

Collins McNicholas
Recruitment & HR Services Group

LABOUR MARKET REVIEW SERIES: VOLUME 2

Biopharma



Executive Summary

Ireland's biopharma industry:

Employs over 30,000 people.

Supports 25,000 jobs indirectly.

25% of all PhD researchers working in industry are in the biopharma sector.

First preferences for science courses at third level have almost doubled since 2008.

5,000 additional staff will be employed in biologics manufacturing by 2020.

Combining replacement demand and growth there will be approximately 8,400 job openings from 2017 to 2020.

There is strong demand for process and chemical engineers and experienced team leaders, particularly in the areas of product and technology transfer, downstream processing and QA professionals, especially from an audit perspective.

NIBRT, The National Institute for Bioprocessing Research and Training, trained over 4,000 people in 2017.

The global biologics market, which represents 20% of the global biopharma market, was estimated at \$238.8 billion in 2017 and is projected to reach \$399.5 billion by 2025.

Given the strong supply of talent, the long history of pharmaceutical manufacturing, and the commitment of government and industry, Ireland is in an excellent position to capitalise on this opportunity. The conditions are extremely favourable for any biopharma company considering establishing an operation in Ireland today.



Introduction

There are over 30,000 people working in the biopharma industry in Ireland today. The industry supports another 25,000 jobs indirectly. Medical and pharmaceutical exports were approximately €65 billion in 2017.

Ireland has always been dominated by the production of traditional pharmaceuticals, however in the last 10 years there has been a rapid expansion of biologics production. In 2003, less than 2% of biopharma companies were involved in manufacturing biologics in Ireland. Today, over 20% of the Irish biopharma industry is working on biologics manufacturing. This transition, which will become more dominant in the future, is in line with global expectations for the industry. The global biologics market is worth \$238.8 billion and represents 20% of the current biopharma market. However, the global biologics market is growing at twice the rate of the traditional pharmaceutical market, showing a growth rate of just under 8%. It is expected to reach \$291 billion by 2020 and \$399.5 billion by 2025. Its importance in terms of the overall productivity and size of the global biopharma market will only increase in the coming years.

Recent Investments

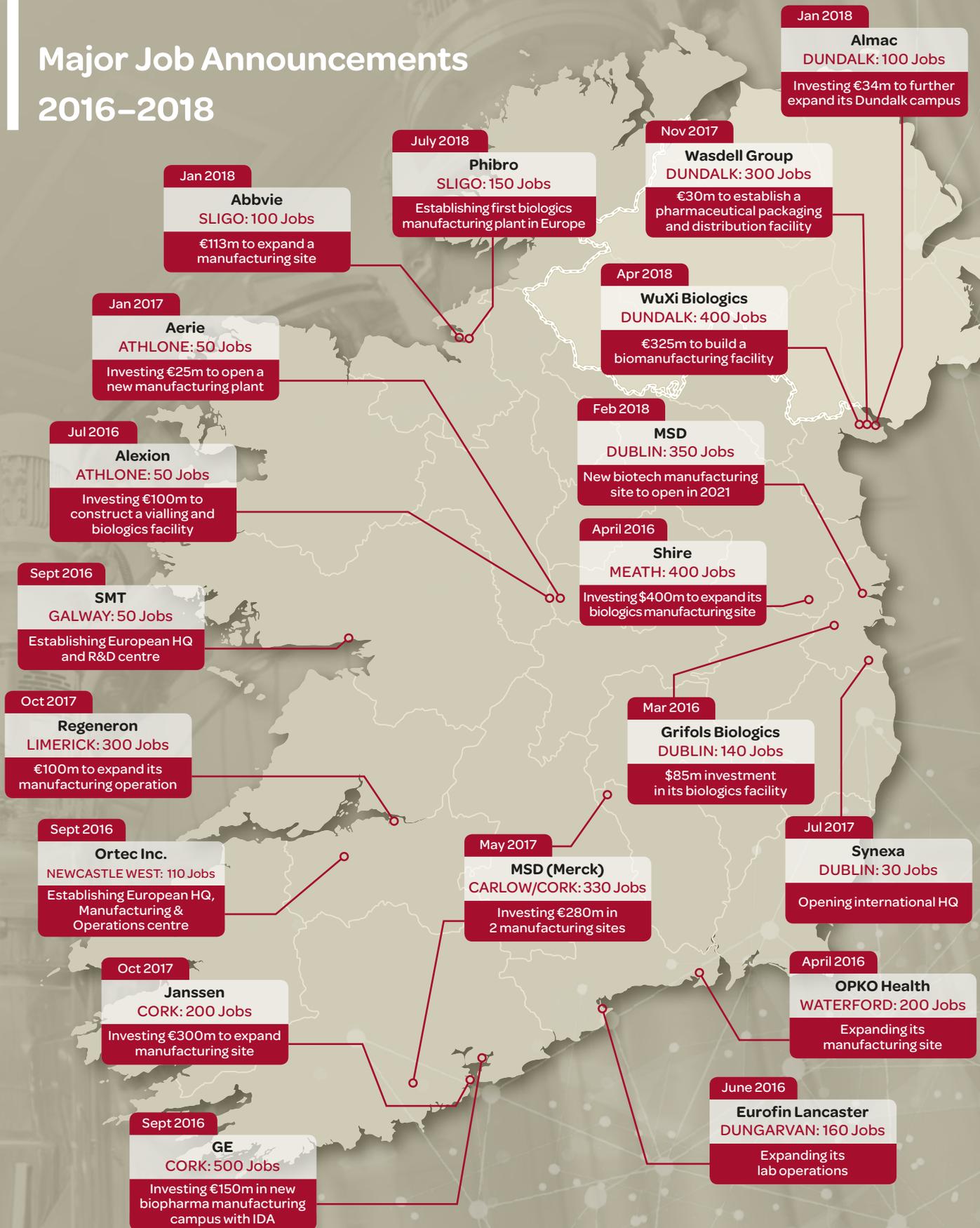
The manufacturing of biologics is a more complex process than the production of traditional pharmaceuticals. A significant investment is required to construct the facilities necessary for biologics production. There have been a number of these large-scale investments in Ireland in recent years. They have covered both biologics-based manufacturing and sterile fill-finish facilities. These investments have generated a significant number of jobs in Ireland which are predominantly well-paid and highly skilled. Recent job announcements are illustrated on the map opposite.

What is the difference between conventional pharmaceutical drugs and biologics?

A **biologic** is manufactured in a living system such as bacteria, yeast, or plant or animal cells. Biologics are much larger and much more complex than pharmaceutical drugs. The manufacturing process is consequently a lot more complicated and sensitive, requiring a larger capital investment in its production facilities. The manufacturing process is intrinsically linked to the product and is largely fixed as a result. Biologics are at greater risk of contamination in the production process as well.

A **pharmaceutical drug** is manufactured via chemical synthesis. It is a small molecule relative to a biologic. The end product is also much more stable and the production process more straightforward than for biologics. This gives greater flexibility in the production process. The end product can be analysed to determine its components making it easier to replicate. Generic counterparts are thus more common for conventional pharmaceutical drugs.

Major Job Announcements 2016–2018





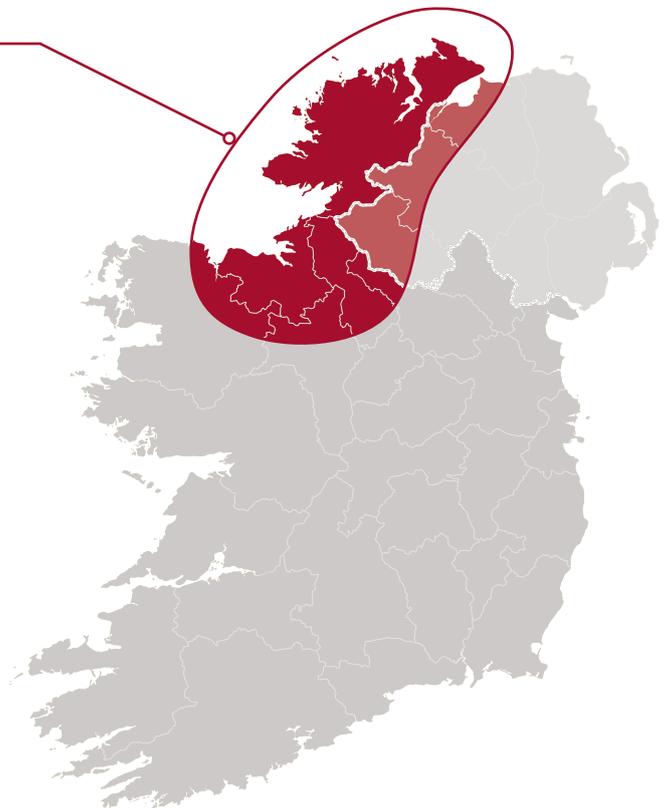
Regional Overview

Although Cork and Dublin feature most prominently as locations for biopharma plants, there are a number of regional locations across the country that have developed clusters of biopharma expertise. This regional diversity broadens the range of options for a company looking to set up a facility in Ireland. They can avail of a broad talent base, accessing the skills and experience they need almost anywhere in the country. The geographical spread of recent investments highlights this.

North West

Sligo, and the North West, represent an important regional cluster for the biopharma industry in Ireland. Abbvie in particular has a very strong presence in Sligo having increased their staff by 175 people when they finished the expansion of their plant in 2015. In January of 2017, they announced plans to invest a further €100 million in one of their two manufacturing facilities in Sligo in order to expand output and take on the production of its new oncology products. This will increase their headcount by 100 staff.

There are a number of pharmaceutical and medical device companies operating in the North West that further contribute to the life science expertise in the region. Topchem and Phibro are both pharmaceutical employers in Sligo. The animal health company, Phibro, announced 150 new jobs for Sligo in July 2018 along with plans to establish a biotech facility producing a range of innovative animal health vaccines. Topchem, which has 25 employees, specialises in the contract manufacturing of niche, low volume, and complex, API products.



West

Allergan invested over €350 million in its Westport site since 2012 bringing its total headcount to over 1,300. Allergan's Westport site is the company's largest manufacturing facility and, in addition to producing the world's supply of Botox, is the location for the production of its next generation of biologics. Their Westport site generates 50% of Allergan's global revenue. In early 2017, a further €42 million investment across Allergan's Westport and Dublin manufacturing sites was announced as well as acquiring Zeltiq in Galway, a medical technology company.

East

Dublin is the location for several shared services and operations centres in the biopharma sector. Companies such as Roche, Novartis, Eli Lilly, Allergan, Shire and Alexion each have sites in the city. Shire opened a new headquarters in 2017 and will employ 300 people by mid-2018. Alexion Pharmaceuticals has its global supply chain operation in Dublin and has recently invested €75 million in a new biologics manufacturing site in Dublin. It has invested €500 million in Ireland since 2013. It also has a facility in Athlone that it is expanding as well and contains both a fill-finish facility and a new biologics manufacturing site. It employs 300 staff across all three sites, including 60 at its global supply chain operation. Amgen operates a formulation, fill and finish site in Dun Laoghaire and opened its expanded site in 2015 after a €300 million investment. SK Biotek purchased Bristol-Myers Squibb's Dublin biologics manufacturing facility. This is the first investment of a South Korean firm in Ireland's biopharma industry. The plant is being transformed into a biologics facility after Bristol invested \$900 million in the four-year construction of the new plant. It will produce multiple therapies in the areas of oncology, virology and immunoscience. The new site will be completed in 2019 and will require 350-400 new staff. MSD has also announced plans to construct a new biotechnology manufacturing site in Dublin. Upon completion in 2021 it will employ 350 staff.

The North East of Ireland has also benefited from several announcements in recent years. In 2017 the Wasdell Group announced a €30 million investment and 300 jobs in Dundalk. While in 2018 Almac announced a €34 million investment and 100 jobs and WuXi Biologics announced a €325 million investment with 400 new jobs for the region.



South

Eli Lilly employs 1,100 people across its three sites in Dublin, Cork and Kinsale. It's biotech manufacturing site in Kinsale has received €650 million in investment in the last decade. Since 2006, Kinsale has become the main centre for the manufacture and supply of active ingredients for Eli Lilly's new biopharma medicines. The site currently employs 400 people. Eli Lilly also has a European shared service centre in Cork with over 350 employees in Little Island. BioMarin, a biopharma company that focuses on rare and genetic diseases, employs approximately 365 staff in Cork. Gileads Cork plant manufactures drugs for the treatment of HIV and hepatitis. The unit employed just 60 people when it was acquired from Nycomed in 2007 and now employs 390 people. MSD is investing €250 million in two manufacturing sites in Cork and Carlow that will eventually add 350 jobs to the total headcount at these sites. Janssen is investing €300 million in its Ringaskiddy site which will add 200 jobs to the 550 already employed when it completes the work in 2020. EirGen Pharma, part of the OPKO Group, is based in Waterford and employs over 200 staff across both the commercial and R&D facility. It is one of the leading developers and suppliers of high potency niche pharmaceutical products in the world. Sanofi employ over 650 people at their biotechnology facility in Waterford and have invested almost €200 million in their Irish operation since 2011.



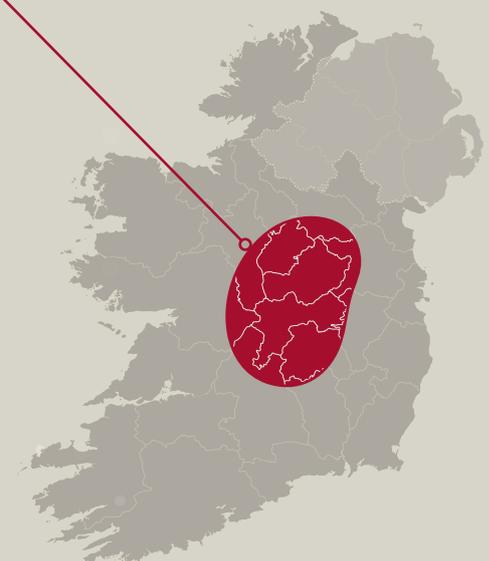
Midwest

Regeneron invested €220 million in Limerick, to construct a state-of-the-art biopharma production facility that will generate 300 high-skilled jobs. They have continued to invest in their Limerick facility, announcing another investment of €100 million in October 2017. This will create an additional 300 jobs, bringing their total headcount to 800 by the end of 2018 and their total investment in Limerick to €750 million since 2013.



Midlands

Alexion Pharmaceuticals and Jazz Pharmaceuticals made investments in Athlone. Alexion, which also has an operation in Dublin, is currently constructing a vialling facility and a biologics facility. Jazz Pharmaceuticals constructed a €50 million manufacturing facility that employs 50 high-skilled professionals since its completion in 2016. In 2017 Aerie Pharmaceuticals announced an investment of €25 million to build a new manufacturing plant along with office facilities in Athlone. The company has already generated up to 30 new jobs and is expected to double over the next 2-3 years. Alkermes, which is headquartered in Dublin, is another major employer in Athlone employing almost 400 staff. In Meath, Shire is constructing a new, state-of-the-art biologics manufacturing centre at a cost of €367 million. The manufacturing plant will employ 400 staff and is expected to commence operations in mid-2019.





Talent and Graduate Output

The EGFSN (Expert Group on Future Skills Needs) estimates that 5,000 additional staff will be employed in biologics manufacturing by 2020. The number of professionals employed in the production of traditional pharmaceuticals will remain stable during this time; however, employment opportunities will continue due to the need for replacement staff.

Combining replacement demand and growth there will be approximately 7,100 job openings from 2017 to 2020. Ensuring that the supply of qualified professionals is sufficient to meet demand will be the crucial step in successfully expanding the biopharma industry in Ireland. Increasing the number of qualified graduates and attracting the right international talent will ensure Ireland can meet the demand of its biopharma industry.

The biopharma sector employs significantly more third level graduates than the average industry. Over 46% of employees in the sector have a third level qualification, compared to a national average of 24%; and 25% of all PhD researchers working in industry are in the biopharma sector. According to the EGFSN there should be a sufficient supply of graduates in the medium term to meet industry demand. The EGFSN identified a short term need for a number of technicians and senior process scientists within the industry, but this is not expected to be a factor in the long term as there are an appropriate number of training places to overcome this minor deficit.

The Government initiated its 'Smart Futures' programme in 2012 with the aim of encouraging young people to pursue careers in Science Technology Engineering and Mathematics (STEM) related industries. The programme has been very successful at increasing the number of secondary students taking higher level maths, with record numbers opting for the higher level at both leaving and junior cert level this year. Since the introduction of the bonus points system for honours maths, the number of students sitting the exam has risen from 20% to 36% between 2011 and 2017. This is an important step in increasing the number of students entering STEM courses at third level. It is graduates from these courses that form the technical backbone of the biopharma industry so growing the volume of applicants to these courses is an important step in providing sufficient talent for the industry. Increasing the number of students taking higher level maths will lead to a greater take up of STEM courses at third level.

Science at Third Level

There has already been a notable move towards science related courses in third level applications. The number of Level 8 (Honours Degree) enrolments in science and maths courses had increased by 19.6% between 2011/12 and 2016/17. However, the amount of Level 8 enrolments in science and maths as a percentage of the overall enrolments at this level has remained largely stable, increasing only slightly from 11.5% to 11.8%. Given the expected growth in the number of job openings in the biopharma industry more will need to be done to increase the number of enrolments in science courses if we wish to avoid a shortage of critical skills in the industry in the long term. As noted above the medium-term outlook is positive and any minor shortfall can be met by recruiting international workers. Ireland is an attractive destination for international workers. The IMD World Competitiveness Centre ranked Ireland 1st among 69 developed countries in its ability to attract highly skilled international workers in 2017. Despite this, the government needs to do more to increase the number of students entering science courses at third level to ensure the biopharma industry is not constrained in its ability to grow.

When compared to the EU average Ireland had the fourth highest level of science graduates, across levels 6-10, among the 28 countries. This is encouraging as access to talent is a key differentiator in attracting foreign investment. Ireland needs to increase its output, as mentioned in the previous paragraph, but its ability to outperform its European rivals in this regard and its ability to attract international workers, should help Ireland remain competitive in attracting foreign investment.

The EGFSN estimates that over 800 graduates entered the biopharma industry in 2014, 86% of whom had a Level 8 degree or higher. Of these, 48% were from science and maths disciplines, 24% from engineering disciplines, 12% from health and welfare disciplines, and 7% were from business disciplines. The EGFSN has also estimated that 3,320 biopharma-related science graduates entered the workforce in 2014, which gives significant scope for biopharma companies to improve their recruitment as only a small percentage of these entered the biopharma industry.

Skills in Demand

The skillset needed to work in a modern biopharma plant is evolving with the growing importance of biologics products. This must be provided for through third level Institutes. Biotechnology, biochemistry, microbiology, analytical chemistry, molecular cell biology, bioinformatics and bioanalytics, are all skills that are in demand. Given the increased numbers entering science courses at third level, the key will be directing them towards biopharma-related courses. This will ensure that graduates are equipped with the appropriate skills for the industry. A broad range of biopharma-related courses are available to students entering third level education at every major university in the country. Biopharma-related courses are also provided by many of the Institutes of Technology, such as IT Sligo, which is partnered with NIBRT, and IT Carlow. Many of these Institutes are also active in providing fast-track, online courses that cater to the specific needs of biopharma companies. These courses, provided through Springboard, the Government's job training initiative, are frequently used to upskill existing staff and will help to provide a significant boost to the number of professionals with biopharma-related skill sets in the future.

Collins McNicholas' View

Salaries in the biopharma sector have remained relatively stable over the last 3 years. This suggests that efforts to maintain the supply of qualified graduates has been broadly successful. With growing numbers of students taking science and STEM related courses at second and third level, this upward trend should continue. Over the last three years, we have noted an increase in both the amount of jobs being advertised by biopharma companies and in the number of professionals registering with us that have biopharma-related qualifications and experience.

We have seen a strong demand for process and chemical engineers and experienced team leaders, particularly in the areas of product and technology transfer, downstream processing and QA professionals, especially from an audit perspective. Professionals with these skills, both recent graduates and those with a number of years' experience, are highly sought after across the biopharma sector.



Collins McNicholas' Life Sciences team attending NIBRT training.

National Institute for Bioprocessing Research & Training

Key to the development of biopharma and bioprocessing expertise has been the National Institute for Bioprocessing Research and Training. NIBRT is a purpose-built facility that replicates a modern biopharma plant. It provides a GMP manufacturing environment, with upstream, downstream, fill-finish and analytical facilities.

NIBRT operates a number of different training programmes to prepare people for biopharma careers, training over 4,000 people each year. It collaborates with universities for both training and research purposes, is an active participant in the Springboard conversion programmes and partners with industry to design courses that meet the specific training needs of a company.

The primary focus is on developing the specific skills that will prepare someone for the demands of a modern biopharma plant. The transition from traditional pharmaceutical manufacturing to biopharma production requires a significant amount of retraining for professionals in the industry. This is particularly important at the operative level. Due to its greater sensitivity and complexity, biopharma production requires greater numbers of highly skilled professionals and correspondingly less personnel at an operative level. CPD will be crucial for many employees who wish to continue working in this sector. Industry has been working with third level Institutes and training centres such as

NIBRT to develop these programmes. This collaboration has extended to the development of modules within the degree and diploma courses offered to students by universities. Consultation with industry has led to the development of more practical research and manufacturing skills, which has improved the standard of graduates further, in recent years.





Trends in the Biopharma Sector in Ireland

Research

R&D expenditure represents approximately 20% of revenue in the pharmaceutical and biotechnology sector. According to EUROSTAT this represents 17.7% of total business R&D expenditure worldwide. The EGFSN cited a need for increased partnership between academia and industry. Consequently, there has been a substantial increase in research funding and a growing partnership between Irish research institutes and biopharma companies. The Ion Channel Biotechnology Centre, the Shannon Applied Biotechnology Centre, the Pharmaceutical & Molecular Biotechnology Research Centre, the Bioscience Research Institute (BRI), the National Institute for Cellular Biotechnology, the Synthesis and Solid State Pharmaceutical Centre (SSPC) and NIBRT, all collaborate with industry to conduct research across a range of biotechnology and biopharma issues. The increased investment in research in Ireland will be a great advantage in luring additional investment to the country and in improving the quality of our graduates. Investment in our research facilities, the provision of R&D tax credits and the collaboration between industry and academia, are beginning to generate more investment from international companies.





Industry Trends & Potential

The global biopharma industry is expanding rapidly. Increasingly it will be the development of biologics that drives this growth. Currently, 20% of all marketed medicines come from biotechnology. This figure is set to rise significantly, with almost 50% of medicines in the pharmaceutical pipeline being biologics. Biopharma research is opening up new treatment possibilities and with that comes new markets and new sources of revenue. Biopharma research has the potential to tackle many diseases that have not found adequate treatments through traditional pharmaceutical methods. There are over 5,000 potential biopharma medicines in the pipeline globally, according to research by PHRMA (Pharmaceutical Researchers & Manufacturers of America).



Due to the significant cost of developing a new drug, which has risen to an estimated \$2.6 billion on average, pharmaceutical companies are increasingly looking to mergers and acquisitions to expand their product offering. It is estimated that biopharma companies need to spend somewhere between \$2-4 billion on R&D annually. Companies in this industry spend approximately 20% of their revenue on R&D, therefore, biopharma companies must earn at least \$10 billion annually if they wish to maintain R&D expenditures and sustain a meaningful portfolio of drug development programmes. The volume of recent acquisitions and mergers, such as Sanofi's purchase of three biopharma companies since the start of 2018 for a total of \$21.4 billion, confirm this trend. Other notable mergers and acquisitions in the last few years include Johnson & Johnson's \$30 billion acquisition of biotech company Actelion, Gilead's \$11.9 billion purchase of Kite Pharma and Shire's \$32 billion purchase of Baxalta. The pursuit of M&A opportunities, driven by the need for new drugs, and the need to reduce costs in the face of an ever more stringent regulatory environment, will continue over the forthcoming 12 months.

Conclusion

The global biopharma industry is expanding rapidly across Ireland.

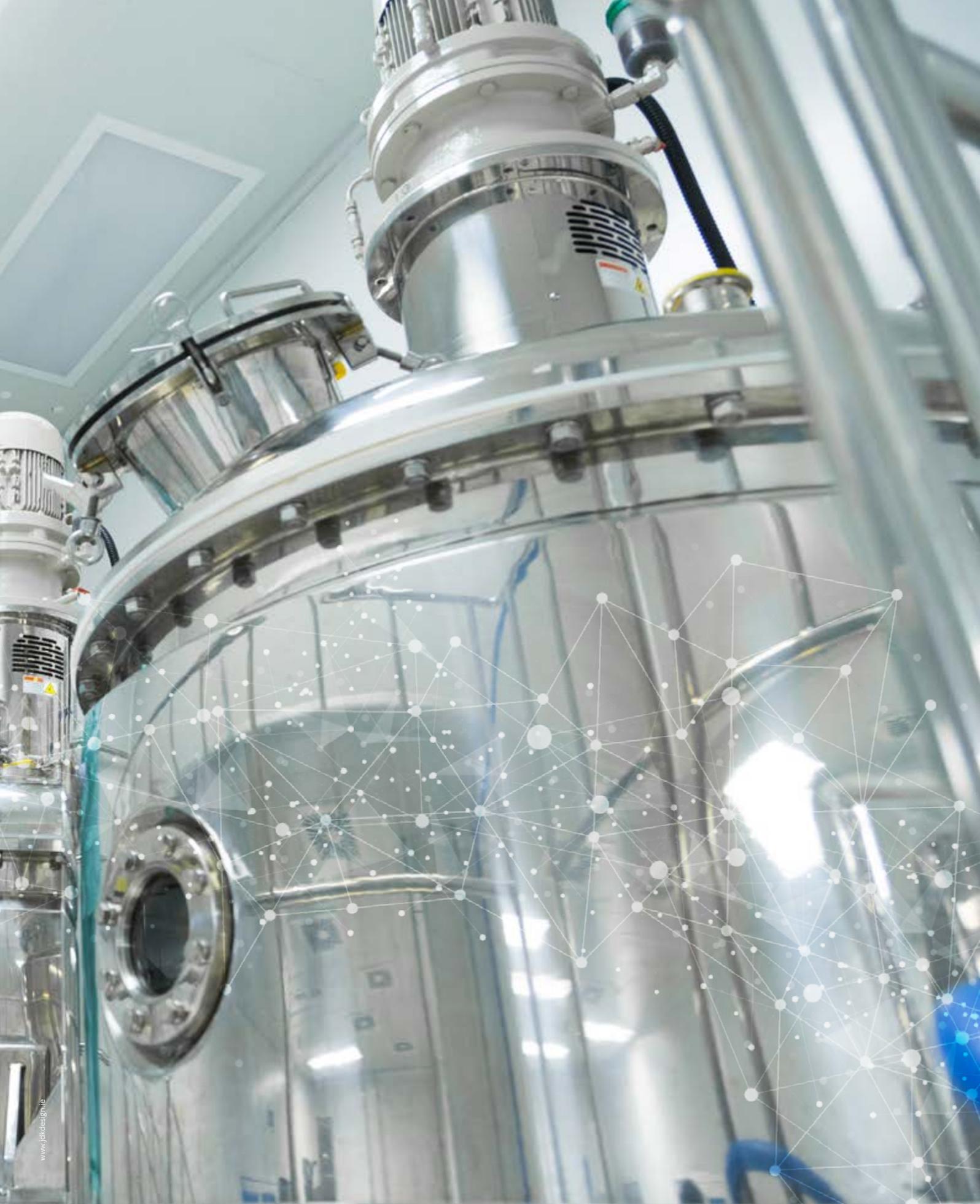
Collins McNicholas has seen an upwards trend in highly-qualified professionals being attracted away from larger urban centres towards more regional locations such as Athlone, Westport, Sligo, Galway and Limerick which are going through a period of positive and sustained growth.

Biologics will play an increasingly important role in the future of the pharmaceutical industry. The Irish government has recognised the potential of this industry and is providing the necessary support through research funding, training and other incentives, to encourage further development of this sector in Ireland. Given the strong supply of talent, the long history of pharmaceutical manufacturing, and the commitment of government and industry, Ireland is in an excellent position to capitalise on this opportunity.

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