding access to new medicines, enhancing the clinical trials landscape and developing skills," he said. Janssen collaborates with external partners along every part of its value chain, from R&D right through to market access.

"We are open to medical breakthroughs wherever they occur, whether it's in a university, a research centre, a small biotech or a large pharma company. We consider ourselves a partner, a participant and an accelerator in this complex ecosystem."

The Hon. James C. Greenwood, President and CEO of BIO, described Ireland as an island at the centre of the biopharmaceutical world. Virtually every country can find a niche in today's global biotechnology industry, he said. Building a strong biotechnology sector is a strategic priority for many global economies. But that doesn't mean innovation should be limited by borders. "Protectionism, nationalism and turning inward simply doesn't work for our global industry. In biotechnology, we simply must be collaborators before we can be competitors," he said.

Inflazome CEO Jeremy Skillington illustrated the benefits of academic-industry collaboration through his story. Founded by immunology research Professor Luke O'Neill of Trinity College Dublin and Professor Matt Cooper of the University of Queensland, so far Inflazome has raised over €57 million for work on NLRP3 inhibitors in a diverse spectrum of inflammatory diseases. Collaboration is a fundamental part of their business. As a small company, Inflazome has outsourced much of its work. That has brought valuable expertise and knowledge, Skillington explained.

James C. Greenwood, President and CEO, BIO

Innovative medicines mean new approaches

Manufacturing needs, Industry 4.0, research – how biopharmaceutical companies are responding

The modality landscape is changing, as the type of products and medicines continues to expand – monoclonal antibodies will be joined by conjugated MAbs, the microbiome, oncolytic viruses, bi-specifics and multi-specifics, among others.

Manufacturing workshop at NIBRT

The nature of many of these products means a different type of supply chain will be required and the logistical challenges this presents will be myriad.

The biggest growth area is ATMPs which encompass cell therapy, gene therapy, gene-edited cell therapy and personalised cancer vaccines. They represent an entirely different paradigm in drug delivery – single-use therapies targeted at often small patient populations, explained **Tom Bannon, Associate Director, Biologics and Advanced Therapies SME, PM Group.**

With more than 1,000 regenerative medicine clinical trials registered, it is no surprise the market is estimated to hit US$24 billion by 2024. Monoclonal antibodies and small molecules are still going to be paying the bills for quite some time but CGT is growing exponentially. Ireland must be attuned to that, Bannon said.

The gene therapy "renaissance" is here, agreed **Shirley O'Dea, Founder and Co-Director of Avectas.** Observed trends in gene therapy are now translating into tangible commercial activity and commercial sponsors are backing most clinical trials. With commercialisation comes challenges, however, and realising the full therapeutic potential for patients will require simplified manufacturing processes and the ability to address solid tumours and allogeneic therapies through new cell engineering technologies.

While much of the market consists of small start-up biopharmaceutical organisations, the major players are increasingly seeking to become active in this space.

The latest data shows that over 600 molecules in the preclinical stage of the pipeline were CGTs. This volume is leading to manufacturing capacity constraints. **Bev Cummings, Account Manager, Life Sciences, at GE Healthcare** warned that projections suggest there will be a CGT capacity shortfall of 500% which could grow to 5,000% in five years' time.

An evolving biopharmaceutical industry means expansion dilemmas and talent crunch realities, said Cummings. Do we have the skills and talents to operate these new processes?

Cummings advocated for biopharmaceutical companies deciding to build rather than buy. One case study illustrated that manufacturing a viral vector in-house rather than outsourcing it to a CMO would cost substantially less. The added benefits of keeping production in-house include flexibility, certain cost predictability and more control of IP.

But choosing to build means choosing to train. Cummings said lack of skilled workers is the second-largest challenge for biopharmaceutical companies. These talent deficits can have far-reaching impacts. One of these is financial, with high employee turnover both inconvenient and costly. Operator errors can result in batch losses which, unlike with traditional therapies, can have a major impact on a patient receiving CGT one-time only.

Industry trends such as enhanced competition, the need for new skillsets, and the time and cost needed to adequately train employees, are propelling hiring difficulties, added Cummings. She sees training as the answer. "Training helps create talent, reduce manufacturing risks and improves retention. Having the right people can prove more critical to success than the right technologies and equipment."

A hallmark of the manufacture of CGTs is the logistical challenge it poses - the isolation and segregation of patients and viral vectors, with its manufacture taking place at the point of care.

"These are personalised cell therapies – the cells used throughout the process aren't a commodity, aren't a raw material. They actually belong to somebody who is currently in hospital and very sick," explained Bannon.

The logistical demands are often underestimated and that is something Ireland must consider if we want to be a major player in this space.

Sebastian Wehle, Head of Stem Cell Manufacturing and Supply, Takeda outlined how building a supply chain for an ATMP with a shelf-life of 48 hours is not impossible but requires ingenuity and agility. An allogeneic stem cell product at room temperature, the 'make-to-order' nature of their stem cell therapy is unique; for starters, there is a seven to 12-week process of conditioning the patient for cell removal.

With more than 150 treatment centres across Europe, the US and Japan, the supply chains will look markedly different, if not unrecognisable, to the standard journey of a product. Wehle explained that the transit of Takeda's therapy generally takes 22 hours. "That's the product ready and released with all documents in place and it hits the clinic 22 hours later." The local airport is critical to fly out the product, but Wehle noted difficulties with Dublin Airport; although it is strong and has the necessary connections, capacity is a problem.

Deciding to proceed in-house helps them build core competencies. Wehle noted that "the knowledge around this process is completely different than somebody who is working in small molecules. If we don't train them here and don't give them the ability to ask the right questions, then we won't get the value from them."

Takeda's facility at Grange Castle, Dublin, is a modular build and essentially involved assembling a complete factory out of individual pre-fabricated facilities. "This is the future – it is highly flexible, you can bespoke your design and bring in your new technology essentially on a flatbed trailer," explained Wehle. He added that Takeda is employing Internet of Things solutions to ensure that procurement of its product is straightforward. "We want the order process to be as easy as buying shoes on Amazon."

Ireland is home to many start-ups that have identified a gap in the emerging CGT market. For example, Avectas' solution, Solupore, is a next-generation delivery system for next-generation therapeutic developers. This addresses a key challenge in cell engineering which is intracellular delivery. While viral transduction plays a pivotal role in therapeutic development and manufacture, the cost and complexity of that means developers are seeking non-viral solutions. The current go-to technologies such as electroporation have inherent challenges with cell viability and functionality at risk of being negatively impacted. Solupore enables the ex-vivo manufacture of gene-modified cell therapy products, essentially allowing successful cell engineering retaining high functionality. Ultimately, that translates to reduced time and cost of manufacture.

Technology as an enabler

Disruptive technologies, data processing

Technology and life sciences are converging. Medicine has moved on from simply offering the right treatment – technological advances will allow us to give individuals access to the right treatment at the right time in the right location, **Jim O'Donoghue, President of S3 Connected Health,** told BioPharma Ambition 2020.

Jim O'Donoghue, President of S3 Connected Health

"The challenge for global healthcare is to ensure better population health, better care and better value." Delivering personalised or precision treatments in an affordable and sustainable way compounds that challenge.

Telehealth and telemedicine are helping to improve access and convenience for patients and the market is forecast to reach US$148 billion by 2025. The COVID-19 pandemic has brought this to the fore as doctors seek to assess patients in the safest way possible.

Digital therapeutics are creating new treatment modalities, with many clinical interventions now delivered digitally. Technology is dealing with that major bugbear – medication adherence. Connected drug delivery devices, such as connected inhalers, can address this problem by transmitting information to clinicians and patients about how and when the drug is taken. Data shows it can increase adherence by as much as 56% and reduce hospitalisations by 50%.

Technology is impacting all aspects of the drug lifecycle - from R&D to clinical development to commercialisation - by accelerating the hit rate and identification of molecules and improving trial efficiency, speed and cost. It can play a significant role in measuring and improving patient outcomes and quality of life. Major biopharmaceutical organisations are beginning to invest heavily in this technology. For example, artificial intelligence is being used in drug discovery by hundreds of start-ups while virtual trials are becoming commonplace.

"The challenge for global healthcare is to ensure better population health, better care and better value."

Jim O'Donoghue, S3 Connected Health

Data-driven approaches can improve outcomes and enhance innovation in cancer. Professor Lawler emphasised the importance of ensuring data access for research and facilitating accelerated data analytics while empowering a citizen-centred data driven ecosystem. The Health Data Research Hub for Cancer in Northern Ireland has patients at the heart

of everything they do. “Our vision is to unlock the power of health data to improve the lives of people affected by cancer.”

Ireland can be a global hub for digital health but we must invest in the necessary accompaniments such as genomics and clinical trials, said O’Donoghue. We have over 100 companies specifically involved in the digital health space.

Digital health offers a unique opportunity for convergence across the biopharmaceutical, technology and medical device sectors. A Digital Health Ecosystem Map is being drawn up which will outline how collaborations in this space can happen. “What we are trying to work towards is the ‘why Ireland?’ story, and I believe we have a great story to tell.”

Putting the patient at the centre

Access, discovery, regulatory pathways, clinical trials

One feature of how the biopharmaceutical industry operates is the centrality of the patient. As an industry, it has become almost wholly patient-centric. **Hannes Toivane, Lead for Strategic Partnerships, Centre of Excellence for Innovation Nordics, Takeda** said the company is just one biopharmaceutical giant ready to go “beyond the pill” by creating value for patients via digitalisation. “We want to know where we can improve the quality of life of the patients. Can we empower the patients?”

Hannes Toivane, Lead for Strategic Partnerships, Centre of Excellence for Innovation Nordics, Takeda

This could involve accelerating time to diagnosis or using artificial intelligence to predict risk but Toivane stressed that the important question is how the patient will benefit.

> **“We want to know where we can improve the quality of life of the patients. Can we empower the patients?”**
>
> *Hannes Toivane, Takeda.*

Takeda’s patient support programme, ‘IBD Predict and Prevent‘, aims to reduce healthcare visits and deliver care based on the individual’s patient needs. The benefits of such an approach are myriad; not only is it more cost-effective, it is more convenient for the patient with fewer routine visits and less travelling. Patients enjoy a better quality of life because the continuous monitoring of their disease allows for early flare triggers. This model ensures that systems can focus on patients with most needs, meaning resources are used more efficiently and patients receive a higher quality of care. It is not just the patient who benefits; HCPs, hospitals and payers benefit from the efficiency and cost savings.

Joan Byrne, VP Parenteral and Combination Products Operations Science and Technology, AbbVie told the conference that the biopharmaceutical industry has no insight into how their products are being used as directed but technology such as wearables can help provide an accurate recording and assessment of the patient experience.

> **“We are a on a journey to enable devices to allow us to understand how the patient actually uses them.”**
>
> *Joan Byrne, AbbVie*

“We are a on a journey to enable devices to allow us to understand how the patient actually uses them. Then, that will provide us with the insight we need to improve the product in the future.”

For example, with AbbVie’s Parkinson’s disease therapy, study insights can be improved through connected health technology in closely monitored controlled populations.

Joan Byrne, VP, Parenteral and Combination Products Operations Science and Technology, AbbVie

Arup K. Roy, Vice-President, BioProduct Research and Development, Eli Lilly told the conference that a number of external pressures are demanding change, including regulatory changes, digital disruption and changing patient behaviour and expectations. Meanwhile the cost of chronic diseases is ballooning, with diabetes alone estimated at US$245 billion each year. This is intensifying competition across most therapeutic areas and, inevitably, leading to heightened price pressure. As a result, valued-based pricing agreements are becoming more common.

Ultimately, this is driving a transition from delivering medicine to enabling patient outcomes, and connected health allows companies to measure that. An example of digital innovation is Lilly’s automated insulin delivery system; it delivers insulin as and when it’s needed. The human factor cannot be forgotten. “Lilly’s digital health strategy is not just about having connected health devices. We need to marry digitally enabled solutions with personalised patient interventions.”

Patient centricity isn’t confined to the industry. **Dr Lorraine Nolan, CEO, HPRA,** highlighted the regulator’s focus on integrating its work across the health system and its commitment to engaging patients, including establishing a patients forum.

Ireland is still not growing clinical trials and that’s something we need to work on. The integration of research into health systems is critical. “We must keep our sights on the fact that a globalised industry calls for a globalised response from regulators… increasing international coordination is a priority,” she said.

Supporting innovation has been a key strategic priority for the HPRA in recent years. It has even established a specific innovation office.

> **“We must keep our sights on the fact that a globalised industry calls for a globalised response from regulators… increasing international coordination is a priority,”**
>
> *Dr Lorraine Nolan, HPRA*

According to Nolan, the real development in the role of regulators is how they are working to enable access so that patients can benefit from these innovations. “The role we play in enabling sustained availability of medicines is as important as that of supporting innovation.”

Joe Keenan, Global Digital Health Solutions Director, Novartis agreed that medicine is being reimagined as data science and digital technology mature. “Connected health is not the future. It’s now, it’s out there.”

The goal is to transform every aspect of Novartis with data and digital technologies. The company has identified strategic priority areas and it is employing external digital expertise to help them where necessary. “We know what we are good at and we know where we need the support.”

In Keenan's own area of ophthalmology, the regulators approved the first algorithm for a non-HCP-assisted diagnosis for diabetic retinopathy in 2017. That "opened the floodgates" but it doesn't mean it automatically becomes part of the treatment pathway, he said.

"Digital health is good for pharma and good for the medical device industry, but if it's not good for the patient, then why would you do it? It is important that we check if the patient actually wants it."

Dr Lorraine Nolan, CEO, HPRA

One area where hundreds of gene therapies are being trialled, with impressive, if not miraculous, outcomes, is that of ocular disease. Jane Farrar, Professor of Genetics at Trinity, outlined the enormous manufacturing and R&D opportunities associated with gene therapy. But she cautioned that this must happen in tandem with appropriate supportive research.

"Ireland should be investing in genomic medicine, sequencing patents and ensuring we have the right patient population to treat when gene therapies finally become available. Big data isn't enough and functional studies are still needed. Ireland needs to invest in this background work."

The future of manufacturing

Humans Vs Machines

What distinguishes Factory 4.0? While Factory 3.0 exploited the arrival of computers and robotics, 4.0 sees a focus on the 'cyber physical' rather than simply computerised control. The Internet of Things, now becoming evident in many aspects of daily life, is moving into the industrial environment. Manufacturing facilities are becoming highly networked, with the transfer of information becoming more important, said **Kieran Sheridan, Director, Global Manufacturing Systems, Alexion.**

"We are moving beyond computerisation of manufacturing processes. Factory 4.0 promises new level of interconnection, using smart, connected machines and devices that interact with intelligent robotics and automation," he explained. Organisations are becoming au fait with the Industrial Internet of Things (IIoT) where intelligence is embedded pervasively down to low levels of manufacturing equipment and infrastructure. This integration into the manufacturing environment can bring great gains, leveraging embedded intelligence to improve manufacturing reliability.

Alexion has relatively new manufacturing buildings and equipment. That helps provide a solid foundation for Factory 4.0 technologies. Much of Ireland's biopharmaceutical manufacturing capacity would be in a similar position.

Manufacturing plants with high levels of automation tend to generate large amounts of data and IIOT is increasing that further. Data drives success in this new manufacturing paradigm, with data availability unlocking tremendous business advantages.
In the future, technologies like blockchain will secure product and manufacturing data being shared across different organisations. This technology-enabled trust will deliver more meaningful collaborations and faster results.

Technological advances are meaningless without the human factor. Ireland must invest in its talent pool and reap the benefits of a young, technology-hungry workforce. "Despite the developments of technology and automation, skilled and technology-savvy operators will still provide the greatest level of flexibility in the manufacturing environment," said Sheridan.

Quicker product launches, agile decision-making and competitiveness are key to the future of Ireland's biopharmaceutical industry, said **Sanofi's Head of Vials Liquid/Lyo and Biologics, Ruth Beadle.** By being faster to launch, patients with serious illnesses receive life-changing products sooner.

"There is a consensus and a recognition that the tools that made us successful in the early years are not what will take us to the next level. We need to reimagine our industrial culture, recognising that the world has changed."

Research shows that smart manufacturing can result in increases in output up to 200%, cut the time to market by up to 90% and reduce the cost of products by up to 40%. "Smart manufacturing offers solutions to unlock the potential of biopharmaceuticals and improve our efficiency and, more importantly, our agility in delivering our products and our medicines to patients."

Digital is not one-size-fits-all and Beadle urged people not to be "blinded by technology". "Don't expect that every digital tool will add value to your organisation. It is not only about technology; it is about technology and people. People matter most of all."

Beadle acknowledged the contribution of IDA Ireland in helping to give Ireland an advantage in manufacturing. With respect to digital, the organisation has helped organisations collaborate with an ecosystem of other industries and sites across Ireland. "This means we will enjoy the advantage we have today for many generations to come."

Alan Shefflin, Head, Digital Capability Management, Bristol Myers Squibb, agreed that digital trends are transforming biopharmaceutical operations. These new capabilities will enable a decrease in costs and organisation size, and drive continuous improvement for better overall performance.

One example is "data lakes"; these collect and process data, allowing integrated analysis and significantly reducing the amount of time a business spends manually trying to find, cleanse, aggregate and analyse data. Another is advanced analytics which bring new levels of insights and higher levels of control for manufacturing. Artificial intelligence is helping organisations by replacing manual processing for better data quality and efficiency.

"To best enable these digital capabilities a convergence of IT and automation solutions is needed. It will also require new talent and skills."

Ian Jones, Founder and Chief Executive of Innopharma Group, told the conference that Industry 4.0 is beyond quicker, safer and more affordable medicines. It's about the environment, too This era sees the transitioning of people and skills from high carbon low value industries to low carbon high value industries. "From the environmental perspective it will teach us how to do things more efficiently," said Jones.

The tipping point

Where do we go from here?

One of the take-home messages from BioPharma Ambition 2020 was that the biopharmaceutical

industry – and indeed Ireland – are at an inflection point. Our reliance on small and large molecules will not evaporate overnight. But our failure to grasp the opportunity that advanced therapies offer could have a lasting negative impact.

> **"This is an industry the Government wants to partner with and ensures continues to grow."**
>
> *Simon Coveney TD, An Tánaiste and Minister for Foreign Affairs and Trade*

The Tánaiste, Simon Coveney, was effusive in his praise for the success of Ireland's biopharmaceutical industry, noting that it contributes €14.7 billion to Ireland's economy and accounts for some 62% of our goods exports. "This is an industry the Government wants to partner with and ensures continues to grow."

The Tánaiste said Ireland's potential in areas such as next-generation therapies, Industry 4.0, immunotherapies and genomics can be realised through partnership. "With the right collaboration between industry and Government, we can catch these new waves of biopharmaceutical innovation while sustaining the significant progress we have made in capturing investments over the past five decades."
In an inspirational speech, the Tánaiste urged the industry to continue to work towards a vaccine and a treatment for COVID-19. "One innovator can change the world," he said.

What obstacles will hinder the future success of Ireland's biopharmaceutical industry?

Shane Gannon, Director and the Sector Lead, Pharmaceuticals and Life Science Consulting, PwC Ireland, told delegates that increased spending pressure on healthcare in the next 10 to 20 years will drive significant change in the industry and likely lead to margin erosion. Biopharmaceuticals will be forced to change in order to compete.

"As more people use healthcare, the per capita spend goes down, eroding operating margins and impacting health outcomes," he said, adding that care delivery and medication will bear the brunt of this.
It will be impossible to cut costs to match the shrinkage in healthcare spending – radical thinking and radical change will be required to address these challenges. Meanwhile, healthcare delivery over the next 15 years will pivot from treatment to prevention strategies, diagnostics and tailored therapies.

ATMPs will explode in the next few years, from around $1.4 billion currently to $57 billion. This growth is almost unprecedented. It still represents a small fraction of the entire market, with CGT accounting for around 5% of global prescription drug sales by 2025. In addition, the scale is different; ATMP manufacturing plants will not bring the same investment and job numbers that traditional biopharmaceutical plants have. "It will be smaller, it will be more focused, it will be higher skilled."

There are over 280 million people worldwide living with a genetic disease, the vast majority of whom have no effective treatment for their condition, said **Dr Ian Winburn, Global Medical Lead Haemophilia, Endocrine and IEM, Pfizer Biopharmaceuticals Group.** CGT offers the promise of cure with a once-off treatment. Indeed, the potential durability of treatment is its USP; gene therapy could enable patients to live without the need for ongoing treatments or the burden of daily disease management, providing significant cost savings over a person's lifetime.

> **"We can't wait five or 10 years for health systems to change. It's imperative that gene therapies are integrated into national policy frameworks."**
>
> *Dr Ian Winburn, Pfizer*

To optimise access for patients in need, governments will have to establish new payment frameworks designed to connect reimbursement pathways with real-world treatment efficacy. The groundwork must be laid now for the next generation of medicines – patients are anxiously awaiting them. "We can't wait five or 10 years for health systems to change. It's imperative that gene therapies are integrated into national policy frameworks," said Winburn.

Precision medicine goes beyond simply treating a disease, and instead offers the potential to cure it. Investing in it is critical from a public health perspective, Greenwood agreed. "It's not just an injection. It's a public health solution."

> **"There is nothing in the science that prevents us from treating and eventually curing every disease that plagues humanity - except health policy."**
>
> *James C. Greenwood, CEO, BIO*

Parallel to this, Ireland must maintain its comparative advantage which is based on a strong manufacturing base, highly skilled workforce, solid employment base and significant export footprint, Greenwood told the conference in his keynote address.

Greenwood heralded our entrepreneurial spirit, strong universities and ambition to innovate, saying that is what will enable us to become a world-leader in the development and manufacture of cutting-edge therapies such as CTG.

With the right government policy, Ireland's innovators could attract additional capital investment to build the biotechnology sector here, expand the economy, attract more clinical trials and help patients.

James C. Greenwood advocated the long-term view. "Every dollar spent on vascular medication results in between US$3 and US$10 dollars saved on hospitalisation and emergency department visits. Politicians can only see the short-sighted impact on the drugs budget and fail to realise the long-term cost savings."

Biopharmaceutical investment works on the basic economic principles of high-risk, high-reward and it is exceptionally difficult to bring a drug to market. Indeed, some 90% of drug candidates will fail. Yet the biopharmaceutical industry continues to plough its profits back into R&D, despite being criticised and even vilified for high drug prices. The failure to provide a return on investment ultimately disincentivises innovation just as we are on the cusp of an unprecedented age of scientific advancement, he said.

Moderator Anton Savage with panelists during the plenary session

Conclusion

COVID-19 has been a shock to the global economy and to people's lives. It has challenged science to respond. The biopharmaceutical industry has been clear in its message: we are here to help. That means working towards a vaccine and a treatment, keeping manufacturing going, maintaining the integrity of the supply chain, partnering with hospitals, charities and the health authorities, and supporting the Government in managing the response.

Across the industry, companies are establishing new partnership agreements or expanding existing ones to mine science for a breakthrough. Companies are pairing with partners and government agencies to pool money, knowhow and people in coming up with ways to prevent or treat the disease.

We will learn many lessons from COVID-19. When it is over, we will need to look at how embedded is the cooperation and how structured is the collaboration between industry and policy leaders. There really is no more time for silos, either within governments or between governments and industry.

In the pre-read circulated to delegates for BioPharma Ambition 2020, the industry called for a strategy. 'BioPharma Ireland: A Strategy for the Development, Production and Provision of 21st Century Medicines' urged collective action in seizing new opportunities for medicines innovation.

It should ensure that we have the best operating environment for medicines innovation, including the availability of the right skills and talent, tax policies that catalyse research and development and draw new investments, a robust intellectual property (IP) regime, and a reformed approval and funding mechanism that makes us as fast as other western European countries in adopting new medicines in the health services.

The strategy, proposed by the industry, called for joint industry-State action in the following action areas:

1. A focus on realising Ireland's potential in cell and gene therapy, including how the development of skills, new production sites, and designated research and therapy areas could help foster innovation, create jobs and draw investments.

2. The development of a sophisticated data capture and analysis architecture in the HSE so that health outcomes can be tracked and measured, creating the foundation for more tailored treatments and precision medicine, improving patient outcomes using existing medicines, and establishing 'value' metrics for the pricing of new medicines.

3. The raising of Ireland's voice in Brussels and in Dublin so that it is an influential advocate for IP rights for medicines innovators, especially in the development of new drugs for rare diseases.

4. The tripling of the number of clinical trials conducted in Ireland, from 125 studies to 375, so that patients can benefit from better health outcomes. This would bring us to closer to Denmark through the standardisation of site contracts that shorten patient recruitment delays and save on legal fees for hospitals and companies.

5. The application of genomics for medicines discovery and development, guided by a White Paper that deals with issues around data privacy, ethics, regulation and research priorities.

6. The development of new higher education programmes, co-designed by industry, academic and clinical leaders, that deliver a new generation of medicines innovators with expertise in the intersection of areas like artificial intelligence, machine learning, CGT, genomics and digital therapeutics.

7. The resolution of Ireland's poor performance in the speed of access to new medicines through a new Agreement between industry and the State that funds innovation in a way that is sustainable and predictable.

8. A focus on sustaining the existing biopharmaceutical manufacturing base through the application of advanced manufacturing, including leveraging Industry 4.0 principles such as connecting information technology and operational technology systems.

This vision for the future of medicines innovation and investments has patients at its core. Each of the action areas outlined above will benefit patients and clinical care. Patient advocacy is increasingly geared towards engagement in health innovation. The growing personalisation of therapeutic interventions means patients will need to be more engaged in their development, as well as reporting the outcomes they generate. The patient's voice is critical.

Ireland needs a relentless focus on innovation at all stages of the medicines lifecycle if we are to retain the biopharmaceutical investments we have and win new ones. We must continue to pursue excellence in manufacturing and research, adapt public policy to the promise of science, and ensure standards of care are raised through the availability of new medicines to patients and their doctors.

All of this will require intense collaboration and a focus that is global-minded, ambitious, constructive and responsible. The beneficiaries of this collaboration will be people, communities and science.

This is a project for Ireland - one that can make us a medicines innovator of global consequence.

Delegates at the plenary session at the Printworks, Dublin Castle

Susan Roche, Partner, PwC at the taxation workshop

Dominic Carolan, CEO, NIBRT