



MTP Connect

MedTech and Pharma Growth Centre

How **Global MedTech & Pharma** Corporates Engage with Australia

A report into the factors determining the attitudes of multinational companies engaging with Australian medical technology and pharmaceutical innovators.

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Australian Government
Department of Industry,
Innovation and Science

Industry
Growth
Centres





Ultimately, we are all here for the same reason
– to improve the health, economy and livelihoods of Australians into the future. We are encouraged by the progress we have made and excited to see the impact continue to grow in the year ahead.



Sue MacLeman
Chair of MTPConnect

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Report prepared by:



Championing the growth of Australia's medical technology, biotechnology and pharmaceutical sector.



BioPacific Partners uses its global experience in life science commercialisation to help Australian innovators become global players.

Executive Summary

The pharmaceutical sector, which discovers, develops, produces and markets drugs for use as medications, is increasingly looking for external innovations to fill its product pipelines. This is in large part due to the high cost of researching and developing new drugs, high risk of failure, and significant exposure many large pharmaceutical multinational companies have to patent expiry of blockbuster drugs.

The medical technology sector, which includes medical devices, diagnostic and medical imaging equipment, is also looking externally for new technologies, however, there are stark differences between the two sectors and the way they seek out external innovation.

The global market size for the pharmaceutical industry is approximately US\$1.2 trillion, compared to US\$350 billion for medical technology sector. There are considerably fewer medical technology multinational companies than pharmaceuticals, and they are smaller due to the relatively smaller size of the sector, fragmentation, and the wide diversity of technologies and specialist product categories in the industry. Compared to the pharmaceutical industry, more of the largest medical technology multinational companies are based in the United States.

The nature of the medical device industry and the innovation that occurs within it means that the largest medical technology, or medtech companies are often looking for incremental changes that will improve devices they already have on the market, and can therefore easily gain registration, rather than introduce a completely new technology (or a blockbuster equivalent) to their portfolio.

These differences make medical technology companies less outward looking when it comes to innovation compared to pharmaceutical companies. It also results in a level of insularity in the United States for medical technology companies that the major pharmaceutical companies, or 'Big Pharma' cannot afford to have.

Medical technology companies also spend substantially less than their pharmaceutical counterparts on research and development. The average R&D spend as a percentage of revenue for medical devices is 7 per cent, versus 18 per cent in the pharmaceutical industry.

The market for innovation is global, and because of this there is a requirement for multinationals to search, recognise, and acquire opportunities outside the geographic footprint of their existing networks. For Australia, these multinationals can act as a conduit to realising value for a significant amount of local innovation.

The interviews and discussion with multinational companies that took place in the preparation of this report revealed that in general, pharmaceutical and medical technology multinationals acknowledge Australia's reputation for excellence in science and research and having a similar regulatory system to major markets.

But while these multinationals say they are agnostic about the location of innovation, there are pragmatic barriers that prevent these companies from considering Australia as an external innovation hunting ground. These include:

- A perception of limited opportunities in Australia (often stemming from a lack of visibility);
- Geographical isolation that consists of long flights, often requiring connections and at a considerably higher cost and time commitment than other regions. The time zone also makes it difficult to seek out innovation and engage with innovators;
- Australian innovation is not considered demonstrably superior and different relative to other, more accessible, major markets; and
- Perceptions that innovators in Australia have low commercial acumen which can make opportunities less 'investment ready' and commercial negotiations and due diligence difficult.

In order to make medical technologies and pharmaceutical innovation more attractive to multinational companies, this report uncovers tangible solutions to mitigate the hurdles that exist. These include:

- Focus on areas of overlap between global multinationals and areas of excellence in Australian innovation;
- Identify the right targets to save wasted effort chasing companies that will ultimately have no interest in a technology;
- Be present at the right events and prepare wisely for them;
- Consider taking part in global accelerator competitions to accelerate development and get noticed;
- Seek early stage collaboration with multinational companies where relevant;
- Prepare for the long game, particularly in medical technology where acquisitions tend to happen at a later stage; and
- Consider geographies outside the traditional regions: As China continues to open up it will increasingly challenge the market dominance of the United States and Europe.

Introduction

Overview

The pharmaceutical and medical technology sectors increasingly rely on external innovation. In particular, multinational companies in these sectors use research and development from universities, research institutes and innovator companies to maintain and bolster their product pipelines.

As the multinationals in these sectors dominate the global markets for innovative new products, they act as a conduit to realising value for a significant amount of Australia's innovation.

This report has been produced to provide insights for researchers, innovators and companies into the factors shaping the desires, behaviours and attitudes of medical technology and pharmaceutical multinationals to engage with external innovation.

The market for innovation is global and because of this, there is a requirement for multinationals to search, recognise and acquire opportunities outside the geographic footprint of their existing subsidiary networks.

The report uncovers the major barriers that exist in these industries when engaging with Australian-based technologies and provides recommendations as to how Australia can be more successful at attracting and engaging with multinational companies.

Interviews

In preparing this report, BioPacific Partners spoke with and interviewed over 20 key personnel within the largest multinational companies in the medical technology and pharmaceutical industries. Face-to-face conversations were preferred over telephone calls, as they resulted in far more frank responses to the questions and areas that were explored.

Those spoken to all occupy key senior roles within their organisation's research and development and/or open innovation team, based in either the United States or Europe. These conversations took place either with BioPacific Partners' existing multinational clients or with key targets at industry conferences and events. These included the BIO International Convention (Boston, United States), AusMedtech (Adelaide, Australia), The MedTech Strategist Innovation Summit (Dublin, Ireland), and The MedTech Conference (Philadelphia, United States).

The companies contacted for this report are representative of large multinational companies in the medical technology and pharmaceutical sectors. The high level of agreement amongst the interviewees suggests that the views expressed provide a valid basis from which to derive useful insights.

Structure

This report contains separate sections on both the medical technology and pharmaceutical sector. Each section contains information on the global market and an overview of the Australian industry, the future of the sector including trends and drivers, details on how these sectors go about external innovation and their thoughts and experiences of accessing Australian innovation.

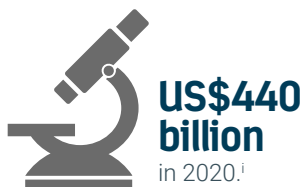
The report concludes with detail on the differences between the medical technology and pharmaceutical sectors in terms of how they seek out external innovations to fill their product pipelines, overlaps between Australian areas of expertise and global demands and separate recommendations for each industry.

Medical Technologies



GLOBAL MARKET

Global medical technology industry overview



The medical technologies market was estimated at US\$350 billion in 2016, with a compound annual growth rate (CAGR) of 6.4 per cent and is forecast to reach US\$440 billion in 2020.¹



The top 15 biggest medical technology companies (by revenue) hold around 50 per cent market share. Company size scales down rapidly as you progress down the list of largest companies.



Of the top 20 medical technology multinationals (by revenue), 12 are based in the United States, the rest are headquartered in Europe and Japan.



Many predict the current big players in medical technologies will be challenged in the near future by large digital and electronics companies entering the market, including Google, Apple, Samsung and Amazon.

Top 15 medical technology multinationals

The table below lists the top 15 medical technology global companies based on 2017/18 revenue figures for their medical device segments.²

	Revenue med dev segment (US\$b)	R&D spend (US\$b)	Main areas of interest
Medtronic (USA)	29.7	2.2	Diabetes management, cardiac rhythm management, patient monitoring systems, surgery devices, anaesthesia, minimally invasive technologies
J&J (USA)	26.6	1.6	Orthopaedics (DePuy Synthes), diabetes, vision, surgery, wound closure, minimally invasive technologies
Philips Healthcare (Netherlands)	20.4	2.1	Medical imaging, ECG, molecular imaging, clinical informatics, emergency care systems, respiratory devices, telehealth, radiation oncology, minimally invasive systems, patient monitoring
GE Healthcare (USA)	19.8	1.01	Medical imaging, patient monitoring, ventilators, cardiology, telemetry systems, critical care systems
Abbott (USA)	14.5 (pharma and nutritionals excluded)	2.2*	Vascular care (stents, imaging), structural heart (pumps, sensors), pacemakers, neuromodulation, pain management, diabetes management, vision care
Cardinal Health (USA)	13.5	N/A	Surgical products
Siemens Healthcare (Germany)	13.4	5.6*	Medical imaging, radiation therapy, hearing aids, respiratory machines, patient monitoring systems, diagnostics

¹ Mercer Capital, "5 Trends to Watch in the Medical Device Industry in 2018," 19 04 2018. [Online]. Available: <https://mercercapital.com/assets/5-Trends-to-Watch-Med-Dev-Industry-2018.pdf>.
² Company annual reports

How Global MedTech & Pharma Corporates **Engage with Australia**

	Revenue med dev segment (US\$b)	R&D spend (US\$b)	Main areas of interest
Stryker (USA)	12.4	0.8	Orthopaedics, reconstructive surgery, spine reconstruction, cardiovascular imaging
Roche Diagnostics (Switzerland)	12.2	1.4	IVD, biomarkers, diagnostic tests, analytical equipment
Becton Dickinson (USA)	12.1	0.8	Needles, syringes, drug delivery systems, insulin pens, surgical blades, ophthalmic instruments, urology catheters, kidney stones, prostate biopsies, wound drains
Baxter (USA)	10.6	0.6	Kidney disease, dialysis, biosurgery products, anaesthetics
Boston Scientific (USA)	9.0	1.0	Structural heart, cardiac rhythm management, pacemakers, defibrillators, neuromodulation, endoscopy, radiology, medical imaging
Zimmer Biomet (USA)	7.8	0.4	Orthopaedics, dental implants
B Braun (Germany)	7.7	0.4	Sutures, infusion technology and solutions, monitoring systems, surgical instruments, sterilisation
Olympus	6.5 (imaging business excluded)	0.7*	Ear nose and throat, gynecology, pulmonology, gastroenterology, general surgery, urology

*Group data (healthcare/medical device segment data not available)

Sub-sectors

Medical technologies can be categorized by their market type, or by their official Global Medical Devices Nomenclature.

Market type

- Anaesthesia
- Cardiology
- Dentistry
- Diabetes care
- Diagnostic Imaging
- Digital health
- Endoscopy
- Implantables
- In vitro diagnostics (IVD)
- Kidney / Dialysis
- Ophthalmology
- Orthopaedics
- Respiratory care devices
- Surgery
- Wearables

Global medical devices nomenclature

There are more than 500,000 medical technologies registered in the European Union. These fall within 16 categories of products, as determined by the Global Medical Devices Nomenclature (GMDN) Agency:

Classification	Examples
Active implantable technology	Cardiac pacemakers, neurostimulators
Anesthetic respiratory technology	Oxygen mask, gas delivery unit, anesthesia breathing circuit
Dental technology	Dentistry tools, alloys, resins, floss, brushes
Electromechanical medical technology	X-ray machine, laser, scanner
Hospital hardware	Hospital bed
In vitro diagnostic technology	Pregnancy test, genetic test, glucose strip
Non-active implantable technology	Hip or knee joint replacement, cardiac stent
Ophthalmic and optical technology	Spectacles, contact lenses, intraocular lenses, ophthalmoscope
Reusable instruments	Surgical instruments, rigid endoscopes, blood pressure cuffs, stethoscopes, skin electrodes
Single use technology	Syringes, needles, latex gloves, balloon catheters
Technical aids for disabled	Wheelchairs, walking frames, hearing aids
Diagnostic and therapeutic radiation technology	Radiotherapy units
Complementary therapy devices	Acupuncture needles/devices, bio-energy mapping systems/software, magnets, moxibustion devices, suction cups
Biological-derived devices	Biological heart valves
Healthcare facility products and adaptations	Gas delivery systems
Laboratory equipment	Most IVD which are not reagents

Sector overviews

These sectors have been highlighted as key areas of interest for large medical technology multinationals.



Ophthalmology

Global market: US\$31 billion.³

Drivers: ageing population, vision care innovations, diagnostic opportunities.

Breakthrough technologies: glaucoma IOP sensing contact lens (Triggerfish lens by Sensimed, Lausanne); IOP sensing IOL (Eyemate lens by Implants for Vision, Hannover); glucose sensing contact lens for diabetics (being developed by Novartis and Google via Alphabet's life sciences subsidiary Verily).

Major players: J&J, Alcon (Novartis), CooperVision, Bausch & Lomb (Valeant), Abbott Medical, Hoya Corp, Topcon, Carl Zeiss Meditec, Nidek Co, STAAR Surgical.



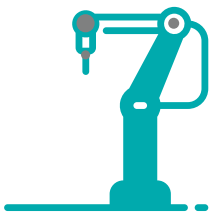
Orthopaedics

Global market: US\$39 billion.⁴

Drivers: ageing population, growing volumes of bone disorders, decreasing reimbursements, growing demand for sports medicine.

Breakthrough technologies: personalised 3D printed orthopaedic implants.

Major players: Stryker, DePuy Synthes (J&J), Zimmer Biomet, Smith & Nephew, Medtronic, DJO Global, Integra Lifesciences, NuVasive Inc, Globus Medical, Wright Medical.



Medical robotics

Global market: US\$6.4 billion.⁵

Drivers: Artificial intelligence (AI) in digital healthcare applications: including robot assisted surgery, virtual nursing assistants, dosage error reduction, connected machines.

Breakthrough technology: 3D high-definition vision systems.

Major players: Intuitive Surgical USA (Da Vinci Robot), Transenterix USA, Medrobotics USA, Verb Surgical USA (joint venture between Google/J&J), Hansen Medical USA, MEDTECH France, Titan Medical Canada, Microrobot Medical USA (needle like, self-propelled semi-disposable endoscope).

³ Global Ophthalmology Devices Market 2017: Analysis By Device Type & Geography - Research and Markets, 2017

⁴ Global Market Insights, "Orthopedic Devices Market Size by Product," Global Market Insights, 2017.

⁵ Oristep Consulting, "Global Medical Robotics Market - By Product, Application, Region - Market Size, Demand Forecasts, Industry Trends and Updates (2016-2022)," 2017.



Digital Health

Global market: US\$118 billion in 2017 (including wearables US\$15 billion in 2015), forecast to reach US\$206 billion by 2020.⁶

Drivers: increasing awareness of fitness and healthy lifestyle, rising chronic diseases, technological innovations, miniaturisation of sensors, wireless data transmission to improve management of chronic diseases.

Breakthrough technology: contact lenses that monitor glucose levels, smart pills to monitor medication, hearing devices, heart rate monitor patches, wrist bands that collect vitals including heart beat and blood pressure, insole sensors, apps and software.

Major players: Gentag Inc, Google, Intel Corp, Intelesens Ltd, LifeWatch AG, Medtronic Plc, Nuubo, Omron Corp, Philips Healthcare, Polar Electro, Sotera Wireless Inc, Winmedical Srl, Withings SA, Roche, Animas Corp (Johnson & Johnson).



In vitro diagnostics

Global market: US\$74 billion in 2017, forecast to reach US\$102 billion in 2022.⁷

Drivers: ageing population, shift from curative to preventative healthcare.

Breakthrough technology: self-use tests and state-of-the-art genomic tests that can be used in the diagnosis of infectious and chronic diseases, as well as for preventive care and drug therapy monitoring.

Major players: Roche, Abbott, Siemens Healthineers, Danaher, Thermo Fisher, Sysmex, bioMerieux, Ortho Clinical, Bio-Rad, Becton Dickinson.

Australian medical technologies overview

There are approximately 500 listed and unlisted medical technology companies in Australia.

ASX-listed medical technology companies can be broken down into the following major sub-sectors:

	Number of listed companies
Digital diagnostics, sensors, e-health	14
IVD	10
Imaging and diagnostic hospital devices	9
Respiratory	8
Surgical	5
Orthopaedics	2
Ophthalmic	2
Wound care	2

When considering all listed and private Australian medical technology companies, the main sub-sectors are: IVD, digital health, biomaterials, implantables, respiratory, orthopaedics, surgical, cardiovascular, wound care, and medical imaging.

⁶ American Marketing Association, "Digital Health," [Online]. Available: https://www.ama.org/publications/enewsletters/marketing-news-weekly/documents/ama_dom_digitalhealth_052017.pdf.
⁷ bcc Research, "In Vitro Diagnostics: Technologies and Global Markets," bcc Research, 2018.

The Future Of Medical Technologies

While many executives within the top multinational medtech companies are uncertain about the future of the industry, most agree that things are going to be very different to how they have been in the past.

"I joke that I'm glad I am closer to the end of my career than the beginning because I'm not inherently wired to think this way. The old generation of medtech I got, and I had a gut, and it was pretty good. I don't have that for the

future – I'm trying to learn it and surround myself with people that get it. A lot of people are in denial, but it is going to happen – and I think it is incredibly naïve to think that technology and digital won't fundamentally change the sector."

Vice President Business Development, top 5 medical device company.

Global trends and drivers

There are a variety of factors that are currently converging to reshape the medical technology industry, including:



An ageing population



Proliferation of chronic diseases: cardiovascular, diabetes, hypertension and cancer



Personalised medicine



Minimally invasive treatments & remote monitoring and treatment to reduce hospital stays



High growth in the Asia-Pacific region (particularly from an improving per capita income and healthcare in China, India, and parts of Southeast Asia)



New materials and advanced manufacturing technologies (such as coatings, miniaturisation, 3D printing)



Technology combinations and increased fusion with digital (such as wearables, implantables, health informatics)



Increased collaboration and M&A



Increased R&D expenditure

Consumerisation of medical technologies

The rapid pace of technological development means that the definition of medical technology is constantly evolving. Medtech innovations are increasingly being developed for a consumer market, rather than for physicians and surgeons.

While consumer-focused medical devices have historically been technologies such as canes, crutches and wheelchairs, there is now a rapid advance in the medical applications using mobile phone sensors, smartwatches, fitness trackers and apps. Innovation in digital medtech is currently mainly focused on wearables and sensors, but artificial intelligence in medtech is expected to rapidly develop in the near future.

Analysts have predicted that the trend of medical technology consumerisation will continue to accelerate, and this shift in the sector will undoubtedly have an impact on how value is created for the largest medical technology companies.

There is a great deal of concern in the industry over where the profit pools are going to lie. Some say that – much like the IT sector – profits will be in data and service, whereas others aren't so sure how that model will work.

Many of the largest medical technology companies have established partnerships with digital players. An example is Johnson & Johnson Medical Devices, who now have a partnership with Google in robotics. Johnson & Johnson have acknowledged that the two companies think quite differently – the value Google puts on data is considerably more than Johnson & Johnson.

“We have so much data that we don't know how to use it. They [Google] want it because they realise there will be a way to monetise it.”

**Senior executive,
Johnson & Johnson Medical Devices**

While some multinationals are showing a greater interest in the consumer side of medical technologies than others, many remain sceptical about how rapidly these technologies are going to transform their sector. There are a number of reasons for this.

Large medical technology companies typically define their area of interest in terms of how the technology will be distributed. Medical technologies tend to be distributed through physicians and surgeons that are trained to use them. If technologies are distributed for home use (such as contact lenses, band-aids, hearing aids, and a lot of dental technologies), then they fall into the consumer health side of medtech, and so many of the largest medical technology multinationals consider them out of scope.

“We have no interest whatsoever in the consumerisation of medtech. Our only interest is in ICU – hospital use only. We're not doing anything for consumer. We're not doing any digital... yet.”

**VP Advanced Technology,
top 30 medical device company**

“No one is going to do brain surgery at home, no one will have their friend replace their hip with something purchased through Amazon.”

**Head of Business Development,
top 5 medical device company**

Traditional medtech multinationals are wary to enter the consumer market, as they are nervous that at any moment the big tech players – such as Amazon, Samsung, Apple, Google, Huawei, Xiaomi – could quickly wipe out the market share of any technologies that begin to gain traction. The new Apple Watch – released in September 2018 – has a heart monitor with two electrocardiogram apps that the FDA has approved.

However, there has not yet been the value created in consumer medtech that was initially promised. The reasons for this are undoubtedly complex, but the low barrier of entry into the market is one factor that makes revenue generation a major challenge.

“A common app is one that helps people make sure they take their medication whenever it is due. There are literally thousands of these apps on the Google Play Store and App Store with very little differentiation.”

**Head of Business Development,
top 5 medical device company**

Investors are more optimistic. There is a desire to see consumerisation of medical technologies accelerate as it is a path to market that avoids reimbursement.

“The digital space is something that we look at, but we haven't yet figured out where the opportunities are. Digital can apply to a huge unmet need and is pretty intriguing.”

**Managing Partner,
life science investment firm with \$500m fund**

“There is a new business model emerging. We're seeing digital health technologies being used at home outside any care setting. This is something we're going to see more of, but finding their unique value – along with clinical validation – is not that easy.”

**Partner,
Germany-based health tech fund**

Digital players transforming the sector

While engineering and product design have dominated the medical technology industry, digital and electronics companies have recently begun entering the market and are becoming increasingly significant players in the sector.

Examples of the blurring between medical devices and digital /artificial intelligence include:

- Medtronic partnering with Fitbit Inc on a mobile app for diabetes patients (Dec 2016).
- Cambridge University Hospitals NHS Foundation Trust supporting the development of a breathalyser as cancer screening tool – using an ‘electronic nose’ to diagnose disease.
- Apple’s increasing interest in wearables: heart rate monitor armband, blood glucose tracker extension to Apple watch, acquisition of health data company Gliimpse in 2016 to develop diagnostic apps, acquisition of sleep tech company Beddit in 2017, and a digital health deal with Nokia in 2017.
- Roche Diagnostics entering into a strategic, long-term partnership with GE Healthcare in 2018 in order to jointly develop and co-market digital clinical decision support solutions.

Verily Life Sciences, a Google spin-out and subsidiary of parent company Alphabet Inc., is a research organisation dedicated to the study of the life sciences. It is developing tools and platforms to enable more continuous health data collection for timely decision-making and effective interventions.

Verily projects include:

- Sensors: working with Dexcom to develop miniaturised continuous glucose monitoring system.
- Smart lenses: partnering with Alcon, a subsidiary of Novartis, to build wireless sensing capability into ocular devices for applications including glucose sensing and accommodative vision correction.
- Bioelectronics: creating bioelectronic medicines to tackle a wide range of chronic diseases with GlaxoSmithKline.
- Retinal Imaging: working with Nikon (including its subsidiary Optos) and Google Research to develop machine learning-enabled solutions for diabetes related eye disease.
- Verb Surgical: advancing surgical robotics to benefit surgeons, patients, and hospitals, in partnership with Ethicon, a division of Johnson & Johnson.

Other companies are developing new interest areas but prefer to fund R&D into those areas internally.

“For [us], robotics has an internal funding focus rather than acquisition. When you have over \$100 million going into the development of a therapy internally what you are doing is not as public as an acquisition – people are less likely to follow.”

**Vice President Corporate Development,
top 5 medical device company**

Disrupting the reimbursement model

There is concern that the cost of chronic disease – particularly with current lifestyles and demographics – will bankrupt governments if the sector stays the same as it has always been. The only lever that can be used to change that are tech enabled lifestyle solutions.

There is already some movement to try and disrupt the current model in the United States. Amazon has recently embarked on a medical device strategy and appointed a head of global healthcare. Amazon estimates that 20-30 per cent of healthcare supply costs are tied up with market, administration, and shipping, and are attempting to lower these.

"I like to joke that someday I am going to need a new hip. I'll go onto Amazon, where there will be a base one, and then ones with extra features..."

...I'll select my hip, pick my doctor, choose a hospital (after reviewing their reviews), and then take my basket to the checkout. Somebody is going to figure it out."

**Director of Business Development,
top 5 medical device company**

Evolving regulations

In May 2017, the European Union introduced Medical Device Regulation (MDR), which radically changed the requirements of medical devices sold in Europe.

These new regulations require 35,000 in vitro diagnostics (IVDs) to gain CE marks for the first time, as well as the reclassification of 314,000 devices that went through the registration process using the old rules. Medtech companies have three to five years (for medical devices and IVDs respectively), to comply with new protocols, products that fail to comply with all aspects of the regulations will lose their CE markings.

There is concern from the industry that there is now under two years to go until the end of the transition period, leaving companies little time to certify or recertify their products. This could force companies to pull their products from the market.

The United States FDA also continues to evolve its regulations. A key focus at the moment is working towards a way to separate digital health tools from those that will be properly regulated as devices, and those that fall outside this category of enforced regulation.

In parallel, the FDA is also developing a pre-certification pilot programme to help fast-track digital health technologies into the market. If the FDA is satisfied that a software firm's products are safe and responsible, it will mean that it will not have to regulate every product from that company.

External Innovation

The nature of the medical device industry and the innovation that occurs within it means that the largest medical technologies companies are often looking for incremental changes that will improve devices they already have on the market – and can therefore easily gain registration – rather than introduce a completely new technology (or a blockbuster equivalent) to their portfolio.

“There is only a certain amount of innovation left in some technologies. People are unlikely to pay too much more for new innovation in stents. We have to realise where ‘good enough’ is, because for a lot of products they are not going to get any better.”

**Head of Business Development,
top 5 medical device company**

Any new medtech device developed is often a range of separate technologies converging in a single device. This results in many acquisitions taking place to bring together validated key components to a multinationals’ product development, as opposed to investing in long-term research with academia.

Adding further to this desire for acquisitions, the medical technologies industry is dominated by small and medium enterprises (consisting of less than 50 employees). Eighty per cent of the 7,000 medtech companies in the United States and 95 per cent of the 25,000 companies in Europe are considered SMEs, and hold the majority of patents. These figures demonstrate that medical technology companies have a rich source of opportunities for acquisitions.

Prove a demand for the technology

The development cycle for medical device products is much shorter than in pharmaceuticals (research and proof of concept: 2 years, preclinical validation: 0.5 years, clinical trials: 1-2 years). The median time to exit in medtech is eight years.

The advice received from multinationals is that start-ups must assume they will need to not only build – but then prove – their technology and their business over a long period of time.

In the current environment more than three-quarters of medical device acquisitions occur after regulatory approval. Most medical technology multinationals prefer to wait until a technology can demonstrate strong sales (often in the tens of millions of dollars). In doing this, they are able to mitigate the challenge of registration and the considerable work involved in convincing physicians and surgeons that this particular piece of technology or innovation is worth considering (and often retraining for) over existing alternatives and will make a real difference to the quality of life to the patient.

“[We] will not acquire companies that do not meet all our criteria. And the universe of buyers is not bigger than it was last year, or the year before – it is smaller. That’s the biggest issue. You could beat your head against the walls wanting to be acquired – instead, companies should be focused on building their business.”

**Vice President Corporate Development,
top 5 medical device company**

“Medical technologies need to know that someone will buy their device, and spend time training physicians and surgeons. In comparison, for the pharmaceutical industry the opportunity is so great and the adoption hurdle is low.”

Head of Business Development, top 5 medical device company

Multinationals are prepared to pay considerably more for a technology once it has been proven in the market and de-risked as much as possible.

“Having a CE mark and \$30 million in sales is the sweet spot for an acquisition for us, although we occasionally look at earlier stage technologies if we have a pipeline gap.”

**Vice President Business Development,
top 5 medical device company**

“Spine-Tech was an orthopedics company with a very interesting, novel technology. It was acquired by Swiss-based orthopedics company Sulzer Medica in 1997 for \$595 million, which allowed Sulzer to enter the spinal market segment. A year before they did the deal, Sulzer could have acquired Spine-Tech for \$80 million, but they chose not to. I was talking to one of the guys from Sulzer who was involved in the deal and asked him if he made a mistake – he said no, absolutely not – because the technology wasn’t established enough yet.”

**David Cassak,
MedTech Strategist**

That said, many of the companies spoken to for this report indicated that the timing of an acquisition depends on what the technology is. Medical technology multinationals are more likely to show an interest in seeking out early-stage technologies that have the potential to be truly transformational, but typically only in areas and indications they know very well and have strong capability or competitive advantage over other companies.

Similarly, if the intellectual property aligns well with their company, they may consider a strategic investment in order to keep an eye on development, and in rare cases will consider licensing a technology in, where appropriate (this route is more likely for software and algorithms).

Collaborations with universities to conduct collaborative research and develop medical devices do occur but are less prominent than in pharma – research in orthopaedics, and projects involving 3D printing technologies to make personalised implants are among the exceptions.

Specific niches

Some medical technology multinationals, such as Edwards Lifesciences, are so focused on their specific niche that they will not consider sourcing any technologies that fall outside their very strict boundaries. This desire to stay focused on their particular area of expertise means that medical technology multinationals tend to have an ongoing effort to optimise their portfolios, with divestitures and spin-outs commonly used as a mechanism to remain focused on their core areas of interest.

“We’re not Medtronic, we’re not Johnson & Johnson... we are focused on structural heart disease and critical care haemodynamic monitoring. That’s it. We’re not going outside of that. Stents? Not interested.”

**VP Advanced Technology,
top 30 medical device company**

“Pfizer suddenly became interested in erectile dysfunction after the unexpected side effects of Viagra. That is not something that would happen so easily in medtech. Medtech companies rarely take on technologies outside their space.”

**Head of Business Development,
top 5 medical device company**

Identifying innovation

Medical technology multinationals use a range of methods to seek out technologies and new innovation:

Internet searches

General Internet searches are continually used to review specific areas they have a keen interest in and already know very well. During interviews for this report, it was not uncommon for business development heads to conclude that they are generally aware of absolutely everything that is happening within their niche areas of interest.

“In certain spaces we know the activity so well we are rarely surprised.”

**Vice President Business Development,
top 5 medical device company**

However, it was noted in several discussions that while ‘Western’ innovation is usually easy to uncover, it is much more difficult to be across technologies from developing regions such as Southeast Asia and China.

Medical device meetings and conferences

Many heads of business development spoken to for this report were less enthusiastic about conference attendance than their pharmaceutical counterparts.

There are a few medical meetings and conferences (particularly the MedTech Strategist Innovation Summit and The MedTech Conference) that business development heads cite as useful events to get together with other industry leaders from the biggest medical technology multinationals and share insights on the direction of the industry.

Medical technology industry events can primarily be considered educational and trade exhibitions, rather than partnering events (as is the case for the BIO International Convention). Multinationals indicated that they are more likely to use these events as an opportunity to walk the floor and get a sense for what new technologies are coming through the pipeline – particularly for areas they may not be so familiar with – rather than treat them as a serious partnering event.

These trade events are also an opportunity to stay informed about technologies which might offer opportunities for the strategic investment arms of a company at an earlier stage.

The MedTech Strategist Innovation Summit

The MedTech Strategist Innovation Summit is considered by industry to be the preeminent medtech investment event in Europe. Taking place in Dublin each year, it is supported by many of the largest medical technologies companies and attracts the top executives and VCs in the sector. The summit is capped at about 450 attendees, which makes it a far more intimate conference than the big tradeshows.

The MedTech Conference

The MedTech Conference is held in different locations in the United States each year, and attracts about 3,000 attendees across the medical technologies sector. Organised by the Advanced Medical Technology Association (AdvaMed) – a trade association that leads the effort to advance medical technology – the conference attracts a wide variety of attendees, with a strong focus on business development, GMP, and regulatory affairs.

But while the MedTech Conference offers a great variety of market and regulatory updates, presentations, and panel discussions, it is far less focused on partnering meetings than, for example, the BIO International Convention.

The MedTech Conference has a small exhibition area (usually open for two out of the three conference days). Exhibitors range from small medical technologies companies (that are usually past regulatory approval), consultants (regulatory, government relations, market development and manufacturing), as well as large medical technologies multinationals.



Exhibition hall at The MedTech Conference

Speaking with the multinational attendees at The Medtech Conference in 2018, they gave the following reasons for attending the conference:

- To demonstrate their corporate responsibility focus. For example, both Stryker and Johnson and Johnson had large displays showcasing their relationship with 'Operation Smile' – an international medical charity providing free surgical procedures for children and young adults born with cleft lip, cleft palate and other facial deformities. These companies had staff from their corporate responsibility teams fronting their booth.
- To support their CEO, VP, or chairperson (or similar) who is on the board of the FDA or AdvaMed, or is working in government affairs.
- To meet vendors (distributors for their products), and showcase their products – or upcoming products to the market. Baxter was showcasing their new home dialysis product on their booth to potential vendors. Smith and Nephew were showcasing their latest robotics technologies – purely to raise profile – as they don't use distributors.
- To promote their company for recruitment purposes.

While some companies indicated they had a small team of business development staff present, but this wasn't considered a focus for the conference.

One multinational indicated that their business development representative was there for the first day, but left the morning of the second day – when the exhibition hall opened. Instead, the engineer at the booth was collecting business cards throughout the conference, and indicated he would follow up following the conference to let them know the website to submit their request for a business development contact.

This is in line with the detail revealed from interviews with multinationals – outlined in the following section of the report – that medical technologies are more likely to directly contact companies of interest, or willingly take cold calls from companies that think they may be of interest to them.

Direct contact from innovators

Medical technology multinationals are frequently contacted directly by companies and technology innovators. Edwards Lifesciences estimates that 95 per cent of the acquisition opportunities they consider from SMEs are from direct approaches. Multinationals that are approached this way are able to very quickly screen a technology and identify whether it fits their portfolio and offers something unique.



Partnering set up at The MedTech Conference

“95% of opportunities come from companies that have called us. We can quickly and easily see pros and cons of various technologies and companies. I know almost every upcoming technology in the field - that is my job. I know what they’re doing, how they’re approaching a problem. We can easily see if this solution will or won’t benefit the patient.”

**VP Advanced Technology,
top 30 medical device company**

However, a challenge for medtech innovators is that the partnering pages and areas of interest listed on the websites of medical device companies are often far less transparent than those from the pharmaceutical industry.

Strategic venture capital arm

Many of the largest medical technology multinationals – such as Johnson & Johnson Development Corporation (JJDC) or Abbott Ventures – have a strategic venture capital arm. They are more likely to consider investment into earlier stage technologies this way, as it provides them a window into the opportunity and its future development, without necessarily having to acquire it.

This arrangement provides a mutual opportunity to both sides. The start-up can glean insights from the multinational that will better position themselves for an acquisition. Traditional venture capital investment into medical technologies has fallen

over the last few years as the returns haven’t been seen in the sector, but strategic investors are helping to fill some of the gap that has been left.

“Our portfolio reflects the strategic interest of our sectors. We’re currently about 60% pharma, 10% consumers, 30% medical devices - but it varies year to year. We invest across all three sectors, and work with all groups to decide which companies are interesting for investment.”

VP Venture Investments, strategic venture capital arm of top 5 medical device company

Scouting

Medtech companies tend to have less external/open or search and evaluation people based in various geographies than is common in the pharmaceutical sector. This is due to the interest in later stage technologies that medtech multinationals have, and the relative ease to find these, especially compared to early-stage drug development candidates.

Demonstrating this, Johnson & Johnson Medical Devices has no one based in Europe for scouting, but instead covers the region with visits whenever necessary from New Jersey.

Build to buy

Some medtech companies, such as Medtronic, run a ‘build to buy’ programme. They use this to work alongside a partner (which is often a smaller, more agile start-up) to put together an idea and fund it – with milestones for additional funding. Alternatively, if a multinational has an internal technology they are not providing funding or resources to, they will sometimes license it to a partner and have them develop it along with funding from the multinational.

“We’ve done a lot of those recently, but most we don’t publicise and announce them because there are benefits to keeping it under wraps until we feel like it’s a meaningful advancement of the technology.”

Vice President Strategy, Growth and Business Development, top 5 medical device company

Tip-offs from industry

Those spoken to for this report indicated that a significant amount of leads generated for medical technology multinationals come directly to the company from suggestions made to the business development team from physicians, board members, and sales representatives.

Sourcing innovation from Australia

Medtech multinationals are agnostic as to where their technologies come from. The companies spoken to for this project said that there is nothing that would prevent them from considering Australia for innovation but nothing to specifically encourage them either.

Australian medtech companies are considered to have very good regulatory compliance, especially compared to innovation coming from emerging markets. Regulatory compliance is very important to multinationals; almost all had an example of a company acquired from an emerging market where it cost more to 'clean it up' than it cost to buy it. This hurdle has prevented many companies from spending much time in emerging markets "as you can only get so much out of diligence."

The most common reason cited by multinationals that prevents them from travelling to Australia however, is the time and distance it takes to get there.

Many argue that it is easier to hunt for medical technologies in their own geography, and Australia's relatively small number of companies compared to the United States and Europe compound their reasoning.

"I left [for Australia] on a Friday to get there on a Saturday. As I transited through San Francisco [having left New York City] I ran into a friend of mine who called me a loser. He said to me 'you're only a quarter of the way there!' It is a very long way."

**Head of Business Development,
top 5 medical device company**

"For Singapore, there used to be a direct flight out of JFK airport. There will be again soon – 18 hours straight. In business class that is not such a bad flight. For me it's the door to door thing. Having to get off and transit is what drives me crazy."

**Vice President Business Development,
top 5 medical device company**

Examples of multinational collaboration with Australian medical technologies

- Both GSK and Medtronic invested in Saluda Medical: "Saluda is advancing and expanding the field of bioelectronic medicines. Saluda has developed the first therapeutic device to treat chronic pain". GSK strategic venture capital arm Action Potential Venture Capital (APVC) invests globally and strategically in pioneering bioelectronic medicines and their enabling technologies. **[Strategic investment in transformative innovations.]**
- Allergan acquired Elastagen: "This acquisition and the development of a next generation of injectables based on this technology will ensure Allergan offers innovative filler products for years to come." **[Incremental innovation to existing product portfolio.]**
- Varian's acquisition offer of Sirtex (Varian was subsequently outbid by Chinese private equity fund CDH Investments): "This acquisition is the latest step in Varian's long-term strategy to become a global leader in multi-disciplinary integrated cancer care solutions." **[Expanding global leadership around existing products.]**
- The Australian government, Melbourne's RMIT University, the University of Technology Sydney (UTS), St. Vincent's Hospital Melbourne, and medical tech company Stryker are working together on a five-year project called "Just in time implants," through which they will develop 3D printed patient-specific implants for people undergoing tumour removal and bone cancer treatment. The innovative 3D printing implant project, which has accumulated AU\$12.1 million in funding, is being primarily financed by medical tech company Stryker as well as Australia's Innovative Manufacturing Cooperative Research Centre (IMCRC), part of the government's Department of Industry, Innovation and Science. **[3D printing collaboration as an innovative area in medical technologies.]**

Pharmaceuticals



Pharmaceuticals

GLOBAL MARKET

Global pharmaceutical industry overview



The pharmaceutical industry consists of prescribed (Rx) and over the counter (OTC) drugs and therapies, chemically or biologically produced, compounds or cell therapies, and novel or generic compounds including biosimilars.



The pharmaceuticals market was estimated at US\$1,105 billion in 2016, and is forecast to reach US\$1,485 billion by 2022.⁸



The top 10 largest pharmaceutical multinationals (by revenue) capture 40 per cent of the global market, the top 15 hold over 50 per cent market share.



The United States has a 40 per cent share of the global pharmaceutical market.

⁸ IMS Institute for Healthcare Informatics, "Global Medicines Use in 2020," November 2015. [Online]. Available: <https://www.iqvia.com/-/media/iqvia/pdfs/institute-reports/global-medicines-use-in-2020.pdf>.

Top 15 pharmaceutical multinationals

The below table lists the top 15 pharmaceutical global companies (by revenue) based on 2017/18 revenue figures for their pharmaceutical segments.⁹

	Pharma revenue (US\$b)	R&D spend (US\$b)	Main areas of interest
Pfizer (USA)	45.3	7.6	Oncology, inflammation & immunology, cardiovascular, metabolism, neuroscience & pain, vaccines, rare diseases
Novartis (Switzerland)	41.9	7.8	Oncology, CNS, immunology, dermatology, ophthalmology, cardiovascular, metabolism, respiratory
Roche (Switzerland)	41.7	9.2	Oncology, immunology & inflammation, ophthalmology, rare diseases, neuroscience, infectious diseases, diagnostics, biomarkers, technologies
Merck & Co. [MSD] (USA)	35.4	7.6	Oncology, cardiovascular, immunology, respiratory, infectious diseases and vaccines, diabetes & endocrinology, reproductive health, neuroscience & ophthalmology, technologies
J&J (USA)	34.4	8.4	Oncology, cardiovascular, metabolism, neuroscience, immunology, infectious diseases & vaccines
Sanofi (France)	34.0	6.2	Diabetes, rare diseases, infectious diseases, vaccines, immunology & inflammation, cardiovascular, metabolism, oncology, neurology, multiple sclerosis, ophthalmology
GlaxoSmithKline (UK)	28.7	5.0	Bioelectronics, biopharmaceuticals technologies and processes, consumer healthcare, immuno-inflammation, infectious diseases including bacterial, viral and parasitic infections, metabolic and cardiovascular, neglected tropical diseases, neurosciences, oncology, ophthalmology, respiratory, vaccines
AbbVie Inc. (USA)	27.7	4.8	Rheumatoid arthritis, psoriasis and dermatological diseases, inflammatory bowel disease, osteoarthritis, systemic lupus erythematosus.
Gilead Sciences (USA)	25.7	3.5	Oncology, haematology, liver diseases, HIV, cardiovascular, inflammation, respiratory
Amgen (USA)	21.8	3.5	Oncology, bone health, nephrology, metabolism, cardiovascular, neuroscience, inflammation, technologies
AstraZeneca (UK)	19.8	5.4	Cardiovascular & metabolism, oncology, respiratory, inflammation & autoimmune diseases, neuroscience
Bristol-Myers Squibb (USA)	19.3	4.8	Oncology, cardiovascular, fibrosis, immunology
Eli Lilly (USA)	18.5	5.0	Oncology, neuroscience, immunology, diabetes, technologies
Teva Pharmaceutical Industries (Israel)	18.3	1.8	Oncology, neuroscience, respiratory (asthma, cystic fibrosis, COPD), technologies, biosimilars, diagnostics
Bayer (Germany)	17.5	3.3	Oncology, cardiology, nephrology, gynaecology, haematology, ophthalmology, radiology, consumer health

⁹Statista, "Top 50 global pharmaceutical companies by prescription sales and R&D spending in 2017," Statista, 2018 (and company annual reports)

Top selling medications

Many large pharmaceutical multinationals are significantly exposed to the imminent patent expiry of the blockbuster drugs that make up the majority of their income and the resulting competition from generics.

For example, AbbVie’s Humira earns US\$18.4 billion of the company’s US\$27.7 billion total revenue. Humira was the top global selling drug in 2017 (as shown in the global top 10 selling drugs table below) with approval for ten indications including rheumatoid arthritis, psoriasis, and Crohn’s disease. Humira’s patent expired in October 2018, and there are already several biosimilars from competitors (including Amgen, Boehringer Ingelheim and Samsung Bioepis) approved in Europe.

Global top ten selling drugs (2017)¹⁰

Marketer	Drug	Primary indication	Sales (US\$m)
AbbVie	Humira	Arthritis	18,427
Roche	Rituxan/MabThera	Non-Hodgkins Lymphoma	9,238
Celgene	Revlimid	Multiple myeloma	8,187
Amgen	Enbrel	Arthritis	7,885
Roche	Herceptin	Cancer	7,441
BMS/Pfizer	Eliquis	Thrombosis	7,395
J&J	Remicade	Arthritis	7,152
Roche	Avastin	Cancer	7,096
J&J	Xarelto	Atrial fibrillation	6,589
Regeneron/Bayer	Eylea	Retinal disease	6,034

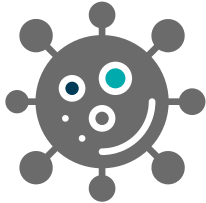
In 2016, the FDA approved 22 new molecular entities, including 15 small molecules and seven biologics. In comparison to these numbers, 633 generics were approved.

By 2020, more than 91 per cent of medicines dispensed in the US are expected to be generics.⁸ Biosimilar sales are also expected to be boosted by several key biologics that face patent expiry over the next few years.

⁸ IMS Institute for Healthcare Informatics, "Global Medicines Use in 2020," November 2015. [Online]. Available: <https://www.iqvia.com/-/media/iqvia/pdfs/institute-reports/global-medicines-use-in-2020.pdf>.
¹⁰ Statista, "Top pharma products by global sales," Statista, 2017.

Sector overviews

These sectors have been highlighted as key areas of interest for large pharmaceutical multinationals.



Infectious diseases

The global market for infectious disease diagnostic, vaccine, and pharmaceutical treatment products reached \$108.4 billion in 2015. The market should reach \$126.2 billion in 2016 and \$183.2 billion in 2021, demonstrating a compound annual growth rate (CAGR) of 7.7% from 2016 to 2021.¹¹

The in vitro diagnostic (IVD) infectious disease global market is predicted to reach US\$19.1 billion in 2019, and US\$26 billion by 2022.¹²

The top two infectious disease therapeutics markets are HIV and hepatitis. The top six markets also include influenza, tuberculosis, malaria, and HPV.



Cardiovascular

The global cardiovascular drug market is currently valued at US\$132 billion, and is forecast to reach US\$148 billion by 2023.¹³

The compound annual growth rate (CAGR) for cardiovascular drug products is low at 2.2 per cent, attributable to major product approvals coinciding with key patent expirations.⁹ Within cardiovascular disease, there are a number of blockbuster products that have recently gone off-patent, and others are expected to over the coming years.

Anti-hypertensive drugs hold the largest share of the global cardiovascular drug market – accounting for 60 per cent of revenue. Lipid lowering drugs make up 16.4 per cent of revenue.

The market for cardiovascular drugs is growing due to the increasing incidence of cardiovascular disease, and the rising number of diabetes and obese patients.

Major players include Pfizer, AstraZeneca, Merck & Co., Sanofi, Bayer, BMS, Novartis and J&J.



Oncology

The global oncology market was valued at US\$118.6 billion in 2016, and is forecast to reach US\$241 billion by 2023 with a CAGR of 10.7 per cent.¹⁴

The oncology market is driven by the growing prevalence of various types of cancer, an increasing demand for biological and targeted drug therapies, the ongoing patent expiry of key cancer drugs, and the rising impact of biosimilars.

The global cancer drug market by cancer type is segmented into blood cancer, breast cancer, gastrointestinal tract cancer, prostate cancer, lung cancer, skin cancer and other cancer. Amongst these different cancer types, blood cancer was the largest revenue generating segment in 2015.¹⁵

Immunotherapy dominates the global market for cancer drugs due to its high efficacy and fewer side effects compared to other treatments. Monoclonal antibodies such as trastuzumab (Herceptin, Roche), bevacizumab (Avastin, anti VEGF-A, Roche) and rituximab (anti-CD20, Roche) are immunotherapeutic agents that have achieved big sales.

The cancer immunotherapy market is primarily driven by huge research investments from multinational pharmaceutical companies, along with research collaborations for the development of cancer immunotherapeutics.

¹¹B. Research, "Global Markets for Infectious Disease Treatments," 2016.

¹²Grand View Research, "IVD Infectious Disease Market Analysis By Product (Instruments, Reagents, Software), By Technology, Application," Grand View Research, 2016.

¹³Market Data Forecast, "Cardiovascular Therapeutic Drugs Market By Disease, By Drug Class And By Region – Global Industry Analysis, Size, Share, Growth, Trends, And Forecast (2018– 2023)," Market Data Forecast, 2018.

¹⁴GBI Research, "Global Oncology Market to 2023 - Robust Growth Driven by Rising Prevalence and Increased Uptake of Immune Checkpoint Inhibitors," GBI Research, 2017.

¹⁵ Bard1 Life Sciences Ltd, "Market Potential," [Online]. Available: <http://www.bard1.com/technology-2/market-potential/>.



Oncology (continued)

The total immuno-oncology market is predicted to be worth US\$14 billion in 2019, rising to over US\$34 billion by 2024.

The main drivers of this growth will come from immune checkpoint inhibitors, which will have sales of approximately US\$10 billion in 2019, rising to US\$24 billion by 2024. The highest-selling immuno-oncology drugs by 2024 are expected to be Opdivo (BMS) and Keytruda (Merck & Co) – both PD-1 inhibitors.

Biomarkers are increasingly used to diagnose cancer subtypes and ensure patients receive the specific therapy they will respond to. The global cancer biomarkers market was valued at US\$10.3 billion in 2016, and is forecast to reach US\$33.7 billion by 2025.¹⁷



Central Nervous System (CNS)

The global CNS therapeutics market was valued at US\$77 billion in 2016, and is forecast to reach US\$145 billion by 2024.¹⁸

Mental health and degenerative disorders are major contributors to the escalating demand globally for CNS therapeutics. Technical advancement in neurological imaging – which helps in early diagnosis – is a key factor fuelling growth.

Over the last decade, more than 50 drug candidates have successfully passed phase 2 clinical trials for Alzheimer's disease, but none have passed phase 3.

Major trends include:

- The development of compounds acting on the main stages of the pathogenesis of the disease or “disease-modifying agents” – these drugs could potentially slow the development of structural and functional abnormalities in the central nervous system providing sustainable improvements of cognitive functions, which persist even after drug withdrawal.
- Focused design of multitargeted drugs acting on multiple molecular targets involved in the pathogenesis of the disease.
- The repositioning of old drugs for new applications offers a very attractive approach to facilitate the completion of clinical trials.



Diabetes

The global diabetes market was valued at US\$125 billion in 2016 and is forecast to reach US\$155 billion by 2021 with a CAGR of 4.4 per cent over this period.¹⁹

The major factor contributing to this growth is the increased incidence of diabetes caused by rapid urbanisation and sedentary lifestyles. Further boosting the market growth is the development of affordable and effective diabetes therapeutics, rise in obesity, consumption of fast food, growth in awareness among people about self-management of diabetes, and support from the government.

The injectables segment accounted for nearly two-thirds share of the global market in 2016.

The insulin segment accounted for 55 per cent of the global market in 2016.²⁰

The GLP-1 receptor agonists segment is expected to grow at a rapid CAGR of 33.1 per cent from 2017 to 2023.¹⁶

Major players include Novo Nordisk, Sanofi, Merck & Co, Eli Lilly, and AstraZeneca.

¹⁷ Grand View Research, “Cancer Biomarkers Market Worth \$33.7 Billion By 2025 | CAGR: 14.3%,” Grand View Research, 2017.

¹⁸ G. I. Analysts, “CNS Therapeutics - Market Analysis, Trends and Forecasts by Global Industry Analysts,” 2018.

¹⁹ bcc Research, “Global Markets for Diabetes Therapeutics and Diagnostics,” bcc Research, 2016.

²⁰ Allied Market Research, “Diabetes Therapeutics Market by Product [Injectables (Insulin, Glucagon-like Peptide-1 (GLP-1) Receptor Agonists, and Amylinomimetic Drugs) and Oral-antidiabetic Drugs (OAD) (Biguanides, Sulfonyleureas, Thiazolidinediones, Alpha-glucosidase Inhibitors, Dip),” Allied Market Research, 2017.



Immunology

The global immunology market was valued at US\$61.5 billion in 2015, and is forecast to reach US\$74 billion by 2022.²¹

The four key indications within immunology are rheumatoid arthritis, systemic lupus erythematosus (SLE), psoriasis and inflammatory bowel disease (IBD).

The populations of many of the indications within immunology are increasing, which is a major driver of growth in the market. For example, the prevalence population of rheumatoid arthritis across the seven major markets is expected to increase from 6.11 million in 2016 to 6.66 million in 2023.²²

Key market players in immunology include AbbVie, Johnson & Johnson, Roche, Amgen and Pfizer. These companies are expected to maintain a strong market share despite several major drugs coming off-patent.



Ophthalmology

The global ophthalmic drug market was valued at US\$24 billion in 2016, and is forecast to reach US\$34 billion by 2025.²³

This market is primarily driven by an increasing geriatric population globally, technological advancement, rising prevalence of eye disorders, increased healthcare expenditure, and an increase in cataract surgeries. In addition to these, the rising prevalence of intraocular eye disorders (including glaucoma, cataract, diabetic retinopathy, and age-related macular degeneration) are further predicted to enhance the growth of the market in the near future.

Major players include Allergan, Abbott, J&J, Bayer, Roche, Santen and Novartis.

²¹ Research and Markets, "Global Immunology Market to 2022 - Large pipeline and competitive market to drive long-term market growth," Research and Markets, 2016.

²² GBI Research, "Global Immunology Drugs Market to 2023 - Shifting Landscape as Uptake of Interleukin Receptor Inhibitors Offsets Losses for Top Blockbuster Drugs," GBI Research, 2018.

²³ Transparency Market Research, "Ophthalmic Drugs Market (Disease Indication - Dry Eye, Glaucoma, Infection/Inflammation, Retinal Disorders (Wet Age-related Macular Degeneration, Dry Age-related Macular Degeneration, and Diabetic Retinopathy), Allergy, and Uveitis)," Transparency Market Research, 2017.

Australian pharmaceutical overview

The Australian Rx and OTC market was estimated at US\$22.9 billion in 2016.²⁴

ASX-listed pharmaceutical companies can be roughly divided into the following sectors:

Sector	Number of listed companies
Oncology	17
Neuroscience, CNS pain	10
Dermatology	7
Immunology & inflammation, autoimmune disease	6
Infection, vaccines	6
Cardiovascular	4
Respiratory	3
Ophthalmology	3
Metabolism, GI, diabetes	2
Rare diseases	2

The dominant focus on oncology is clearly linked with the strong oncology capability at Australia's leading universities and research institutes.

Other recognised areas of Australian pharmaceutical and biotechnology strength includes pain, drug delivery technologies, and inflammation.

²⁴GlobalData, "CountryFocus: Healthcare, Regulatory and Reimbursement Landscape - Australia", GlobalData, 2016.

The Future Of Pharmaceuticals

By the time a medicinal product reaches the market, an average of 12-13 years will have elapsed since the first synthesis of the active substance. On average, only one or two of every 10,000 substances synthesised in laboratories will successfully pass all stages of development required to become a marketable medicine.

The cost and time – and risk of failure – in the pharmaceutical industry has meant that the traditional business model is in jeopardy. This, along with other external trends and drivers, has been dramatically reshaping the industry over the past decade.

Global trends and drivers

There are a variety of factors that are currently influencing the pharmaceutical industry, including:



An ageing population



Personalised medicine



The rate of chronic disease diagnosis is increasing (cardiovascular, diabetes, hypertension, cancer, respiratory), which is placing even more pressure on healthcare budgets around the world.



Advances in medicine are rendering previously fatal diseases chronic.



Rapidly growing demand for medicines in emerging markets.



Large pharmaceutical multinationals are more exposed than ever to the imminent patent expiry of blockbuster drugs, and the introduction of generics.



Regulators are becoming more cautious about approving innovative new medicines.

A push to personalise medicine

In the past – particularly for chronic diseases – a one-size-fits-all approach was taken in the pharmaceutical industry. This resulted in treatment strategies for patients that were based on generalised demographics. This traditional model is now shifting towards a more personalised approach, including an increased attention to rare diseases.

Precision medicine is the use of diagnostics and therapies to deliver maximum effectiveness, by considering factors including individual gene variability, clinical and molecular information, and factors like environment and lifestyle.

This approach has been advanced due to increasing amounts of data available that helps to provide a more holistic view of any individual patient. This enables an increasingly predictive model of healthcare, and is allowing better targeted therapies, mitigating many of the inefficiencies (such as false positives, false negatives, unnecessary treatments and over or under-medication) that have an impact on the cost of treatment and ultimately the quality of care a patient receives.

The FDA approved 16 new precision medicine therapies in 2017. These therapies targeted cancer (including breast cancer, metastatic Merkel cell carcinoma, non-small cell lung cancer, and myeloid leukemia), orphan diseases (CLN2 Batten disease and Sly syndrome), and infectious disease (hepatitis C).

Several drugs already approved received expanded indications in 2017, allowing them to treat new patient populations, including Revlimid (lenalidomide), Keytruda (Pembrolizumab) and Tecentriq (atezolizumab).

Reimbursement challenges

The imminent patent expiry of blockbuster drugs is exposing large pharmaceutical companies to a risk of greatly reduced revenues. As drugs go off-patent, much cheaper generic substitutes are introduced, resulting in payers moving their medicine dollars from 'name brand' medicines toward options that provide the best outcome at an optimal price.

Alongside this, as pharmaceutical companies develop powerful new drugs, they must be able to justify the benefit of these newly developed drugs to payers.

There has never been as many specialty drugs as are available today, and the number of high cost drugs, their complexity and price are expected to continue to grow.

This is influencing the development of new pharmaceuticals from multinational companies. As payers shift from paying for the usage of drugs to paying for the value they are able to provide to the patient, pharmaceutical companies must be able to clearly demonstrate the benefit of a new drug over the increasing pool of generics and cheaper alternatives.

Tech-assisted pharmaceuticals

Technology is increasingly being used alongside pharmaceutical innovation, which is creating a blurring between the pharmaceutical and medical technology sectors.

Collaboration between pharmaceutical companies and unlikely players – such as telecommunications companies and mobile device manufacturers – is expected to become more common place.

These collaborations allow pharmaceutical manufacturers to develop holistic products to support diagnostics, monitoring, and compliance.

Examples include innovation in inhalers that can track doses and smart pills that can monitor patient compliance.

External Innovation

Leading pharmaceutical multinationals – particularly those headquartered in the United States and Western Europe – are increasingly using external innovation as a source of new ideas, novel and promising molecules, technology, and innovative applications.

Adoption of external innovation allows pharmaceutical companies to better cope with rapidly evolving innovation cycles, manage the uncertainty of emerging technologies, and stay at the forefront of global competition.

This differs from the traditional vertically integrated model, where R&D is developed internally and companies generate their own ideas – right through to development, marketing and distribution. This closed model has almost become redundant in the pharmaceutical industry, where R&D investment is notoriously high-risk.

A global search

The market for competitive life sciences innovation is geographically dispersed, and often requires pharmaceutical multinationals to search, recognise, and acquire opportunities outside the geographic footprint of their headquarters.

“Innovation does not have a boundary. There is no border limit, wherever there is good science, we go for it.”

**Head of Business Development,
top 5 pharmaceutical company**

The challenge that comes with this – particularly as the industry is expanding their open innovation activity to include earlier development stages – is that finding these technologies requires significant resources to search, recognise the value of, and ultimately acquire.

An increasing trend

R&D returns for pharmaceutical companies have fallen to the lowest level in nine years, from 10.1 per cent in 2010 to 1.9 per cent in 2018.²⁵ Compounding this push for external innovation, research has shown the success of drug candidates sourced through open innovation is approximately three times higher than those sourced through in-house R&D.²⁶

As multinational pharmaceutical companies look to diversify their pipelines and replace blockbusters that are approaching patent expiry, the number of acquisitions is expected to increase. There is already a notable increase in external collaboration – and the breakdown of barriers – between different life science companies, strategic partners, and researchers inside and outside the pharmaceutical multinationals.

Among recent transactions, licensing of candidates is by far the most common approach, comprising 93 per cent of deals. Mergers and acquisitions make up about six per cent, while joint ventures make up just one per cent of deals

Identifying innovation

The desire for external innovation by pharmaceutical multinationals has made their methods used to scout and identify relevant new innovation for their pipeline sophisticated and efficient.

Biotechnology and pharmaceutical meetings and conferences

All major pharmaceutical multinationals are present at the largest conferences, and they use these events as a convenient opportunity to identify innovations of interest. For multinationals, the most important are the annual BIO International Convention (which boasts nearly 20,000 attendees and over 40,000 one-on-one partnering meetings) and BIO-Europe (held in spring and autumn each year). These events represent a significant investment in time, money and resources.

The 2017 BIO International Convention had 3,491 companies registered for partnering. These companies requested 218,651 meetings, which translated into a record 41,400 scheduled meetings during the event.



Partnering booths at the BIO Convention

²⁵Deloitte LLP, “Unlocking R&D productivity - the state of pharmaceutical innovation in 2018,” Deloitte LLP, 2018.

²⁶Deloitte LLP, “Executing an open innovation model: Cooperation is key to competition for biopharmaceutical companies,” Deloitte LLP, 2015.

Large and midsize pharmaceutical multinationals mostly met with smaller biotech companies (52 per cent), other pharmaceutical companies (17 per cent) and academia (14 per cent). This suggests they are looking for early-stage (preclinical through to phase 2) opportunities, to meet new partners, and discover promising new research.

Pharmaceutical multinationals use these events as an opportunity to meet with new innovators, and catch-up with those they have been paying attention to. These events are one of the most important opportunities for face time with key decision makers within large organisations.



Exhibition hall at the BIO Convention

Regional hubs and scouting

Pharmaceutical companies place a lot of emphasis on having highly efficient regional hubs that can explore the region for exciting new innovation. These roles involve understanding the minutiae of the market, spotting opportunities at early stages, and ‘turning over every stone’ to ensure the next potential blockbuster isn’t snapped up by a competing multinational.

These scouts are usually based in large centres – particularly key research hubs in Asia, Europe, and the United States. Australia has some regional scouts, but many pharmaceutical companies rely on individuals in Asia – typically Singapore or Shanghai – to cover the entire Asia-Pacific.

For those regions that are not covered by regional hubs, some pharmaceutical companies use the services of a third-party, where scouting and representation can be achieved at a much lower cost than having their own presence.

Publicity of areas of interest

Pharmaceutical multinationals have generally become very good at outlining on their websites exactly which technologies are of interest to them for their pipeline.

Innovator companies are able to use this information to identify whether or not a particular multinational is a suitable target for their technology, or whether their time would be better placed courting a more relevant candidate

Innovation centres and research alliances

In recent years, multinational pharmaceutical companies have embraced innovation centres and research alliances to gain access to new technologies for their pipeline. These often involve a collaboration between the pharmaceutical companies and research groups or universities to bring scientists together to deliver innovative products.

The pharmaceutical company contributes its experience in the market, developmental knowledge, financial and human resources, and benefits from the research expertise in disease areas, target biology and patient populations from its academic partners.

Academic grant funding schemes

Multinational pharmaceutical companies are increasingly investing in and partnering with early stage research programmes. This allows them to keep their open innovation funnel open as wide as they can, and provides them with an opportunity to see what is coming – usually with the first rights to license or acquire technologies of interest.

“We can either do 50 academic collaboration deals per annum or invest in 4-5 assets with the same amount of money. The chance we will get a winner out of 50 research programmes is better than from 4-5 early assets. We also get a lot of biological pathway information and can see what is coming.”

Top 10 pharmaceutical BD executive

Sourcing innovation from Australia

Australia's reputation is driven by the region's globally renowned excellence in science and research.

"Australia has a lot going for it because it has great education, great science, a similar regulatory environment, and a great market. If something is making headway there, there's a whole lot of hurdles it has overcome and it makes me think I can pick it up and run with it elsewhere."

**Director, External Innovation,
top 10 pharmaceutical company**

"I think there is really good science in Australia. A lot of original science – really novel ideas, cutting edge technologies."

**Open Innovation Director,
top 5 pharmaceutical company**

The preparation of this report involved many conversations with multinationals about their perspectives on Australian innovation. Despite many executives acknowledging Australia's excellence in science and research, there were many reasons suggested that prevent multinationals from engaging more with Australian innovation.

Geographical isolation

The lack of awareness that pharmaceutical multinationals have of Australian opportunities stems in part from the barriers that come from geographical isolation.

Australia is outside the geographic footprint of most multinational pharmaceutical companies, and the distance from the United States and Europe reduces the frequency and ease of communication and interaction.

As the sourcing process depends on back and forth conversation, discussion and due diligence – particularly when the innovation is early stage – the delay caused by these pragmatic barriers and the inability to easily have face-to-face interaction is perceived as a nuisance. Despite the use of email, video calls and telephone calls, the reduced speed, frequency, and productivity of back-and-forth conversations limit the ability to communicate effectively.

"One really needs to scour the world for innovation. But unfortunately, isolation adds a barrier for people – the time difference is inconvenient to make calls, travel distance – it is reality, and although that's kind of silly with modern communication, it is still reality."

**Head of Business Development,
top 5 pharmaceutical company**

"You need to go and smell the place, interact with people, and get a feel for how far along the technology is. That's

where feet on the ground is useful."

Top 10 pharmaceutical BD executive

Most early-stage technologies are not accessible from a distance and without forming close relationships with universities and researchers. Pharmaceutical multinationals are often not embedded within the Australian research environment as they see the logistics and cost of maintaining a 'scout' in the region as an unjustifiable expense.

"Geography means the bar has to be higher."

**Head of External Innovation,
top 10 pharmaceutical company**

This lack of presence means that these companies are unable to explore innovation opportunities through informal and formal in-person interactions, and are therefore less likely to be aware of potential opportunities.

"There's not enough time to invest in any sort of investigation of the academic world there in a week-long visit which we might do on the outside of a two week visit around a major conference. It requires essentially someone to be on the ground, and that is again just another cost."

**Director, External Innovation,
top 10 pharmaceutical company**

Other regions take priority

Despite its successes, for many multinationals, Australia is not perceived as an obvious target to seek out innovative life science innovation. Many of those working within pharmaceutical multinationals have commented that they consider (albeit naively) that Australian opportunities lack differentiation in the global market and do not cover the broader scope of their interest areas. The result of this is that time and investment is not prioritised towards Australia.

"Australia and New Zealand is a 'nice to have', rather than 'cannot leave out'. But innovation wise, the region deserves to be in the place of being critical rather than being nice to have."

**Head, External Innovation,
top 10 pharmaceutical company**

"If I can only be in five places I want to be in places where I'm more likely to come across good ideas in some shape or form."

**Head of Business Development,
top 5 pharmaceutical company**

"We are very aware that there is high quality research in Australia, we see that in publications in our space. However, we can't justify spending resources in Australia

when we barely have resource to cover China and Japan. Those are our priorities, and after we get established in Asia, we can consider Australia more closely. Until then we have to rely on chance meetings at BIO or research conferences.”

**Director, External Innovation,
top 10 pharmaceutical company**

This attitude towards Australia and lack of awareness of innovation deals and successes in the region means that there is a greater risk perceived with the availability and quality of innovation opportunities.

In general, multinationals have commented that they prefer to scout in regions they are more familiar with: United States, Western Europe, Japan, and rapidly emerging sources of pharmaceutical innovation – in particular China and Korea. These regions are perceived to have invested substantially in science and technology through R&D regimes and infrastructure aimed at developing financial and human capital supporting fast commercialisation.

Even those pharmaceutical companies that appreciate the strength in science in Australia has said that simply having a regional strength in R&D does not necessarily differentiate Australia from competing regions.

This preference has been described as an implication of the limited resources, both human and financial, that multinationals have to investigate each area. Multinationals are forced to prioritise efforts into regions that will generate sufficient returns – in terms of quantity, quality of opportunities, and financial return on investment.

Justifying a trip to Australia to investigate opportunities is seen as difficult. The cost of travel – noted as being “US\$15-20 thousand” – is hard to justify. Visits, when they do happen, are easier to justify when coordinated around a conference (such as AusBiotech), where the multinational can investigate several opportunities simultaneously.

“If we can’t find it anywhere else, we’ll want to go there [Australia].”

**Open Innovation Director,
top 5 pharmaceutical company**

Lack of visibility

The diversity and quality of Australian innovation remains only partly visible to multinational pharmaceuticals. This is at least partly due to Australian innovators having a limited presence in major markets – often only attending the BIO trade exhibition and partnering programme annually.

Many pharmaceutical multinationals claim the effort made by Australia to engage and introduce opportunities is weaker than other regions. Representatives from Australian academia, research institutes, companies, and government were not seen to be active in platforms of exchange with multinationals.

“There are no vehicles or platforms for exchange. To give you an example, is there anything from Australia or New Zealand here today? You can see something from Puerto Rico, Italy... of course this is BIOEurope, but still – the Government of Canada – I’m meeting with them this afternoon.”

**Head of Business Development,
top 5 pharmaceutical company**

“We hadn’t even considered Australia as a source of collaborative research or partnership opportunities until recently.

One of our researchers started a discussion with a researcher in Australia and that is progressing well. Since then we have realised that we are missing out on a portion of the global research by not looking at Australia.”

**Head of Business Development,
top 5 pharmaceutical company**

Lack of commercial experience

The translation of science innovation into commercially attractive developments by Australian innovators is perceived to be poor by many multinational pharmaceutical companies.

“The quality of innovation is high. I think it’s the translation that’s the issue. How is your innovation going to be a worldwide application?”

**Open Innovation Director,
top 5 pharmaceutical company**

Researchers and innovators are thought to have an over-perception of the readiness and investment value of opportunities, with a lack of understanding regarding the risk, global regulatory requirements, and the data required by multinationals. This means that technologies are often not packaged strategically with a value position aligned to the requirements of a multinational.

“I do think [smaller innovator companies] in Australia are not as aware of the regulatory environments outside. If they develop something, it is usually with their own market in mind, so it might be that they have to go back from step five to step three and re-do it.”

**Head of Business Development,
top 5 pharmaceutical company**

“I think there is really good science. A lot of original science – really novel ideas... but it’s more like finding hidden jewels in the rough.”

**Head, External Innovation,
top 10 pharmaceutical company**

The pharmaceutical multinationals spoken to for this report noted an apparent business friction when dealing and negotiating with scientists and research innovators from Australia. This is due to a lack of multi-disciplined scientists trained in business, the lack of commercial understanding and entrepreneurial drive in researchers and scientists.

“Technology transcends geography – but the business culture does not. I would put Australia and New Zealand in the bucket of ‘there is some technology available but the business friction is high.’”

**Open Innovation Director,
top 5 pharmaceutical company**

“You’ll get university professors that think it’s okay to work on their company on the side and keep their full-time job, whereas here in San Francisco, people will leave their full-time job. It wouldn’t be a question, they’d just leave.”

**Head, External Innovation,
top 10 pharmaceutical company**

Pharmaceutical multinationals perceive this lack of business acumen as reducing Australia’s ability to package and position innovation to fit the multinational’s needs.

Conclusion and recommendations

Pharmaceutical and medical technology differences

The pharmaceutical sector is increasingly looking for external innovations to fill its product pipelines, particularly due to the high cost of researching and developing new drugs, high risk of failure, and significant exposure many large pharmaceutical multinationals have to patent expiry of blockbuster drugs.

The medical technology sector is also continually looking out for new technologies externally, however, there are stark differences between the two industries and the way they seek out external innovation.

Unlike the pharmaceutical industry, medical technology multinationals are largely US-based. Of the top fifteen pharmaceutical companies, just seven are US-headquartered. In comparison, when considering the top medical technologies companies, 10 of the top fifteen are US-based.

There are also considerably fewer medical technology multinationals than pharmaceuticals, and they are smaller due to the smaller size of the sector, fragmentation, and the wide diversity of technologies and specialist product categories in the industry – the global market size for the pharmaceutical industry is approximately US\$1.2 trillion, compared to US\$350 billion for medical technologies.

Medical technology companies spend a lot less than their pharmaceutical counterparts on research and development. The average R&D spend as a percentage of revenue for medical devices is 7 per cent, versus 18 per cent in the pharmaceutical industry.

The difference in scale between the two sectors is even more significant when you compare the following:

- In 2006 Medtronic had revenue of US\$11 billion. At the same time, the highest-selling drug – Pfizer's Lipitor – was contributing \$13 billion to the pharma giant's revenue.
- In 2014, the fourth and eighth largest medtech players – Medtronic and Covidien – merged in a US\$43 billion deal. This would pale in comparison if the same happened with the equivalent in big pharma – Novartis and Novo Nordisk – which have a 2018 market capitalisation of US\$176 billion and US\$112 billion, respectively.

These differences make medical technologies companies less outward looking when it comes to innovation compared to pharmaceutical companies. It also results in a level of insularity in the United States for medical technologies

companies that big pharma cannot afford to have.

"I know someone that moved from the pharmaceutical sector to the medtech sector. He came to me and said that he just doesn't understand the industry. He used to do more deals in a month than medtech does in two years!"

**Head, External Innovation,
top 10 pharmaceutical company**

"For every Medtronic, there are 20 buyers in biotech. There is a huge difference."

**Chairman,
Venture capital firm with US\$2 billion total assets**

"Medical technologies is a buyers' market for the most part. What has changed most in recent years is this consolidation of big companies."

**Managing Partner,
life science investment firm with \$500m fund**

The pharmaceutical industry uses licensing – almost exclusively – for its business development efforts. Conversely, the medical technologies industry rarely uses licensing. Instead, the nature of product development in the sector means that they prefer to acquire technologies outright to advance their products and pipeline and remain competitive.

Areas of overlap with Australian innovation

Medical technologies

The United States has around 7,000 medical device companies. Europe has 25,000 (of which 12,600 are in Germany), and Australia has approximately 500. There is a perception from multinationals – right or wrong – that this number of companies makes it unlikely that Australia offers anything unique and not already available in the major markets they are geographically closer to.

Medtech is an industry that lends itself to clusters. Those spoken to for this report pointed to Israel, Ireland, Palo Alto, Minneapolis and Singapore as regions that are globally recognised as world-leading clusters for medical technologies. Australia is respected as a location for clinical trials and is a good base to build on.

The lack of a critical mass, along with the distance from major markets to Australia, were the two biggest issues cited for many of the key decision makers within large medical technology companies when considering Australia for innovation.

“In order to attract the top players from New York to Ireland for the MedTech Strategy Summit, we needed to have 400 companies present. Convincing big corporates that there is enough of a critical mass is important. That is what has helped both Israel and Ireland.”

David Cassak,
MedTech Strategist

One executive suggested that a major government initiative to make medical technologies a priority industry in Australia would help the region to be perceived in a similar way to Ireland or Israel. Both of these regions have been very successful in recruiting a robust medtech start-up scene: they have available seed capital, along with government sponsored programmes that act as a base from which industry can percolate and grow.

“ANZ could be pitched as an English-speaking region that is rich in technology in its own right, but also with window into Asia... though you will get challenged by Singapore – and you also need a lot of venture finance.”

Director of Business Development,
top 5 medical device company

“Think broadly about which companies you want to attract to Australia. In the pharmaceutical industry you have the big 20, but even beyond that the companies are still huge organisations. The scale of medical technology companies is smaller and taper off much more quickly.”

Head of Business Development,
top 5 medical device company

Prominent areas for medical technologies in Australia include: IVD, sensors and digital diagnostics, biomaterials, implantables, respiratory, orthopaedics, surgical, cardiovascular, wound care, medical imaging, health informatics and e-health.

Areas of interest for multinational pharmaceutical companies across different geographies, compared to Australian listed biopharma companies

Areas of interest	Europe (inc. Israel)	USA	Japan	Australia
Metabolism, GI, diabetes	21	8	8	2
Neuroscience, CNS, pain	21	7	6	10
Oncology	15	9	7	17
Immunology & inflammation	10	11	4	6
Cardiovascular	10	6	3	4
Respiratory	9	2	2	3
Ophthalmology	7	2	2	3
Infection, vaccines	6	4	4	6
Rare diseases	6	3	1	2
Reproductive	5	1	0	0
Dermatology	5	2	1	7

Global medical technology trends and Australian innovation overlap considerably for the top three categories of global interest and could be promoted as Australia’s strengths:

- 1. Digital, sensors, wearables and health informatics**
- 2. IVD**
- 3. Medical imaging**

Pharmaceuticals

European pharmaceutical multinationals are generally more diversified across their main therapeutic areas than pharmaceutical companies in the other major markets United States and Japan. However, multinationals in all three geographies share a strong focus on metabolism, GI and diabetes, and to a lesser extent neurology and oncology. In contrast, disease areas with smaller market size such as reproductive health, dermatology, respiratory, and ophthalmology are dominated by European multinationals.

ASX-listed Australian companies, with the exception of CSL, are very small in comparison to those in other geographies, and by necessity have a narrower focus.

For Australian listed companies, oncology is the predominant therapeutic area followed by neurology. There are comparatively fewer Australian biopharma companies in those areas that are in high demand from multinational pharmaceutical companies, including metabolism, gastrointestinal, and diabetes.

Take Australian innovation to the world

In general, pharmaceutical and medical technologies multinationals acknowledge Australia's reputation for globally renowned excellence in science and research, and having a similar regulatory system to major markets.

However, while these multinationals say they are agnostic to the location of innovation, there are pragmatic barriers that prevent these companies from considering Australia as an external innovation hunting ground.

Some of the hurdles mentioned include:

- A perception of limited opportunities in Australia (often stemming from a lack of visibility).
- Geographical isolation that consists of long flights – often requiring connections – at a considerably higher cost and time commitment than other regions.
- Not considered demonstrably superior and different relative to other, more accessible, major markets.
- Difficult time zones for seeking out innovation and liaising with innovators.
- Innovators are perceived to have low commercial acumen, which can make opportunities less 'investment ready' and negotiations and due diligence difficult.

There are many ways these barriers can be addressed, but one of the easiest ways multinationals suggested is to remove the barrier of distance, and get innovators in front of them for face time with key decision makers as much as possible.

Some suggested that inviting and hosting executives to Australia can be a worthwhile exercise, but cautioned that it would only appeal to some people within their organisation.

"Concentrate efforts on engaging the technology scouts and the people a little lower down, not the business development heads. They might not have the same level of budget, but you'll have an easier time getting those people to visit Australia."

**Director, External Innovation,
top 10 pharmaceutical company**

An alternative might be to take delegations of Australian companies to medtech and pharmaceutical hotspots, and coordinate a visit to the most relevant multinationals. While it may not be possible to secure a meeting with the right person at a conference, arranging a targeted visit to their premises (particularly as a government or industry-led initiative), can be an easier way to get their attention.

Find the right targets

As pharmaceutical multinationals increasingly use open innovation to seek out innovative opportunities for their pipelines, they have become much better at outlining on their websites exactly which technologies are of interest to them.

Medical technologies companies tend to be less proactive about advertising their areas of interest online, however most indicate they seek out innovation only within their defined niche, and are not interested in technologies that fall outside this area. They are, however, open to receiving direct approaches from companies and technology innovators when it fits their portfolio – medical technologies multinationals spoken to for this report indicated that up to 95 per cent of the acquisition opportunities they consider from SMEs are from direct approaches. This can be attributed to the fact that they do not have as many scouts or business development people spread around the world as pharmaceutical multinationals do.

Time spent understanding which multinationals are likely targets for any particular innovation can save a significant amount of wasted effort chasing companies that will ultimately have no interest in a technology. The importance of targeting companies that are relevant to any particular innovation cannot be understated.

Be present at the right events – and prepare

There are many different industry events for both biotechnology & pharmaceuticals, and the medical technologies sector – but they have different purposes, and attract different audiences.

The BIO International Convention is undisputedly the leading global biotechnology and pharmaceutical event, and attracts close to 20,000 attendees from across the sector. All the largest pharmaceutical multinationals are present, and they use this event as a convenient opportunity to identify and track innovations and opportunities of interest. Providing work is done ahead of time to identify and prioritise leads, the partnering service allows attendees to easily target the best candidates for meetings.

While there are many different global medical technologies events, there are few that offer a high likelihood of targeting the right business development or open innovation leads from multinationals. Multinationals spoken to for this report were less enthusiastic about conference attendance for identification of innovation opportunities than their pharmaceutical counterparts, but two events that were highlighted as relevant are the MedTech Strategist Innovation Summit and The MedTech Conference.

Unlike pharmaceutical events where partnering is a prominent part of the event, the advice received from multinationals is that having a booth where you can exhibit your technology and be visited – often incognito – by multinational scouts is a good way to get noticed. They often have representatives walking the floor on the lookout for relevant technologies.

On top of the big events for pharmaceuticals and medical technologies, there are targeted events, tradeshows and conferences held that attract key players in particular sub-sectors of the biotechnology and pharmaceutical industry. These events are often smaller, and provide a greater chance for innovators to target the right individuals and gain exposure from multinationals.

Best practice at partnering events

- Start with a target list, and supplement it by searching the partnering platform with key words, in order to identify potentially relevant parties.
- Strive for personal pre-introductions wherever possible.
- Send meeting requests that are personalised and targeted to the recipient in order to stand out amongst the thousands of meeting requests big pharmaceutical companies will receive.
- If possible, send parallel emails alongside formal partnering requests directly to targets.
- Prepare a high impact pitch deck that is short enough to allow discussion during the short meeting time slots – make sure the right information is included in the pitch, and that it is tailored to the audience.
- Follow up quickly – and repeatedly, if there is no initial response.

Global accelerator competitions

Alongside industry events, there are global accelerator competitions that Australian innovators can leverage. One of the most prominent examples, supported by most of the largest medical technology multinationals, is the MedTech Innovator competition, a non-profit global competition and accelerator for medical device, digital health and diagnostic companies.

The MedTech Innovator's mission is to improve the lives of patients by accelerating the growth of companies that are transforming the healthcare system. It holds competitions each year, culminating in a pitch event at the world's most prominent medtech conferences (Medtech Strategist Innovation Summit in Dublin, the Wilson Sonsini Medical Device Conference in San Francisco, and The MedTech Conference in Philadelphia).

Early to mid-stage medical device, diagnostic and digital health companies are selected to participate in the programme



The MedTech Innovator pitch event

and compete for non-dilutive cash prizes. Since 2013, MedTech Innovator has awarded US\$1.4m to participants. The programme also provides participants with full conference scholarships, access to partnering, and exposure to multinationals, investors, and other key stakeholders.

The programme has significant involvement from most of the largest medtech multinational companies, with supporters including Johnson & Johnson, Baxter, Amgen, BTG, and Olympus.

As an example, last year Johnson & Johnson Medical Devices' Vice President of Business Development personally reviewed all 400 applications for the accelerator programme.

"If we don't foster this stuff and get these people the audiences where people like us can see and hear from them, then patients are going to suffer. I have a lot of personal passion for early stage technology and for helping to prepare the ecosystem. The majority of the stuff there isn't going to fit us, but it is more an ecosystem thing."

**Vice President Business Development,
top 5 medical device company**

"When you're one of the bigger companies you feel like you need to do it. And strategies change. And for some of the inventors, while one particular innovation may not fit or be relevant, the next one might. And it's good developmentally for my team to get them out of there. It's time, but doesn't take a lot of money."

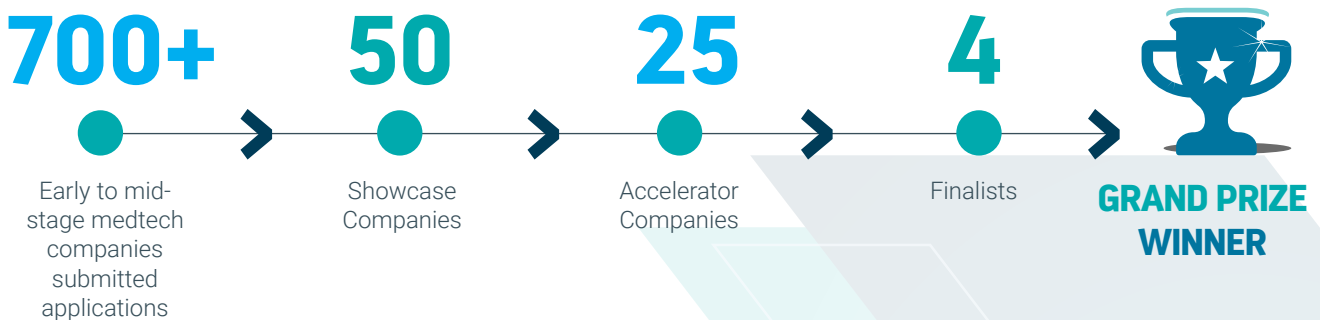
**Head of Business Development,
top 5 medical device company**

Based on this successful competition, APACMed is now looking to bring the MedTech Innovator competition to the Asia-Pacific region. The APACMed industry association has over 90 members, with most located in Singapore and Korea. Founding members include Johnson & Johnson, Boston Scientific, and Medtronic. During the meeting for this report, chief executive Fredrik Nyberg expressed a strong interest in having Australia play a key role in any Asia-Pacific iteration of this initiative.

Early stage collaboration

Pharmaceutical multinational companies are continuing to invest and partner with early stage research programmes. The trend towards biologics-based therapeutics requires a deeper understanding of the underlying biology largely provided by academic researchers. Academic collaborations also allow global corporates to keep their open innovation funnel as wide as possible, often providing first rights to license or acquire technologies of interest at a lower cost than direct deals with early stage companies. There are many examples of these relationships between global corporates and research groups at universities in Australia.

Partnerships with multinationals for medical technology research seems less prominent than in the pharmaceutical sector. Australian university bioengineering centres tend to collaborate mostly with domestic medical technology companies to commercialise research, as opposed to global multinationals. As an example, Monash University lists five pharmaceutical multinationals as partners and none for medical technology multinationals.



Prepare for the long game

In the current environment more than three-quarters of medical device acquisitions occur after regulatory approval. Most medical technology multinationals prefer to wait until a technology can demonstrate strong sales (often in the tens of millions of dollars).

For this reason, Australian innovators in the medtech sector should aim to progress their technology through the regulatory process (such as gaining a CE mark), and not assume they will be able to gain significant attention before this stage. Following regulatory approval, the visibility and credibility of the company and the technology is raised to multinationals.

In order to better prepare themselves for an acquisition or partnership, even early stage medical technology and pharmaceutical companies can benefit by appointing directors to their board that have been previously employed by or have close relationships with those multinationals that are potential acquisition or license targets. The acquisition of Elastagen by Allergan is a good example of where this strategy has worked well in Australia.

Find a champion – and get in early

Many of the large medical technology and pharmaceutical multinational executives spoken to expressed a desire for start-ups and innovators to 'get in early' with them – not necessarily for investment or an early acquisition, but so that a technology can be developed strategically.

"Our advice to companies is to get in early with us, so we can be strategic and allow us to 'build to buy'. That'll make a successful exit - and keeping you on our radar - more likely."

**Vice President Strategy,
Growth and Business Development,
top 5 medical device company**

But regardless, it is important to find a champion within a relevant business unit at a multinational. The receptiveness of sourcing innovation from Australia tends to come down to particular individuals, and their individual experience, knowledge, and perception of Australia will play a large role on whether they have an interest or not.

These key decision makers include the CEO and top management that direct the overall vision of the multinational company, the external R&D lead, and the representatives of various functions involved in decision making of R&D opportunities. Note that there are usually multiple entry points into multinationals, and it is not uncommon to find that one division, team, or geography is completely unaware of what others are doing – so it can be worth trying to find more than one open door.

The external R&D leads are responsible for acting on behalf of the external innovation as an ‘internal champion’, in which they attempt to sell the opportunity internally. The importance of the internal champion in driving and taking risks to actively promote innovations from Australia has been stressed from those spoken to in the preparation of this report. They must believe that Australia has the potential to deliver and is worth spending the time, human and financial resources on – despite the perceived uncertainty and risk around the quality and return on investment relative to tried and true regions. The internal champion must be able to persuade their wider team of the merit of any particular opportunity.

Consider geographies outside traditional regions

China’s President Xi Jinping – as part of China’s “Made in China 2025” plan – has set out plans to bolster the Chinese healthcare industry and limit its reliance on foreign firms. This has become particularly critical for the country as its population ages, and its growing middle-class is prepared for pay for medicines and medical technologies.

China is considered the world’s second-largest pharmaceutical market, worth an estimated US\$122.6 billion in 2017 and expected to reach US\$145 billion to US\$175 billion by 2022.²⁷

Traditionally, the Chinese pharmaceutical sector has been highly fragmented, keeping R&D low. However, recent changes to government policy is helping to consolidate these companies, and increase R&D spending. As a result, in 2017 biopharmaceuticals was the second largest investment market in China in 2017 – coming just behind information technology.

Over the coming years, China is expected to challenge the market dominance of the pharmaceutical and medical technology giants in the United States and Europe. Those Western multinationals spoken to for this report mentioned the growth of companies in developing regions, and noted that although their names are relatively unknown outside the region, they are of sufficient scale that they represent a tremendous opportunity for partnerships and capital.

“China wants medical devices, it wants pharmaceuticals. There are corporates there – I don’t even know their name – that are billions in market cap, and could provide a very interesting alternative source for cash to fund innovation, or could be potential acquirers. If Medtronic doesn’t want to buy you, maybe one of them will want to.”

**Chairman,
Venture capital firm with US\$2 billion total assets**

China’s largest listed pharmaceutical company, Jiangsu Hengrui Medicine, has a market capitalisation of US\$35 billion. Although this is low in comparison to the largest Western multinationals, the number and size of these companies in China are expected to increase.

²⁷ H. Tan, “China’s pharmaceutical industry is poised for major growth,” CNBC, 19 04 2018. [Online]. Available: <https://www.cnbc.com/2018/04/19/chinas-pharmaceutical-industry-is-poised-for-major-growth.html>.

Summary of key recommendations

The following section contains a summary of the key recommendations uncovered in this report. Recommendations have been separated by sector (medical technologies and pharmaceuticals) due to the way the two industries behave quite differently – including in relation to Australian innovation.

Medical Technologies

Focus on building the company. Acquisitions in the medical technologies sector typically occur after regulatory approval and when a technology is able to demonstrate strong sales. Innovator companies should be able to demonstrate how they plan to progress their technology through to this stage whenever speaking to multinationals.

Promote those areas of overlap between Australian innovation and demands from multinationals (eg: digital, sensors, wearables and health informatics; IVD; Medical imaging), in order to increase the perception of a critical mass in the Australian sector.

Medical technologies multinationals will often use trade events as a hunting ground for new innovation. While partnering meetings for new technology adoption is not as popular at medical technologies events as it is in the pharmaceutical sector, conferences are still key events for multinationals to seek out and understand new trends in the industry and innovation that may be of interest to them. Being seen at the right events can help put Australian innovation on the map. Major events for the medical technologies industry are the MedTech Strategist Innovation Summit, and The MedTech Conference – many multinationals indicated they use these events as a way to explore exhibitor stands incognito.

Many multinationals indicated they see Australian innovators as unprepared, and lacking commercial acumen. Preparation for meetings, having concise, targeted material, and professional follow-ups is essential for a successful engagement with these companies.

Take time to understand what each potential medical technology multinational is interested in. Medical technology companies tend to only seek out innovation within their defined niche, and are not usually interested in technologies that fall outside this area.

Consider participating in global accelerator events – such as the MedTech Innovator competition, that provide significant exposure to key individuals within multinationals.

Consider appointing directors to the board – even at an early stage – that have been previously employed by, or have close relationships with those multinationals that are potential acquisition or license targets.

Attract more partnerships between medical technologies multinationals and prominent Australian university bioengineering centres.

Find a champion within target multinational companies, and use them to ensure the development of a technology is targeted towards what global corporates are looking for. Note that there are multiple entry points into these big companies, and often one division or team doesn't know what the other is doing – so try finding more than one open door.

Increasingly, geographies outside the traditional regions (United States and Europe) are becoming significant players in the pharmaceuticals sector. Many of the Western multinationals spoken to in the preparation of this report indicated that there are large companies in China that even they are unaware of. As the pharmaceuticals sector increases in these regions, these players are going to be more important to pay attention to and will provide opportunities for engagement with Australian innovators.

Consider taking a delegation of innovative medical technologies companies to major markets to visit medical technology multinationals that may not otherwise consider travelling to Australia. A targeted visit to their premises (particularly as a government or industry-led initiative), is a simple way to get noticed, and could happen alongside a delegation to the major industry conferences.

Pharmaceuticals

Promote those areas of overlap between Australian innovation and demands from multinationals (oncology, neurology), in order to increase the perception of a critical mass in the Australian sector.

Increase the visibility of Australian innovation by being seen at the right, targeted events that are attended by key targets within the open innovation function of multinationals. The key event for the biotechnology and pharmaceutical industry is the annual BIO International Convention.

Expect to spend considerable time ahead of partnering events, identifying target companies, profiling and prioritising them, securing meetings, and preparing short high impact pitch decks that are tailored to the audience.

Being well prepared and being able to pitch how your innovation addresses the corporate's needs is of key importance.

Follow up on new contacts after the event and build a relationship.

Consider taking a delegation to major markets to visit pharmaceutical multinationals that may not otherwise consider travelling to Australia. Assuming relevant companies are targeted, they would be prepared to meet with innovator companies.

Use the websites of pharmaceutical companies to identify the right multinational targets. Pharmaceutical companies tend to advertise widely exactly what technologies are of interest to them.

Consider appointing directors to the board – even at an early stage – that have been previously employed by, or have close relationships with those multinationals that are potential acquisition or license targets.

Find a champion within target multinational companies, and use them to ensure the development of a technology is targeted towards what their global corporate is looking for. Note that there are multiple entry points into these big companies – often one division, team, or geography doesn't know what the other is doing – so try to find more than one open door. Additionally, don't get boxed in by having just one enthusiastic champion who is not empowered – find out the decision-making structure and have multiple relationships leading to it if possible.

Increasingly, geographies outside the traditional regions (United States and Europe) are becoming significant players in the medical technologies sector. Many of the Western multinationals spoken to in the preparation of this report indicated that there are large companies in China that even they are unaware of. As the medical technologies sector increases in these regions, these players are going to be more important to pay attention to and will provide opportunities for engagement with Australian innovators.

Appendices

Examples of acquisitions and collaborations

The following tables contain examples of recent acquisitions of and collaborations with Australian innovation.

Examples of multinational acquisitions of Australian pharmaceutical and medical technologies companies

Target	Focus	Acquirer	Year	Price
Fibrotec	Fibrosis drug	Shire	2014	US\$75 million plus milestones
Spinifex	Pain drugs	Novartis	2015	US\$200 million plus milestones
Vision Eye Institute	Ophthalmology	Jangho Co Group	2015	US\$149 million
Viralytics	Oncology	Merck & Co	2018	US\$394 million
Elastagen	Elastin for cosmetic fillers	Allergan	2018	US\$95 million
RHS	Single cell genomics	Perkin Elmer	2018	US\$20 million

Examples of multinational collaborations

Multinational	Companies	Universities & research institutes
Bayer		The University of Queensland
Boehringer	Pharmaxis (NASH)	The University of Queensland (pain)
Novartis	Acquired Spinifex (pain) Cytopia (autoimmune) Immutep (oncology) Phosphagenics (pain)	Garvan Institute of Medical Research (genomics)
Roche (including Genentech)		Monash University (inflammation) Peter MacCallum Cancer Centre (oncology) The Walter and Eliza Hall Institute (oncology) Garvan Institute of Medical Research (epigenetics)
Sanofi		University Melbourne (infection)
Servier		Monash University (GPCR research) The Walter and Eliza Hall Institute (oncology)
Novo Nordisk		Garvan (inflammation)
GSK	EvoGenix (protein drugs) Immutep (oncology)	Monash University (joint innovation centre) Australian Discovery Challenge 2018
GSK Ventures (Action Potential Venture Capital)	Saluda Medical (neurostimulation)	
AstraZeneca	Starpharma (oncology) Adherium (smart inhaler) Phyllogica (antibiotics)	The University of Queensland The Walter and Eliza Hall Institute

Multinational	Companies	Universities & research institutes
Mundipharma	MDI (pain)	
	Starpharma (bacterial vaginosis)	
	Vital Foods (GI)	
Shire	Fibrotec (fibrosis)	
Teva	SUDA (insomnia)	
Pfizer	Phylogica (vaccines)	The University of Queensland (peptide drugs)
		Peter MacCallum Cancer Centre (oncology)
		Monash University
Merck & Co	Viralytics (oncology)	The University of Queensland (Gardasil license)
	Bionomics (pain)	CTx (oncology drug license)
	Immutep (oncology)	
J&J	Orthocell (orthopaedics)	Queensland University of Technology (innovation partnering)
	Phylogica (peptide platform)	Monash University (innovation partnering)
		The University of Queensland (autoimmune)
AbbVie		The Walter and Eliza Hall Institute (oncology - jointly with Genentech)
BMS		Peter MacCallum Cancer Centre (oncology)
		QIMR Berghofer (oncology)
Eli Lilly	AcruX (transdermal testosterone)	
	Starpharma (drug delivery)	
Takeda	Prana (neurology)	Monash University (GI)
	HaemaLogiX (immune oncology)	Australian Innovation Grants Programme 2018
Otsuka	LCT (diabetes)	
Celgene	Mesoblast (cell therapies)	
Mylan	Phosphagenics (pain, dermatology)	
Stryker		RMIT, UTS, St Vincent Hospital (real time orthopaedic implants by 3D printing)
Ferring		Ferring Global Grants
Tasly Pharmaceutical Group (China)	Mesoblast (cardiac repair)	
Axovant Sciences	Benitec Biopharma (RNA therapies)	
BASF	Xerion (omega-3 test kit)	
Unilever Ventures	Frank Body (skincare)	
	Grown Alchemist (skincare)	

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MTPConnect

MedTech and Pharma Growth Centre

CONTACT US FOR FURTHER INFORMATION

Phone +61 3 9905 1753

Email info@mtpconnect.org.au

Head Office

New Horizons Building
Monash University
20 Research Way
Clayton VIC 3168
Australia

NSW Sydney Hub

Level 5
J12 School of IT
University of Sydney
1 Cleveland Street
Darlington NSW 2006
Australia

WA Perth Hub

The University
of Western Australia
Harry Perkins Institute of
Medical Research Building
QEII Medical Centre
6 Verdun Street
Nedlands WA 6009
Australia

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